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Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule

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Visit http://www.epa.gov/waterscience/316b/ for more information on this rule.

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Chapter A1: Introduction

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INTRODUCTION

EPA is promulgating regulations implementing section 316(b) of the Clean Water Act (CWA). This regulation is the third in a series of rulemaking actions under CWA section 316(b), addressing the environmental impacts of cooling water intake structures (CWIS). The Final Section 316(b) Regulation for Phase III Facilities establishes national performance requirements for the location, design, construction, and capacity of CWIS for new offshore oil and gas extraction facilities. Although several regulatory options were considered for promulgation for existing manufacturing facilities, EPA has decided that Phase III existing facilities should continue to have section 316(b) limits established on a case-by-case, best professional judgment basis.

This *Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule* report (hereinafter "Economic Analysis" or "EA") presents the economic analysis of the final regulation, as it applies to new oil and gas extraction facilities, as well as several regulatory alternatives that EPA considered in the development of a potential regulation for existing Phase III manufacturing facilities.

A1-1 OVERVIEW OF POTENTIALLY REGULATED SECTORS AND FACILITIES

Setting aside those facilities covered by the Phase II Final Regulation, the facilities potentially subject to regulation under Phase III consisted of facilities that employ a cooling water intake structure and are designed to withdraw two million gallons per day or more from waters of the United States and that fall in two general categories:

1. *New Offshore Oil and Gas Extraction Facilities*; and
2. *Existing Facilities*, which include Electric Power Producing Facilities with DIF of less than 50 MGD, Manufacturing and Other Industries Facilities ("Manufacturers").

In the documents for the Phase III proposed regulation, these facilities were collectively described as the "potential Phase III facilities."

A1-1.1 New Offshore Oil and Gas Extraction Facilities

In developing the Final Section 316(b) Regulation for Phase III Facilities, EPA analyzed the proposed regulations' applicability to new offshore oil and gas extraction facilities (abbreviated as "new OOGE facilities"), seafood processing vessels, and offshore liquid natural gas (LNG) terminals. EPA's analysis of these facilities is discussed in *Part C: Economic Analysis for Phase III New Offshore Oil and Gas Extraction Facilities* of this EA and in the *Technical Development Document for the Final Section 316(b) Phase III Existing Facilities Rule* (U.S. EPA, 2006b).

The Phase III final regulation applies to only the new offshore oil and gas extraction facilities category of these additional categories listed above. EPA estimates that 124 new offshore oil and gas extraction facilities will be subject to the final regulation. All of these facilities will be located off the coast of California, Alaska, or the Gulf of Mexico, henceforth referred to as "Coastal Waterbodies."

A1-1.2 Existing Phase III Facilities and Sectors

A1-1.2.1 Regulatory Options Considered

EPA considered requirements for Phase III existing facilities to meet performance standards similar to those required in the final Phase II rule, including an 80-95% reduction in impingement mortality and a 60-90% reduction in entrainment. In the final Phase III rule, however, EPA determined that uniform national standards are not the most effective way to address cooling water intake structures at existing Phase III facilities. Phase III existing facilities continue to be subject to permit conditions implementing section 316(b) of the Clean Water Act set by the permit director on a case-by-case basis, using BPJ.

The performance standards presented at proposal were intended to reflect the best technology available for minimizing adverse environmental impacts determined on a national categorical basis. The type of performance standard applicable to a particular facility (i.e., reductions in impingement only or impingement and entrainment) would have varied based on several factors, including the facility's location (i.e., source waterbody) and the proportion of the waterbody withdrawn. Impingement reductions were required at all facilities subject to the performance standards. Entrainment reductions are required at facilities 1) located on an estuary, tidal river, ocean, or one of the Great Lakes, or 2) located on a freshwater river and withdrawing greater than 5% of the mean annual flow of the waterbody. At proposal, facilities located on lakes or reservoirs may not disrupt the thermal stratification of the waterbody, except in cases where the disruption is beneficial to the management of fisheries.

EPA proposed three possible options for defining which existing Manufacturing Facilities would be subject to uniform national requirements, based on design intake flow threshold and source waterbody type: The facility has a total design intake flow of 50 million gallons per day (MGD) or more, and withdraws from any waterbody; the facility has a total design intake flow of 200 MGD or more, and withdraws from any waterbody; or the facility has a total design intake flow of 100 MGD or more and withdraws water specifically from an ocean, estuary, tidal river, or one of the Great Lakes. These are Options 5, 9, and 8 respectively in Table A1-1, below.

In addition, EPA considered a number of options (specifically Options 2, 3, 4, and 7 below) that would have established different performance standards for certain groups or subcategories of Phase III existing facilities. Under these options, EPA would have applied the proposed performance standards and compliance alternatives (i.e., the Phase II requirements) to the higher threshold facilities, apply the less-stringent requirements as specified below to the middle flow threshold category, and would apply BPJ below the lower threshold.

The regulatory options as well as other options considered are described in detail below:

Option 1: Facilities with a design intake flow of 20 MGD or greater would be subject to the performance standards discussed above. Under this option, section 316(b) permit conditions for Phase III facilities with a design intake flow of less than 20 MGD would be established on a case-by-case, BPJ, basis.

Option 2: Facilities with a design intake flow of 50 MGD or greater, as well as facilities with a design intake flow between 20 and 50 MGD (20 MGD inclusive), when located on estuaries, oceans, or the Great Lakes would be subject to the performance standards. Facilities with a design intake flow between 20 and 50 MGD (20 MGD inclusive) that withdraw from freshwater rivers and lakes would have to meet the performance standards for impingement mortality only and not for entrainment. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 20 MGD would be established on a case-by-case, BPJ, basis.

Option 3: Facilities with a design intake flow of 50 MGD or greater would be subject to the performance standards. Facilities with a design intake flow between 20 and 50 MGD (20 MGD inclusive) would have to meet the performance standards for impingement mortality only and not for entrainment. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 20 MGD would be established on a case-by-case, BPJ, basis.

Option 4: Facilities with a design intake flow of 50 MGD or greater, as well as facilities with a DIF between 20 and 50 MGD (20 MGD inclusive), when located on estuaries, oceans, or the Great Lakes would be subject to the performance standards. Facilities that withdraw from freshwater rivers and lakes and all facilities with a design intake flow of less than 20 MGD would have requirements established on a case-by-case, BPJ, basis.

Option 5: Facilities with a design intake flow of 50 MGD or greater would be subject to the performance standards. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 50 MGD would be established on a case-by-case, BPJ, basis.

Option 6: Facilities with a design intake flow of greater than 2 MGD would be subject to the performance standards. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of 2 MGD or less would be established on a case-by-case, BPJ, basis.

Option 7: Facilities with a design intake flow of 50 MGD or greater would be subject to the performance standards. Facilities with a design intake flow between 30 and 50 MGD (30 MGD inclusive) would have to meet the performance standards for impingement mortality only and not for entrainment. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 30 MGD would be established on a case-by-case, BPJ, basis.

Option 8: Facilities with a design intake flow of 200 MGD or greater would be subject to the performance standards. Under this option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 200 MGD would be established on a case-by-case, BPJ, basis.

Option 9: Facilities with a design intake flow of 100 MGD or greater and located on oceans, estuaries, and the Great Lakes would be subject to the performance standards. Under this regulatory option, section 316(b) requirements for Phase III facilities with a design intake flow of less than 100 MGD would be established on a case-by-case, BPJ, basis.

Table A1-1 summarizes the application of performance standards under each of the proposed options considered for Phase III existing facilities (Options 5, 8, and 9) as well as the other options considered:

Table A1-1: Performance Standards for the Regulatory Options Considered

Option	Minimum Design Intake Flow Defining Facilities as Existing Phase III Facilities					
	> 2 MGD	**20 MGD**	**30 MGD**	**50 MGD**	**100 MGD**	**200 MGD**
1	BPJ	I&E				
2	BPJ	Freshwater rivers and lakes: I only All other waterbodies: I&E		I&E		
3	BPJ	I only		I&E		
4	BPJ	Estuaries, oceans, Great Lakes: I&E All other waterbodies: BPJ		I&E		
5	BPJ			I&E		
6	I&E					
7	BPJ		I only	I&E		
8	BPJ					I&E
9	BPJ				Estuaries, oceans, Great Lakes: I&E All other waterbodies: BPJ	

Key:

BPJ - Best Professional Judgment

I&E - 80-95% reduction in impingement mortality and a 60-90% reduction in entrainment, where applicable

I only - 80-95% reduction in impingement mortality

Estuaries - includes tidal rivers and streams

Lakes - includes lakes and reservoirs

None of the regulatory options for Phase III existing facilities (Options 5, 8, and 9) that were presented at proposal would have covered electric generators not already covered by the Phase II rule, as that rule addresses electric power generators with DIF of 50 MGD or more. Therefore, EPA focused its analysis for the final regulation for Existing Facilities on the Manufacturers segment and did not give further consideration to electric generators. As a result, in presenting analyses for the Existing Facilities, this document focuses on the Manufacturing and Other Industries ("Manufacturers") category of existing facilities.

The EA, including the discussion in the remainder of this section, does present information on the more comprehensive set of *potential Phase III existing facilities* and the regulatory options that would have applied to them. However, the information for existing facilities below the 50 MGD applicability threshold is considerably more limited in scope than the information for facilities with a DIF of at least 50 MGD since the smaller flow facilities do not fall within the applicability thresholds for the regulatory options that were presented at proposal.

The discussions for existing facilities in the remainder of this document focus on the three regulatory options comprising the regulatory proposal (i.e., Options 5, 8, and 9). In the remainder of this document, these three options are referred to as follows:

1. Option 5, which would have applied to existing Manufacturers segment facilities with a total design intake flow of **50 MGD or more** and located on **any source waterbody type** is referred to as the **"50 MGD All Option"**.
2. Option 8, which would applied to existing Manufacturers segment facilities with a total design intake flow of **200 MGD or more** and located on **any source waterbody type** is referred to as the **"200 MGD All Option"**.
3. Option 9, which would applied to existing Manufacturers segment facilities with a total design intake flow of **100 MGD or more** and located on **certain source waterbody types** (i.e., an ocean, estuary, tidal

river/stream or one of the Great Lakes) is referred to as the **"100 MGD Certain Water Bodies Option"** or **"100 MGD CWB Option"**.

In addition to these three regulatory analysis options, this document also presents information on the other options that EPA analyzed in development of the Phase III proposal and the final regulation (i.e., Options 2, 3, 4 and 7, also referred to as the "Supplemental Options"). The information for the supplemental options is presented in appendices to the relevant chapters in this EA report. EPA also proposed not to promulgate a national categorical rule, and instead continue to rely on case-by-case, best professional judgment to establish 316(b) limits for Phase III facilities.

The remainder of this section provides an overview of the existing Phase III sectors and facilities that were analyzed for this rulemaking. Chapter *C2: Profile of Manufacturers* presents more detailed information on these Manufacturers sectors and facilities.[1]

A1-1.2.2 Sector Information

Based on past section 316(b) rulemakings, EPA's effluent guidelines program, and the 1982 Census of Manufactures, EPA identified two major industry segments of existing facilities for analysis in developing this regulation: (1) steam electric generators; and (2) manufacturing industries with substantial cooling water use. Steam electric generators are the largest industrial users of cooling water. The condensers that support the steam turbines in these facilities require substantial amounts of cooling water. EPA estimates that steam electric utility power producers (SIC Codes 4911 and 4931) and steam electric nonutility power producers (SIC Major Group 49) account for approximately 92.5% of total cooling water intake in the United States (U.S. EPA, 2001).

Beyond steam electric generators, facilities in other industry segments use cooling water in their production processes (e.g., to cool equipment, for heat quenching, etc.). As described in the EA for the Phase III Proposed Regulation, EPA used information from the *1982 Census of Manufactures* to identify four major manufacturing sectors showing substantial cooling water use: (1) Paper and Allied Products (SIC Major Group 26); (2) Chemicals and Allied Products (SIC Major Group 28); (3) Petroleum and Coal Products (SIC Major Group 29); (4) Primary Metals Industries (SIC Major Group 33). For its analyses in support of the proposed rule, EPA later divided the Primary Metal Industries (SIC 33) into a Steel sector (SIC 331) and an Aluminum sector (SIC 333/335), based on the business and other operational differences in these two major industries. EPA referred to these five industries – Paper, Chemicals, Petroleum, Aluminum, and Steel – as the "Primary Manufacturing Industries" in the documentation for the proposed regulation. As shown in Table A1-2, following page, together with electric power producers, these industries account for approximately 99% of the total cooling water intake in the United States. EPA focused its initial data gathering and regulation development analyses for the manufacturers segment of the 316(b) Phase III regulation on these industries.

A key data source for EPA's analysis for the 316(b) Phase III regulation is the detailed questionnaire issued to a sample of facilities potentially subject to regulation under Phase III. Based on responses to a screener survey, EPA targeted the detailed questionnaire to facilities believed to be in the electric power industry and the Primary Manufacturing Industries. As discussed in the EA for the proposed Phase III regulation and further elaborated on in the November 2005 Notice of Data Availability (NODA), EPA received survey questionnaires from facilities with business operations in industries other than the Primary Manufacturing Industries. EPA originally believed these facilities to be non-utility electric power generators; however, inspection of their responses indicated that the facilities were better understood as cooling water-dependent facilities whose principal operations lie in businesses other than the electric power industry or the Primary Manufacturing Industries listed above. These surveys

[1] The EA for the proposed regulation includes a detailed profile for Electric Power Producers. For the reasons just stated, this profile was not updated for the EA for the final Phase III regulation.

included 12 questionnaires from facilities in the Food and Kindred Products industry and 10 additional questionnaires from facilities in a range of other manufacturing and non-manufacturing industries. In the EA for the proposed Phase III regulation, EPA referred to these additional industries as the "Other Industries" and the facilities as the "Other Industries facilities."

Because the questionnaire responses for these Other Industries facilities were not received through the structured sample framework, EPA did not apply sample weights to these facilities in the analyses for the proposed regulation, and treated them as "additional known facility" observations with a sample weight of one. Although EPA's analyses for these Other Industries facilities were less precise than the analyses undertaken for the Primary Manufacturing Industries, EPA concluded that its analysis for the Other Industries group provided a sufficient basis for regulation development. In particular, EPA's review of the engineering characteristics of cooling water intake and use in the Other Industries group indicated that cooling water intake and use in these industries do not differ materially from cooling water intake and use in the electric power industry and the Primary Manufacturing Industries. In addition, EPA specifically analyzed the economic impacts of evaluated options on the sample facilities in the Other Industries group. Finally, because the statistically valid survey group of six industries (i.e., for the five Primary Manufacturing Industries and Electric Generators) reflects 99% of total cooling water withdrawals, EPA concluded that few additional facilities in the Other Industries group would be potentially subject to Phase III regulation. Based on these considerations, EPA concluded at Proposal that the Phase III regulation could be extended to all industries and without imposing material economic/financial impact in industries beyond those on which EPA initially focused in developing the Phase III regulation. In the Federal Register notice for the proposed Phase III regulation, EPA sought comment on the analytic treatment and regulatory findings for these facilities.

Following proposal, EPA undertook additional analyses of these facilities, and of the Food and Kindred Products industry, in particular, to confirm its regulatory analytic findings for the Other Industries facilities. These analyses, which are documented in the EA and in the public record for the final regulation, included: (1) comparative analysis of cooling water use and compliance costs between the original set of Primary Manufacturing Industries and the 22 facilities in the Other Industries facilities set; (2) preparation of a detailed industry profile and assessment of business conditions and outlook for the Food and Kindred Products industry; and (3) development of a cooling water usage-based multiplier for extrapolating results from its analysis of the Food and Kindred Products industry questionnaire facilities to the broader population of facilities in the industry. EPA sought comment on these analyses in the NODA.

Based on the findings from these analyses, EPA made the following changes in its analysis for the Manufacturers category of facilities. *First*, EPA now groups the Food and Kindred Products industry within the previously defined Primary Manufacturing Industries set of industries. As previously described, EPA received over half (12) of the 22 Other Industries questionnaires from facilities in this industry and it is also the next largest user of cooling water, after the electric power industry and the original Primary Manufacturing Industries, as reported in the Census of Manufacturers reports of cooling water usage. The Primary Manufacturing Industries thus include the following industries: Paper, Chemicals, Petroleum, Aluminum, Steel, and Food and Kindred Products. *Second*, EPA used the cooling water usage-based multiplier of 3.11, as documented at NODA, for estimating the industry-level costs and impacts of Phase III regulatory compliance for the Food and Kindred Products industry. *Third*, EPA includes a detailed industry profile for the Food and Kindred Products industry in this EA.

Table A1-2, below, documents the estimated cooling water usage in the electric power industry, the redefined Primary Manufacturing Industries (including Food and Kindred Products), and the remaining cooling water-reliant industry sectors ("Other Industries"). Together, the electric power industry and the Primary Manufacturing Industries account for approximately 99.6% of total estimated cooling water usage. This document refers to the Primary Manufacturing Industries and the remaining Other Industries collectively as "Manufacturers."

Table A1-2: Cooling Water Intake by Sector

Sector[a] (SIC Code)	Cooling Water Intake Flow[b]		
	Billion Gal./Yr.	Percent of Total	Cumulative Percent
Steam Electric Utility Power Producers (49)	70,000	90.9%	90.9%
Steam Electric Nonutility Power Producers (49)	1,172	1.5%	92.4%
Chemicals and Allied Products (28)	2,797	3.6%	96.0%
Primary Metals Industries (33)	1,312	1.7%	97.8%
Petroleum and Coal Products (29)	590	0.8%	98.5%
Paper and Allied Products (26)	534	0.7%	99.2%
Food and Kindred Products (20)	272	0.4%	99.6%
Additional 14 Categories[c]	335	0.4%	100.0%

[a] The table is based on reported primary SIC codes.

[b] Data on cooling water use are from the 1982 Census of Manufactures, except for traditional steam electric utilities, which are from the Form EIA-767 database, and the steam electric nonutility power producers, which are from the Form EIA-867 database. 1982 was the last year in which the Census of Manufactures reported cooling water use.

[c] 14 additional major industrial categories (major SIC codes) with effluent guidelines.

Source: U.S. DOC, 1986; U.S. DOE, 1995; U.S. DOE, 1996.

The six Primary Manufacturing facility sectors analyzed for the Phase III rulemaking comprise a substantial portion of all U.S. industries. As shown in Table A1-3, the six sectors combined account for over 64,000 facilities, over 3.6 million employees, more than $1.8 trillion in value of shipments and almost $155 billion in payroll. They also account for over 42% of total U.S. manufacturing value of shipments and 27% of manufacturing employment. As shown in Table A1-4 (see page 9), however, only a subset of facilities in these industry sectors would be subject to regulation under Phase III based on the applicability thresholds under each of the regulatory analysis options.

Table A1-3: Summary Economic Data for Major Industry Sectors Potentially Subject to §316(b) Regulation: Facilities, Employment, Value of Shipments, and Payroll

Sector (SIC)[a]	Number of Facilities[b]	Employment	Value of Shipments (millions, $2004)	Payroll (millions, $2004)
Paper & Allied Products (26)	561	137,044	70,505	8,121
Chemicals & Allied Products (28)	29,005	1,651,237	710,762	75,785
Petroleum & Coal Products (29)	2,262	96,673	312,885	7,017
Steel (331)	1,069	154,364	92,693	8,773
Aluminum (333,335)	590	63,538	31,471	2,943
Food & Kindred Products (20)	30,823	1,571,096	584,908	52,152
All §316(b) Sectors	**64,310**	**3,673,952**	**1,803,224**	**154,791**
Total U.S. Manufacturing (NAICS 31 - 33)	350,828	13,404,292	4,265,784	569,414
§316(b) Manufacturing Sectors as a Percent of Total U.S. Manufacturing	18.3%	27.4%	42.3%	27.2%

[a] Data from 2004 Annual Survey of Manufactures is available by NAICS code. Therefore, the following proxies were used to gather data: Paper & Allied Products (26) = NAICS 3221; Chemicals & Allied Products (28) = NAICS 325 and 326; Petroleum & Coal Products (29) = NAICS 3241; Steel (331) = NAICS 3311 and 3312; Aluminum (333,5) = NAICS 3313; Food & Kindred Products (20) = NAICS 311 and 3121.

[b] Number of facilities is not available in the Annual Survey of Manufactures; data were collected from the 2002 Economic Census.

Source: U.S. DOC, 2005; U.S. DOC, 2002.

A1-1.2.3 Facilities and Cooling Water Usage

EPA's 2000 Section 316(b) Industry Survey collected cooling water information for 656 power producers (hereafter referred to as "Electric Generators"), 211 facilities in Primary Manufacturing Industries, and 13 additional known facilities in Other Industries determined to be potentially subject to regulation under Section 316(b). Industry-wide, these facilities represent 671 power producers, 575 facilities in Primary Manufacturing Industries, and 17 facilities in Other Industries. Details of cooling water usage and other information on these facilities follows:

- The 671 Electric Generators withdraw 79,000 billion gallons of cooling water per year. Of the 671 power producers, 554 were covered under the final Phase II rule. These 554 facilities accounted for 90.9% of total cooling water flow for Phase II and potential Phase III Electric Generators and Manufacturers (see Table A1-4). The remaining 117 facilities were considered for potential regulation in Phase III. Based on the survey, the 117 potential Phase III facilities account for approximately 392 billion gallons of cooling water per year, or 0.5% of the estimated total flow for Phase II and potential Phase III Electric Generators and Manufacturers.
- The 575 facilities in Primary Manufacturing Industries potentially subject to the final regulation withdraw 7,600 billion gallons of cooling water per year. The 17 additional known facilities in Other Industries withdraw 200 billion gallons of cooling water per year. Overall, the Manufacturing facilities potentially subject to Phase III regulation account for approximately 9.0% of total flow for Phase II and potential Phase III Electric Generators and Manufacturers.

Table A1-4 presents summary information about the number of facilities and water intake for existing facilities by sector and analysis option.

Table A1-4: Estimated Cooling Water Intake by Sector and Analysis Option (Sample Weighted) - EPA Survey

Sector	Total		Subject to Phase II Rule		Potentially Subject to Phase III Rule		Estimated Subject to Phase III Final Rule Under the Regulatory analysis options for Existing Facilities: 50 MDG All		200 MGD All		100 MDG CWB	
	Est. No. of Facilities	Annual Intake Flow (BGY)	Est. No. of Facilities	Annual Intake Flow (BGY)	Est. No. of Facilities	Annual Intake Flow (BGY)	Est. No. of Facilities	Annual Intake Flow (BGY)	Est. No. of Facilities	Annual Intake Flow (BGY)	Est. No. of Facilities	Annual Intake Flow (BGY)
Steam Electric Power Producers	671	79,100	554	78,700	117	400	-	-	-	-	-	-
Primary Manufacturing Industries	575	7,600			575	7,600	155	6,100	31	3,900	73	4,900
Chemicals and Allied Products	*185*	*2,400*			*185*	*2,400*	*57*	2,000	7	1,100	28	1,600
Steel	*68*	*1,700*			*68*	*1,700*	*26*	1,600	13	1,200	19	1,400
Aluminum	*20*	*200*			*20*	*200*	*4*	100	1	100	1	100
Petroleum and Coal Products	*39*	*500*			*39*	*500*	*17*	500	4	300	8	300
Paper and Allied Products	*225*	*2,400*			*225*	*2,400*	*42*	1,700	3	1,000	11	1,200
Food and Kindred Products	*37*	*400*			*37*	*400*	*9*	300	3	100	6	200
Additional Known Facilities in Other Industries	17	200			17	200	7	200	2	100	4	100
Total Surveyed	***1,263***	***86,900***	***554***	***78,700***	***592***	***7,800***	***161***	6,200	33	3,900	77	5,000

BGY = Billion Gallons per Year.

[a] Totals may not sum due to independent rounding.

Source: U.S. EPA Analysis, 2006.

Two of the primary parameters considered by EPA in developing the Phase III regulation are the design intake flow (DIF) of the facilities and the type of waterbody from which a facility withdraws cooling water. As previously described, EPA presented three options at Proposal based on 50 MGD, 100 MGD, and 200 MGD applicability thresholds. The two main types of waterbody are (1) "sensitive waterbodies," which are generally considered of higher biological productivity and more sensitive to adverse environmental impact (including estuaries/tidal rivers, and oceans and Great Lakes); and (2) "inland waterbodies" (including freshwater rivers/streams and lakes/reservoirs). Of the three regulatory options presented at Proposal, EPA further differentiated the 100 MGD or greater facilities based on waterbody type.

Table A1-5 shows, by waterbody type and industry segment, the number of Manufacturers facilities potentially subject to national requirements under the three DIF applicability thresholds presented at Proposal, and the total of facilities *potentially* subject to a Phase III regulation – that is, with DIF of at least 2 MGD. EPA estimates that as many as 592 existing facilities in the Manufacturers segment (including 575 facilities in the Primary Manufacturing Industries and 17 known facilities in Other Industries), were potentially subject to regulation under Phase III, based on a 2 MGD DIF applicability threshold. EPA estimates that 161 of these facilities would be subject to regulation under the 50 MGD option. Of these 161 facilities, 49 are located on Sensitive Waterbodies and 112 are located on Inland Waterbodies. For the 100 MGD or greater facilities, 27 are located on Sensitive waterbodies. Under the 100 MGD option, only the 27 facilities on Sensitive Waterbodies would be subject to regulation. Lastly, under the 200 MGD option, EPA estimates that 33 facilities would be subject to regulation, of which, 16 are located on Sensitive Waterbodies and 17 are located on Inland Waterbodies.

Table A1-5: Existing Manufacturers Facilities by Applicability Threshold and Waterbody Type

Industry Segment	Subject to National Requirements with DIF Applicability Threshold of Greater than or Equal to			
	2 MGD	**50 MGD**	**100 MGD**	**200 MGD**
All Waterbodies				
Primary Manufacturing Industries	*575*	*155*	*73*	*31*
Other Industries	*17*	*7*	*4*	*2*
Total	**592**	**161**	**77**	**33**
Sensitive Waterbodies (Coastal Waterbodies and Great Lakes)				
Primary Manufacturing Industries	*92*	*45*	*24*	*14*
Other Industries	*5*	*4*	*3*	*2*
Total	**97**	**49**	**27**	**16**
Inland Waterbodies				
Primary Manufacturing Industries	*482*	*109*	*49*	*17*
Other Industries	*12*	*3*	*1*	*0*
Total	**494**	**112**	**50**	**17**

Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

A1-2 SUMMARY OF THE FINAL RULE

A1-2.1 New Offshore Oil and Gas Extraction Facilities

The Phase III final regulation applies to new offshore oil and gas extraction facilities. Under the final rule, EPA is promulgating the regulatory requirements presented at proposal: new offshore oil and gas extraction facilities that withdraw 2 MGD or more and meet other applicability criteria are subject to requirements similar to those applicable to other new facilities in the Phase I (new facility) 316(b) regulation. These requirements address intake flow velocity, proportional flow restrictions, specific impact concerns (e.g., threatened or endangered species; critical habitat; or migratory, sport, or commercial species), and information submission, monitoring, and recordkeeping. As described at proposal, available information indicates that it is not feasible for offshore oil and gas extraction facilities to employ closed-cycle recirculating cooling systems to reduce cooling water flow levels because such facilities have neither the physical space nor the technical capacity to install technologies such as cooling towers or other closed-cycle systems. Thus, the final regulation does not require new offshore oil and gas extraction facilities to reduce intake flow to a level commensurate with a closed-cycle recirculating cooling system or to use close-cycle recirculating cooling as a baseline for performance standards.

A1-2.2 Existing Facilities

EPA has chosen not to promulgate any of the regulatory options considered for the Phase III regulation for existing facilities. Instead, EPA has decided that Phase III existing facilities should continue to have section 316(b) limits established on a case-by-case, best professional judgment basis.

A1-3 SUMMARY OF ECONOMIC ANALYSIS RESULTS

This section presents a brief summary of the main results of EPA's economic analyses for the final rule. This summary includes results for the regulation of new oil and gas extraction facilities, and the results of the analysis of the regulatory analysis options for existing facilities. More detail on each analysis, including methodology and results, is provided in later chapters of this EA.

a. Number of Facilities Subject to National Categorical Requirements

❖ ***New Facilities***

For today's final rule, EPA is promulgating a 2 MGD flow threshold for new offshore oil and gas extraction facilities, the same flow threshold applicable to other new facilities under Phase I. EPA's analysis of new offshore oil and gas extraction facilities includes oil and gas production platforms/structures and mobile offshore drilling units (MODUs). EPA estimated the number and characteristics of new offshore oil and gas extraction facilities based on data on existing offshore oil and gas extraction facilities collected through EPA's 316(b) survey of offshore oil and gas extraction facilities and from other sources of publicly available information, such as the Minerals Management Service.

EPA estimates that 21 new offshore oil and gas extraction platforms and 103 new MODUs would be subject to the national requirements of the final rule, assuming a 20-year period of construction from 2007 (the assumed effective date of the rule) to 2026.

❖ ***Existing Facilities***

EPA evaluated three regulatory options for existing facilities: 50 MGD or greater for All Waterbodies, 200 MGD for All Waterbodies, and 100 MGD for Certain Waterbodies. These three options had the same national categorical requirements, but they differed with respect to the number of existing facilities that would be subject to these requirements. Specifically, the number of regulated facilities differs as a result of (1) the design intake flow (DIF) applicability thresholds of the regulatory analysis options; and (2) the type of waterbodies to which the options would apply.

Table A1-6 on the following page presents, by industry segment and regulatory analysis option, (1) the number of existing facilities potentially subject to regulation under Phase III, (2) the estimated number of baseline closures, (3) the number of existing manufacturing facilities estimated to be subject to national categorical requirements under the three regulatory analysis options, and (4) the number of facilities estimated to install a technology to comply with each analysis option. Facilities that are not baseline closures and would not be subject to the requirements under the regulatory analysis options would be ("Potentially Subject to Regulation" minus "Baseline Closure" minus "Subject to National Requirements – Total") subject to permitting on a case-by-case, best professional judgment basis.

As shown in Table A1-6, EPA estimates that as many as 592 Manufacturers facilities (including 575 facilities in the Primary Manufacturing Industries and 17 Other Industries facilities) were potentially subject to the Phase III final regulation for existing facilities, based on the 2 MGD DIF cutoff. Of these, EPA estimates that 77 Manufacturers would be baseline closures – i.e., they would be in severe financial distress independent of regulation. As a result, EPA estimates that 515 Manufacturers financially viable facilities were potentially within the scope of a Phase III final regulation.

Under the 50 MGD applicability threshold, EPA estimates that 146 existing Manufacturers facilities would be subject to regulation under this option.[2] Of these, 111 are estimated to install a technology to comply with the potential regulation requirements. The 100 MGD and 200 MGD options would apply to smaller sets of facilities. The 200 MGD All option would apply to 31 facilities in the Manufacturers segment, with 27 facilities estimated to install a technology. The 100 MGD CWB option would apply to the smallest number of manufacturing facilities (23), with 22 of these facilities estimated to install a technology.

Table A1-6: Phase III Existing Facility Counts, by Industry Segment and Option

Industry	Potentially Subject to Regulation	Baseline Closure	Subject to National Requirements, Excluding Baseline Closures					
			50 MGD All Option		200 MGD All Option		100 MGD CWB Option	
			Total	w/ Technology	Total	w/ Technology	Total	w/ Technology
Primary Manufacturing Industries	575	75	140	105	30	26	21	20
Other Industries	17	2	6	6	1	1	2	2
Total[a]	***592***	***77***	***146***	***111***	***31***	***27***	***23***	***22***

[a] Individual numbers may not sum to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

b. Economic Impacts

❖ *New Facilities*

EPA conducted several types of economic impact analysis for the new offshore oil and gas extraction industry segment. These analyses include three analyses for platforms/structures (facility-level production value and closure analysis, facility-level barrier-to-entry analysis, and firm-level cost-to-revenue analysis) and three analyses for MODUs (facility-level closure analysis, facility-level barrier-to-entry analysis, and firm-level cost-to-revenue analysis). These analyses found no economic impact on any new offshore oil and gas extraction facility that would be subject to regulation under the final Phase III rule or any firm projected to build a new offshore oil and gas extraction facility that would be subject to regulation under Phase III.

For a detailed discussion of EPA's economic impact analyses for new facilities, see *Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry*.

[2] This number of existing facilities (146 facilities) estimated to be subject to the Phase III final regulation differs from the value (161 facilities) reported in Table A1-4 and Table A1-5 because it excludes baseline closures.

❖ ***Existing Facilities***

EPA identified a facility as a regulatory closure if it would have operated under baseline conditions but would fall below an acceptable financial performance level under the proposed regulatory requirements. EPA's analysis of regulatory closures is based on the estimated change in facility after-tax cash flow (cash flow) as a result of the regulation and specifically examines whether the change in cash flow would be sufficient to cause the facility's going concern business value to become negative. EPA calculated the going concern value of each facility using a discounted cash flow framework in which cash flow is discounted at an estimated cost of capital. The definition of cash flow used in these analyses is after-tax free cash flow available to all capital – equity and debt. Correspondingly, the cost of capital reflects the combined cost, after-tax, of equity and debt capital. For its analysis of economic/financial impacts, EPA used 7% as a real, after-tax cost of capital.

EPA also identified facilities that would likely incur moderate financial impacts, but that would not be expected to close, under each of the regulatory analysis options. EPA established thresholds for two measures of financial performance and condition – interest coverage ratio and pre-tax return on assets – and compared the facilities' performance before and after compliance under each option with these thresholds. EPA attributed incremental moderate impacts to the options if both financial ratios exceeded threshold values in the baseline (i.e., there were no moderate impacts in the baseline), but at least one financial ratio fell below the threshold value in the post-compliance case.

EPA estimated that none of the facilities estimated to be subject to regulation under each option would close or incur employment losses as a result of implementation of the three options. EPA also found that none of these facilities would incur a moderate economic impact as a result of the regulatory analysis options.

EPA also assessed whether firms owning regulated facilities might incur a material adverse impact, based in particular on the possibility of owning more than one regulated facility. This analysis, which relied on a firm-level cost-to-revenue test, found that no firms owning Manufacturing facilities would be materially affected under the options considered for existing facilities.

For a detailed discussion of EPA's economic impact analyses for existing facilities, see *Chapter C3: Economic Impact Analysis for Manufacturers*.

c. Regulatory Flexibility Analysis

❖ ***New Facilities***

The Regulatory Flexibility Act (RFA) requires EPA to consider the economic impact that the final rule would have on small entities. In the new offshore oil and gas extraction industry segment, EPA estimates that one small entity, a new offshore oil and gas extraction platform, would be subject to the national requirements of the final rule. EPA estimates that this entity would incur annualized, after-tax compliance costs of less than 0.1% of annual revenue. Table A1-7 outlines the total number of small entities in the new offshore oil and gas extraction industry segment, the number of small entities potentially subject to final regulation under Phase III, and the estimated cost-to-revenue ratio that small entities would incur in complying with the final regulation. For a detailed discussion of these analyses, see *Chapter D1: Regulatory Flexibility Analysis*.

Table A1-7: Summary of Small Entity Impact Ratio Ranges For New OOGE Facilities

Industry	Total Number of Small Entities	Number of Small Entities Owning Facilities Potentially Subject to Regulation	Percentage of Small Entities Subject to Regulation	Compliance Cost/Annual Revenues		
				0-1%	1-3%	>3%
New OOGE Facilities	24	1	4.2%	1	-	-

Source: U.S. EPA Analysis, 2006.

❖ ***Existing Facilities***

EPA estimates that no existing small entities in the Manufacturers industry segments would be subject to national categorical requirements under each analysis option.

d. UMRA Analysis

❖ ***New Facilities***

Under section 202 of the Unfunded Mandates Reform Act (UMRA), EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that might result in expenditures by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year. EPA's UMRA analysis for the final rule found the following:

- ***Final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for the Final Regulation to be $1.9 million ($2004). All of these direct facility costs are incurred by the private sector (including 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is subject to the national requirements under the final rule. Additionally, State and local permitting authorities will not incur costs to administer the rule for new offshore oil and gas extraction facilities because these facilities are not under State jurisdiction. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $1.5 million in 2013.

❖ ***Existing Facilities***

EPA also conducted the UMRA analysis for the three options for existing facilities. The results of these analyses combined with the actual costs of the final rule are presented below:

- ***50 MGD for All Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for this option to be $32.8 million ($2004). All of these direct facility costs are incurred by the private sector (including 146 manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is subject to the national requirements under the final rule. Additionally, State and local permitting authorities are estimated to incur $0.6 million annually to administer the rule under this option, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $132.1 million in 2011.
- ***200 MGD for All Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for this option to be $17.9 million ($2004). All of these direct facility costs are incurred by the private sector (including 31 manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by

State and local governments is subject to the national requirements under this evaluated option. Additionally, State and local permitting authorities are estimated to incur $0.2 million annually to administer this option, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $78 million in 2010.

- ***100 MGD for Certain Waterbodies option for existing facilities and final rule for new offshore oil and gas extraction facilities:*** EPA estimates the total annualized after-tax costs of compliance for this option to be $13.0 million ($2004). All of these direct facility costs are incurred by the private sector (including 23 manufacturing facilities and 124 new offshore oil and gas extraction facilities). No facility owned by State and local governments is subject to the national requirements under this evaluated option. Additionally, State and local permitting authorities are estimated to incur $0.2 million annually to administer this option, including labor costs to write permits and to conduct compliance monitoring and enforcement activities. EPA estimates that the highest undiscounted after-tax cost incurred by the private sector in any one year is approximately $79 million in 2011.

Table A1-8 summarizes the total annualized cost and maximum one-year cost, by facility and government costs, for the final rule and regulatory analysis options. For a detailed discussion of these analyses, see *Chapter D2: UMRA Analysis*.

Table A1-8: Summary of UMRA Costs (millions, $2004)

Sector	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs	Government Implementation Costs	Total	Facility Compliance Costs	Government Implementation Costs	Total
Final Rule for New Facilities						
Government Sector (excl. Federal)	n/a	n/a	n/a	n/a	n/a	n/a
Private Sector	$1.9	n/a	$1.9	$1.5	n/a	$1.5
50 MGD All Option for Existing Facilities / Final Rule for New Facilities						
Government Sector (excl. Federal)	$0.0	$0.6	$0.6	$0.0	$2.3	$2.3
Private Sector	$32.8	n/a	$32.8	$132.1	n/a	$132.1
200 MGD All Option for Existing Facilities / Final Rule for New Facilities						
Government Sector (excl. Federal)	$0.0	$0.2	$0.2	$0.0	$0.8	$0.8
Private Sector	$17.9	n/a	$17.9	$77.9	n/a	$77.9
100 MGD CWB for Existing Facilities / Final Rule for New Facilities						
Government Sector (excl. Federal)	$0.0	$0.2	$0.2	$0.0	$1.1	$1.1
Private Sector	$13.0	n/a	$13.0	$79.5	n/a	$79.5

Source: U.S. EPA Analysis, 2006.

e. Energy Effects

Executive Order 13211, ("Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001)) requires EPA to prepare a Statement of Energy Effects when undertaking regulatory actions identified as "significant energy actions." This rule is not a "significant energy action" as defined in Executive Order 13211 because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

EPA analyzed the potential for energy effects of the final rule for new offshore oil and gas extraction facilities as well as the potential effects of the options considered for existing facilities and found that it would not lead to adverse outcomes. From these analyses, EPA concludes that this rule would have minimal energy effects at a national and regional level. As a result, EPA did not prepare a Statement of Energy Effects. For more detail on the potential energy effects of the final regulation, see *Chapter D3: Other Administrative Requirements, Section D3-7*.

f. Social Costs

❖ *New Facilities*

EPA calculated the social cost for regulated new offshore oil and gas extraction facilities also using 3% and 7% discount rates. EPA estimated total annualized social costs of $3.8 million at a 3% rate and $3.2 million at a 7% rate. The largest component of social cost is the pre-tax cost of regulatory compliance incurred by complying facilities; these costs include pilot study costs, one-time technology costs of complying with the rule, one-time costs of installation downtime, annual operating and maintenance costs, and permitting costs (initial permit costs, annual monitoring costs, and permit reissuance costs). Social cost also includes implementation costs incurred by the Federal government. States are not involved in administering the permits for new offshore oil and gas extraction facilities since the offshore oil and gas industry is permitted under General Permits at the Regional EPA level (which is part of the Federal government).

Table A1-9 presents the total social cost for new facilities under the final regulation by type of cost, using 3% and 7% discount rates.

Table A1-9: Social Cost for New Facilities (annualized, millions, $2004)

	3% Discount Rate	7% Discount Rate
Direct Compliance Cost:		
MODUs	$1.9	$1.7
Platforms/Structures	$1.5	$1.2
Total Direct Compliance Cost[a]	$3.4	$2.8
Federal Administrative Cost	$0.4	$0.3
Total Social Cost for New Facilities[a]	$3.8	$3.2

[a] Individual numbers may not sum to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

❖ *Existing Facilities*

EPA also calculated the social cost of the regulatory analysis options for existing manufacturers using two discount rate values: 3% and 7%. At a 3% rate, EPA estimated total annualized social costs of $38.2 million for the 50 MGD All option, $19.5 million for the 200 MGD All option, and $14.6 million for the 100 MGD CWB option (all dollar values in $2004). At a 7% rate, these values are $39.0 million, $20.2 million, and $14.1 million, respectively. The largest component of social cost is the pre-tax cost of regulatory compliance incurred by complying facilities; these costs include pilot study costs, one-time technology costs of complying with the rule, one-time costs of installation downtime, annual operating and maintenance costs, and permitting costs (initial permit costs, annual monitoring costs, and permit reissuance costs). Social cost also includes implementation costs incurred by Federal and State governments. As described above, EPA's social cost estimates exclude the cost of facilities estimated to be baseline closures.

Table A1-10 presents the total social cost for existing facilities under the regulatory analysis options by type of cost, using 3% and 7% discount rates. As shown in the table, direct compliance cost in the manufacturers segment accounts for the substantial majority of total social cost for existing facilities for each of the regulatory analysis options. EPA's estimate of Federal and State government costs for administering each option is comparatively minor in relation to the estimated direct cost of regulatory compliance.

Table A1-10: Social Cost for Existing Facilities (annualized, millions, $2004)

	50 MGD All Option		**200 MGD All Option**		**100 MGD CWB Option**	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
Direct Compliance Cost:						
Manufacturers[a]	$37.6	$38.3	$19.3	$20.0	$14.4	$13.9
Primary Manufacturing Industries	$36.3	$37.1	$18.8	$19.5	$13.7	$13.3
Other Industries	$1.3	$1.2	$0.5	$0.4	$0.7	$0.7
Total Direct Compliance Cost[a]	$37.6	$38.3	$19.3	$19.9	$14.4	$13.9
State and Federal Administrative Cost	$0.6	$0.6	$0.2	$0.2	$0.2	$0.2
Total Social Cost for Existing Facilities[a]	$38.2	$39.0	$19.5	$20.2	$14.6	$14.1

[a] Individual numbers may not sum to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

❖ *New and Existing Facilities*

Although EPA is promulgating final Phase III regulations only for new offshore oil and gas extraction facilities, EPA also considered the total social cost of including each regulatory analysis option for existing facilities in the final rule. Under the 50 MGD All option for existing facilities and the final regulation for new offshore oil and gas extraction facilities, total annualized social costs are $42.2 million and $42.3 million, using 3% and 7% discount rates, respectively. Under the 200 MGD All option for existing facilities and final rule for new offshore oil and gas extraction facilities, total annualized social costs are $23.4 million under both the 3% and 7% discount rates. Under the 100 MGD CWB option for existing facilities and the final rule for new offshore oil and gas extraction facilities, total annualized social costs are $18.5 million under the 3% discount rate, and $17.4 million under the 7% discount rate.

Table A1-11 summarizes the total social costs for new and existing facilities under the final rule and each regulatory analysis option. For details of EPA's social cost analyses, see *Chapter E1: Summary of Social Costs*.

Table A1-11: Total Social Cost for New and Existing Facilities (annualized, millions, $2004)

	2 MGD *New*/ 50 MGD All *Existing*		2 MGD *New*/ 200 MGD All *Existing*		2 MGD *New*/ 100 MGD CWB *Existing*	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
Direct Compliance Cost:						
Existing Facilities	$37.6	$38.3	$19.3	$20.0	$14.4	$13.9
New Facilities	$3.5	$2.9	$3.5	$2.9	$3.5	$2.9
Total Direct Compliance Cost[a]	$41.1	$41.2	$22.8	$22.9	$17.9	$16.8
State and Federal Administrative Cost:						
Existing Facilities	$0.6	$0.6	$0.2	$0.2	$0.2	$0.2
New Facilities	$0.4	$0.3	$0.4	$0.3	$0.4	$0.3
Total State and Federal Administrative Cost[a]	$1.1	$1.0	$0.6	$0.5	$0.6	$0.5
Total Social Cost[a]	$42.2	$42.3	$23.4	$23.4	$18.5	$17.4

[a] Individual numbers may not sum to totals due to independent rounding.

Source: U.S. EPA Analysis, 2006.

g. Benefit-Cost Analysis

❖ *Existing Facilities*

The benefit-cost analysis compares total annualized use benefits to total annualized pre-tax costs (social costs) for facilities that remain open in the baseline. Benefits and costs were discounted using both a 3% and 7% discount rate. The cost estimates include costs of compliance to facilities subject to regulation under the regulatory analysis options considered for the Phase III rule for existing facilties, as well as administrative costs incurred by State and local governments and by the Federal government. The benefits estimates include monetized benefits to commercial and recreational fishing. Total monetizable benefits include only use benefits because non-use benefits were evaluated qualitatively.

Table A1-12 summarizes the number of facilities potentially subject to regulation under the regulatory analysis options, the number of facilities estimated to install I&E technologies, total annualized benefits, total annualized costs, and net benefits. Because EPA was unable to estimate benefits for the new offshore oil and gas extraction industry segment[3], the benefit-cost analysis only includes existing facilities. As reported in Table A1-12, estimated costs exceed estimated use benefits under all three options for existing facilities. Under the 50 MGD All option, 146 facilities are estimated to be subject to the national categorical requirements. Of those facilities, 111 are estimated to install technologies to reduce impingement and entrainment. Using a 3% discount rate, total costs would exceed total use benefits by $36.0 million; using a 7% discount rate, total costs would exceed total use benefits by $37.2 million. Under the 200 MGD All option, 31 facilities would be subject to the national categorical requirements, with 27 facilities estimated to require new technologies. This option yields total social costs in excess of total benefits of $18.0 million and $19.0 million, discounted at 3% and 7%, respectively. Under the 100 MGD CWB option, 23 facilities would be subject to the national categorical requirements, and 22 are estimated to install technologies. Total social costs would exceed total use benefits by $12.7 million using a 3% discount rate, and $12.6 million using a 7% discount rate. For further discussion of the benefit-cost analysis, see *Chapter E3: Comparison of Benefits and Social Costs.*

[3] EPA was unable to do so because this would require an estimation of where these new facilities would be built, since these are new facilities, such estimation was not feasible.

Table A1-12: Summary of Benefits and Social Costs for Existing Facilities (millions, $2004)

Option	Number of Facilities Subject to Option	Number of Facilities Installing Technology	Annualized Use Value of I&E Reductions (Mean)[a]	Total Annualized Costs	Cost-Benefit Ratio
3% Discount Rate					
50 MGD All option	146	111	$2.3	$38.2	17.0
200 MGD All Option	31	27	$1.5	$19.5	13.0
100 MGD CWB Option	23	22	$1.9	$14.6	7.8
7% Discount Rate					
50 MGD All option	146	111	$1.8	$39.0	21.7
200 MGD All Option	31	27	$1.2	$20.2	16.9
100 MGD CWB Option	23	22	$1.5	$14.1	9.5

[a] The total monetizable value of I&E reductions includes use benefits only. EPA evaluated non-use benefits only qualitatively.

[b] Cost-benefit ratios are calculated by dividing total annualized costs by total annual use benefits. The ratios presented here are based on the comparison of a substantially complete measure of social costs with an incomplete measure of benefits.

Source: U.S. EPA Analysis, 2006.

A1-4 ORGANIZATION OF THE EA REPORT

The EA assesses the costs, economic impacts, and benefit-cost relationships of the final regulation and the other regulatory options evaluated in its development. The EA consists of five parts, organized as follows:

Part A: Background Information

Chapter A1: Introduction provides a brief discussion of the regulated industry sectors and facilities, summarizes the final rule and other evaluated options, and presents a summary of economic analysis results.

Chapter A2: Need for the Regulation discusses the environmental impacts from operating CWIS and explains the need for this regulatory effort.

Part B: Economic Analysis for Phase III New Offshore Oil and Gas Extraction Facilities

Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities summarizes the cost categories included in the economic analyses for Phase III new facilities and describes certain elements of the analytic framework of the economic analyses of new offshore oil and gas extraction facilities.

Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry presents a profile of existing offshore oil and gas production platforms and mobile offshore drilling units (MODUs) and characterizes new facilities subject to the final Phase III requirements. The profile summarizes the existing facilities, their associated firms, and the financial conditions of those firms. The profile also projects the number and type of new facilities estimated to begin operation over a twenty-year period.

Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry presents an overview of the methodology used to estimate the economic impacts potentially incurred by new offshore oil and gas extraction facilities under the final Phase III regulation and provides the impact analysis results. The chapter assesses the potential impacts on MODUs, platforms, and firms, including a cost-to-revenue analysis at the facility and firm levels. The chapter also presents a barrier-to-entry analysis for new facilities.

Part C: Economic Analysis for Phase III Existing Facilities

Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities summarizes the cost categories included in the economic analyses for Phase III existing facilities and describes certain elements of the analytic framework that are common to the economic analyses of Manufacturers and Electric Generators.

Chapter C2: Profile of Manufacturers presents profiles of the markets in which affected manufacturing facilities operate (SIC codes 26, 28, 29, 331, 333/335, and 20). Each manufacturing industry profile presents an outline of domestic production, discusses market structure and competitiveness, summarizes industry-wide financial performance and condition, and characterizes facilities potentially subject to regulation under Phase III.

Chapter C3: Economic Impact Analysis for Manufacturers presents an overview of the methodology used to estimate the economic impacts incurred by Phase III manufacturing facilities under the three options and provides the impact analysis results. The chapter describes the analytic framework used to assess severe and moderate facility-level impacts associated with the regulatory analysis options. The chapter also includes a discussion of firm- and market-level impacts.

Part D: Additional Economic Analyses for New and Existing Facilities

Chapter D1: Regulatory Flexibility Analysis presents EPA's estimates of small entity impacts from this final rule and other evaluated options.

Chapter D2: UMRA Analysis outlines the requirements for analysis under the Unfunded Mandates Reform Act and presents the results of the analysis for this final regulation and other evaluated options.

Chapter D3: Other Administrative Requirements presents additional analyses conducted in developing this final rule and other evaluated options. These analyses address the requirements of Executive Orders and Acts applicable to this proposal.

Part E: Social Costs, Benefits, and Benefit-Cost Analysis for New and Existing Facilities

Chapter E1: Summary of Social Costs presents the social costs of the final rule and other evaluated options, including time profiles of direct facility costs and administrative costs.

Chapter E2: Summary of Benefits provides an overview of the regional studies used to support the benefits assessment and a summary of the analyses. The chapter also presents the results of each regional study for the regulatory analysis options considered for Phase III existing facilities. Finally, the chapter outlines the methodology used to extrapolate regional study results to develop national estimates of baseline losses from impingement and entrainment at in-scope facilities and presents monetized benefits.

Chapter E3: Comparison of Benefits and Social Costs compares total benefits to total social costs at the national and regional levels for the regulatory analysis options considered for Phase III existing facilities. This chapter includes a discussion of net benefits, an incremental analysis of net benefits, cost/benefit ratio, and a break-even analysis. Lets

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Chapter A2: Considerations in Assessing the Need for Phase III Regulation

INTRODUCTION

Many cooling water intake structures (CWIS) have been constructed on sensitive aquatic systems with capacities and designs that have potential to cause damage to the waterbodies from which they withdraw water. In fact, of the 709 existing facilities that were considered potentially within the scope of the 316(b) Phase III regulation, only 67 indicated on EPA's 2000 Section 316(b) Industry Survey that they have ever performed an impingement and entrainment (I&E) study (U.S. EPA, 2000).[1] In addition, EPA and the Bureau of Land Management's Minerals Management Service (MMS) could only identify one case where the potential environmental impacts of the CWIS of a new oil and gas extraction facility were considered (U.S. DOI, 2001). In a subsequent literature review, MMS did not find any information related to potential environmental impacts or I&E controls for any existing oil and gas extraction facilities (U.S. DOI, 2004).

This chapter presents information that documents how EPA addressed the question of the need for regulation.

CHAPTER CONTENTS

A2-1 DESCRIPTION OF ENVIRONMENTAL IMPACTS FROM CWIS

The withdrawal of cooling water by Phase III existing facilities removes tens of billions of aquatic organisms from waters of the United States each year, including plankton (small aquatic animals, including fish eggs and larvae), fish, crustaceans, shellfish, sea turtles, marine mammals, and many other forms of aquatic life. Most impacts are to early life stages of fish and shellfish. Aquatic organisms drawn into CWIS are either impinged on components of the intake structure or entrained in the cooling water system (CWS) itself.

Rates of I&E depend on species characteristics, the environmental setting in which a facility is located, and the location, design, and capacity of the facility's CWIS.

In addition to direct losses of aquatic organisms from I&E, a number of indirect, ecosystem-level effects may also occur, including (1) disruption of aquatic food webs resulting from the loss of impinged and entrained organisms that provide food for other species, (2) disruption of nutrient cycling and other biochemical processes, (3) alteration of species composition and overall levels of biodiversity, and (4) degradation of the overall aquatic environment. In addition to the impacts of a single CWIS on currents and other local habitat features, environmental degradation can result from the cumulative impact of multiple intake structures operating in the same watershed or intakes located within an area where intake effects interact with other environmental stressors.

[1] This number is sample-weighted and includes manufacturing facilities and electric generators only. Facilities estimated to be baseline closures are excluded from this count and all analyses presented in this chapter. See Chapter C3 for additional information on EPA's baseline closure analyses.

A2-2 LEVELS OF PROTECTION AT PHASE III FACILITIES

Facilities subject to the Phase III final regulation use a wide variety of cooling water intake technologies to maximize cooling system efficiency, minimize damage to their operating systems, and to reduce environmental impacts. The following subsections present data on technologies that have been identified as effective in protecting aquatic organisms from I&E. The first subsection presents information for the Phase III new facilities; the second subsection presents information for Phase III existing facilities.

A2-2.1 Phase III New Facilities

In general, oil and gas extraction facilities have not considered the potential environmental impacts of their CWISs. EPA and the Bureau of Land Management's Minerals Management Service (MMS) could only identify one case where the environmental impacts of a fixed offshore oil and gas extraction facility's CWIS were considered (U.S. DOE, 2001). Although plans for the Liberty Island Project in Beaufort Sea, Alaska, were put on hold in January 2002 (FR, 2002), BP Exploration (Alaska) Inc. (BPXA) had plans to locate a vertical intake pipe for a seawater-treatment plant on the south side of Liberty Island, Beaufort Sea, Alaska. The project would have had the following specifications:

- a vertical pipe with an opening of 8 feet by 5.67 feet, located approximately 7.5 feet below the mean low-water level;
- a continuous flush system discharge that pumps the seawater through the process-water system to prevent ice formation and blockage;
- recirculation pipes located just inside the opening to help keep large fish, other animals, and debris out of the intake;
- two vertically parallel screens (6 inches apart), located in the intake pipe above the intake opening, with a mesh size of 1 inch by 1/4 inch;
- maximum water velocity of 0.29 feet per second at the first screen and 0.33 feet per second at the second screen (maximum velocities only during a few hours each week while testing the fire-control water system – at other times, considerably lower velocities); and
- periodical removal, cleaning, and replacement of the screens.

MMS stated in the Liberty Draft Environmental Impact Statement (which was prepared prior to BP's decision to hold development plans) that the proposed seawater-intake structure would likely harm or kill some young-of-the-year arctic cisco during the summer migration period and some eggs and fry of other species in the immediate vicinity of the intake. However, MMS estimated that less than 1% of the arctic cisco in the Liberty area would likely be harmed or killed by the intake structure. Further, MMS concluded that the intake structure (1) would not have a measurable effect on young-of-the-year arctic cisco in the migration corridor and (2) would not have a measurable effect on other fish populations because of the wide distribution/low density of their eggs and fry.

In general, the importance of controlling I&E at offshore oil and gas extraction facilities is highlighted by the fact that these structures provide an important fish habitat. For example, oil and gas platforms and artificial reefs undoubtedly serve as red snapper habitat, and they may serve as an important (but not obligate) link in the life history of both juvenile and adult red snapper (Gulf of Mexico Fishery Management Council, 1996). In general, five to 100 times more fish can be concentrated near offshore platforms than in the soft mud and clay habitats elsewhere in the Gulf of Mexico (Fury, 2002). As a result, 70% of all fishing trips in the Gulf of Mexico head for oil and natural gas platforms. Likewise, 30% of the 15 million fish caught by recreational fishermen every year off the coasts of Texas and Louisiana come from the waters around platforms.

A2-2.2 Potential Phase III Existing Facilities

EPA used information from its 2000 Section 316(b) Industry Survey to characterize the 709 existing facilities potentially subject to Phase III regulation (i.e., with DIF of at least 2 MGD) with respect to their CWS configuration, their CWIS technologies, and their cooling system location. These estimated 709 facilities include 592 Manufacturers facilities and 117 Electric Power Producers. Closed-cycle cooling systems (e.g., systems employing cooling towers) are the most effective means of protecting organisms from I&E. Discussions with NPDES permitting authorities and utility officials identified fine mesh screens as an effective technology for minimizing entrainment. They can, however, increase impingement. Another effective approach for minimizing Adverse Environmental Impact (AEI) associated with CWIS is to locate the intake structures in areas with low abundance of aquatic life, and to design the structures so that they do not provide attractive habitat for aquatic communities. However, this approach is of little utility for existing facilities where options for relocating intake structures are infeasible.

A2-3 ADDRESSING MARKET IMPERFECTIONS

Facilities withdraw cooling water from U.S. waters to support production activities, and, in the process impinge and entrain organisms without accounting for the consequences of these actions on the ecosystem or other parties who do not directly participate in the production process. The actions of these facilities impose harm or costs on the environment and on other parties (sometimes referred to as *third parties*). These costs, however, are not recognized by the responsible entities in the conventional market-based accounting framework. Because the responsible entities do not account for these costs to the ecosystem and society, they are *external* to the market framework and the consequent production and pricing decisions of the responsible entities. In addition, because no party is reimbursed for the adverse consequences of I&E, the externality is *uncompensated*.

Business decisions will yield a less than optimal allocation of economic resources to production activities, and, as a result, a less than optimal mix and quantity of goods and services, when external costs are not accounted for in the production and pricing decisions of the section 316(b) industries. In particular, the quantity of AEI caused by the business activities of the responsible business entities will exceed optimal levels and society will not maximize total possible welfare. Adverse distributional effects may be an additional consequence of the uncompensated environmental externalities. If the distribution of I&E and ensuing AEI is not random among the U.S. population but instead is concentrated among certain population subgroups based on socio-economic or other demographic characteristics, then the uncompensated environmental externalities may produce undesirable transfers of economic welfare among subgroups of the population.

Market imperfections are often the reason that governments consider regulatory actions against a business or group of businesses. Depending on the nature of the AEI and potential costs for control technologies, governments may decide to address the market imperfection through a wide-ranging regulation or on a case-by-case basis.

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Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities

Chapter Contents

Introduction

This chapter presents an overview of the cost categories and certain elements of the analytic framework that are common to the economic analyses of the two major industry segments covered by the final standards for new Offshore Oil and Gas Extraction facilities: mobile offshore drilling units (MODUs) and oil and gas production platforms or structures.

B1-1 Cost Categories

In its analyses of the costs and economic impacts of the final rule on new oil and gas extraction facilities, EPA considered three categories of costs:

- costs of installing and operating compliance technology,
- administrative costs incurred by complying facilities, and
- administrative costs incurred by permitting authorities.

In contrast to the analysis conducted for the Manufacturing industry segment (see also Chapter B1), EPA assumed that no downtime is associated with installing or maintaining CWIS technologies for new offshore oil and gas extraction facilities, for two reasons. First, new facilities do not have to retrofit equipment; the equipment is built to specification and installed before the facility begins operations. Second, even the maintenance of CWISs should not result in downtime in the oil and gas industry. MODUs are hauled out on a regular basis for other types of maintenance activities, and production platforms are shut in one to two times per year for other maintenance, making incremental downtime due to CWIS maintenance unlikely (see the *Technical Development Document for the Final Section 316(b) Phase III Rule* (hereafter referred to as the *"Phase III Technical Development Document*"; U.S. EPA, 2006b).

Subsection B1-1.1 provides an overview of the three cost categories included in the analysis for new offshore oil and gas extraction facilities, addressing those aspects of each category that are relevant to the oil and gas industry. Table B1-1 summarizes the type of new offshore oil and gas extraction facility assumed to be subject to Phase III regulation and the compliance technologies considered for each facility type. Subsection B1-1.2 presents information on administrative costs incurred by new oil and gas facilities. Additional detail on the costs of installing and operating compliance technology is provided in the *Phase III Technical Development Document*.

B1-1.1 Cost of Installing and Operating Compliance Technology

Oil and gas drilling and production facilities will need to implement technologies to reduce impingement mortality and/or entrainment. The choice of technology varies depending on CWIS diameter and flow rate or diameter, or type of CWIS (e.g., sea chest or simple pipe). Note that for new MODUs, which EPA assumes will use sea chests, only impingement requirements will apply. EPA determined that entrainment controls on sea chests are not technically practicable (U.S. EPA, 2006b).

Table B1-1: Technologies for Implementing 316(b) Requirements for New Offshore Oil and Gas Extraction Facilities

Category	CWIS Type	Technology Description
Platform	Simple Pipe or Caisson	Stainless steel wedge wire screen - no air sparge cleaning
Platform	Simple Pipe or Caisson	Stainless steel wedge wire screen - with air sparge cleaning
Platform	Simple Pipe or Caisson	CuNi wedge wire screen - no air sparge cleaning
Platform	Simple Pipe or Caisson	CuNi wedge wire screen - with air sparge cleaning
Platform	Simple Pipe or Caisson	Stainless steel and CuNi velocity caps
Jackup	Simple Pipe or Caisson	Cylindrical wedge wire screen over tower inlet
Jackup	Simple Pipe or Caisson	Horizontal Flow Modifier
Jackup[a]	Sea Chest	Flat panel wedge wire screen over sea chest opening
Jackup[a]	Sea Chest	Horizontal Flow Diverter for Side Sea Chests
Jackup	Submersible Pumps	Cylindrical wedge wire screen over suction pipe inlet
Submersibles, Semi-Submersibles and Drill Ships[a]	Sea Chests	Flat panel wedge wire screen over sea chest
Submersibles, Semi-submersibles and Drill Ships[a]	Sea Chests	Horizontal flow diverter over side sea chest
Drill Barges	Simple Pipes	Cylindrical wedge wire screen over simple pipes
Drill Barges	Simple Pipes	Velocity Cap on the CWIS

[a] All semi-submersibles and drill ships and most jackups in EPA's technical database use sea chests. EPA determined that entrainment controls on sea chests are not technically practicable. New MODUs, which are represented by typical existing MODUs, are assumed to use sea chests (see U.S. EPA, 2006b).

Source: U.S. EPA, 2006b.

EPA developed technology cost estimates for the final rule based on the impingement mortality and entrainment reduction technologies (as appropriate) projected for each new oil and gas facility. Technology costs include capital costs and operating and maintenance (O&M) costs. The technology costs developed for the final rule analysis are engineering cost estimates, expressed in July 2002 dollars. These costs were converted to mid-year 2004 values for most applications (see Section B1-2.2 below for a discussion of adjusting monetary values to a common time period of analysis).

More detailed information on the compliance technologies considered by EPA, on technology costs, and on EPA's characterization of baseline technologies already in-place at new offshore oil and gas extraction facilities, is available in the *Phase III Technical Development Document*. In addition, *Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry* provides more detail on the engineering costs assumed for each of the different types of oil and gas facilities analyzed in this report.

EPA received no substantive comments on compliance costs or costing methodologies, so no changes have been made to these, other than to inflate costs for the 2003 values presented at proposal to 2004 values in this final economic analysis report.

B1-1.2 Administrative Costs for Complying Facilities

Compliance with the standards of the final rule requires new offshore oil and gas extraction facilities to carry out certain administrative functions. For Phase III existing facilities, these administrative functions, which help them determine their compliance requirements and provide the documentation needed for issuance of their new National Pollution Discharge Elimination System (NPDES) permits, fall on each facility individually. For new oil and gas facilities, however, General Permits apply.

There are three General Permits (GPs) that will apply to new offshore oil and gas extraction facilities subject to Phase III regulation. The Region 6 General Permit applies to the relatively active Western Gulf of Mexico (GOM) region; the Region 4 General Permit applies to the currently relatively inactive Eastern GOM region, and the Region 10 General Permit (Cook Inlet permit) applies to Cook Inlet, Alaska. The GPs are expected to be rewritten to accommodate the requirements of section 316(b) following promulgation of the final rule and as each GP comes up for renewal at the end of its 5-year cycle.

The current Region 6 permit was effective as of 2002, expired in 2003, and was renewed in 2004. This renewal is for 3 years only, to allow for information from a produced water study to be incorporated more expeditiously. The next rounds of permitting, therefore, are assumed to 2007 and 2012. The Region 4 permit expired in 2003 and was renewed in 2004. The probable post-promulgation GP renewal schedule is considered to be 2009 and 2014. The proposed permit for Cook Inlet is currently in comment period. The likely renewal is therefore mid to late 2006. However, the permit expired in 2004. Assuming the 5-year schedule will still apply, regardless of this delay, the likely post-promulgation renewal schedule for the Cook Inlet permit is 2009 and 2014.

The 316(b) Phase III final rule is scheduled to be promulgated in 2006, with the effective date assumed to be the beginning of 2007. Three years of environmental studies are assumed to be required prior to permitting under the section 316(b) rule. Thus, the first possible compliance date after the 2007 effective date would be 2010. However, the general permits may not be able to incorporate section 316(b) requirements during the 2007-2009 repermitting cycles. Therefore, EPA assumed that the oil and gas industries will be required to comply starting in 2012 (or 2014 in the case of Region 4 and 10 permits).

Because the rule becomes effective in 2007, however, EPA is assuming, for both simplicity and to be conservative, that starting in 2007, new offshore oil and gas extraction facilities will have installed and will be operating relevant CWIS controls, since they will be relatively inexpensive to install during construction. The pre-permitting studies are assumed to start in 2007 (for both Region 6 and Region 4), but other permitting tasks will not begin until the year prior to when the GPs renewals are finalized (2012 or 2014), or the year prior to when the facility is assumed to come on line or be launched, whichever is later. Monitoring will begin only in the year the renewals are finalized or the year in which the facility comes on line or is launched, again, whichever is later. The timing assumptions for Region 6 and Region 4 permits may overstate costs, since costs are moved several years earlier in the analysis time frame than they would be if EPA assumed only those facilities constructed in 2012 or later incur compliance costs. The costs of compliance in this industry, however, are relatively small overall, so the numerical significance of any overestimation would be small. More specific details of the timing assumptions of costs incurred are provided in a memorandum to the Rulemaking record (ERG, 2004).

Because new offshore oil and gas extraction facilities will be subject to Phase III regulation under these GPs, EPA assumes that certain administrative functions can be shared among new facilities. All MODUs and platforms expected to be built in the first five years before the revised Region 6 General Permit is issued (2012) are expected to share the initial costs of certain biological characterization studies that will be required by section 316(b) under the Region 6 GP. They are also assumed to share the cost of monitoring studies, which must be performed at a minimum for the first two years of the permit and then at least once per year for each repermitting cycle. Only MODUs are assumed to share the costs of permitting studies under the Region 4 GP. Permitting costs for platforms are assumed to be those incurred under the Region 6 permit. Should platforms with affected CWISs be constructed in Region 4 locations, permitting costs will be similar to Region 6 permitting costs. Since it is not known which MODUs might operate in the Eastern GOM, all MODUs constructed in 2007 and beyond are assumed to incur permitting costs under a Region 4 GP. This roughly doubles the permitting costs assigned to MODUs. The assumption may overstate total costs, since not all MODUs might operate in the Eastern Gulf. Furthermore, there might be significant costs savings once a Region 6 permit application is completed, since much of the information required for both permits would most likely be identical.

Only one Alaska project is anticipated, at most, over the period of analysis (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*), so this project is expected to incur the entire cost of facility permitting. This project is assumed to go on line in the year the Region 10 permit is finalized (2014). For this project, EPA assumes that the 3-year studies are performed in the three years prior to start-up (2011-2013).

The administrative functions associated with incorporating the 316(b) requirements into the applicable General Permits are either one-time requirements (compilation of information for the initial post-promulgation General Permits) or recurring requirements (compilation of information for subsequent General Permit renewals; and monitoring, record keeping, and reporting). More detailed information on the derivation of permitting activities and costs can be seen in U.S. EPA (2006a).

EPA received no substantive comments on the administrative costs of permitting activities, nor on the timing or cost sharing assumptions. All costs and methodologies are the same as those at proposal, although costs have been updated from the 2003 values used at proposal to the 2004 values in this final economic analysis report.

B1-1.2.1 Initial Post-promulgation General Permit Application

EPA assumes that the final rule will encourage firms to pool their resources. Therefore, those firms that are planning to construct new platforms or MODUs to operate in the GOM within the first 5 years before the applicable General Permit is reissued with 316(b) requirements in place are assumed to share certain pre-permitting costs. EPA expects that these firms will hire a consultant to perform the more general information gathering tasks required of industry before facilities can be permitted under a GP and also to perform the two years of monitoring studies required in the first two years of the permit (monitoring costs are assumed shared by the number facilities permitted in the first or second year of the first permit cycle). Other activities are specific to each facility and it is assumed each facility will incur the cost of these activities individually. Some of the permitting activities, however, will not be incremental to existing requirements. Minerals Management Service (MMS) has finalized a rule (August 2005) that requires some of the same information (Federal Register, 2005). (The MMS rule is, however, not applicable to Cook Inlet.) All information submitted will be consistent with Phase I, Track 1 requirements.

Activities and costs associated with the initial permit renewal application include:

- ***Start-up activities:*** reading and understanding the rule; mobilizing and planning; and training staff. This is a facility-specific activity.
- ***Permit application activities:*** identifying source water physical data, velocity information, and cooling water intake structure data, including description of CWIS operations, flow distribution and water balance diagram, and drawings and maps to support CWIS descriptions, and maintaining copies of these records. These activities are assumed facility-specific, but several of the activities duplicate activities required by MMS. There are no incremental costs associated with duplicate activities.
- ***Source waterbody flow and CWIS velocity flow information****:* Information used to demonstrate that the facility's CWIS meets the proportional flow requirements. The CWIS velocity flow information and demonstration is assumed to be facility-specific, but none of these activities is incremental to MMS

requirements. The waterbody flow calculation activities are only those associated with compiling site-specific information. Other waterbody characterization activities that can be shared are included in the biologic characterization study activities.

- ***Design and construction technology plan:*** delineation of the hydrologic zone of influence for the CWIS, description of technologies to be implemented; the basis for technology selection; expected performance of the technology; and design calculations, drawings and estimates to support the technology description and performance. These activities are assumed facility-specific. Development of the narrative description of technologies is considered an MMS requirement, so no costs are assumed incurred for this activity.
- ***Source water baseline biological characterization data:*** characterization of the biological community in the region and operation of CWISs; list of species in region; identification and evaluation of primary period of reproduction, larval recruitment, and period of peak meroplankton abundance for relevant taxa; and description of the likely impact of CWISs on the biological community due to impingement and entrainment. This is considered a regional study to be conducted over a 3-year period by a contractor; costs are assumed to be shared among affected facilities, since the entire monitoring program is assumed to apply region-wide.

Table B1-2 below lists the estimated costs per facility of each of the initial post-promulgation General Permit activities described above (permit costs for MODUs in the Eastern GOM are lower in some cases, since MODUs are assumed to use sea chests and are not required to meet entrainment requirements, eliminating any costs associated with entrainment studies).

Table B1-2: Cost of Initial Post-Promulgation NPDES General Permit Application Activities (Per Facility, 2004$)

Activity	Region 6	Region 4	Region 10
Start-up activities[a]	$2,291	$2,291	$2,291
Permit application activities[b]	$959	$959	$959
Source waterbody flow information[a]	$1,470	$1,470	$1,470
CWIS velocity flow information[f]	$0	$0	$0
Design and construction technology plan[b]	$1,334	$1,185	$1,334
Biological characterization study[c,e]	$64,574	$40,407	$297,695
Total Initial Post-Promulgation NPDES General Permit Application Cost[d]	$70,627	$46,311	$303,748

a The costs for these activities are incurred in 2007 for facilities built in 2007 to 2011 in both Eastern and Western Gulf. For Alaska, they occur in 2011.
b The costs for these activities are incurred in 2011 for facilities built in 2007 to 2012 for both Eastern and Western Gulf. For Alaska, they occur in 2013.
c The costs for these activities are incurred during 2007-2009 in the Eastern and Western Gulf and are shared costs. For Alaska, these costs are incurred during 2011-2013.
d Individual numbers may not add to total due to independent rounding.
e Shared study costs.
f Measured as incremental to MMS requirements.
Source: U.S. EPA, 2006a. See also ERG, 2004 and DCN 9-4000.

B1-1.2.2 Subsequent NPDES General Permit Renewals

Subsequent General Permit renewals will require collecting and submitting the same type of information required for the initial permit renewal application. EPA expects that both the facility and the contractor can use some of the information from the initial studies. Building upon existing information is expected to require less effort than developing the data the first time, especially in situations where conditions have not changed. The shared recurring permit costs are assumed to be shared by all new offshore oil and gas extraction facilities built in the first 5-year cycle plus all new facilities built in the next 5-year cycle, etc., so as time goes on, shared costs are shared by more and more facilities (except Alaska, where only one project is assumed during the time frame of the analysis). As facilities go off line or are retired (after 30 years), fewer projects share in these studies.

Table B1-3 lists the estimated costs of each of the NPDES General Permit renewal activities subsequent to the first round. Since these numbers change slightly as facilities come on or off line, the costs shown are for the first repermitting cycle following the initial GP renewal.

Table B1-3: Cost of Subsequent NPDES General Permit Application Activities (Per Facility, 2004$)

Activity	Region 6	Region 4	Region 10
Start-up activities[a]	$732	$732	$732
Permit application activities[a]	$194	$194	$194
Source waterbody flow information[a]	$416	$416	$416
CWIS velocity flow information[a]	$0	$0	$0
Design and construction technology plan[a]	$834	$720	$834
Biologic characterization study[a]	$12,162	$7594	$193,324
Total Recurring NPDES Permit Application Cost[d]	**$14,338**	**$9,656**	**$195,501**

[a] The costs for these activities are incurred during the year of the General Permit renewal. Shared costs shown are for the first permit renewal period after the initial permit (e.g., 2017); these costs change as the number of permitted facilities change. For simplicity, all costs for repermitting are assumed to be incurred in one year, rather than spread over several years as was assumed for the initial round of permitting.

Source: U.S. EPA, 2006a. See also ERG, 2004 and DCN 9-4000.

B1-1.2.3 Annual monitoring, record keeping, and reporting

Annual monitoring, record keeping, and reporting activities and costs include:

- Biologic monitoring for impingement
- Biologic monitoring for entrainment
- Velocity monitoring
- Preparing and maintaining a yearly status report

Table B1-4 on the following page outlines the associated costs of these activities.

Table B1-4: Cost of Monitoring Activities (Per Facility, 2004$)

Activity	Region 6	Region 4	Region 10
Biologic monitoring for impingement	$4,320	$1,949	$0
Biologic monitoring for entrainment	$2,699	$0	$45,723
Velocity monitoring[a]	$1,037	$468	$6,393
Preparing and maintaining yearly status report	$1,861	$840	$11,474
Total Monitoring Cost	**$9,917**	**$3,257**	**$63,661**

[a] The costs for these activities are incurred during the first two years of the initial General Permit renewal (i.e., 2012 or 2014) and are shared. These costs are incurred for one year in each subsequent permit renewal cycle. Shared costs shown are for the first permit cycle only (2012 or 2014); these costs change as the number of permitted facilities changes over time.

Source: U.S. EPA, 2006a. See also ERG 2004.

B1-1.2.4 Administrative Costs for Permitting Authorities

In addition, permitting authorities have to review the information provided by new offshore oil and gas extraction facilities and have to issue new general permits that reflect the requirements of the final rule. These activities impose costs on the responsible governmental units. For more details on the specific costs and timing assumptions for federal administration of new offshore oil and gas extraction facilities, see *Chapter D2: UMRA Analysis*. These costs and assumptions are summarized briefly below.

The requirements of section 316(b) are implemented through the National Pollutant Discharge Elimination System (NPDES) permit program. In the case of the oil and gas industry, NPDES permitting is consolidated under several General Permits, which are administered at the EPA regional level. Unlike the Phase III existing facilities discussed in *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities*, no states are involved in these permitting activities. Thus, three Regions (Region 6, Region 4, and Region 10) are expected to be the only entities responsible for permitting. Because states are not involved in permitting, there are no costs associated with Federal oversight as there are for state-administered NPDES permits. The three Regions will incur three types of costs associated with implementing the requirements of the final rule on a per-facility basis, i.e., for each facility permitted under a GP: (1) start-up activities (considered not incremental to existing activities; $0 cost) , (2) activities associated with the initial General Permit containing the new section 316(b) requirements ($12,677 in each region) and subsequent permit renewals ($4,743 in each region), and (3) annual activities ($1,471 in each region).[1]

The start up activities apply only once to each Region, but the remaining activities are incurred on a per-facility basis.

For a detailed discussion of administrative costs for permitting authorities, see *Chapter D2: UMRA Analysis*, section D2-1.2.

B1-2 KEY ELEMENTS OF THE ECONOMIC ANALYSIS FOR NEW OFFSHORE OIL AND GAS EXTRACTION FACILITIES

The economic analysis of regulation of new offshore oil and gas extraction facilities addresses the cost to, and impact on, the affected industry segments and society generally. Although these analyses differ in important respects for the individual industry segments – particularly in terms of the analytic models and methods for assessing the economic/financial impact of the final rule on complying parties within the segments – several elements of the analysis have features common to all new offshore oil and gas extraction facilities. This section reviews the following key common elements:

- Compliance Schedule
- Adjusting Monetary Values to a Common Time Period of Analysis
- Discounting and Annualization: Costs to Society or Social Costs
- Discounting and Annualization: Costs to Complying Facilities

EPA received no substantive comments on these timing or discounting assumptions. All such methodologies are the same as those at proposal, although inflation factors have been changed to compute 2004 values in this final economic analysis report.

[1] The costs associated with implementing the requirements for new offshore oil and gas extraction facilities are documented in EPA's Information Collection Request (U.S. EPA, 2004a).

B1-2.1 Compliance Schedule

For its analysis of the cost and impacts of the final rule, EPA developed a profile of the expected compliance year (year in which the new MODU or platform is launched or comes on line) for each of the types of facilities considered in the economic analysis. Unlike the analysis for the Phase III existing facilities, the compliance year is not necessarily the same year as the year in which the facility must comply with the General Permit, since EPA is assuming that CWIS controls are installed and are operating in new MODUs and platforms starting in 2007, even though the first General Permit is assumed to be reissued with 316(b) requirements in 2012. Developing an explicit profile of compliance years for new offshore oil and gas extraction facilities is important because the schedule of compliance years determines the timing of outlays by facilities and society in complying with the regulation, both for the initial outlays and for the ongoing profile of outlays in maintaining compliance with the regulation. This information is important in properly assessing the present value of the regulation's costs to society.

For the analysis, EPA initially assumed that firms planning to build facilities in the first permit cycle (Region 6 General Permit) (2012-2016) would contract to perform the studies necessary for these facilities to be permitted starting in 2007. The Region 4 permit is assumed not to incorporate 316(b) requirements until 2014, but studies are started in 2007 as well. Starting in 2014, any new MODUs are assumed to incur the costs of the Region 4 permit as well as the Region 6 permit. No platforms/structures are assumed to incur costs of the Region 4 permit (they will incur the costs of one permit only, assumed to be issued under the Region 6 General Permit). The next group of facilities to be launched or come on line in the next permit cycle (2017 or 2019) will need to be involved only in repermitting activities for the shared studies, and thus, for the shared costs, would share repermitting costs with each other as well as with operations begun in the first 5-year cycle. These new operations will, however, incur initial permitting costs among those activities that are facility specific. The years in which facilities are expected to be completed are specifically spelled out, given the number of facilities expected to be completed in each year (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*). More information on specific timing assumptions can be seen in ERG (2004) and the 316(b) Oil and Gas Compliance Cost Model for the Final Rule (DCN 9-4000).

B1-2.2 Adjusting Monetary Values to a Common Time Period of Analysis

The various economic information used in the cost and impact analyses was initially provided or estimated in dollars of different years. For example, facility financial data obtained in the 316(b) survey for the oil and gas industry are for the years 2000, 2001, and 2002, while the technology costs of regulatory compliance were estimated in dollars of the year 2002. To support a consistent analysis using these data that were initially developed in dollars of different years, EPA needed to bring the dollar values to a common analysis year. Generally, for this analysis, EPA adjusted all dollar values to constant dollars of the year 2004 (mid-year) using an appropriate inflation adjustment index. For adjusting compliance costs, EPA used the Construction Cost Index (CCI) published by the Engineering News-Record. Administrative costs were updated as described in U.S. EPA (2006a).

B1-2.2.1 CCI

EPA used the CCI to adjust compliance cost estimates from 2002 to mid-year 2004. EPA judges the CCI as generally reflective of the cost of installing and operating process and treatment equipment such as will be required for compliance with Phase III regulation. Table B1-5, below, shows CCI values for 2002, 2003, and 2004.

Table B1-5: Construction Cost Index

Year	Value	% Change
2002	6605	—
2003	6694	1.3%
2004	7115	6.3%

Source: ENR, 2006.

B1-2.2.2 GDP Deflator

EPA used the GDP Deflator to adjust 316(b) survey financial data from 2000, 2001, and 2002 to 2003, but did not further adjust survey data to 2004. Financial survey data in 2003 dollars were used with engineering and permitting costs in 2003 dollars to compute vessel-level and platform-level impacts at proposal. Costs have not been changed since proposal (except to account for values in 2004 dollars), so impact results were not updated and are considered final for the purposes of this economic analysis of the final regulation. The deflators for adjusting the survey data are shown below in Table B1-6.

Table B1-6: GDP Deflator Series

Year	Value	% Change
2000	100.0	
2001	102.4	2.4%
2002	103.9	1.5%
2003	105.7	1.7%

Source: U.S. BEA, 2004.

B1-2.3 Discounting and Annualization – Costs to Society or Social Costs

Discounting refers to the economic conversion of future costs (and benefits) to their present values, accounting for the fact that society tends to value future costs or benefits less than comparable near-term costs or benefits. Discounting is important when the values of costs or benefits occur over a multiple year period and may vary from year to year. Discounting is also important when the time profiles of costs and benefits are not the same – which is the case for the regulatory analysis of new oil and facilities. Discounting enables the accumulation of the cost and benefit values from multiple years at a specified point in time, accounting for the difference in how society values those costs and benefits depending on the year in which the values are estimated to occur.

For its analysis of the costs to society, or the social costs, of the final rule for new offshore oil and gas extraction facilities, EPA first developed a profile of the costs expected to be incurred as a result of the regulation over the period of analysis. EPA defined the analysis period as follows. The analysis period begins in 2007 (5 years before the first of the General Permits is reissued with 316(b) requirements) and includes facilities constructed over the next 20 years – i.e., to 2026 – *plus* a period of 30 years in which each newly constructed facility is assumed to continue compliance. Thus, for the social cost analysis for Phase III new offshore oil and gas extraction facilities, the analysis period extends to 2055 (see the 316(b) Oil and Gas Compliance Cost Model for the Final Rule, DCN 9-4000). In developing the time profile of costs, EPA assigned costs according to the following schedule:

B1-2.3.1 Direct Costs of Regulatory Compliance

- ***Capital Costs of Compliance Technology:*** This cost is first incurred in the year that the facility begins operation. However, the equipment for complying with the regulation is expected to have a useful life of

10 years, or a period shorter than the 30 years of compliance. Accordingly, following the first installation, facilities are assumed to reinstall, and re-incur the cost of, the compliance equipment at year 11 and year 21 of the facility-specific compliance period.

- ***Compliance Technology Operation and Maintenance:*** This cost is assumed to occur in each year of a facility's 30-year compliance year period.

B1-2.3.2 Administrative Costs Incurred by Complying Facilities

- ***Biological Characterization Study:*** This is a three-year study required for all facilities, which is assumed to be shared by the affected facilities. The cost of this study is incurred over the years immediately following the effective date of the final rule or the years preceding the first post-promulgation GP (2007-2009 for Eastern and Western Gulf, and 2011-2013 for Alaska).
- ***Initial Permitting Cost***. In addition to incurring a share of the cost of characterization studies, complying facilities will also incur an initial permitting cost, which is assigned to the year preceding the first year of a facility's 30-year compliance period, or in 2007 for facilities launched or coming on line in 2007 through 2011.
- ***Repermitting Costs:*** As explained above, General Permits are renewed each five years during the period of compliance. Repermitting costs, both shared and facility-specific, are assumed to recur at years 5, 10, 15, 20, and 25 of the General Permit cycles. For new offshore oil and gas extraction facilities, EPA assumes that 30 years is the reasonable maximum lifetime of these facilities; thus, no repermitting cost is incurred in the 30th year of facility operation.
- ***Annual Monitoring, Record Keeping, and Reporting Activities:*** These costs are assumed to occur in the first two years of the initial permit and in each year of the permit renewal year. These costs begin in 2012 or 2014, depending on permit.

B1-2.3.3 Administrative Costs Incurred by Permitting Authorities

- ***One-time Start-up Costs:*** These costs are assumed to be nonincremental to existing costs of permitting in the three regions.
- ***Permit Processing Costs:*** These costs are assigned to the years in which facilities apply for initial permits or renewal permits during the compliance period.
- ***Annual Permit Administration Activities:*** The cost of these activities is assumed to occur in parallel with the annual permit-related activities by complying facilities and thus occurs in each year of a facility's compliance period.

EPA assigned costs by facility and governmental unit according to this framework and then summed these costs on a year-by-year basis over the total time period of analysis. For the social cost analysis, these costs were tallied on a pre-tax basis, which differs from the treatment of costs for the facility impact analysis as described below. These profiles of costs by year were then discounted to the assumed date the final rule would take effect, beginning of year 2007, at two values of the social discount rate, 3% and 7%. These discount rate values reflect guidance from the Office of Management and Budget regulatory analysis guidance document, Circular A-4 (OMB, 2003).[2]

[2] See *Chapter E1: Summary of Social Costs*, for further discussion of the framework for analyzing the social costs of the 316(b) Phase III regulation.

For more detailed information see ERG (2004) and the 316 (b) Oil and Gas Compliance Cost Model for the Final Rule (DCN 9-4000).

EPA used the following formula to calculate the present value of the time stream of costs as of the beginning of 2007:[3]

$$Present\ Value = \sum_t \frac{Cost_t}{(1+r)^{t-2007}} \qquad \text{(B1-1)}$$

where:

$Cost_t$	=	Costs in year t
r	=	Social discount rate (3% and 7%)
t	=	Year in which cost is incurred (2007 to 2055)

After calculating the present value of these cost streams, EPA calculated their constant annual equivalent value (annualized value) using the annualization formula presented below, again using the two values of the social discount rate, 3% and 7%. Although the analysis period extends from 2007 through 2055, a period of 49 years, inclusive, EPA annualized costs over 30 years, since 30 years is the assumed period of compliance. This same annualization concept and period of annualization were also followed in the analysis of benefits, although for benefits the time horizon of analysis for calculating the present value is longer than for costs. Using a 30-year annualization period for both social costs and benefits allows comparison of constant annual equivalent values of costs and benefits that have been calculated on a mathematically consistent basis. The annualization formula is as follows:

$$Annualized\ Cost = PV\ of\ Cost\ x\ \frac{r \times (1+r)^{(n-1)}}{(1+r)^n - 1} \qquad \text{(B1-2)}$$

where:

r	=	Social discount rate (3% and 7%)
n	=	Annualization period, 30 years for the social cost analysis

B1-2.4 Discounting and Annualization – Costs to Complying Facilities

In general, EPA followed similar concepts and procedures in the discounting and annualization required for the analysis of costs to, and impacts on, complying facilities as those followed for the analysis of social costs. However, the analysis of costs to complying facilities differs from that for costs to society in several important ways, which are described below.

- ***Consideration of taxes.*** For understanding the impact of the regulation on complying facilities, the costs incurred by complying facilities are adjusted for taxes, as relevant, and calculated on an after-tax basis. The tax treatment of compliance outlays and income effects (e.g., from installation) shifts part of these costs to the tax-paying public and reduces the actual cost to private, tax-paying businesses. For this reason, the after-tax costs of compliance are a more meaningful measure than the pre-tax costs of the

[3] Calculation of the present value assumes that the cost is incurred at the beginning of the year.

financial burden on complying facilities. In analyzing and reporting the impact of compliance costs on private facilities, annualized costs are therefore calculated on an after-tax basis. Since most companies that operate MODUs or platforms are headquartered in states without corporate income taxes, EPA assumes a state tax rate of 0%. On the Federal level, EPA assumes that the highest marginal corporate tax rate applies. This rate is 35% (IRS, 2005), so post-tax costs will be 65% of the pre-tax costs. EPA does this because all platform and MODU owners that are likely to operate in Alaska or the Gulf of Mexico are large corporations by SBA standards and/or all have earnings in most years that place them in the highest corporate tax bracket.

- ***Calculation of present value and annualization of costs at the year of compliance.*** In the social cost analysis, costs were summed on a present value basis at the beginning of 2007, the assumed date the final regulation would take effect. For the analysis of costs to complying facilities, costs were calculated on a present value basis and annualized at the first year of compliance for each facility (assumed to be the year the facility is brought on line or launched). The calculation of annualized costs at the first year of compliance provides more accurate and meaningful insight for assessing financial impact in relation to the baseline financial performance and conditions of the complying facility than would be achieved if, for example, costs were further discounted – and reduced numerically – by bringing them to the year the rule will take effect. The aggregates of annualized cost *over facilities* for purposes of reporting total cost to complying facilities and total financial burden are likewise the sum of costs at the initial year of compliance for each facility, even though those years differ across facilities. These costs are annualized and used to report the aggregate costs to industry. The costs used to determine impacts are derived somewhat differently and the method used to incorporate them into the impact analysis varies by type of facility (MODU or platform) as explained in *Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry*.

- ***Use of discount rates in present value and annualization calculations.*** The discounting and annualization calculations for the complying facility cost calculations use the same formulas as used for the social cost calculations. However, the discount rate used in the facility cost calculations generally has a different interpretation than the rate used for the social cost calculation (even though the numerical value of the rate may be the same). Instead of being a social discount rate, the discount rate used for the present value and annualization calculations for complying facility costs represents a cost of capital to the individual complying facility, which may reasonably differ from the concept of the social discount rate. The social discount rate may be derived on several bases, including as an opportunity cost of capital *to society* or as a societal inter-temporal preference or indifference rate – i.e., the required rate of change over time in a value of consumption or outlay at which society would be indifferent to the time period in which the consumption or outlay occurs. The social discount rates based on these *society-level* concepts may reasonably differ from the cost of capital used for assessing costs and financial impacts to the complying firm.

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Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry

CHAPTER CONTENTS

INTRODUCTION

EPA's final 316(b) cooling water intake rulemaking will affect new construction among offshore components of the oil and gas industry. The rule will affect new offshore oil and gas extraction facilities only, because EPA will not be regulating existing oil and gas facilities. This profile compiles and analyzes economic and financial data for several sectors of the offshore oil and gas extraction industry that may be affected by certain of the Phase I 316(b) requirements for new facilities that will be a part of requirements for new offshore oil and gas extraction facilities under Phase III. The profile characterizes the firms and facilities that currently exist to provide information on the characteristics of facilities that might be constructed in the future and the firms that are most likely to construct such facilities.

Two key industry sectors are primarily associated with offshore oil and gas drilling and production, both of which might intake ambient cooling water from the surrounding oceans or navigable waterways for a wide variety of cooling needs.

The two major offshore oil and gas extraction industry users of CWIS are:

- mobile offshore drilling units (MODUs)
- offshore oil and gas production platforms

EPA also investigated the liquid natural gas (LNG) re-gasification industry, but determined that only one new LNG facility recently completed has (or would have) cooling water intakes meeting the 316(b) requirement that 25% or more of total design intake flow be used for cooling water purposes (U.S. EPA, 2006). EPA proposes to apply Best Professional Judgment (BPJ) to this industry. This industry, therefore, is not discussed further in this report. See U.S. EPA (2006), however, for profile information on this industry (including some economic information) and a more complete discussion of EPA's rationale for covering this industry using BPJ.

The following sections provide a profile for MODUs and production platforms (Sections B2-1 and B2-2). Within each profile, a brief overview of the industry is provided, including a look at existing facilities and their associated firms, and the financial conditions of those firms (where firm financial data are publicly available). The existing facilities are then discussed in more detail to provide information for the financial modeling of new facilities. Also discussed are factors affecting the future of each of these two groups of CWIS users. Finally, EPA projects the numbers of new MODUs or platforms that might be constructed with CWIS flow rates greater than 2 MGD, greater than 20 MGD, and greater than 50 MGD during the construction portion of the time frame of this economic analysis (construction spans the years 2007 to 2026).

Section C2-3 concludes this chapter with a summary of the estimated total number of new facilities in the offshore oil and gas extraction industry with at least 2 MGD intake rates by MGD flow rate category.

B2-1 MOBILE OFFSHORE DRILLING UNITS (MODUS)

B2-1.1 Overview

Offshore drilling operations often use MODUs, which are vessels or other sea-going rigs that are used to transport drilling equipment to the offshore site and from which drilling operations can be undertaken. The MODUs of interest are active primarily in the State offshore waters of the Gulf of Mexico (GOM). MODUs operating close to shore in State waters tend to be small barges and submersibles that do not use cooling water at the rates of concern (significantly less than 2 MGD) (U.S. EPA, 2006).

MODUs provide nearly all of the exploration and delineation drilling in the offshore development of oil and gas resources. MODUs also provide developmental drilling services. In exploratory drilling, drilling is undertaken to determine whether oil and gas resources are available near existing fields or in areas where no resources have been previously found (wildcats). Once an exploratory well has identified the presence of potentially recoverable oil and gas resources, delineation drilling is undertaken. Delineation entails the drilling of additional wells to determine the extent and nature of the new field. These two types of drilling often occur at a distance from existing platforms and thus are usually conducted from a mobile rig.

Drilling of development wells can be done from either a platform or a MODU. The same types of mobile rigs used to drill exploratory and delineation wells can also be used to drill developmental wells. Once a field has been delineated and a decision is made to develop the field, a platform is typically constructed and developmental drilling is initiated to construct wells for producing the field. A discussion of platform-based drilling is presented below in Section C2-2.

MODUs encompass a variety of vessel or rig types. The two basic groups of MODUs are bottom-supported units and floating units. **Bottom-supported units** include submersibles and jackups. **Floating units** include inland barge rigs, drill ships, ship-shaped barges, and semi-submersibles.

Bottom-supported drilling units are typically used when drilling occurs in shallow waters. Types of bottom-supported units include:

- Submersibles–barge-mounted drilling rigs that are towed to the drill site and sunk to the bottom. These rigs may be either posted barge or bottle type. A posted barge rig consists of a barge hull that rests on the bottom, with steel posts that rise from the top of the hull and a deck built on top of the posts well above the water line. These are used in water depths no more than 30 to 35 feet. A bottle type submersible consists of several steel cylinders or bottles. When the bottles are flooded, the rig submerges and sinks to the bottom, and when water is removed, they rise to the surface. These rigs can be used in water depths up to 100 feet.
- Jackup rigs–barge-mounted rigs with extendable legs that are retracted during transport. At the drill site, the legs are extended to the seafloor. As the legs continue to extend, the barge hull is lifted above the water. Jackup rigs, which can be used in waters up to 300 feet deep, can be categorized by their leg type: columnar leg and open-truss leg.

Floating drilling units are typically used when drilling occurs in deep waters and at locations far from shore. Types of floating units include:

- Semi-submersible–a type of floating drill unit that can withstand rough seas with minimal rolling and pitching tendencies, thus they are used for drilling projects in ultra-deep water Gulf regions. They are hull-mounted and float on the surface of the water when empty. At the drilling site, the hulls are flooded and sunk to a certain depth below the surface of the water. When the hulls are fully submerged, the unit is stable and not susceptible to wave motion due to its low center of gravity. The unit is moored with anchors to the seafloor. The two types of semi-submersible rigs are bottle-type (similar in concept to the bottle-type submersible) and column-stabilized.

- Drill ships and ship-shaped barges–vessels that float on the surface of the water equipped with drilling rigs. These vessels maintain position above the drill site by anchors on the seafloor or the use of propellers mounted fore, aft, and on both sides of the vessel (dynamic positioning). Drill ships are the other major drilling rig used in ultra-deep Gulf waters. In these locations, drill ships typically operate using dynamic positioning. Drill ships and ship-shaped barges are susceptible to wave motion since they float on the surface of the water, and thus are not suitable for use in heavy seas.

Of the five basic types of MODUS (submersibles, jackups, semi-submersibles, drill ships, and drill barges), the drill ships, semi-submersibles, and jackups are the three types that typically intake over 2 MGD of cooling water, with drill ships having the highest intake rates. Among drill ships with known intake rates above 2 MGD, all intake more than 50 MGD. Jackups and semi-submersibles do not generally appear to intake more than 20 MGD, but many intake more than 2 MGD. Submersibles and drill barges generally have cooling water intake below the 2 MGD cutoff. Drilling operations use cooling water for purposes such as cooling engines, compressors, winches, and pumps (U.S. EPA, 2006).

B2-1.2 Existing MODUs and Their Associated Firms

The final rule will not cover existing MODUs. However, EPA has updated the profile presented in the economic analysis report for the proposal (U.S. EPA, 2004) to provide the broadest illustration of the types of firms that might construct MODUs. Later in this chapter, only those firms considered the likeliest to build new MODUs with CWISs that will be regulated by the 316(b) Phase III rulemaking will be profiled, but this section presents information that will be used in the small business analysis in Chapter D1. EPA received no comments concerning the MODU profile presented at proposal, nor any substantive comments on EPA's assessment of which types of MODUs, the numbers of MODUs, or the specific firms considered likely to be affected by the rulemaking.

Table B2-1 presents a listing of all firms operating in the Gulf of Mexico (either active, with stacked rigs, with ready rigs, or with rigs under construction) as compiled by Rigzone (2006a), along with the parent company of the owner. These affiliations were determined primarily on the basis of Security and Exchange Commission (SEC) data. SEC maintains an online database (the Edgar Database), on which all filings of publicly held firms are available. The 10K annual reports and 8K reports are used the most to collect this information. The 10K annual reports to SEC generally list significant subsidiaries and are the source of income statement and balance sheet information for characterizing financial conditions at a firm. Subsidiary lists are used to confirm ownership relationships. The 8-K forms, in which significant changes to the firm must be announced, are often the source of information on mergers and acquisitions.

Table B2-1: Owners of MODUs Currently Operating in GOM and Parent Company

Listed Owner	Parent Company
Aban Lloyd	Aban Group
Atwood Oceanics	Atwood Oceanics
Axxis Drilling	Axxis Drilling
Blake Offshore	Blake Offshore
CNSPC	China National Star Petroleum Co.
Coastal Drilling	Coastal Drilling Company
Conoco	ConocoPhillips
Delta Seaboard	American International Industries
Devon Energy	Devon Energy Corp.
Diamond Offshore	Diamond Offshore
ENSCO	ENSCO International, Inc.
GlobalSantaFe	GlobalSantaFe
Helmerich & Payne	Helmerich & Payne
Hercules Offshore	Parker Drilling
Nabors Offshore	Nabors Industries
Noble Drilling	Noble Corp.
Parker Drilling	Parker Drilling
Perforadora Central	Perforadora Central
Pride International	Pride International
Rowan	Rowan Companies
Scorpion Offshore.	Scorpion Offshore
Songa Drilling AS.	Songa Offshore
Tetra Applied Technology	Tetra Technologies
Todco	Todco
Transocean	Transocean, Inc

Source: Rigzone, 2006a; SEC, 2006.

The difference between this list and the list compiled for the proposal is that a number of small entities no longer appear on the list of operators. Five small or presumed small (those not filing with SEC) firms no longer appear to be operating in the GOM. These include Blue Dolphin, BSI drilling, Energy Equipment Resources, Newfield Exploration Co., and NR Marine. Only Blake Drilling and Workover (apparently affiliated with Blake Offshore, which is the name that appears currently) remain on the list as an assumed small firm for lack of financial data. Additionally, four foreign firms no longer appear on the list. These are Caspian Drilling Co., Ocean Rig Asa, Cyprus Company, and Worships BV. New firms on the list in Table B2-1 include five foreign firms, Aban Group, China National Star Petroleum Co., Perforadora Central, Scorpion Offshore, and Songa Drilling AS; five large firms, Todco, ConocoPhillips, Helmerich & Payne, American International Industries, and Devon Energy; and two presumed small firms, Axxis Drilling and Coastal Drilling Company (for more information on how these size categories are defined, see below). Overall, more large and foreign firms and fewer small firms are now operating in the GOM.

Table B2-2 presents a listing of the existing MODUs' owners and the number of rigs they are currently operating in the GOM (as of 2006). These include MODUs that may have CWIS intake rates that do not exceed 2 MGD and include all types of MODUs regardless of whether they are likely types to have CWISs of this size. The table also shows the number of semi-submersibles, jackups, or drill ships owned. As discussed in the economic analysis for the proposal (U.S. EPA, 2004), these were noted to be the likeliest MODU types to have CWIS that exceed 2 MGD intake rates.

Once firms that do not operate the key MODU types are removed from the analysis, only one small firm remains—Blake Offshore, which operates four jackups.

The firms that own MODUs generally work as contractors to the oil and gas exploration and production industry. The provision of drilling and related services to U.S. and/or foreign offshore regions is the major focus of their business.

Just a few firms hold most MODUs. At proposal, GlobalSantaFe, Transocean, Rowan Companies, Noble Corp. Parker Drilling, Pride International, ENSCO International, and Diamond Offshore operated 326 MODUs, 85% of the total MODUs in the analysis at that time. Currently, the leading MODU owners are again, GlobalSantaFe, Rowan Companies, Parker Drilling, Pride International, ENSCO, with Nabors Industries and Todco also coming in as top MODU owners. This group of firms owns 75 percent of the total MODUs listed, and 76 percent of the relevant types of MODUs.

Compared to the number of rigs at proposal, the current count of rigs in the GOM has dropped from 384 to 298, a 22 percent decrease (see U.S. EPA, 2004). Although higher oil and gas prices in the last few years have increased interest in drilling in the GOM, MODUs are mobile, and interest in drilling has increased worldwide. The market for MODU services is worldwide, and foreign operations can outbid the U.S., due to greater production expectations in more productive areas of the world. Rig utilization, is not, however, at 100 percent capacity, so the fewer numbers of rigs in the GOM generally would not have constrained drilling. However, MMS has offered extensions to leasing agreements following the extensive damage to GOM platforms due to Hurricanes Katrina and Rita to ensure any potential for delayed drilling do not interfere with lease development (MMS, 2006a).[1]

[1] Lease activity automatically grants extensions to leases, but if activity is delayed due to rig unavailability or other circumstances beyond the lessee's control, extensions can be otherwise granted.

Table B2-2: Number of Existing MODUs and Parent Firms

Company	Number of Rigs	Number of Rigs of Types Associated with CWIS Intake Rates > 2 MGD
Aban Group	1	1
American International Industries	4	0
Atwood Oceanics	2	1
Axxis Drilling	4	0
Blake Drilling & Workover	4	4
China National Star Petroleum Co.	1	1
Coastal Drilling	3	0
ConocoPhillips	1	0
Devon Energy	1	0
Diamond Offshore	24	24
ENSCO International Inc	19	18
GlobalSantaFe	15	15
Helmerich & Payne	12	0
Nabors Industries	49	10
Noble Corp.	12	9
Parker Drilling	28	7
Perforadora Central	1	1
Pride International	23	12
Rowan Companies Inc	17	17
Scorpion Offshore	5	5
Songa Drilling AS	5	5
Tetra Technologies	8	0
Todco	48	18
Transocean Inc.	11	11
Total Number of Rigs	298	159

Source: Rigzone, 2006a; Table B2-1.

The identification of corporate parent is critical to determining which firms should be defined as small under SBA standards. SBA defines the size of the firm to be that of the firm at the highest level of organization. Generally, EPA characterized a firm at the higher level of organization if it was majority owned by the larger entity. This approach is consistent with SBA's definition of affiliation. Small firms that are affiliated (e.g., 51% owned) by firms defined as large by SBA's standards (13CFR Part 121) are not considered small for the purposes of regulatory flexibility analysis (see Section D1 for more details). Affiliated firms can also be firms owned by the same owners or that have the same corporate officers as another firm.

Another key piece of information needed for classifying firms as small or large is what industry the firm belongs to. SBA defines small businesses differently for different types of industry and currently uses NAICS to classify industries. SEC still requires companies to report their SIC code, not the NAICS code. Crosswalks between NAICS and SIC, however, are available from Bureau of the Census (2006).

Once the parent firms were identified as above and the proper NAICS identified based on the reported SIC code in the 10K reports and the NAICS crosswalk information, the revenue and employment (or other criteria, as appropriate) for these parent firms were determined and compared to the SBA definition of small based on their NAICS classification. Table B2-3 shows the SBA definitions for the industries identified.

It is assumed that all domestic firms that could not be identified as large are small businesses. Also, for the purposes of this analysis, MODU operators owned by foreign firms are assumed to be large, even when data on employment could not be found, because SBA defines a small business as one "with a place of business in the United States, and which operates primarily in the United States or which makes a significant contribution to the economy" (13 CFR Part 121). Only large businesses in this industry would meet the latter criteria, and few, if any, foreign firms operate primarily in the United States.

Table B2-3 presents the number of MODU parent companies that operate the MODUs of concern by NAICS and SIC code, where that information is available. Eight firms do not appear in these counts. Five foreign firms and three other firms, presumed small, had no information available on the SEC website. Note that no firms are positively identified as small out of the 24 total firms operating existing MODUs.

The key firms of concern, however, constitute a smaller group of firms. The remainder of this profile focuses only on firms that currently operate types of MODUs that have been identified as likely to have CWIS intake rates > 2MGD. The firms dropped from further analysis include two presumed small firms, Coastal Drilling, and Axxis Drilling, and five large firms, ConocoPhillips, Devon Energy, Helmerich & Payne, American International Industries, and Tetra Technologies.

Table B2-3: NAICS Classification of MODU Parent Companies

SIC code	NAICS code	NAICS Description	SBA Definition of Small	Total Number of Firms[a]	
				Small	Large
1311	211111	Crude Petroleum and Natural Gas Extraction	500 employees	0	1
2911	324110	Petroleum Refineries	1,500	0	1
2810	325110	Industrial Chemical Mfgs.	1,000[b]	0	1
1381	213111	Drilling Oil and Gas Wells	500 employees	0	11
1389	213112	Support Activities for Oil and Gas Operations	$6.5 million in revenues	0	1
6799	Several NAICS	Various, related to misc. investment firms	$6.5 million in revenues[c]	0	1

[a] Does not include five foreign firms and three potentially small, unknown firm for which NAICS or SIC codes could not be located in publicly available data.

[b] Specific NAICS not listed in SBA definitions; largest employment definition from NAICS 325 used here.

[c] All three NAICS matched to SIC 6799 are listed $6.5 million in revenues.

Source: SEC, 2006; 13 CFR Part 121, Census, 2006

Table B2-4 presents the financial conditions at the parent firms listed in Table B2-2 with MODUs likely to have CWISs with intake rates >2MGD. A number of parent companies are privately held or are foreign and do not have financial information available on the SEC database, so information is not presented for these firms. The financial data shown are from 2002 through 2005. Data for 2004 represent the base year for the new offshore oil and gas extraction facility firm-level analysis in Chapter B3. In 2004, the total assets of the MODU parent companies ranged from $498 million to $10.8 billion. The revenues ranged from $163 million to $2.6 billion. The three financial ratios calculated in the table are the return on assets, return on equity, and the profit margin. Each of these ratios calculates the net income as a ratio over the total assets, stockholder's equity, and total revenues respectively, and is commonly used measures of financial health in the oil and gas industry. The return on assets percentages ranged from –6.48% to 5.16%, and the profit margin ranges from –12.50% to 13.70%. In 2004, five firms with financial data had negative net income. Note that 2005 was a much better year for most of the firms in this analysis, with only one firm reporting negative net income.

Table B2-4: Financial Condition of MODU Parent Companies (2002-2005)

Firms	Year of Data	Size	Type	No. of Employees	Assets ($000)	Equity ($000)	Revenues ($000)	Net Income ($000)	Return on Assets	Return on Equity	Profit Margin
Aban Group		Large	Foreign								
Atwood Oceanics	2005	Large	Drilling	1,100	$495,694	362,137	$176,156	$26,011	5.25%	7.18%	14.77%
	2004			**1,100**	**$498,936**	**$271,589**	**$163,454**	**$7,587**	**1.52%**	**2.79%**	**4.64%**
	2003			800	$522,674	$263,467	$106,761	$(12,802)	-2.45%	-4.86%	-11.99%
	2002			800	$444,530	$276,133	$118,376	$28,285	6.36%	10.24%	23.89%
Blake Drilling & Workover		Small[a]	Unknown								
China Nat'l. Star Petroleum		Large	Foreign								
Diamond Offshore	2005	Large	Drilling	4,500	$3,606,922	$1,853,327	$1,221,002	$260,337	7.22%	14.05%	21.32%
	2004			**4,200**	**$3.379.386**	**$1,625,828**	**$814,662**	**($7,243)**	**-0.21%**	**-0.45%**	**-0.89%**
	2003			3,740	$3,135,019	$1,680,480	$680,941	$(48,414)	-1.54%	-2.88%	-7.11%
	2002			3,766	$3,256,308	$1,807,514	$752,561	$62,520	1.92%	3.46%	8.31%
ENSCO International, Inc	2005	Large	Drilling	3,600	3,617,900	$2,533,200	$1,046,900	$294,200	8.13%	11.61%	28.10%
	2004			**3,600**	**$3,322,000**	**$2,187,900**	**$740,600**	**($1,900)**	**-0.06%**	**-0.09%**	**-0.26%**
	2003			4,300	$3,183,000	$2,081,100	$742,300	$108,300	3.40%	5.20%	14.59%
	2002			4,300	$3,061,500	$1,967,000	$698,100	$59,300	1.94%	3.01%	8.49%
GlobalSantaFe	2005	Large	Foreign	5,700	$6,222,100	$4,957,500	$2,263,500	$423,100	6.80%	8.53%	18.69%
	2004			7,100	$5,998,200	$4,466,400	$1,723,700	$143,700	2.40%	3.22%	8.34%
	2003			7,100	$6,149,700	$4,327,600	$1,808,200	$129,400	2.10%	2.99%	7.16%
	2002			8,800	$5,828,700	$4,234,200	$1,870,000	$277,900	4.77%	6.56%	14.86%
Nabors Industries	2005	Large	Foreign	22,599	$7,230,407	$3,758,140	$3,551,009	$648,695	8.97%	17.26%	18.27%
	2004			**19,776**	**$5,862,609**	**$2,929,393**	**$2,448,152**	**$302,457**	**5.16%**	**10.32%**	**12.35%**
	2003			17,417	$5,602,692	$2,490,275	$1,923,999	$192,228	3.43%	7.72%	9.99%
	2002			15,261	$5,063,872	$2,158,455	$1,518,179	$121,489	2.40%	5.63%	8.00%
Noble Corp.	2005	Large	Foreign	5,600	$4,346,367	$2,731,734	$1,382,137	$296,696	6.83%	10.86%	21.47%
	2004			**5,300**	**$3,307,973**	**$2,384,434**	**$1,066,231**	**$146,086**	**4.42%**	**6.13%**	**13.70%**
	2003			3,364	$3,189,633	$2,178,425	$987,380	$166,416	5.22%	7.64%	16.85%
	2002			3,747	$3,065,714	$1,989,210	$990,248	$209,503	6.83%	10.53%	21.16%
Parker Drilling	2005	Large	Drilling	3,040	$801,620	$259,829	$531,662	$98,883	12.34%	38.06%	18.60%
	2004			**3,014**	**$726,590**	**$148,917**	**$376,525**	**$(47,083)**	**-6.48%**	**-31.62%**	**-12.50%**
	2003			2,920	$847,632	$192,803	$338,653	$(109,699)	-12.94%	-56.90%	-32.39%
	2002			2,898	$953,325	$300,626	$385,714	$(114,054)	-11.96%	-37.94%	-29.57%
Perforadora Central		Large	Foreign								
Pride International	2005	Large	Well	12,600	$4,399,981	$1,697,562	$1,180,016	($9,137)	-0.21%	-0.54%	-0.77%

Table B2-4: Financial Condition of MODU Parent Companies (2002-2005)

Firms	Year of Data	Size	Type	No. of Employees	Assets ($000)	Equity ($000)	Revenues ($000)	Net Income ($000)	Return on Assets	Return on Equity	Profit Margin
	2004		Service	**12,600**	**$4,041,993**	**$1,716,320**	**$1,712,200**	**$9,839**	**0.24%**	**0.57%**	**0.57%**
	2003			10,100	$4,377,095	$1,688,708	$1,565,806	($15,954)	-0.36%	-0.94%	-1.02%
	2002			9,500	$4,399,981	$1,677,135	$1,180,016	($17,106)	-0.39%	-1.02%	-1.45%
Rowan Companies Inc	2005	Large	Drilling	4,577	$2,975,183	$1,619,739	$1,068,800	$229,800	7.72%	14.19%	21.50%
	2004			**4,392**	**$2,492,286**	**$1,408,884**	**$679,700**	**($1,300)**	**-0.05%**	**-0.09%**	**-0.19%**
	2003			5,395	$2,190,809	$1,136,830	$529,300	($7,800)	-0.36%	-0.69%	-1.47%
	2002			5,237	$2,054,504	$1,131,777	$443,931	$86,278	4.20%	7.62%	19.44%
Todco	2005	Large	Drilling	2,420	$825,000	$495,500	$534,200	$59,400	7.20%	11.99%	11.12%
	2004			**1,800**	**$761,400**	**$480,600**	**$351,400**	**($28,800)**	**-3.78%**	**-5.99%**	**-8.20%**
	2003				$778,200	$137,700	$227,700	($286,200)	-36.78%	-207.84%	-125.69%
	2002				$2,227,200	$561,900	$187,800	($5,558.2)	-0.25%	-0.99%	-2.96%
Transocean Inc.	2005	Large	Foreign	8,600	$10,457,000	$7,981,700	2,891,700	$715,600	6.84%	8.97%	24.75%
	2004			**10,100**	**$10,758,000**	**$7,393,000**	**$2,614,000**	**$152,200**	**1.41%**	**2.06%**	**5.82%**
	2003			13,200	$11,663,000	$7,193,000	$2,434,300	$19,200	0.16%	0.27%	0.79%
	2002			14,260	$12,665,000	$7,141,000	$2,674,000	($3,732,000)	-29.47%	-52.26%	-139.57%

[a] Presumed small due to lack of data.

Note: 2002 values may not match those reported in the EA for the proposal (U.S. EPA, 2004) as firms may have restated their financials for a variety of reasons, including the Sarbanes-Oxley Act of 2002, which changed requirements for disclosing financial data.

Source: Table C2-2; SEC, 2006; 2002-2005 10-K or 20-F reports.

B2-1.3 Existing MODUs with Intake Rates Meeting Proposed Rule Criteria

B2-1.3.1 Overview of Existing MODUs as Models for New MODUs

The following information remains unchanged from proposal. EPA received no comments that questioned EPA's approach in applying information on existing MODUs to model new MODUs, including the number of MODUs likely to be built over the period of analysis that are expected to be affected by the final rule.

To provide information on whether new MODUs might be subject to Phase III regulation, EPA investigated information obtained from a survey of MODUs undertaken for the Phase III rulemaking decision. Not all of the MODUs owned by the firms listed above meet the applicability standard (at least 2 MGD design intake flow) and other criteria of the proposed rule. EPA used a multi-step process to estimate the total number of existing MODUs that would be regulated under the proposed rule if they were newly constructed (i.e., CWISs with total design flow of at least 2 MGD or more or less than 25% of intake volume used for cooling water purposes).[2] The sampling frame used 384 MODUs as shown in Table B2-1). Among these 384 MODUs in this universe, EPA sampled 30 MODUs in the survey. The survey weights for all MODUs are thus 384 divided by 30, or 12.8.

The following is the status of the economic survey respondents:

- 23 respondents returned surveys
- 8 respondents were determined to have CWISs that meet proposed rule criteria.
- 15 respondents were determined to have CWISs that do not meet proposed rule criteria or were not operating in U.S. waters
- 4 surveys were not returned from among a group of MODUs whose CWIS intake rates were known (based on voluntary data submitted during the 316(b) Phase I rulemaking)
- 3 surveys were not returned among a group of MODUs whose CWIS intake rates were unknown.

Based on the ratio of respondents whose intake rates meet Phase III rule criteria to total respondents (8/23), EPA assumed that among the three MODUs with unknown intake rates, one will have intake rates meeting the proposed rule's criteria and two will have intake rates not meeting these criteria. Thus, the total number of MODUs in the economic survey sample whose intake rates are assumed to meet proposed rule criteria was estimated to be 13. Multiplying this number by the survey weight of 12.8 yielded an estimate of a total of 166 MODUs with intake rates meeting proposed rule criteria. Another six MODUs, originally thought to have intake rates of less than 2 MGD were determined to have intake rates greater than 2 MGD, and these were added to the estimate of MODUs with CWISs meeting Phase III rule criteria, for a total of 172 MODUs meeting the Phase III rule's criteria – roughly half of the existing MODUs operating in U.S. waters (331 MODUs or about 52 %). EPA therefore assumed that approximately half of new MODUs built might meet Phase III rule criteria. Of the 172 MODUs meeting proposed rule criteria, EPA estimated that all new semi-submersibles and jackups will have CWIS flow rates below 20 MGD, based on all surveyed semi-submersibles and jackups having rates below 20 MGD. EPA also estimated that all new drill ships will have rates above 50 MGD, based on all surveyed drill ships having intake rates of this size. For more information on the estimate of existing MODUs that might meet proposed rule criteria, see ERG, 2004a.

[2] For simplicity, the text refers to operations that meet either of these criteria as not meeting Phase III rule criteria, even though the proposed rule does not apply to existing facilities..

B2-1.3.2 Current Drilling Activity and Trends

Offshore drilling rigs are extremely capital intensive. Therefore, once a company has invested in a rig, it is in their best interest to keep the rig in operation. Currently, the utilization of all rigs worldwide stands at about 95%, which is up significantly from 72% in 2003(Rigzone, 2006b; Drilling Contractor, 2003a). The Bureau of Land Management's Minerals Management Service (MMS) predicted that oil production in the Gulf of Mexico would be between 1.5 and 2.0 million barrels per day (bpd) by the end of 2005 and gas production would be between 11 and 17 billion cubic feet per day (bcfd) by the same time period. (Drilling Contractor, Nov/Dec 2001). However, actual figures for 2005 indicate that total oil production averaged about 1.1 million bpd and total gas production averaged about 7.6 bcfd, down from 1.6 million bpd and 12.4 bcfd in 2002 (MMS, 2006b). The lower than expected production figures are due in part to the significant production losses associated with Hurricanes Katrina and Rita. Deepwater exploration and deep exploration in the shallow waters of the GOM continued to grow. MMS notes that the deepwater GOM is "the driving force in Gulf production and potential growth (MMS, 2006c). MMS recently announced 10 new discoveries in the deepwater Gulf ad also noted that 42 rigs were operating in this region in mid-March 2006 (MMS, 2006c).[2]

B2-1.3.3 Estimates of New MODUs To Be Constructed

At proposal, EPA noted that the progress report published by *Offshore* magazine showed that the majority of offshore production investment in 2003 is in the refurbishment of old rigs, however some new rigs are being built. In 2003, the majority of new offshore construction comprised jackup rigs. Surveys indicated that 14 jackups were completed in 2003, and that eight additional jackups were to be completed by 2005. Of the eight jackups to be completed, three were being built with a new Rowan Companies design specifically introduced for deep shelf drilling in the shallow water of the Gulf of Mexico (Offshore, July 2003). The outlook of the offshore industry showed increased growth in deepwater drilling. Three companies were reported as having deepwater semi-submersibles completed by 2004. The projections predicted that up to 67% of oil production and 27% of gas production will come from deepwater drilling by 2005. (Drilling Contractor, Nov/Dec 2001).

EPA's economic analysis report for the proposal (U.S. EPA, 2004) noted that jackups and semi-submersibles were among the most frequent MODUs to have CWIS intake rates that would meet Phase III rule criteria. Therefore, EPA focused on these as an indication of how many MODUs might be built with CWIS intake rates of concern (U.S. EPA, 2004). Given that 22 jackups were expected to be completed over the time period of 2003-2005 (three years) (Drilling Contractor, 2003b), EPA assumed at proposal that seven jackups might be built each year during the time frame of the economic analysis; of this group (based on the assumption that half of all new MODUs would meet Phase III rule criteria, discussed above) EPA assumed four of these would be affected by the 316(b) requirements. EPA further assumed that about one semi-submersible will be built per year. To be conservative, EPA assumed each of these semi-submersibles would meet Phase III rule criteria. Drill ships may also be constructed during the time frame of the analysis, but there were very few drill ships operating in the GOM at proposal (six are currently operating in the GOM [Rigzone, 2006a]). Only 12 out of a total 384 MODUs operating in the GOM (3%) at proposal were drill ships. EPA conservatively assumes three drill ships might be constructed over the entire 20-year time frame of the analysis, all of which are assumed to meet final rule criteria.

The other two types of MODUs (submersibles and barges) are seldom associated with CWIS intake rates meeting proposed rule criteria (U.S. EPA, 2004). EPA assumed no submersibles or barges with total design intake rates meeting proposed rule criteria will be built during the time frame of the analysis. EPA assumed that half the jackups and semi-submersibles would be built with proposed technologies in place to control intake of aquatic species under a two MGD cutoff. The drill ships were assumed to be built with 50 MGD or greater intake rates,

[2] Not all discoveries are developed, and many of these will most likely be developed as undersea completions. The vast majority of deepwater projects are undersea completions (MMS, 2006d)

and the jackups and semi-submersibles were assumed to be built with intakes having a total intake rate of less than 20 MGD, based on the intake rates of existing MODUs of these types in the survey.

Since proposal, EPA has not changed the estimate of how many MODUs subject to the rulemaking will be constructed over the time frame of the analysis. EPA notes that more current information (Rigzone, 2006a) indicates that 12 jackups slated for GOM operation are currently under construction. No semi-submersibles or drill ships are currently listed as under construction in the GOM listing. Given that not all jackups currently under construction will be launched this year and given that no substantive comments were received that disputed these estimates, EPA is continuing to assume that these numbers of jackups, semi-submersibles, and drill ships estimated to be built during the time frame of the analysis are reasonable. Should new MODUs constructed for foreign use be reconsidered for use in the GOM, costs for retrofitting will be the same as those estimated for new MODUs, since engineering cost estimates were based on retrofit costs (U.S. EPA, 2006) EPA did not estimate aggregate costs under this scenario, but impacts from such costs, should they be incurred, would be negligible, given the results of impact analyses. Firms owning foreign-based MODUs are either the same ones analyzed in Chapter B3 or are likely to be similar firms, and foreign-based vessels are similar to those analyzed in Chapter B3. EPA believes that, given the decline in numbers of MODUs operating in the GOM from 2002 to 2006 despite increased interest in drilling in the GOM sparked by high oil and gas prices, that significant numbers of new MODUs constructed for operation in foreign locations will not be affected.

At proposal, the firms with the largest numbers of MODUs of the type considered likely to have CWISs with intake rates >2 MGD were considered the likeliest to build new MODUs. For this analysis of the final rule, two additional firms have been added to the group analyzed in Chapter B3, since these firms (Nabors and Atwood Oceanics) were noted to have jackups under construction for Gulf drilling purposes.

B2-2 OIL AND GAS PRODUCTION PLATFORMS

B2-2.1 Overview

Oil and gas production operations generally take place on platforms or other structures. The primary areas of offshore oil and gas production activity are the GOM, California, and Alaska. In shallow offshore waters, platforms are the typical structure used to support the resource extraction activities. These activities may involve drilling wells, producing oil and gas from wells, separating production streams, gathering and compressing gas, and working over older wells to increase production. Platforms often support buildings for crews, including in some cases, long-term living quarters.

There are several different types of platforms, and non-platform structures used in the GOM. Seven major types of production systems are used in offshore oil and gas production.

- The fixed platform is the most commonly used for shallow-water drilling. It is anchored directly into the seabed with a deck to support living quarters etc. While it is primarily used for shallow water drilling, it is economically feasible for depths up to 1,650 ft.
- The compliant tower is a flexible tower and piled foundation with a conventional deck. The compliant tower differs from the fixed platform in that it can withstand large lateral forces. Therefore, it is effective at greater depths and is typically used in water depths between 1,500 and 3,000 ft.
- The Seastar platform is a floating mini-tension leg platform used for smaller deepwater reserves. It is used in water depths from 600 to 3,500 ft.
- A floating production system (FPS) is a semi-submersible with drilling and production equipment. The FPS can be dynamically positioned using rotating thrusters. The FPS is used at depths from 600 to 6,000 ft.

- Another type of offshore platform is the Tension Leg platform (TLP). It is connected to he sea floor with tension tendons. TLPs are used up to depths of 6,000 ft.
- The Spar platform consists of a large diameter cylinder supporting a deck and is used in water depths up to 3,000 ft.
- The Subsea system can produce single or multiple wells using manifold pipeline systems. The Subsea system is used for production at depths greater than 7,000 ft. (U.S. EPA, 2000). In this system, all well completions are at the seafloor level, with piping leading to production platforms in shallower water or nearby deepwater structures.

B2-2.2 Existing Platforms/Structures and Their Associated Firms

Because EPA determined that so few existing platforms would be likely to have CWISs with intake rates >2MGD at proposal (U.S. EPA, 2004) and because EPA received no substantive data indicating other key areas where new platforms that might install CWISs that meet the final rule criteria, EPA continues to determine that the deepwater Gulf and Alaska are the primary focus of analysis.[3] This profile of existing platforms and associated firms, therefore, focuses only on those two areas and on what structures have been constructed since proposal. Other areas with offshore oil and gas operations, i.e., shallow water Gulf and California, either have not been identified as likely to be sites where structures with CWISs affected by the final rule are located or are areas where no new construction is occurring (U.S. EPA, 2004). Furthermore, if any platforms were to be built in shallow waters with CWISs of the regulated size, the size and scope of the operation that would drive the need for a CWIS this size would indicate a very expensive operation similar to the scope and size of deepwater operations. The firms likely to be involved in such an operation would be similar to those that operate in the deepwater GOM. Because EPA located no information that indicated that such shallow water operations were being built, and commenters did not provide data indicating that such operations are being or will be built, no costs were estimated for such operations. Therefore, the shallow water GOM and California regions are not discussed further.

B2-2.2.1 Structures/Platforms/Structures in the Deepwater GOM

At proposal, EPA profiled all operations in the Federal GOM. Since the vast majority of shallow water projects were determined at that time to be highly unlikely to install CWISs that would meet final rule criteria, this extent of profiling is not continued in this final economic analysis report. The discussion here focuses entirely on the deepwater GOM.

Since proposal, a number of new structures have been built in the deepwater GOM. This new construction also brought in a number of new firms into the area. At proposal, 24 deepwater structures either had CWISs with intakes >2MGD or their intake rates were unknown. Between 2003 and 2006, a total of 11 new structures have been installed. The intake rates of CWISs on these structures are unknown. As Table B2-5 shows, four structures were installed in 2003, seven structures were installed in 2004, and no structures were installed in 2005, for an average of three to four structures per year installed. This average corresponds well to EPA's estimate, at proposal, that about three structures would be added per year in the deepwater GOM.

[3] One commenter indicated that deep gas operation could be affected by the final rule, but provided EPA with no examples of any deep gas operations in shallow water where CWIS intake rates currently or are expected to exceed 2 MGD.

Table B2-5: GOM Deepwater Platforms Constructed between 2003-2005t

Platform Name	Year of Construction	Owner Firm
Gunnison	2003	Kerr-McGee Oil & Gas Corp.
Magnolia	2004	ConocoPhillips Co.
Red Hawk	2004	Kerr-McGee Oil & Gas Corp.
Front Runner	2004	Murphy Exploration & Production Co.-USA
Marco Polo	2004	Anadarko Petroleum Corp.
Holstein	2004	BP Exploration & Production, Inc.
Mad Dog	2004	BP Exploration & Production, Inc.
Matterhorn	2003	Total E&P USA, Inc.
Nakika	2003	BP Exploration & Production, Inc
Medusa	2003	Murphy Exploration & Production Co.-USA
Devils Tower	2004	Dominion Exploration & Production, Inc.

Source: MMS, 2006d

These platforms are operated by a number of firms of different sizes and types. The potentially affected firms can be divided into two basic categories. The first category consists of the major integrated oil companies, which are characterized by a high degree of vertical integration (i.e., their activities encompass both "upstream" activities—oil exploration, development, and production—and "downstream" activities—transportation, refining, and marketing). The second category of affected firms consists of independents engaged primarily in exploration, development, and production of oil and gas and not typically involved in downstream activities. Some independents are strictly producers of oil and gas, while others maintain some service operations, such as contract drilling and well servicing.

The major integrated oil companies are generally larger than the independents. As a group, the majors typically produce more oil and gas, earn significantly more revenue and income, and have considerably more assets and greater financial resources than most independents. Furthermore, majors tend to be relatively homogeneous in terms of size and corporate structure. All majors are considered large firms under the Regulatory Flexibility Act (RFA) guidelines and generally are C corporations (i.e., the corporation pays income taxes). Independents can vary greatly by size and corporate structure. Larger independents tend to be C corporations; small firms might also pay corporate taxes, but they also can be organized as S corporations (which elect to be taxed at the shareholder level rather than the corporate level under subchapter S of the Internal Revenue Code). Small firms also might be organized as limited partnerships, sole proprietorships, etc., whose owners, not the firms, pay taxes.

One change of note since proposal is the effect of the 2005 Hurricanes Katrina and Rita on some of the deepwater structures. One deepwater structure is listed as destroyed by Hurricane Rita –Typhoon, owned by Chevron (CWIS intake rate unknown) (MMS, 2006e; ERG, 2004a). Chevron reports in their 2005 10-K report that they are assessing damage and weighing options for restarting operations (SEC, 2006). Katrina damaged four other structures in the deepwater GOM. These include Cognac, Matterhorn, Mars, and Virgo (MMS, 2006e). Matterhorn (Total) is a new structure since proposal, with CWIS intake rate unknown. Cognac (Shell Offshore) was known to have CWIS intake rates <2 MGD, and Virgo (Total) has unknown rates (ERG, 2004a). Mars, the structure with the largest share of production of any such structure in the GOM, is known to have CWIS intake rates exceeding 2 MGD (ERG, 2004a). This structure is expected to be back in production in the latter half of 2006 (New York Times, 2006).-

The proportions of majors and independents operating in the deepwater GOM have not changed significantly since proposal, and the platforms/structures existing at the time of proposal have not changed hands in the interim.

At proposal, the active firms in the deepwater included ExxonMobil, Agip (now a subsidiary of Eni), El Paso Production, Shell Offshore, ConocoPhillips, Chevron, BP, and Total E&P (majors or integrated utilities) and Kerr-McGee and Amerada Hess (independents). The newest structures have added Murphy E&P, Anadarko Petroleum, and Dominion E&P to the firms operating in the deepwater. These new firms comprise one independent (Anadarko) and one gas/electric utility firm (Dominion), adding to the two independents (Kerr-McGee and Amerada Hess) and one utility (El Paso) covered at proposal. All the remaining firms are considered majors, including the new deepwater operator, Murphy Oil.

Table B2-6 summarizes the information, listing the firms operating in the deepwater GOM and their parent company.

Table B2-6: Operators and Parent Companies of GOM Deepwater Structures

Operator Company	Parent Company
Amerada Hess Corporation	Amerada Hess Corporation
Anadarko Petroleum Corp.	Anadarko Petroleum Corp.
BP Exploration & Production Inc	BP PLC
Chevron USA Inc	Chevron Corp.
ConocoPhillips Co.	ConocoPhillips Co.
Dominion Exploration & Production, Inc.	Dominion Resources, Inc.
El Paso Production GOM Inc	El Paso Corp.
Eni US Operating Co., Inc.	Eni SpA
Exxon Mobil Corporation	Exxon Mobil Corporation
Kerr-McGee Oil & Gas Corporation	Kerr-McGee Corporation
Murphy Exploration & Production Company - USA	Murphy Oil Corporation
Shell Offshore Inc	Royal Dutch Shell plc
Total E&P USA Inc	Total SA

Source: MMS, 2006d; SEC, 2006.

It is important to note that companies may share ownership of a platform. In general, the company listed as the operator in the MMS databases is the 100 percent owner or largest shareholder of the platform, but this is not always the case. The economic analyses in this report, however, make the simplifying assumption that only one firm owns a platform. In reality, several firms might share the impacts from regulatory costs to a platform.

The same methodology used to identify small firms in the MODU profile (Section B2-1) is used for this profile. Table B2-7 lists the numbers of firms in the GOM by their NAICS definition.[4] Also listed is the SIC code, which is the identifier used in the 10K reports. In the table, NAICS and SICs are mapped in the key industry sectors represented by firms operating in the GOM.

[4] The North American Industry Classification System (NAICS) supercedes the Standard Industrial Classification (SIC) codes, however, the transition to the new system is still in progress.

Table B2-7: Count of Firms by SIC and NAICS Code

SIC code	NAICS code	NAICS Title	SBA Size Standard	GOM Number of Firms	
				Small	Large
1311	211111	Crude Petroleum and Natural Gas Extraction	500 employees	0	6
2911	324110	Petroleum Refineries	1,500 employees	0	5
4911	221112	Fossil Fuel Electric Power Generation	4.0 million megawatt hours	0	1
4922	486210	Pipeline Transportation of Natural Gas	$6.5million in revenues	0	1

Note: Include 4 foreign firms for which NAICS or SIC codes were available on the SEC website..

Source: SEC, 2006, 13 CFR Part 121, Census, 2006

As Table B2-7 shows, the predominant firm types operating in the GOM are those in the oil and gas extraction NAICS and the refineries NAICS. No firms were identified as small. All four foreign firms are also large.

Table B2-8 shows the firms considered potentially affected firms operating in the deepwater GOM and their relevant financial data spanning 2002 (the year of data used at proposal) through 2005, along with 2004 data, which is used to compare to compliance costs in 2004 dollars in Chapter B3. These data include number of employees, assets, liabilities, and revenues, along with several ratios that provide a general indication of financial health, where data are available in 10-K or 20-F reports in U.S. dollars.

The ratios used to establish company financial status are profitability ratios, namely: return on assets, return on equity, and profit margin. As described earlier, these three financial indicators are calculated as the ratio of the net income to the total assets, stockholders' equity, and net sales respectively. While individually these ratios only tell a part of the financial stability of a company, when analyzed together, they give a much clearer picture of a company's financial health.

Table B2-8 also presents summary financial ratios. Among firms with data available in dollars, median return on assets for the group in 2004 is 8.31%, median return on equity is 19.77%, and median profit margin (net income/revenues) is 8.50%, according to 2004 financial data. Among these 13 firms, all reported positive net income for 2004. Most firms had sizeable increases in revenue between 2004 and 2005.

Table B2-8: Financial Condition of Platform/Structure Parent Companies (2002 – 2005)

Firms	Year of Data	Size	Type	No. of Employees	Assets (thousand)	Equity (thousand)	Revenues (thousand)	Net Income (thousand)	Return on Assets (%)	Return on Equity (%)	Profit Margin (%)
Eni		Large	Foreign								
Amerada Hess Corporation	2005	Large	Major		$19,115,000	$6,286,000	$22,747,000	$1,242,000	6.5	19.76	5.46
	2004				**$16,312,000**	**$5,597,000**	**$16,733,000**	**$977,000**	**5.99**	**17.46**	**5.84**
	2003				$13,983,000	$5,340,000	$14,311,000	$643,000	4.6	12.04	4.49
	2002				$13,262,000	$4,249,000	$11,551,000	$218,000	1.64	5.13	1.89
Anadarko Petroleum Corp.	2005	Large	Independent	3,300	$22,588,000	$11,051,000	$7,100,000	$2,466,000	10.92	22.31	34.73
	2004			**3,300**	**$20,192,000**	**$9,285,000**	**$6,079,000**	**$1,601,000**	**7.93**	**17.24**	**26.34**
	2003			3,500	$20,543,000	$8,599,000	$5,113,000	$1,287,000	6.26	14.97	25.17
	2002			3,800	$18,248,000	$6,972,000	$3,833,000	$825,000	4.52	11.83	21.52
BP plc	2005	Large	Major	NA	NA	NA	NA	NA	NA	NA	NA
	2004			**102,900**	**$205,648,000**	**$86,435,000**	**$285,059,000**	**$17,090,000**	**8.31**	**19.77**	**6.00**
	2003			103,700	$186,576,000	$80,292,000	$232,571,000	$12,941,000	6.94	16.12	5.56
	2002			115,250	$164,103,000	$67,274,000	$178,721,000	$8,109,000	4.94	12.05	4.54
Chevron Corp	2005	Large	Major	59,000	$125,833,000	$62,676,000	$198,200,000	$14,099,000	11.2	22.5	7.11
	2004			**56,000**	**$93,208,000**	**$45,230,000**	**$155,300,000**	**$13,328,000**	**14.3**	**29.47**	**8.58**
	2003			61,533	$81,470,000	$36,295,000	$121,277,000	$7,230,000	8.87	19.92	5.96
	2002			53,014	$77,359,000	$31,604,000	$98,537,000	$1,132,000	1.46	3.58	1.15
ConocoPhillips Company	2005	Large	Major	35,600	$106,999,000	$52,731,000	$179,442,000	$13,529,000	12.64	25.66	7.54
	2004			**35,800**	**$92,861,000**	**$38,943,000**	**$135,076,000**	**$8,129,000**	**8.75**	**20.87**	**6.02**
	2003				$82,455,000	$30,853,000	$104,246,000	$4,735,000	5.74	15.35	4.54
	2002				$76,836,000	$32,328,000	$56,748,000	($295)	0.0	0.0	0.0
Dominion Resources, Inc.	2005	Large	Other	17,400	$52,660,000	$10,397,000	$18,041,000	$1,033,000	1.96	9.94	5.73
	2004				**$45,418,000**	**$11,426,000**	**$13,991,000**	**$1,249,000**	**2.75**	**10.93**	**8.93**
	2003				$44,186,000	$10,538,000	$12,095,000	$318,000	0.72	3.02	2.63
	2002				$39,996,000	$10,213,000	$10,218,000	$1,362,000	3.41	13.34	13.33
ExxonMobil Corporation	2005	Large	Major	83,700	$208,335,000	$111,186,000	$370,680,000	$36,130,000	17.34	32.5	9.75
	2004			**85,900**	**$195,256,000**	**$101,756,000**	**$298,035,000**	**$25,330,000**	**12.97**	**24.89**	**8.5**
	2003			88,300	$174,278,000	$89,915,000	$246,738,000	$21,510,000	12.34	23.92	8.72
	2002			92,500	$152,644,000	$74,597,000	$204,506,000	$11,460,000	7.51	15.36	5.6
Forest Oil Corporation	2005	Small	Independent	506	$3,645,546	$1,684,522	$1,072,045	$124,413	3.41	7.56	11.61
	2004			**496**	**$3,112,505**	**$1,472,147**	**$912,898**	**$56,417**	**1.81**	**3.83**	**6.17**
	2003			458	$2,693,548	$1,185,798	$657,178	$56,305	2.09	4.75	8.58
	2002			456	$1,924,681	$921,211	$472,868	$58,115	3.02	6.31	12.29

Kerr-McGee Corporation	2005	Large	Independent	3,865	$14,276,000	$4,115,000	$5,927,000	$3,211,000	22.49	78.03	54.18
	2004			**4,084**	**$14,518,000**	**$5,318,000**	**$4,398,000**	**$404,000**	**2.78**	**7.6**	**9.19**
	2003			3,915	$10,250,000	$2,636,000	$3,289,000	$219,000	2.14	8.31	6.66
	2002			4,470	$9,909,000	$2,536,000	$2,579,000	($485,000)	-4.89	-19.12	-18.81
Murphy Oil Company	2005	Large	Major	6,248	$6,368,511	$3,460,990	$11,877,151	$846,452	13.29	24.46	7.13
	2004			**5,826**	**$5,458,243**	**$2,649,156**	**$8,359,839**	**$701,315**	**12.85**	**26.47**	**8.39**
	2003			4,789	$4,712,647	$1,950,883	$5,164,657	$294,197	6.24	15.08	5.7
	2002			4,010	$3,885,775	$1,593,553	$3,984,327	$111,508	2.87	7	2.8
Royal Dutch Shell	2005	Large	Major, Foreign	109,000	$223,646,000	$94,103,000	$306,731,000	$25,688,000	11.49	27.30	8.37
	2004			**113,000**	**$193,625,000**	**$90,545,000**	**$266,386,000**	**$18,182,000**	**9.39**	**20.08**	**6.83**
	2003			119,000	$169,766,000	$78,251,000	$198,362,000	$12,313,000	7.25	15.74	6.21
	2002			111,000	$153,320,000	$66,195,000	$163,453,000	$9,656,000	6.30	14.59	5.91
Total SA		Large	Foreign								
Unocal	2005	Large	Independent	NA	NA	NA	NA	NA	NA	NA	NA
	2004			**6,590**	**$13,101,000**	**$5,217,000**	**$8,204,000**	**$1,346,000**	**10.27**	**25.8**	**16.41**
	2003			6,700	$11,798,000	$4,009,000	$6,512,000	$831,000	7.04	20.73	12.76
	2002			6,615	$10,846,000	$3,298,000	$5,273,000	($67,000)	-0.62	-2.03	-1.27
XTO	2005	Large	Independent	1,680	$9,857,000	$4,209,000	$3,519,000	$1,152,000	11.69	27.37	32.74
	2004			**1,356**	**$6,110,000**	**$2,599,000**	**$1,948,000**	**$508,000**	**8.31**	**19.55**	**26.08**
	2003			1,007	$3,611,000	$1,466,000	$1,189,000	$288,279	7.98	19.66	24.25
	2002			867	$2,648,000	$908,000	$810,163	$186,059	7.03	20.49	22.97

Note: 2002 values may not match those reported in the EA for the proposal (U.S. EPA, 2004) as firms may have restated their financials for a variety of reasons, including the Sarbanes-Oxley Act of 2002, which changed requirements for disclosing financial data

Source: Table C2-2; SEC, 2006, 2002-2005 10-K or 20-F.

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B2-2.2.2 Alaska Operations

There are two major regions of oil and gas production in Alaska. The first, the North Slope region, operates generally from onshore locations or on gravel islands. Platforms are not used here.

The second region, Cook Inlet, Alaska, is divided into two regions: Upper Cook Inlet, which is in State waters and is governed by the Coastal Oil and Gas effluent guidelines; and Lower Cook Inlet, which is considered Federal OCS waters and is governed by the Offshore Oil and Gas Effluent Guidelines. This section refers primarily to Upper Cook Inlet.

There are 16 platforms and 3 onshore production facilities in Cook Inlet, Alaska, of which two platforms have ceased operation and two platforms have suspended operation. Five companies own the platforms: Forest Oil Corporation, Marathon Oil Corp., ConocoPhillips, XTO Energy, and Unocal Corp. Marathon owns the two out-of-operation platforms and is not considered a potentially affected firm in Alaska. Unocal Corp. operates the majority of platforms in the Cook Inlet region, with 10 platforms and 2 onshore treatment facilities. Only one company operating in Cook Inlet waters, Forest Oil, is an independent and considered a small business. XTO is also an independent, but is a large business. The remaining operators are all listed as majors, as is the operator (BP) of the Duck Island structure in the Beaufort Sea (North Slope) (not discussed further here). One firm in Alaska is listed under NAICS 324110 (SIC 2911), Petroleum Refineries, and the three additional firms are listed as NAICS 211111 (SIC 1311), Crude Petroleum and Natural Gas Extraction. Financial data for these firms are also presented in Table B2-8.

The Department of Fish and Game in Alaska developed a standard lease requirement for all water intake pumps to be fitted with a screened enclosure. The requirement further States that the water intake at the surface of the screen enclosure should not exceed 0.1 feet per second. For the purposes of the regulatory analysis, therefore, any new platforms in the Cook Inlet or the North Slope regions are considered to be potentially affected by the 316(b) requirements for entrainment, but not impingement, since the Alaska requirement meets or exceeds 316(b) Phase III impingement standards.

B2-2.3 Existing Platforms/Structures with Intake Rates Meeting Proposed Rule Criteria

B2-2.3.1 Overview of Existing Platforms/Structures as Model for New Platforms/Structures Subject to Phase III Regulation

The following information is unchanged from proposal. EPA received no comments pertaining to the use of existing platforms and models for new platforms subject to Phase III regulations.

Very few existing platforms appear to have CWISs with intake rates that meet the proposed rule's criteria. Most of the existing platforms with CWISs of this size are located in the deep waters of GOM and in California and Alaska waters (Cook Inlet). Using the same approach as outlined for determining existing MODUs with CWIS intake rates meeting proposed rule criteria, EPA makes the following estimates, using the survey conducted for the oil and gas sectors to support this rulemaking and voluntary data submitted by industry. See also ERG (2004b).

At proposal, EPA stratified the survey in the GOM into three strata: deepwater, shallow large (20+ slot platforms), and shallow small (fewer than 20 slots).

The survey universe of deepwater structures was 24 (two structures were removed from the universe prior to the survey because their CWIS intake rates were known to be less than 2 MGD). For the survey, EPA sampled four facilities. There were no non-respondents. Only one of the four reported data showing them to have CWIS intake rates meeting proposed rule criteria. Thus EPA estimated that six deepwater structures would have CWIS intake rates meeting proposed rule criteria (24 divided by 4 is a weight of 6; with one respondent reporting an intake rate of 2 MGD or more, this produces an estimate of six total new structures meeting proposed rule criteria). However, earlier data (see ERG, 2004a) indicate that eight structures in the deepwater have CWIS intake rates meeting proposed rule criteria. EPA used the higher number of structures to estimate the proportion of existing structures with CWISs meeting the proposed rule criteria to total structures in the deepwater. Given eight structures meeting proposed rule criteria and 24 total structures, EPA believes that about 1/3 of deepwater structures to be built will be equipped with intakes meeting the Phase III rule's criteria. Only one existing deepwater structure had a total intake rate of over 20 MGD, and none had a total rate of over 50 MGD. All firms currently operating multi-well structures in the deepwater GOM with CWIS rates that meet criteria are large.

For shallow water large platforms, EPA determined that 206 existing platforms were either known to have CWISs with intake rates meeting Phase III rule criteria or their intake rates were unknown (an additional 3 platforms were known to have CWIS intake rates less than 2 MGD and were dropped from the sampling frame). EPA sampled 33 platforms among the large platform group. Three of these were nonrespondents. No additional platforms with intake rates meeting Phase III rule criteria were detected using the survey. The nonrespondents were thus assumed also to have CWIS intake rates not meeting proposed rule criteria. Four platforms, however, were known to have CWISs meeting proposed rule criteria based on earlier data (see ERG, 2004a). None of these were sampled. EPA therefore assumes only these four platforms have intake rates meeting proposed rule criteria. These platforms were owned by large firms (ExxonMobil and Marathon). Thus, EPA assumes that if any large platforms with CWIS intake rates meeting proposed rule criteria were to be built, large firms would build them.

For shallow-water, small platforms, EPA determined that 2,194 platforms were in the universe of platforms in the Federal GOM at the time of proposal (U.S. EPA, 2004). The vast majority of these platforms had unknown CWIS intake rates. Four such platforms were identified prior to EPA's Phase III Survey as having CWIS intake rates exceeding 2 MGD (ERG, 2004a). None of these was sampled. A total of 18 platforms with unknown CWIS intake rates were sampled (all responded), but EPA determined that none of the sampled platforms had total design flow rates meeting proposed rule criteria. Although this is a very small sample, this finding is bolstered by EPA's observations that platforms in State waters are unlikely to have CWIS with intake rates totaling 2 MGD or more (ERG, 2004a). Platforms in State waters and small platforms in Federal waters are generally similar structures. EPA therefore assumed that only four small platforms located in the shallow water GOM have CWIS intakes meeting proposed rule criteria. These four platforms were owned by ExxonMobil and BP, thus no small firms were estimated likely to build platforms with greater than 2 MGD intake rates in shallow water.

In the GOM, therefore, EPA estimated that a total of 16 existing platforms had CWIS intake rates meeting Phase III rule criteria. All were owned by large firms, and most operated in the deepwater regions (U.S. EPA, 2004).

In California, EPA determined that 20 platforms either have CWIS intake rates totaling 2 MGD or more or their CWIS intake rates were unknown (13 platforms with known intake rates were eliminated from the sampling frame because their total intake was less than 2 MGD). EPA sampled 3 of these 20 platforms. Only one was found to have an intake rate meeting proposed rule criteria. EPA thus assumed seven existing platforms in California had total intake rates meeting proposed rule criteria (20 divided by 3 is a weight of 6.7, which yields 7 platforms weighted). A total of six platforms were known from earlier data (see ERG, 2004a) to have intakes rates meeting Phase III rule criteria, including the surveyed platform. Three had intake rates greater than 20 MGD but less than 50 MGD. Of the six platforms with flow data showing rates meeting Phase III rule criteria, three of these were owned by small businesses (Plains Exploration and Production/Arguello). The rest were owned by large businesses (Aera Energy, a joint venture between Shell and ExxonMobil, and ExxonMobil).

In Alaska, EPA determined that 19 platforms/production facilities were in the survey universe (one platform was known to have a total CWIS intake rate of less than 2 MGD and was dropped from the sampling frame). EPA sampled two platforms, but only one was determined to have a CWIS intake rate meeting Phase III rule criteria.

EPA therefore estimated that there were 10 platforms in Alaska with intakes that met Phase III rule criteria (19/2 is a weight of 9.5). Five of these (all located in Cook Inlet) had CWIS data showing them to have CWISs meeting Phase III rule criteria (ERG, 2004a). Of these structures with known CWISs of this size, all were platforms owned by Unocal. Based on this, EPA might have assumed no small businesses currently operating would be affected in Alaska. However, a small firm constructed the most recently built platform in Cook Inlet, Osprey (Osprey's CWIS intake rates are unknown). To be conservative, EPA assumed that a small firm, much like Forest Oil (Osprey's owner), might be the type of firm to build a new structure in Alaska and such a structure might have CWIS intake rates meeting Phase III criteria. However, it is also entirely likely that no such structures will be built within the time frame of the analysis.

In summary, EPA identified 16 platforms in the GOM, 7 platforms in California, and 10 platforms in Alaska, for a total of 33 existing platforms that met Phase III rule criteria. Of these, three platforms or structures (one in the deepwater and two in California) had CWIS intake rates greater than 20 MGD, and one platform (California) had an intake rate greater than 30 MGD. No platforms had CWIS intake rates exceeding 50 MGD (U.S. EPA, 2004).

B2-2.3.2 Current Oil and Gas Production Levels and Trends

In 2002, 567 million bbls of total oil and 4.5 million MMcf of total gas were produced in the GOM, while in 2005, 440 million bbls and 3.0 million MMcf were produced. Sixty one percent of all oil production and 28 percent of all gas production in the GOM came from deepwater wells in 2002, while in 2005, 70 percent of oil and 39 percent of gas came from deepwater wells, continuing the trend of deepwater regions providing a growing share of GOM production (MMS, 2006b). MMS has been using incentives such as royalty relief to promote drilling of deep gas wells in GOM for many years, adding a new royalty relief system for deep gas wells drilled from existing platforms to extend the life of platforms in the GOM (Federal Register, Vol. 69, No. 16, pg. 3492-3514, January 26, 2004). In recent years, the drilling of such wells has increased and trends show a continuation of deep gas drilling and exploration in GOM. As technology advances and more deep gas wells are drilled, reserve estimates are being revised, as more gas is presumed recoverable. Deep gas wells in the GOM consist of deepwater drilling and deep shelf drilling in shallow waters. At proposal, deep shelf gas production had increased by 137 Bcf from 2000 to 2002. Approximately 20% of all GOM exploration drilling was at well depths greater than 15,000 ft. at the end of 2003 (Drilling Contractor, Jan./Feb. 2004). In 2004, MMS predicted that deep gas resources might total as much as 55 trillion cubic feet (Tcf) in the GOM (MMS, 2006f).

Standard & Poor's annual Report Card of the Oil and Gas industry in 2003 predicted that oil prices would average approximately $19 per barrel, and that natural gas prices would average $3 per million Btu (MMBtu) (S&P, 2003). Prices have ballooned in recent years, with current oil futures hovering around $67/bbl and current gas futures at nearly $7/MMBtu (Bloomberg.com, 2006). DOE, in their most recent projection, however, predicts some moderation of these prices in the future. DOE expects that oil prices will drop to $46.90/bbl in 2014, and then rise to $46.90/bbl by 2030 (2004 dollars). Gas prices are expected to follow a similar trend, dropping to $4.46/Mcf in 2016, and then rising to $5.92/Mcf by 2030 (2004 dollars) (DOE, 2006).[4] The economic analysis of deepwater platforms employs long run wellhead oil and gas prices used by 316(b) survey respondents to project future platform financials. These prices are considerably lower than either current prices or future projections, so can be considered a very conservative estimate of prices and thus of revenues at deepwater platforms.

According to DOE, demand for both oil and natural gas is projected to increase over time. U.S. demand for oil is expected to rise from about 20 million bpd in 2004 to about 30 million bpd in 2030, while demand for gas is expected to rise from 22.4 Tcf (total annual demand in 2004) to 26.9 Tcf (2030). The Gulf of Mexico is expected to continue to be a major source of both oil and gas. DOE projects that oil production will decline in the shallow water Gulf, going from 0.4 million bpd (2004) to 0.3 million bpd (2030), but deepwater oil will increase from 1.0

[4] 1 Mcf ~ 1 MMBtu.

million bpd (2004) to 2.2 million bpd (2016), then declining to 1.7 million bpd by 2030, for a total of 1.6 million bpd in 2004 rising to 2.0 million bpd by 2030 (DOE, 2006). Gas production follows this same pattern in the Gulf. Shallow water Gulf production is expected to decline, going from 2.4 Tcf to 1.8 Tcf between 2004 and 2030, while deepwater Gulf production is expected to increase, going from 1.8 Tcf in 2004 to 3.2 Tcf in 2014, then declining to 2.1 Tcf in 2030 (DOE, 2006).

B2-2.3.3 Estimate of Platforms/Structures To Be Built That May Be Affected by the Proposal

In the deepwater region, EPA determined at proposal, based on MMS data, that approximately 2 to 4 structures are built each year (see MMS, 2003; U.S. EPA 2004). EPA assumed that an average of three such deepwater structures are completed each year. EPA noted that out of 24 total structures in the deepwater as of 2003, 8 were estimated to meet Phase III rule criteria, or about a third of the total. EPA thus assumed that one structure per year out of the three installed annually might have intakes meeting Phase III rule criteria. Because only one structure at proposal was identified as having a CWIS intake rate of greater than 20 MGD (and none had a CWIS intake rate of more than 30 MGD), EPA assumed that only one structure out of 10 would be built having a CWIS intake rate of 20 MGD or more. This would mean that EPA estimated two structures would be built with these intake rates over the 20-year construction time frame.

All of these structures are assumed to be constructed by large firms. To date (2006), only large firms have built structures in the deepwater GOM, except for a few subsea completions, which have not been identified as associated with intake rates meeting Phase III rule criteria. This scenario is likely to continue, given the resources required to construct deepwater structures, the cost of which sometimes exceed $1 billion dollars (U.S. EPA, 2000).

Among large (20+ slot) platforms, EPA determined that few, if any, such platforms might be built during the time frame of the analysis. In the EA for the proposal, EPA noted that no platforms of this size had been installed since 1998 (U.S. EPA, 2004). A recent download of MMS data (MMS, 2006g) indicates that no additional platforms of this size had been installed in the 2003-2005 time frame. Given that so few of the existing platforms appear to resemble a new regulated project, EPA continues to assume no new platforms of this size and with CWIS meeting final rule criteria would be constructed.

Among smaller platforms, EPA determined at proposal that they are unlikely to install CWIS of the size considered to meet proposed rule criteria. EPA continues to assume no new smaller platforms constructed in shallow water would be affected by the rulemaking.

In Cook Inlet, Alaska, only one new platform has been constructed in recent years. Most new exploration and development in this region takes place from existing infrastructure or from onshore locations using directional drilling, in which wells are drilled both vertically and horizontally to reach potential reserves, sometimes thousands of feet from the top-hole locations. No definitive plans appear to be in place for any new platforms in State waters. In Federal waters, lower Cook Inlet is a source of potential activity, since MMS completed a lease bid in April 2004. No activity in this region was noted since that time, however. Given the long lead times between lease bid to operation, it may be relatively unlikely that this lease bid will result in new platforms during the time frame of the analysis in either location. To be conservative, however, EPA assumes one such platform might be constructed in Upper Cook Inlet (State waters) and begins operation during the time frame of analysis. In other Federal areas in the Alaska region, little new activity is underway BP has dropped plans for its Liberty project in the Beaufort Sea area (Federal Register, Vol. 67, No. 99 pp. 36020-36022). The only other activity that has taken place in recent years in Federal waters is an exploratory well drilled in the Beaufort Sea in 2003. No further activity has been noted since that time (MMS, 2006h). MMS has completed lease sales in the Beaufort Sea in 2003 and 2005 (MMS 2006i), but the time frame for development, if any is undertaken, could be beyond the time frame of this analysis.

B2-3 TOTAL NEW OIL AND GAS OPERATIONS

Table B2-9 summarizes the number of existing MODUs and platforms that are estimated to meet the proposed rule's criteria, had EPA decided to regulate existing oil and gas facilities, as well as new MODUs and platforms expected to be built over the 20-year analytical period that might be required to install control technologies. Also presented is an assessment of the number of firms involved that might be small businesses.

Table B2-9: Number of Existing and Future Offshore Oil and Gas Extraction Facilities Estimated or Assumed To Meet Final Phase III Rule Criteria over a 20-Year Analysis Time Frame

Type of Oil and Gas Facility	Existing Facilities				New Facilities			
	No. with >2 MGD flows	No. with >20 MGD flows	No. with >50 MGD flows	No. of Small Firms Potentially Involved	No. Built in 20-Year Period >2 MGD	No. Built in 20-Year Period >20 MGD	No. Built in 20-Year Period >50 MGD	No. of Small Firms Potentially Involved
MODUs	172	12	12	6	103	3	3	0
Deepwater Platforms (GOM)	8	1	0	0	20	2	0	0
20+ Slot Platforms (GOM)	4	0	0	0	0	0	0	0
Other GOM Platforms	4	0	0	0	0	0	0	0
California Platforms	7	3	0	1	0	0	0	0
Alaska Platforms	10	0	0	1	1	0	0	1
Total	205	16	12	8	124	5	3	1

Source: U.S. EPA Analysis, 2006. See the 316(b) Oil and Gas Compliance Cost Model for the Final Rule, DCN 9-4000 and ERG, 2004b.

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Chapter B3: Economic Impact Analysis for the Offshore Oil and Gas Extraction Industry

CHAPTER CONTENTS

INTRODUCTION

The Final Section 316(b) Rule for Phase III Facilities will potentially affect any new MODUs and oil and gas production structures that use CWISs with daily design combined intakes totaling at least 2 MGD (and at least 25% of water used for cooling water purposes). This regulatory structure is the similar to that applied to new facilities under the Section 316(b) Phase I regulation.

This economic impact analysis is divided into four sections. Section B3-1 presents the analysis of the 316(b) rulemaking on MODUs, Section B3-2 presents the analysis of offshore oil and gas production platforms, Section B3-3 summarizes the costs and impacts on both MODUs and platforms and provides totals for the combined industry subgroups, and Section B3-4 presents costs to the Federal government and total social costs. The first two sections each discuss the aggregate national after-tax compliance cost estimates for new MODUs and platforms (as well as briefly summarizing what these costs would be had existing MODUs and platforms been covered by the final rule). These sections also present vessel-level or platform-level pre- and after-tax compliance costs, and discuss impacts, both at the vessel/platform level and at the firm level. The vessel/platform level impacts are assessed using two approaches. The first approach uses the existing facilities that might represent new facilities and applies a cash-flow/net income-based analysis. The second approach is a standard barrier-to-entry analysis that investigates the present value of initial permitting costs (discounted to the assumed year of compliance) plus initial one-time capital/installation costs as a percentage of the cost to construct a new MODU or platform. The firm-level analysis uses firm revenues at firms that are the likeliest to construct new facilities. EPA applies a pre-tax and after-tax annualized cost of compliance (incorporating permitting, monitoring, capital/installation, and O&M costs) for each MODU/platform the firm is expected to build over the period of analysis. For the comparison of annualized costs of compliance with annual revenue, EPA assumed that all of a firm's new MODUs or platforms/structures would be constructed in one year. This assumption maximizes the potential impact of compliance cost in relation to revenue. If EPA instead assumed a firm would spread construction over more than one year, the ratio of compliance cost to revenue would be less in any single year and the likelihood of finding economic impacts would diminish. In this way, the assumption that all compliance costs are incurred in the same year is highly conservative. With no firm-level impacts found under this conservative assumption, then there will also be no impacts under other, possibly more likely, scenarios in which costs are incurred over several years. The ratio of these costs to revenues is then calculated and assessed as to whether this ratio might indicate the potential for firm-level impacts.

The methodologies used in each analysis are presented first in each section, followed by a discussion of the analytic results.

No substantive comments were received on the costs or impacts estimated at proposal. Costs, therefore, have only been updated to reflect 2004 values. Impacts on individual platforms and vessels were not rerun, since these impacts are based on survey data that were updated to reflect 2003 dollar values at proposal for comparison with engineering and permitting costs that reflect the same year dollars. Since these costs remain the same in 2003 dollars, impacts remain unchanged from proposal and are considered final for the purposes of this economic analysis report.

B3-1 MODU ANALYSES

B3-1.1 Aggregate National After-tax Compliance Cost Analysis

A number of costs must be considered in calculating the aggregate national after-tax compliance costs, each with distinct timing considerations. Permitting costs are incurred by facilities, but these costs are incurred by facilities to come under one of three General Permits. EPA assumes costs of studies needed to incorporate permit requirements under the General Permits can be shared. EPA further assumes that all permitting costs would be grouped into three general permit regions. These regions are Eastern Gulf of Mexico, Western Gulf of Mexico, and Alaska. Other permit activities are facility-specific and will fall on each facility affected. The timing of permitting costs is complex and was discussed in *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities*. More information can also be found in U.S. EPA (2006a) and ERG (2004a).

EPA assumes that four jackups and 1 semi-submersible will be built each year over the time frame of the analysis. EPA also assumes that three drill ships will be built, launched in 2012, 2017, and 2022 for a total of 103 MODUs over the 20-year period of construction. Permitting costs, therefore, apply to 80 jackups, 20 semi-submersibles and 3 drill ships. See *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*.

Pre-tax costs of installing and operating control technologies and for various permitting activities are input to a spreadsheet in the year in which they are assumed to be incurred. Capital costs are assumed to be incurred every 10 years, and repermitting costs occur every 5 years. Each MODU is assumed to operate over a 30-year compliance period[1]. Costs are discounted to the year of compliance, assumed to be the year the MODU is launched, and summed to produce the present value of costs in the year of compliance. These costs are then annualized over 30 years. See *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities* for more details on the cost discounting methodology.

To create after-tax costs, EPA assumes that the highest marginal corporate tax rate applies. This rate is 35% (IRS, 2005), so after-tax costs would be 65% of the pre-tax costs. EPA does this because all MODU owners that are likely to build MODUs are large corporations by SBA standards and all have earnings in most years that place them in the highest corporate tax bracket.

Table B3-1 summarizes the national aggregate after-tax compliance costs for MODUs. As the table shows, these costs are $1.9 million per year over the time frame of the analysis in 2004 dollars. See ERG (2004a) for a detailed description of how these costs were calculated (note, however, the costs shown in this reference are the

[1] The 30 year compliance period does not reflect the anticipated operational life of the MODU, rather it is the period of analysis for assessing long-term costs and benefits.

2003 dollar values). See also the 316(b) Oil and Gas Compliance Cost Model for the Final Rulemaking, DCN 9-4000 (hereinafter, Compliance Cost Model for Final.

Had existing MODUs been covered by the final rule, the total national cost of the rule would have included an additional $3.6 million per year in 2003 dollars (ERG, 2004b).

Table B3-1: Total Aggregate National After-tax Compliance Costs for MODUs ($2004)

Type of Cost	Present Value (year of compliance)	Annualized Cost of Compliance
Permitting	$7,270,132	$547,546
Capital/Installation		
Semi-submersibles	$634,915	$47,818
Jackups	$15,277,346	$1,150,604
Drill ships	$813,165	$61,243
Total	$16,725.426	$1,259,665
Monitoring	$1,370,001	$103,181
O&M	$0	$0
Total	**$25,365,559**	**$1,910,392**

Source: U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-1.2 Vessel-Level Compliance Costs

This section addresses costs to each of the three types of new vessels. Again, permitting and monitoring costs are from U.S. EPA (2006a), and capital/installation costs are from U.S. EPA (2006b). Weighted average costs reported in the TDD (U.S. EPA, 2006b) and derived for existing facilities are calculated and applied to new facilities as presented in a spreadsheet located in the rulemaking record (DCN 7-4030) and in the Compliance Cost Model for Final, DCN 9-4000. Pre-tax costs per vessel are used in the firm-level analysis. After-tax per facility costs are also presented. After-tax costs are used for comparison to pre-tax costs and are used in the firm-level analysis, but are not used directly as shown in the vessel impact analysis.[1] Additional details on how these costs are calculated are presented in ERG (2004a).

B3-1.2.1 Pre-Tax Cost of Compliance for Representative Vessels

The costs shown in Table B3-2 reflect the costs assigned to each vessel, by type of vessel. The representative vessels are those launched in 2007 (jackups and semi-submersibles) and 2012 (drill ship) for the purposes of timing assumptions. All costs are discounted to the year of compliance, which is the same as the assumed year of launching. This date may be prior to the date actual compliance is required for some vessels. Those constructed in 2007-2012 or 2014 (depending on location) are assumed to install and operate compliance equipment immediately when they are constructed, even though permit requirements may not be in place at that time (see *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities* for more details). The present value costs are calculated by inputting each cost into the year that it is

[1] In the impact analysis, after-tax costs are applied to existing MODUs, but these are calculated in a more exact way, since the existing MODUs have known marginal tax rates, and a depreciation schedule is used to more precisely calculate the after-tax cost impact on cash flow; see Section B3-1 below and ERG, 2004c). Also note that neither survey data nor compliance costs were updated from 2003 to 2004 for the impact modeling, since the costs did not change from proposal except for adjusting for inflation. All vessel-level modeling results from proposal, therefore, are considered final.

assumed to be incurred, which includes additional capital costs in years 11 and 21 after initial construction, repermitting costs every 5 years, and monitoring costs in the appropriate years. The costs are taken out over 30 years, discounted to the year of compliance at the recommended OMB discount rate of 7%, and then summed. The present value cost is then annualized using a 30-year time frame assumption and 7% discount rate. *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities* also discusses this process, as does ERG (2004a).

Table B3-2 presents the costs of compliance on an annual basis for the three types of MODUs. As the table shows, these costs range from $15,307 to $39,106 per year depending on type of vessel. These costs are small in comparison to revenues associated with drilling even one exploration well in the deepwater GOM. The construction of these types of wells cost oil and gas production companies at least $25 million to $30 million per well (U.S. EPA, 2000). A large portion of this outlay is paid to the operator of the MODU that drills the well. These costs are also small in comparison to typical MODU day rates, which can range from $50,000 to $180,000 per day (Rigzone, 2006a).

Table B3-2: Per-Vessel Annualized Pre-Tax Cost of Compliance ($2004)

Type of Cost	Present Value (year of compliance)	Annualized Cost of Compliance
Permitting		
Semi-submersibles	$129,990	$9,790
Jackups	$129,990	$9,790
Drill ships	$68,188	$5,136
Capital/Installation		
Semi-submersibles	$48,840	$3,678
Jackups	$293,795	$22,127
Drill ships	$417,008	$31,407
Monitoring		
Semi-submersibles	$24,405	$1,838
Jackups	$24,405	$1,838
Drill ships	$34,046	$2,564
O&M	$0	$0
Total		
Semi-submersibles	$203,235	$15,307
Jackups	$448,191	$33,755
Drill ships	$519,242	$39,106

Source: U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-1.2.2 After-tax Costs

After-tax costs are presented here for comparison purposes. After-tax costs are assumed to be lower than the pre-tax costs by the top marginal corporate tax rate of 35%. Thus the costs calculated are 65% of the pre-tax costs in Table B3-2 above. The annual after-tax, annualized, per-vessel compliance costs are $9,949 for semi-submersibles, $21,941 for jackups, and $25,419 for drill ships, based on the pre-tax costs presented above.

B3-1.3 Impact Analysis

EPA has not rerun the impact analysis at the vessel level from proposal. Other than for inflation, all costs remain the same as those at proposal. EPA considers the impact results from proposal, therefore, to be final.

The impact analysis is conducted at two levels: vessel-level and firm-level. Although the financial condition of new vessels cannot be known, the financial conditions of a few, representative existing vessels are reflected in EPA's 316(b) survey of MODUs. EPA received eight economic surveys from three semi-submersibles, three jackups, and two drill ships. The financial information from these representative vessels is used for a general assessment of how well these vessels would do financially if costs of the final regulation applied. The representative vessels are thus a proxy for new sources subject to Phase III regulation. This analysis provides an alternative assessment of the potential for barrier to entry.

The second vessel-level analysis is a more typical barrier-to-entry analysis conducted by EPA for new entities, which looks at the present value of the initial permitting costs (including those associated with start-up activities, pre-permitting studies and initial permit application activities), discounted to the applicable compliance year, plus the initial one-time capital/installation costs of required control equipment and compares these costs to the baseline construction costs for each type of MODU. EPA uses an initial permit cost stream represented by MODUs expected to be constructed in 2007 (jackups and semi-submersibles) or 2012 (drill ships). See the Compliance Cost Model (DCN 7-4018) that was prepared at proposal.

The firm-level analysis is a revenue test, comparing the revenues of firms likely to construct MODUs with the annualized compliance costs for representative new vessels, assuming each firm identified as potentially affected builds a share of the new MODUs expected to be constructed over the time frame of the analysis. For the comparison of annualized costs of compliance with annual revenue, EPA assumed that all of a firm's new MODUs would be constructed in one year. This assumption maximizes the potential impact of compliance cost in relation to revenue. If EPA instead assumed a firm would spread construction over more than one year, the ratio of compliance cost to revenue would be less in any single year and the likelihood of finding economic impacts would diminish. In this way, the assumption that all compliance costs are incurred in the same year is highly conservative. With no firm-level impacts found under this conservative assumption, then there will also be no impacts under other, possibly more likely, scenarios in which costs are incurred over several years. EPA uses the annualized cost stream for MODUs constructed in 2007 (or the cost stream for a drill ship constructed in 2012, the first year post-compliance in which a drill ship is assumed to be constructed) to represent the annualized costs to each potentially affected firm. EPA uses both the pre-tax and after-tax compliance costs for comparison with revenues.

B3-1.3.1 Vessel Impact Analysis Using Survey Vessels

To calculate the impact of today's rule on new MODUs, EPA used two models – a cash flow/net income model, which computes the estimated present value of after tax cash flow/net income for representative MODUs (based on survey data) over a 30-year operating period for each new facility, and a post-tax cost calculation model, which estimates the present value after-tax costs of compliance using engineering and permitting cost inputs. These two models are used to analyze the effect of after-tax costs on after-tax vessel cash flow or net income. For additional details on these models, see ERG (2004c) and DCN 7-4020.

Using data provided by surveyed MODU operators, EPA used both the reported after-tax net income and a calculated cash flow figure for each survey MODU. EPA calculated cash flow using after-tax net income and adding depreciation, depletion, and amortization (DD&A) back into net income, since DD&A are not cash expenses. EPA used cash flow as an upper bound estimate of available cash and after-tax net income as a lower bound estimate. EPA was only able to undertake financial analysis for those MODUs with a positive net income or cash flow for the three years of financial information provided in the survey. EPA assumes that any MODU whose cash flow or net income is negative over the three years of financial data availability is unlikely to be a viable operation in the baseline and cannot be analyzed with respect to compliance costs.

EPA used the cash flow/net income over the three years of data collected to create a moving cycle of cash flow/net income over the period of analysis. The years of data collected were 2000, 2001, and 2002, with 2002 generally being a poorer year for the industry as a whole. In this way, EPA was able to represent industry financials in both good and bad years. The 3-year cycle provides a means for projecting the volatile oil and gas business over each facility's 30-year operating period, which is expected to include major swings in the prices of oil and gas, the driving force behind the level of operations, pricing, and thus the financial performance of newly constructed vessels. EPA assumed that cash flow/net income will be flat on average over the 30 years of analysis and thus does not apply any factors to increase or decrease cash flow or net income over the years of analysis within those cyclical movements. The cash flow/net income figures from the survey, therefore, repeat every three years for 30 years. EPA then computes the present value of that stream of cash flow/net income figures and compares it to the present value of after-tax compliance costs for the preferred option.

EPA used the capital, O&M, and permitting costs to calculate the present value of the after-tax annualized cost of compliance with the regulatory requirements. Each cost is accounted for in the year in which it is assumed to be incurred. EPA made the simplifying assumption that the existing MODUs would represent new MODUs that are launched in 2007. Since EPA assumes MODUs launched in this year install and operate compliance equipment at that time (even though they do not become permitted for compliance with 316(b) requirements until the date of the first applicable General Permit renewal), EPA considers the date of launching the "compliance year."

The first costs to be incurred are the Region 6 and Region 4 pre-permitting costs (the shared study costs) and the capital costs of installation and incremental O&M costs (O&M costs are estimated to be $0 for all MODUs). Costs for permit application activities occur in 2011 for the Region 6 permit and in 2013 for the Region 4 permit. Only MODUs are assumed to be permitted under the Region 4 permit, since relatively little production activity is currently underway in the Eastern Gulf.[2] Monitoring costs begin to be incurred in 2012. Repermitting costs enter in 2017, and every 5 years thereafter. EPA estimated capital costs for each MODU for which a financial survey response was received (with one exception), as well as many other MODUs for which financial data were not obtained (all were used to calculate the average costs of compliance for new facilities). In this analysis, however, only the costs for the eight MODUs with economic survey information were used for developing the costs for this impact analysis.

EPA's post-tax compliance cost model determined the marginal tax rate of the owner company based on the firm's average taxable earnings over the three years of survey data (which were put on a mid-year 2003 basis to match the engineering costs, which were also set to 2003 dollars) and used the modified accelerated cost recovery system (MACRS) to calculate depreciation on the capital outlay. Depreciation was then used to compute a "tax shield" on the investment (for more information on EPA's post-tax cost calculation model, see ERG [2004c] and DCN 7-4020). The post-tax cost calculation model calculates the present value of after-tax compliance costs.

The present value output from the post-tax cost calculation model is then input to the cash flow/net income model and used to compare with the present value of cash flow/net income of the vessel as discussed above. If the present value of baseline after-tax cash flow or net income minus the present value of after-tax compliance costs is greater than $0, EPA assumes that the MODU would be able to continue to operate post-compliance. If the cash flow value becomes negative, EPA assumes the MODU would no longer continue to operate. If the net income value becomes negative, EPA assumes the longer-term viability of the vessel is potentially jeopardized. In either case, such a MODU would be counted as a potential "regulatory closure." This analysis is considered an alternative assessment of the potential for barrier to entry.

[2] Permitting costs to platforms are assumed to be associated with the Western Gulf Permit; use of this assumption avoids potentially understating the magnitude of shared costs to MODUs in Region 4.

Although many of EPA's analyses investigate whether costs of compliance can be passed through to customers, this analysis makes an assumption that costs cannot be passed through. Because existing MODUs will not have to meet the requirements of the rulemaking, and new MODUs must compete with these existing MODUs, it is unlikely that new MODUs would be able to pass through any compliance costs. Assuming zero cost pass-through provides a realistic estimate of potential economic impacts to new MODUs.

Due to confidential business information (CBI) constraints, EPA is not able to provide detailed impact results on a MODU-specific level. Detailed results are provided in the CBI portion of the Rulemaking Record (ERG, 2004c, CBI version, and DCN 7-4020). The general findings of the closure analysis are that no new MODUs will be regulatory closures, based on an assumption that finances for new MODUs might look like those for existing MODUs, as a result of the incremental costs of compliance with the preferred option using either a cash flow or net income approach.

B3-1.3.2 Barrier to Entry Analysis (Vessel-Level)

EPA used the incremental capital/installation costs and the net present value of permitting costs of compliance for MODUs, as discussed above, using the cost streams associated with vessels launched in 2007 (jackups and semi-submersibles) and 2012 (drill ships), discounted to the compliance year. The sum of these costs (capital and permitting) was then compared to the costs of constructing new MODUs. If these compliance costs comprised a small fraction of construction costs, EPA assumed that compliance costs would not have a major impact on future MODUs and would not have an effect on a decision to build additional MODUs.

EPA estimated the incremental capital costs to install CWISs that meet the requirements of 316(b) Phase I, Track 1. These costs are $27,643 for semi-submersibles, $166,290 for jackups, and $236,028 for drill ships. The present value of a share of the permit costs is $102,429 for each vessel except those for drill ships, which are $25,673 (because they are assumed not be involved in the initial study cost sharing due to their much later assumed launch dates). The total incremental initial investment costs, therefore, are $130,072 for semi-submersibles, $268,718 for jackups, and $261,702 for drill ships). According to Rigzone (2006b), the cost of new MODUs planned to be built in the next few years averages $385 million for semi-submersibles, $130 million for jackups, and $525 million for drill ships. Incremental present value of permitting costs plus capital/installation costs are therefore estimated to range from 0.03% to 0.21% of construction costs, regardless of type of MODU. Because this is only a tiny fraction of total costs of construction (and a tiny fraction of contingency, which typically ranges from 10% to 20% of capital/installation costs), EPA believes that these costs will not have a material effect on decisions to build new MODUs.

One commenter was concerned about the potential for barriers to trade due to compliance costs. The results of the barrier to entry analysis indicate that costs are minuscule relative to construction costs, so foreign companies wishing to construct new MODUs that meet the requirements of the final rule will not be dissuaded from doing so. Furthermore, should foreign firms wish to relocated MODUs built after the effective date of the rule to U.S. waters, the costs to retrofit controls should not have an impact on this decision. The costs calculated in U.S. EPA (2006b) and presented here are derived assuming controls must be retrofitted. The vessel-level and firm level impact analyses indicate negligible impacts, as does this barrier to entry analysis. EPA, therefore, has determined that no barriers to trade will exist as a result of the final 316(b) rulemaking.

B3-1.3.3 Firm-Level Analysis

To determine the impact of the final rule on firms, EPA uses a revenue test, which compares the annualized pre-tax and after-tax costs of compliance (calculated for each representative MODU as discussed above), with 2004 revenues reported by all firms determined likely to build new MODUs meeting the final rule's criteria. Because nearly all of these firms (other than foreign-owned) are publicly owned, EPA relied on the revenue data reported in *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*, which was compiled from corporate 10K reports downloaded from SEC's Edgar Database. EPA determined the number of MODUs likely to be built by each firm under the final rule. Only those firms that were identified as currently owning jackups, semi-submersibles, and drill ships that will meet the final rule's criteria if newly constructed or those actively constructing MODUs at this time are considered likely to construct the estimated 103 new MODUs that will be affected by the final rulemaking (see also *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*). [2] EPA then assigned a number of potentially in-scope MODUs to be built by each of the firms and used the average per-MODU compliance costs multiplied by the number of these potentially in-scope MODUs to calculate the total compliance costs that might be faced by these firms.

To calculate costs to revenues, EPA uses the pre-tax and after-tax costs shown in Table B3-2 for the firms identified as likely to construct new MODUs meeting the final rule's criteria. Each firm is assumed to build 9 jackups or semi-submersibles over the time frame of the analysis (about one every other year), except for GlobalSantaFe and Transocean, which are assumed to build 18 jackups and one drill ship or two drill ships, respectively.[3] The total number of new MODUs estimated to be built is divided equally amongst the firms. However, GlobalSantaFe and Transocean own a disproportionately large share of existing MODUs. So EPA expects their share of new MODUs to be approximately twice that of the other firms. For the comparison of annualized costs of compliance with annual revenue, EPA assumed that all of a firm's new MODUs estimated to be constructed by these firms are launched in one year. This assumption maximizes the potential impact of compliance cost in relation to revenue. If EPA instead assumed a firm would spread construction over more than one year, the ratio of compliance cost to revenue would be less in any single year and the likelihood of finding economic impacts would diminish. In this way, the assumption that all compliance costs are incurred in the same year is highly conservative. With no firm-level impacts found under this conservative assumption, then there will also be no impacts under other, possibly more likely, scenarios in which costs are incurred over several years. EPA uses the higher cost of a jackup rig to represent the cost of compliance for both jackups and semi-submersibles for simplicity.

Table B3-3 shows all of the MODU owners that are considered likely to build an in-scope MODU. As the table shows, annualized pre-tax costs per firm range from $0.3 to $0.7 million. The ratio of pre-tax costs to revenues ranges from 0.01% to 0.19% and after-tax costs to revenue range from 0.01% to 0.12%. Given that the highest ratio seen is 0.19 percent, EPA concludes that firm-level impacts will be minimal. Furthermore, even if these costs applied to other firms (among those that own jackups or semi-submersibles with unknown CWIS intake rates that are considered unlikely to build new MODUs subject to Phase III regulation), impacts on any firm would still be estimated to be much less than 1 percent.[4]

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[2] Two firms have been added to the list of likely MODU constructors since proposal, based on information showing that they are in the process of constructing new MODUs. These are Nabors and Atwood Oceanics (Rigzone, 2006c). Nabors is larger in revenues than the other firms, and Atwood Oceanics is smaller. Two other firms are currently building MODUs, One, Perforadora Mexico, does not have financial data readily available, but is assumed to have revenues in the range of those shown in Table B3-3. The other, Scorpion, is a new firm, organized in April of 2005. This foreign firm is currently building 5 jackups and has no revenues to report at this time. With 5 MODUs in operation and assuming only 90 days per year of operation for each MODU (that is, a 25 percent utilization rate when the average for the GOM is currently at 85 percent [Rigzone, 2006d]) at an average $100,000/day, this would imply a revenue stream of about $45 million per year. If it is further assumed that this firm builds as many as 9 MODUs in one year, the impact of the final rule will still be less than 1 percent of revenues.

[3] The number of MODUs per firm was changed from proposal to accommodate a higher number of firms identified as constructing MODUs (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry).*

[4] At proposal, there were several firms owning jackups or semi-submersibles that did not submit voluntary technical data, so EPA was not able to determine whether they own MODUs that might meet the final rule's criteria were they to be newly

These costs reflect the assumption that all new jackups would be built with sea chests and, therefore, these vessels will not be required to meet entrainment controls. However, jackups on rare occasions use straight pipes. If jackups are not built with sea chests, the costs to comply with both impingement and entrainment controls would result in the annualized per-vessel compliance costs to rise from $33,755 to about $40,800.[5] Under this scenario, the costs to revenue ratios shown in Table B3-3 would be at most 0.2 percent (see DCN 7-4030 and DCN 7-4018).

Table B3-3: Revenue Test for MODU Owners

Name	No. of Likely In-scope Rigs >2 MGD Built in One Year	2004 Revenues ($millions)	Annualized Pre-Tax Costs per Firm ($millions)	Costs to Revenues (%)	Annualized After-tax Costs per Firm ($millions 2004)	Costs to Revenues (%)
Diamond Offshore	9	$815	$0.3	0.04%	$0.2	0.02%
ENSCO	9	$741	$0.3	0.04%	$0.2	0.03%
GlobalSantaFe	19	$1,724	$0.6	0.04%	$0.4	0.02%
Noble	9	$1,351	$0.3	0.02%	$0.2	0.01%
Pride	9	$1,712	$0.3	0.02%	$0.2	0.01%
Rowan	9	$679	$0.3	0.04%	$0.2	0.03%
Transocean	20	$2,614	$0.7	0.03%	$0.4	0.02%
Nabors	9	$2,448	$0.3	0.01%	$0.2	0.01%
Atwood Oceanics	9	$163	$0.3	0.19%	$0.2	0.12%
Total/Avg.	~103	$12,247	$3.5	0.03%	$2.2	0.02%

Source: SEC, 2006; U.S. EPA Analysis, 2006. See Compliance Cost Model for Final, DCN 9-4000.

B3-2 Economic Impact Analysis for Oil and Gas Production Platforms

This section presents the aggregate national after-tax compliance costs for new oil and gas production platforms that will be built in scope. It also presents platform-level compliance costs (in after-tax and pre-tax terms). Impacts on platforms are then presented in two sections. The first section uses a model of a new platform to determine the potential for any effect on production. The second section uses an approach for identifying barriers to entry for all platforms likely to be built in scope and for assessing impacts on those platforms for which information was not sufficient to create a detailed economic model. As discussed in *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry*, only 20 in-scope deepwater platforms and one in-scope Alaska

constructed. These firms were Atwood Oceanics, Caspian Drilling Co., Energy Equipment Resources, Nabors Industries, Newfield Exploration, Ocean Rig ASA, Parker Drilling, Tetra Technologies, and Workships BV (note that several of these firms are no longer on Rigzone's list of current operators [Rigzone, 2006c]). Most of these firms, however, own only one or two such MODUs and are considered far more likely to purchase MODUs from the firms included in this analysis than to build their own (several of these MODUs have clearly been purchased from GlobalSantaFe, for example). As noted earlier, however, Noble and Atwood Oceanics are constructing new MODUs and have been added to the analysis. Had others of these firms been included in the analysis, however, EPA's findings would not have changed. Atwood Oceanics is considered representative of the smaller (yet still large by SBA standards) MODU operators who might construct MODUs subject to the rule.

[5] Based on the average inflation factor for permits and construction costs of about 4.5% from 2003 to 2004 (per-vessel compliance costs for jackups were estimated to rise from $32,295 in 2003 dollars to $33,755 in 2004 dollars, while costs for jackups with entrainment controls were estimated to be $39,063 in 2003 dollars).

platform are expected to be constructed over the 20 year construction time frame of the analysis under the final rule.

B3-2.1 Aggregate National After-tax Compliance Costs

The methodology for calculating the aggregate national after-tax compliance costs are identical to that used for calculating these same costs for MODUs, although the costs incurred are different. Costs are input in each year in which they occur over the 30-year time frame of the analysis, including recurring capital replacement costs, repermitting costs, and O&M. The costs in each year are discounted to the compliance year (assumed the year the platform comes on line) and summed to calculate the present value of the cost stream. These present value costs are then annualized. For more details on timing assumptions and annualized and present value cost calculations, see *Chapter B1: Summary of Cost Categories and Key Analysis Elements for New Offshore Oil and Gas Extraction Facilities* and ERG (2004a).

To create after-tax costs, EPA assumes that the highest marginal corporate tax rate applies. This rate is 35 percent (IRS, 2005), so after-tax costs will be 65 percent of the pre-tax costs. EPA does this because all platform owners that are likely to build in-scope platforms are large corporations by SBA standards and/or have earnings that place them in the highest corporate tax bracket (including the one small corporation considered likely to build an Alaska platform).

Table B3-4 summarizes the national aggregate after-tax compliance costs for production platforms. As the table shows, these costs are $1.3 million per year over the time frame of the analysis. See ERG (2004a) for a detailed description of how these costs were calculated. Also see DCN 9-4000.

Had existing platforms been covered by the final rule, the total national cost of the rule would have included an additional $4.5 million per year in 2003 dollars (ERG, 2004b).

Table B3-4: Total National Aggregate After-tax Compliance Costs for Platforms ($2004)

Type of Cost	Present Value (to year of compliance)	Annualized Cost of Compliance
Permitting		
Deepwater	$859,982	$64,769
Alaska	$483,126	$36,386
Total	$1,343,109	$101,155
Capital/Installation		
Deepwater	$5,556,764	$418,504
Alaska	$414,536	$31,221
Total	$5,971,300	$449,725
Monitoring		
Deepwater	$188,497	$14,197
Alaska	$191,478	$14,421
Total	$379,975	$28,618
O&M		
Deepwater	$8,187,952	$616,671
Alaska	$1,458,124	$109,818
Total	$9,646,076	$726,488
Total Compliance Costs		
Deepwater	$14,793,195	$1,114,141
Alaska	$2,547,264	$191,846
Total National Compliance Costs	$17,340,460	$1,305,986

Source: U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-2.2 Platform-Level Compliance Costs

This section addresses costs to each of the two types of platforms (deepwater and Alaska). Again, permitting and monitoring costs are from U.S. EPA (2006a), and capital/installation and O&M costs are from U.S. EPA (2006b), with the weighted average of the capital and O&M costs applied to new platforms/structures as calculated in DCN 7-4030. Pre-tax costs per platform are used in the firm-level analysis, along with after-tax costs. After-tax costs are used for comparison to pre-tax costs but are not used directly in the platform impact analysis.[5] See ERG (2004a) for more detail on how these costs were calculated. Also see DCN 9-4000.

B3-2.2.1 Pre-Tax Cost of Compliance for Representative Platforms

The costs shown in Table B3-5 reflect the estimated costs incurred by each platform, by type of platform. Costs are derived as above for computing national aggregate costs, but these costs are for a representative deepwater platform that comes on line in 2007 (year of compliance is assumed to be 2007) and the representative Cook Inlet platform coming on line in 2014 (year of compliance). Costs (which are incurred over the full time frame of the analysis, including recurring capital replacement and repermitting costs) are discounted to the applicable year of compliance and annualized over 30 years at 7 percent.

5 In the impact analysis, costs are input in the year in which they are assumed to be incurred, and the financial model internally calculates the tax shield on these costs given depreciation schedules; see Section B3-2.3a below and ERG [2004d]).

Table B3-5 presents the costs of compliance on an annual basis for the two types of platforms. As the table shows, these costs are $87,141 or $295,147 depending on type of platform.

Table B3-5: Per-Platform Annualized Pre-Tax Cost of Compliance ($2004)

Type of Cost	Present Value (Year of Compliance)	Annualized Cost of Compliance
Permitting share		
Deepwater	$81,586	$6,145
Alaska	$743,271	$55,979
Capital/Installation		
Deepwater	$427,443	$32,193
Alaska	$637,748	$48,032
Monitoring share		
Deepwater	$18,164	$1,368
Alaska	$294,582	$22,186
O&M		
Deepwater	$629,842	$47,436
Alaska	$2,243,267	$168,950
Total		
Deepwater	$1,157,035	$87,141
Alaska	$3,918,868	$295,147

Source: U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-2.2.2 After-tax Costs for Representative Platforms

After-tax costs are presented here for comparison purposes. After-tax costs are assumed to be lower than the pre-tax costs by the top marginal corporate tax rate of 35 percent (IRS, 2005). Thus the costs calculated are 65 percent of the pre tax costs in Table B3-5 above.

The annual after-tax per-platform compliance costs are $56,642 for deepwater platforms and $191,846 for the Alaska platform, based on the pre-tax costs shown above in Table B3-5.

B3-2.3 Impact Analysis

The impact analysis for oil and gas production platforms is divided into two types: platform-level and firm-level. The platform-level analyses include two approaches to determining the potential for impacts. Because costs were not changed from proposal, except to adjust for inflation, the impact analysis on platforms were not rerun. EPA considers the results of the impact analysis at proposal as final.

Although the financial condition of new platforms cannot be known, the financial conditions of a few, representative existing platforms are reflected in EPA's 316(b) survey of production platforms. EPA received economic surveys from one deepwater platform and one Alaska platform with CWIS intake rates meeting the final rule's requirements. The financial information from the deepwater platform is used for a general assessment of how well new deepwater platforms would do financially if the final rule's costs applied. The Alaska platform that was surveyed, however, is a very old structure and is at the end of its productive life, thus has a production profile completely different from what would be expected of a new operation. Furthermore, new platforms constructed in Cook Inlet are far likelier to look like the Osprey platform, which is a departure from the older technology represented by the other Cook Inlet platforms. The Osprey platform was designed to operate as a

MODU until a productive reservoir was located, at which point the MODU was designed to convert to a stationary production platform. This design allowed Osprey to be built at a significantly lower cost than the traditional fixed platforms located in the inlet. EPA does not have sufficient financial information at this time to model an Osprey-type platform. For these reasons, the potential for impact on a new Alaska platform is assessed only in the second platform-level analysis, described below.

The second platform-level analysis is a more typical barrier-to-entry analysis used for new entities. It uses the present value of initial permitting costs (discounted to the year of compliance) plus the capital/installation costs and compares these costs to the construction costs for each type of platform. This is a typical barrier-to-entry analysis, which assesses incremental start-up costs associated with compliance to baseline start-up costs.

The firm-level analysis is a revenue test, comparing the revenues of firms likely to construct platforms whose CWISs meet the final rule's criteria with the annualized compliance costs for each platform, assuming each firm considered likely to build a regulated platform in the deepwater builds four platforms/structures over the time frame of the analysis. For the comparison of annualized costs of compliance with annual revenue, EPA assumed that the firms bring all platforms on line in one year. This assumption maximizes the potential impact of compliance cost in relation to revenue. If EPA instead assumed a firm would spread construction over more than one year, the ratio of compliance cost to revenue would be less in any single year and the likelihood of finding economic impacts would diminish. In this way, the assumption that all compliance costs are incurred in the same year is highly conservative. With no firm-level impacts found under this conservative assumption, then there will also be no impacts under other, possibly more likely, scenarios in which costs are incurred over several years. One small firm is assumed the likeliest to build one platform in Alaska during the time frame of the analysis, and this firm is assigned the cost of the one Alaska platform assumed to be constructed during the analysis period.

B3-2.3.1 Platform Impact Analysis Using Survey Platforms

Oil and gas production platforms are modeled somewhat differently than most other Phase III entities. Because the surveyed deepwater platform was a relatively new structure in 2002 (the first year of survey data provided), the model is built using survey data to represent new, later-built structures.

Generally, the model can show production extending as far out as 30 years. Calculations, such as the after-tax costs of compliance that are computed outside of the model platform framework (presented earlier in this Chapter), use a 5 or 10-year time frame over which to annualize costs. The platform model operates somewhat differently. Pre-tax costs are input into the model in the year in which they occur (including costs incurred in pre-production years). The model calculates after-tax costs, which are then annualized over the modeled production life, which could be shorter than 30 years. For this reason, repermitting costs are input into the model every five years and capital costs for CWISs are input every 10 years, until the model shows the platform is uneconomical to operate.

EPA has developed a model deepwater oil and gas production platform based on information obtained from EPA's survey and from other sources of publicly available information, such as that from MMS. ERG (2004d; non-CBI version) contains additional details on the methodology, non-CBI data, and assumptions on which the model is based and how the model was constructed. EPA has used the same basic approach a number of times for analyzing impacts of effluent guidelines on oil and gas facilities (see, for example, U.S. EPA, 2000). Usually, the only differences are the input variables, such as production rates, that are used to model individual platforms. For specific details on the values of variables defined by survey information and the detailed impact results, see ERG (2004d; CBI version).

The model is based on both a cash flow and net income approach. The projected net revenues are compared to operating costs at each year for each model project. Net revenues (after subtracting royalties and severance, which are payments to the lease owner and a State, if relevant) are based on an assumed price of oil, current and projected production of oil and gas, well production decline rates, and severance and royalty rates. Operating costs are based on a calculated cost per barrel of oil equivalent (BOE) produced. The model runs for 30 years or is assumed to shut in when operating costs exceed revenues. That is, the economic model can calculate differing lifetimes according to project characteristics. The model then calculates the lifetime of the project, total production and the net present value of the operation (net income of the operation over the life of the project in terms of today's dollars), which includes the net operating earnings, taxes, expenditures on drilling, other capital expenditures, etc. A positive net present value means that the project is a good investment. In this case the return is greater than the discount rate, which represents the opportunity cost of capital. If the net present value is negative, it means that money would have been better invested elsewhere.

The model is run twice–with and without the change due to the 316(b) Phase III requirements. The incremental cost to retrofit I&E equipment is input into a capital expenditure line (which is used in both the cash flow and net income calculations), and additional O&M and permitting costs are input to the cash flow section of the model. The post-compliance results (including production, project life, and net present value of income) are compared to those calculated under baseline assumptions.

There are two ways the increased costs can have an impact on a platform. First, any increase in operating costs might raise total operating costs enough to cause the operating costs to exceed net revenues earlier than in the baseline. If the platform life is reduced, there will be a concomitant loss of production. Second, any increase in costs, whether operating, capital or permitting, could also drive the net present value of a marginal operation negative. The decision in this case would be to not develop the project rather than build the project with I&E controls in place, since the project would not be considered a good investment. If the platform has a positive net present value under baseline conditions but a negative net present value in the post-compliance scenario, EPA notes an impact on the platform and estimates the production lost as a result.

Due to issues with CBI, the detailed results of the platform-specific impacts are not reported here. See ERG (2004d; CBI version) in the CBI portion of the Rulemaking Record for detailed information on impacts. However, EPA determined that there will be no impacts on deepwater oil and gas development or production due to the final rule's costs based on model results. Impacts on net present value of projects are expected to be very small.

B3-2.3.2 Barrier to Entry Analysis (Platform Level)

EPA uses the incremental capital costs and present value of initial permitting costs for compliance for new deepwater and Alaska platforms to compare to the costs of construction of new platforms, identical to the approach used to measure impacts on MODU owners. If the initial investment costs of compliance are a small fraction of baseline construction costs, EPA assumes that compliance costs would not have a major impact on future platforms and would not have an effect on a decision to build additional oil and gas production platforms.

Costs for constructing deepwater platforms are estimated to range at least from $114 million to $2.3 billion (see U.S. EPA, 2000). Forest Oil (Forest Oil, 2002) reports that the 2002 capital outlay for the Osprey platform in Cook Inlet was $120 million (which does not include exploration, delineation, or additional costs to continue to develop the platform). For deepwater platforms, EPA estimates that a platform coming on line in 2007 will incur costs of $306,323 (deepwater) and $708,058 (Alaska) in capital/installation costs plus the present value cost of the initial round of permitting costs. The ratio of incremental compliance costs to construction costs ranges from 0.01 percent to 0.3 percent for deepwater projects and 0.6 percent for an Alaska project.

B3-2.3.3 Firm Level Impacts

The firms that are considered affected are those identified as currently having platforms or structures in the deepwater that meet the final rule's criteria. In Alaska, Forest Oil is selected as the likeliest type of firm to build an Alaska platform during the time frame of the analysis. All the firms considered likely to build a new platform/structure subject to the final rule have publicly available data on 2005 revenues. Each firm is expected to bring on line two affected platforms over the period of analysis, except for Forest Oil, in Alaska, where only one structure is expected to be built over the period of analysis. The count of platforms per firm in the Gulf has changed from proposal, since 6 additional firms were identified as having constructed deepwater platforms in the intervening years (see *Chapter B2: Profile of the Offshore Oil and Gas Extraction Industry).* For the comparison of annualized costs of compliance with annual revenue, EPA assumed both platforms are brought on line in the same year. This assumption maximizes the potential impact of compliance cost in relation to revenue. If EPA instead assumed a firm would spread construction over more than one year, the ratio of compliance cost to revenue would be less in any single year and the likelihood of finding economic impacts would diminish. In this way, the assumption that all compliance costs are incurred in the same year is highly conservative. With no firm-level impacts found under this conservative assumption, then there will also be no impacts under other, possibly more likely, scenarios in which costs are incurred over several years. The costs of compliance are calculated as the cost stream over the compliance lifetime of a representative deepwater platform constructed in 2007 and an Alaska platform constructed in 2014, discounted to the year of compliance and annualized (the same approach used for judging impacts on MODU owners). These costs are then compared to firm-level revenues in a revenue test. Both pre-tax costs, reported in Table B3-5 above, and after-tax costs are used to compare to revenues.

Table B3-6 presents the affected firms in both regions of concern (deepwater and Alaska), their annual revenues, their annualized pre-tax costs of compliance applied to all potentially affected structures they might construct, and the ratio of their compliance costs to revenues. As the table shows, costs to revenues are 0.032 percent or less for all affected firms.

Table B3-6: Revenue Test for Platform Owners

Name	No. of Platforms	2004 Revenues ($millions)	Pre-Tax PV Costs ($millions 2004)	Pre-Tax Costs to Revenues	After-tax Initial Investment Costs ($millions 2004)	After-tax Costs to Revenues
Amerada Hess	2	$16,733	$0.2	0.001%	$0.1	0.001%
BP	2	$285,059	$0.2	<0.001%	$0.1	<0.001%
ChevronTexaco	2	$150,865	$0.2	<0.001%	$0.1	<0.001%
ExxonMobil	2	$291,252	$0.2	<0.001%	$0.1	<0.001%
Forest Oil	1	$913	$0.3	0.032%	$0.2	0.021%
Royal Dutch/Shell	2	$266,386	$0.2	<0.001%	$0.1	<0.001%
Murphy Oil	2	$8,299	$0.2	0.002%	$0.1	0.001%
Kerr-McGee	2	$4,398	$0.2	0.004%	$0.1	0.003%
Anadarko	2	$6,079	$0.2	0.003%	$0.1	0.002%
Total S.A.	2	$115,540[a]	$0.2	<0.001%	$0.1	<0.001%
ConocoPhillips	2	$135,076	$0.2	<0.001%	$0.1	<0.001%
Dominion	2	$13,991	$0.2	0.001%	$0.1	0.001%
Total	24	$1,264,636	$2.2	<0.001%	$1.4	<0.001%

[a] Converted from Euros to dollars using value from 12/31/2004 obtained at XE.com, Interactive Currency Table.

Source: SEC, 2006; U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-3 TOTAL COSTS AND IMPACTS AMONG ALL AFFECTED OIL AND GAS INDUSTRY ENTITIES

Table B3-7 summarizes the total costs and impacts associated with the 316(b) Phase III Rulemaking on the oil and gas industry.

As the table shows, impacts on new MODUs and platforms and their associated firms are expected to be minimal. Aggregate national after-tax compliance costs are also shown in the table. These costs total $1.9 million per year for MODUs and $1.3 million per year for platforms, which is $3.2 million per year over all affected new oil and gas operations estimated to be constructed over the period of the analysis.

Table B3-7: Total National Aggregate Annualized After-tax Compliance Costs and Impacts for the Oil and Gas Industry ($2004)

O&G Facility	Annualized After-tax Compliance Costs (in $millions, discounted to year of compliance)	Facility Impacts	Firm Impacts
MODUs	$1.9	0	0
Platforms	$1.3	0	0
Total[a]	$3.2	0	0

[a] Totals may not sum due to independent rounding.

Source: U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-4 TOTAL COSTS TO GOVERNMENT ENTITIES AND SOCIAL COSTS OF THE 316(B) PHASE III RULEMAKING

B3-4.1 Total Costs to Government Entities

The costs in Table B3-8 reflect those costs to Region 6, Region 4 and Region 10 to administer the costs of the three General Permits as well as to maintain these permits over time as the number of permittees increases or decreases. The details of individual cost items and timing assumptions can be seen in *Chapter D2: UMRA Analysis.* Costs are arrayed over the time frame of the analysis and discounted at either 3% or 7% to 2007.

Table B3-8: Total Costs to Government Entities ($2004)

Government Entity	Present Value Cost (2007)	Annualized Cost
3% Discount Rate		
EPA Region 6	$4,807,900	$238,151
EPA Region 4	$3,903,492	$193,353
EPA Region 10	$41,987	$2,080
Total government cost	$8,753,379	$433,583
7% Discount Rate		
EPA Region 6	$2,465,458	$185,684
EPA Region 4	$1,944,024	$146,413
EPA Region 10	$23,272	$1,753
Total government cost	$4,432,755	$333,850

Source: U.S. EPA 2006a; U.S. EPA Analysis, 2006. See the Compliance Cost Model for Final, DCN 9-4000.

B3-4.2 Total Social Costs

The total costs to government entities, plus the total pre-tax cost to industry are used as an approximation of total social cost. There is no lost production of oil and gas calculated and no closures or firm failures are estimated. Thus no social costs associated with employment dislocations are incurred. A small deadweight cost to society of lost production due to forces other than supply and demand, such as taxes on monopolies, may occur, but this is not calculated. Consumer and producer surplus losses are also not calculated, but they are captured in the total pre-tax cost to industry.

Table B3-9 presents the total social costs associated with the 316(b) requirements under the final rule. The annualized social costs of the rule associated with the affected oil and gas industries under the final rule is approximately $3.8 million using the 3 percent social discount rate suggested by OMB and $3.2 million per year using OMB's 7 percent discount rate.

Table B3-9: Total Social Costs of the Final Rulemaking for Oil and Gas Industries (in millions, $2004)

Cost Item	Present Value Cost (2007)	Annualized Costs
3 % Discount Rate		
MODU compliance costs	$39.3	$1.9
Platform compliance costs	$29.5	$1.5
Total pre-tax compliance costs	$68.8	$3.4
Government cost	$8.8	$0.4
Total social costs	$77.6	$3.8
7 % Discount Rate		
MODU compliance costs	$22.4	$1.7
Platform compliance costs	$15.4	$1.2
Total pre-tax compliance costs	$37.8	$2.8
Government costs	$4.4	$0.3
Total social costs	$42.3	$3.2

Note: Totals may not sum due to independent rounding.

Source: EPA Analysis, 2006. See the Compliance Cost Model for Final DCN 9-4000.

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Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities

CHAPTER CONTENTS

INTRODUCTION

This chapter presents an overview of the cost categories and certain elements of the analytic framework that are common to the economic analyses of the industry segments analyzed for existing facilities.

C1-1 COST CATEGORIES

In its analyses of the costs and economic impacts of the regulatory analysis options considered for the final rule for Phase III existing facilities, EPA considered four categories of costs:

1. Costs of installing and operating compliance technology,
2. Net income loss from installation downtime,
3. Administrative costs incurred by complying facilities, and
4. Administrative costs incurred by permitting authorities.

The following discussion provides an overview of each of these cost categories. Additional detail on the costs of installing and operating compliance technology and the net income loss from installation downtime is provided in the *Technical Development Document for the Final Section 316(b) Phase III Existing Facilities Rule* (hereafter referred to as the "*Phase III Technical Development Document*"; U.S. EPA, 2006b) and Chapter *C3: Economic Impact Analysis for Manufacturer*.

This chapter addresses cost components relevant for the regulatory analysis options as well as the supplementary options analyzed for existing facilities. As a result, some of the concepts are not relevant to the three regulatory analysis options for existing facilities, which do not regulate Electric Generators.

C1-1.1 Costs of Installing and Operating Compliance Technology

Depending on the option under consideration, facilities with a DIF that meets or exceeds that option's respective applicability threshold (i.e., 50 MGD, 100 MGD or 200 MGD) that are not currently in compliance with the performance standards for Phase III existing facilities would need to implement technologies to reduce impingement mortality and/or entrainment. The specific technologies projected by EPA for the analyzed facilities depend on the performance standard each facility would need to meet (based on the waterbody type, design intake flow, and annual intake flow as a percent of source waterbody mean annual flow) and the facility's baseline technologies in-place. A list of the technologies considered for this analysis is provided in Table C1-1 below.

EPA developed technology cost estimates for the regulatory analysis options based on the impingement mortality and entrainment reduction technologies projected for each potential existing Phase III facility. Technology costs include capital costs and operating and maintenance (O&M) costs. The annual O&M cost estimates used in the cost modules are the *net* O&M costs, which are defined as the difference between the estimated baseline O&M costs and the incremental compliance O&M costs. O&M costs are further differentiated into fixed and variable O&M costs. Fixed O&M costs do not vary with the level of production (i.e., they are incurred even when a business unit is periodically shut down). EPA assumes any periodic maintenance tasks (e.g., changing screens, changing nets, or inspection/cleaning by divers) are performed regardless of plant operation, and therefore are considered fixed costs. Variable O&M costs do vary with the level of production and are allocable based on estimated intake operating time (e.g., annual labor estimates for passive screens include increased labor for several weeks during high debris episodes). The actual fixed and variable portions of O&M costs for each facility may vary depending on the mix of baseline and compliance technologies. The technology costs developed for the regulatory analysis options are engineering cost estimates, expressed in mid-2004 dollars (see Section C1-2.2 below for a discussion of adjusting monetary values to a common time period of analysis).

More detailed information on the compliance technologies considered by EPA, on technology costs, and on EPA's characterization of baseline technologies already in-place at potential Phase III existing facilities is available in the Phase III Technical Development Document (U.S. EPA, 2006b).

C1-1.2 Net Income Loss from Installation Downtime

Installation of some of the compliance technologies considered for potential Phase III existing facilities would require a one-time, temporary downtime of the facility's cooling water intake system. Table C1-1, below, lists the estimated durations of net system downtime, in weeks, for each of the compliance technology modules considered for compliance with the final standards. The lower end of the range is used at lower flow rates. For a more complete discussion of facility downtime estimates, see Chapter 5 of the Phase III Technical Development Document (U.S. EPA, 2006b, DCN 9-0004).

Table C1-1: Estimated Average Downtime for Technology Modules

Description	Net Downtime (Weeks)
Fish handling and return system	0
Fine mesh traveling screens with fish handling and return	0
New larger intake structure with fine mesh, handling and return	0 - 2
Passive fine mesh screens with 1.75 mm mesh size at shoreline	7 - 9
Fish barrier net	0
Relocate intake to submerged offshore with passive fine mesh screen with 1.75 mm mesh size	7 - 9
Velocity cap at inlet of offshore submerged	0
Passive fine mesh screen with 1.75 mm mesh size at inlet of offshore submerged	0
Double-entry, single-exit with fine mesh and fish handling and return	0
Passive fine mesh screens with 0.75 mm mesh size at shoreline	7 - 9
Relocate intake to submerged offshore with passive fine mesh screen with 0.75 mm mesh size	0
Passive fine mesh screen at inlet of offshore submerged with 0.75 mm mesh size	7 - 9

Source: U.S. EPA Analysis, 2006.

The "net" downtime duration accounts for any expected annual period of cooling water system downtime for regular maintenance and repair – the net downtime is the number of weeks the cooling water system would need to be out of service above and beyond any regular maintenance downtime period. EPA assumed that facilities would minimize the disruption to their operations by making the required technology upgrades during these periods of scheduled maintenance. Scheduled maintenance periods can range from several weeks to several months, depending on the type of facility and the specific maintenance requirements.[1] Therefore, by scheduling the technology upgrades during maintenance periods, facilities could minimize the net impact of their system changes. For the purposes of analyzing the regulatory analysis options, the Agency assumed that the typical scheduled annual maintenance downtime would be four weeks.

During the downtime period, the facility's cooling-water dependent operations would most likely be halted, with a potential loss of revenue and income from those operations. Accordingly, a key element of the cost to facilities in complying with the standards set forth under each analysis option for Phase III existing facilities is the loss in income from installation downtime. In the facility impact analyses, EPA accounted for the cost of installation downtime as the loss in pre-tax income in the facility's affected business operations. The cost of installation downtime is accounted for as a loss in revenue offset by a reduction in variable costs in the affected business operation plus any increase in operating costs due to temporary removal of the cooling water intake system from service.

The cost and impact analysis discussion for potentially regulated manufacturing industry segments provides additional detail on the calculation of the cost of installation downtime (see Chapter C3).

C1-1.3 Administrative Costs for Complying Facilities

Compliance with the standards set forth under each analysis option requires Phase III existing facilities to carry out certain administrative functions, which help them determine their compliance requirements and provide the documentation needed for issuance of their new National Pollution Discharge Elimination System (NPDES) permits. These administrative functions are either one-time requirements (compilation of information for the initial post-promulgation NPDES permit) or recurring requirements (compilation of information for subsequent NPDES permit renewals; and monitoring, record keeping, and reporting).

a. Initial post-promulgation NPDES permit application

The regulatory analysis options require Phase III existing facilities to submit information regarding the location, construction, design, and capacity of their existing or proposed cooling water intake structures, technologies, and operational measures, as part of their initial post-promulgation NPDES permit applications. Some of these activities would be required under the current case-by-case cooling water intake structure (CWIS) permitting procedures, regardless of the potential standards for Phase III existing facilities, but are still included in EPA's compliance cost estimate; therefore, the permitting costs presented in this economic analysis may be overestimated. EPA took this approach, however, because there is no way to identify which of these requirements may otherwise be required. Activities and costs associated with the initial permit renewal application include:

- ***Start-up activities:*** reading and understanding the rule; mobilizing and planning; and training staff.
- ***Permit application activities:*** developing a statement of the compliance option selected; developing drawings that show the physical characteristics of the source water; developing a description of the CWIS configuration and location; developing a facility water balance diagram; developing a narrative of CWIS and cooling water system (CWS) operational characteristics; performing engineering calculations; submitting materials for review by the Director; and keeping records.

[1] For a discussion of scheduled maintenance outages, see the *Phase III Technical Development Document*.

In addition, the initial permit renewal application would require some facilities to conduct a comprehensive demonstration study.[2] The comprehensive demonstration study is a broad set of activities meant to: (1) characterize the source water baseline in the vicinity of the intake structure(s); (2) characterize operation of the cooling water intake(s); and (3) confirm that the technology(ies), operational measures, and restoration measures proposed and/or implemented at the CWIS meet the applicable performance standards. The following activities are associated with the comprehensive demonstration study portion of the initial permit application:

- ***Proposal for collection of information for comprehensive demonstration study:*** describing historical studies that would be used; describing the proposed and/or implemented technologies, operational measures, and restoration measures to be evaluated; developing a source water sampling plan; submitting data and the plan for review; revising the plan based on State review; and keeping records;
- ***Source waterbody flow information****:* gathering information to characterize flow (for freshwater rivers/streams only); developing a description of the thermal stratification of the waterbody (for lakes/reservoirs only); performing engineering calculations; submitting data for review; and keeping records;
- ***Design and construction technology plan:*** delineating hydraulic zone of influence; developing narrative descriptions of technologies; performing engineering calculations; submitting the plan for review; and keeping records;
- ***Impingement mortality and/or entrainment characterization study:*** performing biological sampling; performing impingement and entrainment monitoring; conducting laboratory analyses; profiling source water biota; identifying critical species; developing a description of additional stresses; developing a report based on study results; revising the report based on State review; and keeping records;
- ***Verification monitoring plan:*** developing a narrative description of the frequency of monitoring, parameters to be monitored, and the basis for determining the parameters and frequency and duration of monitoring; submitting data and a plan for review; revising the plan based on State review; and keeping records.

Finally, Phase III existing facilities would have to submit a plan that describes the installation, operation, and maintenance, of the technology(ies) proposed and/or implemented at the CWIS(s):

- ***Technology installation and operation plan:*** developing an installation and maintenance schedule; describing the proposed monitoring parameters; listing the technology efficacy assessment activities; developing a schedule and methodology for efficacy assessment activities; submitting plan for review; and keeping records.

Table C1-2, following pages, lists the estimated maximum costs of each of the initial post-promulgation NPDES permit application activities described above. The specific activities that a facility would have to undertake depend on the facility's source water body type, proportional flow thresholds, and its baseline technologies in-place. Certain activities are expected to be more costly for marine facilities than for freshwater facilities.[3] Some activities would be required of all facilities, while other activities would be required only if the facility exceeds the capacity utilization rate or proportional flow thresholds. Facility administrative cost estimates were developed for the activities that facilities were expected to perform under the three regulatory analysis options considered. Hourly burden estimates for each activity are based on the anticipated effort to perform these activities under

[2] For more information on the Comprehensive Demonstration Study, please refer to EPA's Information Collection Request (U.S. EPA, 2006a).

[3] For permitting requirements, marine facilities include those withdrawing from the Great Lakes.

normal conditions. For a more extensive discussion of the estimated administrative burden and costs associated with the regulatory analysis options, see the supporting statement for the EPA ICR (DCN 9-2730).

The table shows that certain Phase III existing facilities would only have to carry out a minimal set of permitting requirements (i.e., start-up activities and permit application activities). Facilities with such minimal requirements include (1) facilities that have recirculating systems in the baseline and (2) facilities that already have or are required to install certain pre-approved technologies (including cylindrical wedgewire screens) and that only have to comply with impingement requirements. Freshwater facilities that would have to meet both impingement and entrainment standards and that already have or are required to install a pre-approved technology have to develop a technology installation and operation plan and a verification monitoring plan in addition to the minimal activities. The maximum initial permitting cost is estimated to be approximately $974,000 for a facility that would have to meet both impingement and entrainment standards and that withdraws from a marine waterbody.

Table C1-2: Cost of Initial Post-Promulgation NPDES Permit Application Activities ($2004)

Activity	Estimated Cost per Permit							
	Minimal Require-ments	Freshwater				Marine (incl. Great Lakes)		
		Pre-Appr. with I&E	I-only	E-only	I&E	I-only	E-only	I&E
Start-up activities[b]	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
Permit application activities[a]	$11,000	$11,000	$11,000	$11,000	$11,000	$11,000	$11,000	$11,000
Proposal for collection of information for comprehensive demonstration study[b]	$0	$0	$14,000	$14,000	$14,000	$14,000	$14,000	$14,000
Source waterbody flow information[a]	$0	$0	$4,000	$4,000	$4,000	$0	$0	$0
Design and construction technology plan[a]	$0	$0	$3,000	$3,000	$4,000	$3,000	$3,000	$4,000
Impingement mortality and/or entrainment characterization study[c]	$0	$0	$350,000	$405,000	$508,000	$631,000	$738,000	$933,000
Technology installation and operation plan[a]	$0	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Verification monitoring plan[a]	$0	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000
Total Initial Post-Promulgation NPDES Permit Application Cost[d]	$13,000	$22,000	$393,000	$448,000	$552,000	$670,000	$777,000	$974,000

[a] The costs for these activities are incurred during the year prior to the permit application.

[b] The costs for these activities are incurred during one year, three years prior to the permit application.

[c] The costs for these activities are incurred during the three years prior to the permit application.

[d] Individual numbers may not add to total due to independent rounding.

Key to permitting types:

Minimal requirements: Has recirculating systems in the baseline; or already has or is required to install a pre-approved technology and only has to comply with impingement requirements.

Pre-appr. with I&E: Already has or is required to install a pre-approved technology and has to comply with impingement and entrainment requirements.

I-only: Only has to comply with impingement requirements.

E-only: Only has to comply with entrainment requirements.

I&E: Has to comply with both impingement and entrainment requirements.

Source: U.S. EPA, 2006a.

Another potential cost associated with the initial NPDES permit is pilot studies of compliance technologies. Facilities carry out pilot studies to determine if the compliance technology would function properly when installed and operated. EPA assumed that any facility with both I&E requirements would consider doing a pilot study, *except* if (1) the technology is sufficiently inexpensive to install ($500,000 or less) or (2) the technology is such that a scaled down version is infeasible. EPA further assumed that a pilot study would cost either $162,000 or 10% of technology installation costs, whichever is greater. Activities associated with pilot studies include:

- ***Deploying the pilot technology:*** installing an intake pipe separate from the facility's actual cooling water system, but in the vicinity of the operating CWIS; installing the proposed technology to feed into the separate intake pipe; and pumping water through the intake pipe under various pumping scenarios and seasonal conditions;

- ***Monitoring efforts:*** collecting five samples over a 24 hour period, every two weeks for six months;
- ***Evaluation of data:*** analyzing the data; summarizing the results; and using this information to evaluate the effectiveness of the technology.

In addition to the activities described above, some facilities would be expected to conduct a site-specific determination of Best Technology Available (BTA). Since activities associated with site-specific determinations are voluntary and would only be conducted if the facilities expected them to be less expensive than complying with the requirements for Phase III existing facilities, EPA did not include site-specific determination costs in its compliance cost estimates.

b. Subsequent NPDES permit renewals

Each facility would have to apply for NPDES permit renewal every five years. Subsequent permit renewal applications would require collecting and submitting the same type of information required for the initial permit renewal application. EPA expects that facilities can use some of the information from the initial permit application. Building upon existing information is expected to require less effort than developing the data the first time, especially in situations where conditions have not changed.

Table C1-3 lists the maximum estimated costs of each of the NPDES repermit application activities. The specific activities that a facility would have to undertake depend on the facility's source water body type, proportional flow thresholds, and its baseline technologies in-place. Certain activities are expected to be more costly for marine facilities than for freshwater facilities. Some activities would be required of all facilities, while other activities would be required only if the facility exceeds the capacity utilization rate or proportional flow thresholds. The maximum repermitting cost is estimated to be approximately $331,000 for a facility that would have to meet both impingement and entrainment standards and that withdraws from a marine waterbody.

Table C1-3: Cost of NPDES Repermit Application Activities[a] ($2004)

Activity	Estimated Cost per Permit							
	Minimal Require-ments	Freshwater				Marine (incl. Great Lakes)		
		Pre-Appr. with I&E	I-only	E-only	I&E	I-only	E-only	I&E
Start-up activities	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Permit application activities	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000
Proposal for collection of information for comprehensive demonstration study	$0	$0	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
Source waterbody flow information	$0	$0	$1,000	$1,000	$1,000	$0	$0	$0
Design and construction technology plan	$0	$0	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
Impingement mortality and/or entrainment characterization study	$0	$0	$137,000	$168,000	$171,000	$251,000	$312,000	$316,000
Technology installation and operation plan	$0	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
Total Initial Post-Promulgation NPDES Permit Application Cost[b]	$8,000	$9,000	$153,000	$184,000	$187,000	$266,000	$326,000	$331,000

[a] The costs for these activities are incurred during the year prior to the permit application.

[b] Individual numbers may not add to total due to independent rounding.

Key to permitting types:

Minimal requirements: Has recirculating systems in the baseline; or already has or is required to install a pre-approved technology and only has to comply with impingement requirements.

Pre-appr. with I&E: Already has or is required to install a pre-approved technology and has to comply with impingement and entrainment requirements.

I-only: Only has to comply with impingement requirements.

E-only: Only has to comply with entrainment requirements.

I&E: Has to comply with both impingement and entrainment requirements.

Source: U.S. EPA, 2006a.

c. Annual monitoring, record keeping, and reporting

Annual monitoring, record keeping, and reporting activities and costs include:

- ***Biological monitoring for impingement:*** collecting monthly samples for at least two years after the initial permit issuance; analyzing samples; performing statistical analyses; and keeping records;
- ***Biological monitoring for entrainment:*** collecting biweekly samples during the primary period of reproduction, larval recruitment, and peak abundance for at least two years after the initial permit issuance; handling and preparing samples; conducting laboratory analyses; performing statistical analyses, and keeping records;
- ***Bi-annual status report activities:*** reporting on inspection and maintenance activities; detailing biological monitoring results; compiling and submitting the report; and keeping records; (these activities are conducted every two years, instead of annually);

- ***Verification study:*** conducting technology performance monitoring; performing statistical analyses; submitting monitoring results and study analysis; and keeping records;

Table C1-4 lists the estimated costs of each of the monitoring, record keeping, and reporting activities described above. Certain activities would be more costly for marine facilities than for freshwater facilities. The maximum annual cost is estimated to be approximately $82,000 for a facility that would have to meet both impingement and entrainment standards and that withdraws from a marine waterbody.

Table C1-4: Cost of Annual Monitoring, Record Keeping, and Reporting Activities ($2004)

Activity	Estimated Cost per Permit							
	Minimal Require-ments	Freshwater				Marine (incl. Great Lakes)		
		Pre-Appr. with I&E	I-only	E-only	I&E	I-only	E-only	I&E
Biological monitoring for impingement	$0	$0	$19,000	$0	$19,000	$24,000	$0	$24,000
Biological monitoring for entrainment	$0	$39,000	$0	$39,000	$39,000	$0	$49,000	$49,000
Bi-annual status report activities[a]	$0	$9,000	$9,000	$9,000	$9,000	$9,000	$9,000	$9,000
Total Annual Monitoring, Record Keeping, and Reporting Cost	$0	$48,000	$28,000	$48,000	$67,000	$33,000	$58,000	$82,000
Verification study[a]	$0	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000

[a] This is a cost that is incurred once every two years. Therefore, only half of the total report cost of approximately $17,000 is accounted for in this annual framework.

[b] This is a one-time cost incurred during the year of compliance.

Key to permitting types:

Minimal requirements: Has recirculating systems in the baseline; or already has or is required to install a pre-approved technology and only has to comply with impingement requirements.

Pre-appr. with I&E: Already has or is required to install a pre-approved technology and has to comply with impingement and entrainment requirements.

I-only: Only has to comply with impingement requirements.

E-only: Only has to comply with entrainment requirements.

I&E: Has to comply with both impingement and entrainment requirements.

Source: U.S. EPA, 2006a.

C1-1.4 Administrative Costs for Permitting Authorities and the Federal Government

In addition, permitting authorities would have to review the information provided by Phase III existing facilities and would have to issue new NPDES permits that reflect the requirements of each potential option. These activities would impose costs on the responsible governmental entity.

The requirements of section 316(b) are implemented through the National Pollutant Discharge Elimination System (NPDES) permit program. Forty-five States and one Territory currently have NPDES permitting authority under section 402(c) of the Clean Water Act (CWA). EPA estimates that States and Territories would incur three types of costs associated with implementing the requirements of each potential option: (1) start-up activities, (2) permitting activities associated with the initial NPDES permit containing the new section 316(b) requirements and subsequent permit renewals, and (3) annual activities.[4]

Start-up costs would be incurred only once by each of the 46 permitting authorities. Permitting costs and annual activities would be incurred for every permit. The incremental administrative burden on States would depend on the extent of each State's current practices for regulating cooling water intake structures (CWIS). States that currently require relatively modest analysis, monitoring, and reporting of impacts from CWIS in NPDES permits may require more permitting resources to implement the standards for Phase III existing facilities than are required under their current programs. Conversely, States that currently require very detailed analysis may require fewer permitting resources to implement a potential rule than required under their current programs.

In addition to costs to permitting authorities, the Federal government would likely incur costs to review those parts of NPDES permits associated with the compliance requirements of a potential rule and to ensure that the permitting authorities implement a potential rule properly.

For a detailed discussion of administrative costs for permitting authorities and the Federal government see *Chapter D2: UMRA Analysis*, section D2-1.2.

C1-2 Key Elements of the Economic Analysis For Phase III Existing Facilities

The economic analysis conducted in analyzing the potential requirements for Phase III existing facilities addresses the cost to, and impact on, the affected industry segments and society generally. Although these analyses differ in important respects for the individual industry segments – particularly in terms of the analytic models and methods for assessing the economic/financial impact on complying parties within the segments – several elements of the analysis have features common to all Phase III existing facilities. This section reviews the following key common elements:

- Compliance Schedule
- Adjusting Monetary Values to a Common Time Period of Analysis
- Discounting and Annualization: Costs to Society or Social Costs
- Discounting and Annualization: Costs to Complying Facilities

C1-2.1 Compliance Schedule

For its analysis of the cost and impacts of the regulatory analysis options, EPA developed a profile of the expected compliance year for each of the sample facilities considered in the economic analysis. The estimated compliance years of facilities are important for two reasons:

- First, the compliance years determine the timing of outlays by facilities and society in complying with the regulation, both for the initial outlays and for the ongoing profile of outlays in maintaining compliance with the regulation. This information is important in properly assessing the present value of the regulation's costs to society.
- Second, the profile of compliance is likewise important in understanding the time profile, and thus present value, of benefits achieved by compliance with the regulation. Explicit analysis of the compliance schedule is particularly important for the benefits analysis because the regulation's benefits are not achieved instantly upon facilities' reaching compliance, but build up over a period of several years.

[4] The costs associated with implementing the requirements for Phase III existing facilities are documented in EPA's Information Collection Request (U.S. EPA, 2006a).

Accordingly, EPA also used the compliance schedule developed for the cost and impact analysis in developing the time profile of benefits.

EPA initially assumed that facilities would comply with each options respective requirements during the year their first post-promulgation NPDES permit is issued (based on a 5-year permit cycle, this would be 2007 to 2011). However, since some of the permitting requirements need to be performed over a three-year period prior to compliance, facilities that would be renewing NPDES permits within the first three years after promulgation of the final Phase III rule (2007 to 2009) would not comply until their second post-promulgation NPDES permit is issued (2012 to 2014). From these assumptions, EPA estimates that all facilities would come into compliance between 2010 and 2014. Following research on when sample facilities' current NPDES permits would expire and thus need to be renewed, EPA developed an explicit compliance schedule for all Phase III existing facilities in the analysis.

C1-2.2 Adjusting Monetary Values to a Common Time Period of Analysis

The various economic information used in the cost and impact analyses was initially provided or estimated in dollars of different years. For example, facility financial data obtained in the *Detailed Questionnaire* for Manufacturers are for the years 1996, 1997, and 1998, while the technology costs of regulatory compliance were estimated in dollars of the year 2002. To support a consistent analysis using these data that were initially developed in dollars of different years, EPA needed to bring the dollar values to a common analysis year. For this analysis, EPA adjusted all dollar values to constant dollars of the year 2004 (average or mid-year, depending on data availability) using an appropriate inflation adjustment index. For adjusting compliance costs, EPA used the ***Construction Cost Index (CCI)*** published by the Engineering News-Record. For financial statement information, EPA used the ***Gross Domestic Product Implicit Price Deflator (GDP Deflator)*** to bring dollar values to mid-year 2004. In some instances, EPA used the Producer Price Index series for a specific industry to adjust values to a common analysis year.

a. CCI

EPA used the CCI to adjust compliance cost estimates from July 2002 to mid-year 2004. EPA judges the CCI as generally reflective of the cost of installing and operating process and treatment equipment such as would be required for compliance with the options considered for this regulation. Table C1-5 shows CCI values for mid-year 2002, 2003 and 2004.

Table C1-5: Construction Cost Index

Year	Value	% Change
2002	6605	
2003	6694	1.3%
2004	7115	6.3%

Source: ENR, 2006.

b. GDP Deflator

EPA used the GDP Deflator to adjust 316(b) survey financial data from 1996-1998 to 2004. The GDP Deflator is a quarterly series that measures the implicit change in prices, over time, of the bundle of goods and services comprising gross domestic product. Table C1-6 shows GDP Deflator values from 1996 to mid-year 2004. From 1998 to 2004, the total change in the deflator series was approximately 13.0% (109.0/96.5).

Table C1-6: GDP Deflator Series

Year	Value	% Change
1996	93.847	
1997	95.410	1.7%
1998	96.468	1.1%
1999	97.862	1.4%
2000	99.997	2.2%
2001	102.399	2.4%
2002	104.185	1.7%
2003	106.298	2.0%
2004 Q2	108.987	2.5%

Source: U.S. DOC, 2006.

C1-2.3 Discounting and Annualization – Costs to Society or Social Costs

Discounting refers to the economic conversion of future costs (and benefits) to their present values, accounting for the fact that society tends to value future costs or benefits less than comparable near-term costs or benefits. Discounting is important when the values of costs or benefits occur over a multiple year period and may vary from year to year. Discounting is also important when the time profiles of costs and benefits are not the same – which is the case for the regulatory analysis of Phase III existing facilities. Discounting enables the accumulation of the cost and benefit values from multiple years to a single point in time, accounting for the difference in how society values those costs and benefits depending on the year in which the values are estimated to occur.

To estimate the social costs of options considered in developing potential requirements for Phase III existing facilities, EPA first developed a profile, over the period of analysis, of the compliance costs associated with each of the regulatory analysis options. EPA defined the period of analysis as starting with the assumed date that a rule would take effect, beginning of year 2007, and extending through the latest year in which any affected facility is assumed to reach compliance (2014) *plus* a period of 30 years in which facilities are assumed to continue compliance. Thus, for the social cost analysis for Phase III existing facilities, the analysis period extends to 2043. In developing the time profile of costs, EPA assigned costs according to the following schedule:

- ***Direct Costs of Regulatory Compliance***
  - ***Capital Costs of Compliance Technology:*** This cost is first incurred in the year that the facility's first post-promulgation permit is issued. However, the equipment for complying with the regulation is expected to have a useful life of 10 years, or a period shorter than the 30 years of compliance. Accordingly, following the first installation, facilities are assumed to reinstall, and re-incur the cost of, the compliance equipment at year 11 and year 21 of the facility-specific compliance period.
  - ***Cost of Installation Downtime:*** This cost is incurred in the year that the facility installs the technology. Although the compliance technology must be reinstalled at a 10-year interval over the analysis period, the engineering analysis of compliance requirements indicates that facilities would not need to incur additional installation downtime for reinstallation of the compliance technology equipment.
  - ***Compliance Technology Operation and Maintenance:*** This cost is assumed to occur in each year of a facility's 30-year compliance period.
  - ***Pilot Study:*** Pilot study costs are incurred one year before the facility's first post-promulgation permit is issued.

- ***Administrative Costs Incurred by Complying Facilities***
  - ***Impingement Mortality and Entrainment Characterization Study:*** All facilities conduct this two- or three-year study except those that already have recirculating systems in the baseline and those that already have or are installing a pre-approved technology. The cost of this study is incurred over the years immediately preceding the facility's first post-promulgation permit, but not including the first year of compliance. Facilities withdrawing from a marine waterbody (including the Great Lakes) are required to do a three-year study; facilities withdrawing from a freshwater body are required to do a two-year study.
  - ***Initial Permitting Cost:*** In addition to incurring the cost of characterization studies, complying facilities would also incur an initial permitting cost, which is assigned to the first year of a facility's 30-year compliance period.
  - ***Repermitting Costs:*** As explained above, facilities would need to renew their NPDES permits each five years during the period of compliance. Repermitting costs are assumed to recur at years 5, 10, 15, 20, and 25 of a facility's 30-year compliance year period. If a facility were to continue compliance beyond the assumed 30-year compliance period, it would incur an additional round of repermitting costs in year 30 of the compliance period. However, these costs would be incurred to support compliance in years beyond the 30^{th} year of compliance, and were therefore not accounted for in this analysis.
  - ***Annual Monitoring, Record Keeping, and Reporting Activities:*** This cost is assumed to occur in each year of the 30-year compliance year period.

- ***Administrative Costs Incurred by Permitting Authorities***
  - ***One-time Start-up Costs:*** This cost is assigned to the year the rule would take effect (2007).
  - ***Permit Processing Costs:*** These costs are assigned to the years in which facilities apply for initial permits or renewal permits during the compliance period.
  - ***Annual Permit Administration Activities:*** The cost of these activities is assumed to occur in parallel with the annual permit-related activities by complying facilities and thus occurs in each year of a facility's compliance period.

- ***Administrative Costs Incurred by the Federal Government***
  - ***Permit Review:*** The Federal government is assumed to review the first permit for each Phase III existing facility that would include the new 316(b) requirements specified under each regulatory analysis option. Federal administrative costs would therefore be incurred between 2010 and 2014.

For each option analyzed, EPA assigned costs by facility and governmental unit according to this framework and then summed these costs on a year-by-year basis over the total time period of analysis. For the social cost analysis, these costs were tallied on a pre-tax basis, which differs from the treatment of costs for the facility impact analysis as described below. These profiles of costs by year were then discounted to the assumed date the final rule would take effect, beginning of year 2007, at two values of the social discount rate, 3% and 7%. These discount rate values reflect guidance from the Office of Management and Budget regulatory analysis guidance document, Circular A-4 (OMB, 2003).[5]

[5] See *Chapter E1: Summary of Social Costs*, for further discussion of the framework for analyzing the social costs of the 316(b) Phase III regulation.

EPA used the following formula to calculate the present value of the time stream of costs as of the beginning of 2007[6]:

$$Present\,Value = \sum_t \frac{Cost_t}{(1+r)^{t-2007}} \qquad \text{(C1-1)}$$

where:

$Cost_t$ = Costs in year
r = Social discount rate (3% and 7%)
t = Year in which cost is incurred (2007 to 2043)

After calculating the present value (PV) of these cost streams, EPA calculated their constant annual equivalent value (annualized value) using the annualization formula presented below, again using the two values of the social discount rate, 3% and 7%. Although the analysis period extends from 2007 through 2043, a period of 37 years, EPA annualized costs over 30 years, since 30 years is the assumed period of compliance. This same annualization concept and period of annualization were also followed in the analysis of benefits, although for benefits the time horizon of analysis for calculating the present value is longer than for costs because the measurable benefits will not occur immediately after the control technologies are put into place. Using a 30-year annualization period for both social costs and benefits allows comparison of constant annual equivalent values of costs and benefits that have been calculated on a mathematically consistent basis. The annualization formula is as follows:

$$Annualized\ Cost = PV\ of\ Cost\ x \frac{r \times (1+r)^{(n-1)}}{(1+r)^n - 1} \qquad \text{(C1-2)}$$

where:

r = Social discount rate (3% and 7%)
n = Annualization period, 30 years for the social cost analysis

C1-2.4 Discounting and Annualization – Costs to Complying Facilities

In general, EPA followed similar concepts and procedures in the discounting and annualization required for the analysis of costs to, and impacts on, complying facilities as those followed for the analysis of social costs. However, the analysis of costs to complying facilities differs from that for costs to society in several important ways, which are described below.

- ***Consideration of taxes.*** For understanding the impact of the regulation on complying facilities, the costs incurred by complying facilities are adjusted for taxes, as relevant, and calculated on an after-tax basis. The tax treatment of compliance outlays and income effects (e.g., from installation downtime) shifts part of these costs to the tax-paying public and reduces the actual cost to private, tax-paying businesses. For this reason, the after-tax costs of compliance are a more meaningful measure of the financial burden on complying facilities than the pre-tax costs. In analyzing and reporting the impact of compliance costs on private facilities, annualized costs are therefore calculated on an after-tax basis.

[6] Calculation of the present value assumes that the cost is incurred at the beginning of the year.

- ***Use of discount rates in present value and annualization calculations.*** The discount rate used in the facility cost calculations generally has a different interpretation than the rate used for the social cost calculation (even though, in some instances, the numerical value of the rate may be the same). Instead of being a social discount rate, the discount rate used for the present value and annualization calculations for complying facility costs represents a cost of capital to the individual complying facility, which may reasonably differ from the concept of the social discount rate. The social discount rate may be derived on several bases, including: (1) as an opportunity cost of capital *to society* or (2) as a societal inter-temporal preference or indifference rate – i.e., the required rate of change over time in a value of consumption or outlay, at which society would be indifferent to the time period in which the consumption or outlay occurs. The discount rates based on these *society-level* concepts may reasonably differ from the cost of capital used for assessing costs and financial impacts to the complying firm.

- ***Calculation of present value and annualization of costs at the year of compliance.*** In the social cost analysis, costs incurred over 30 years were summed on a present value basis at the beginning of 2007, the assumed date the potential regulation would take effect. The present value was then annualized over 30 years. The analysis of costs to complying facilities differs in two respects: (1) Costs were calculated on a present value basis and annualized *at the first year of compliance for each facility*, rather than at the beginning of 2007. The calculation of annualized costs at the first year of compliance provides more accurate and meaningful insight for assessing financial impact in relation to the baseline financial performance and conditions of the complying facility than would be achieved if, for example, costs were further discounted – and reduced numerically – by bringing them to the year the rule would take effect. (2) Each non-annually recurring cost component was only *accounted for once*, rather than repeated at each occurrence over the 30-year period. EPA accounted for the recurring nature of these costs (e.g., technology costs are assumed to recur every 10 years) through the annualization period (see bullet below). The resulting aggregates of annualized cost over facilities, for purposes of reporting total cost to complying facilities and total financial burden, are the sum of costs at the initial year of compliance for each facility, even though those years differ across facilities. EPA used the following formula to calculate the present value of the time stream of costs as of the beginning of each facility's compliance year:[7]

$$Present\,Value = \sum_{t} \frac{Cost_{x,t}}{(1+r)^{t-ComplianceYear_x}} \quad \text{(C1-3)}$$

  where:

  $Cost_{x,t}$ = Costs incurred by facility x in year t
  r = Discount rate (7%)
  t = Year in which cost is incurred (2007 to 2018)[8]
  Compliance $Year_x$ = Estimated compliance year of facility x.

- ***Annualization period.*** The present value estimates of the one-time or non-annually recurring costs were then annualized over the relevant period for which the outlay is expected to produce compliance value. The capital outlays for compliance equipment installation were annualized over the expected useful life of the compliance equipment, 10 years. The income loss from installation downtime was annualized over

[7] Calculation of the present value assumes that the cost is incurred at the beginning of the year.

[8] The first compliance year is 2010. A facility with a 2010 compliance year and a 3-year study requirement would incur its first costs in 2007. The last compliance year is 2014. A facility with a 2014 compliance year would incur the costs of its last non-annual recurring cost component, repermitting, five years after compliance, in 2018.

the facility's 30-year compliance period. Although compliance equipment would need to be reinstalled at 10-year intervals during the compliance period, the engineering analysis indicates that reinstallation would not require additional downtime. Thus, the relevant period for annualization of the income loss from installation downtime is the full 30 years of compliance assumed for this analysis. The pre-permit study costs and other initial permitting costs were also annualized over the 30-year compliance period while repermitting costs were annualized over 5 years, the interval at which these costs occur. All annualized cost values, which were developed on a consistent discounting and annualization basis, can then be summed with annually recurring costs (e.g., annual operating and maintenance expense) to yield a total annualized cost to complying facilities. The annualization formula is as follows:

$$Annualized\ Cost = PV\ of\ Cost\ x \frac{r \times (1+r)^{(n-1)}}{(1+r)^{n} - 1} \qquad \text{(C1-4)}$$

where:

r = Discount rate (7%)
n = Annualization period (10 years for compliance equipment; 30 years for installation downtime and initial permitting costs; 5 years for repermitting costs)

See Chapter C3 for additional detail on the present value and annualization concepts and procedures used in the specific analyses for existing manufacturing facilities.

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Chapter C2: Profile of Manufacturers

Chapter Contents

Introduction

Using information from the *1982 Census of Manufactures*, effluent guideline development materials, and subsequent research on industries since Proposal, EPA identified five 2-digit SIC-code manufacturing industries that would likely be subject to regulation under section 316(b). After the electric power industry, these industries – Paper and Allied Products (SIC 26), Chemicals and Allied Products (SIC 28), Petroleum Refining (SIC 2911), Primary Metal Industries (SIC 33), and Food and Kindred Products (SIC 20) – are most reliant on cooling water for their operations.

Facilities in other industries also use cooling water and could therefore be subject to section 316(b) regulations; however, based on the *1982 Census of Manufactures* data and engineering-based insight into industrial use of cooling water, the cooling water intake flow of these remaining industries is small relative to that of the power industry and the five selected industries. Therefore, this Profile of Manufacturers focuses on the manufacturing groups listed above. In its review of these industries, EPA divided the Primary Metal Industries (SIC 33) into Steel (SIC 331) and Aluminum (SIC 333/335) based on the business and other operational differences in these two major segments. The resulting six manufacturing industries – (1) Paper and Allied Products, (2) Chemicals and Allied Products, (3) Petroleum and Coal Products, (4) Steel, (5) Aluminum, and (6) Food and Kindred Products – comprise the "Primary Manufacturing Industries," as referred to in this profile and elsewhere in this Economic Analysis report.

A key data source for EPA's analysis for the 316(b) Phase III regulation is the detailed questionnaire issued to a sample of facilities identified as potentially subject to the Phase III regulation. Based on responses to a screener survey, EPA targeted the detailed questionnaire to facilities believed to be in the major cooling water-use industries, including the electric power industry, listed above. EPA received a number of responses from facilities with business operations in industries other than the manufacturing industries listed above. EPA originally believed these facilities to be non-utility electric power generators; however, inspection of their responses indicated that the facilities were better understood as cooling water-dependent facilities whose principal operations lie in businesses other than the electric power industry or manufacturing industries listed above. This profile includes information for these facilities, referred to as "Other Industries."

The remainder of this chapter is divided into seven sections:

- C2A: Paper and Allied Products (SIC 26),
- C2B: Chemicals and Allied Products (SIC 28),
- C2C: Petroleum and Coal Products (SIC 29),
- C2D: Steel (SIC 331),
- C2E: Aluminum (SIC 333/335),
- C2F: Food and Kindred Products (SIC 20), and
- C2G: Other Industries.

Each industry section, except for "Other Industries," is divided into the following five subsections: (1) summary insights from this profile, (2) domestic production, (3) structure and competitiveness, (4) financial condition and performance, and (5) facilities potentially subject to the Phase III regulation. The “Other Industries” section contains only summary information for those facilities for which questionnaire responses were received; this section does not include the industry specific discussions since the “Other Industry” facilities are in a variety of different industries, which, as noted above, rely to a much less substantial degree on cooling water to support their operations.

This profile uses the Standard Industrial Classification (SIC) system as the primary framework for analyzing and reporting information about the industries analyzed for the section 316(b) Phase III regulation. However, the more recent data were often reported in the North American Industry Classification System (NAICS), which the U.S. Census Bureau adopted in 1997 for economic reporting. Where necessary, EPA converted information reported in the NAICS framework to the SIC framework using the 1997 Economic Census *Bridge Between NAICS and SIC*. In most instances, these translations are straightforward; however, for some segments, the translation may introduce inconsistencies in data series at the point of changeover from the SIC to the NAICS frameworks.

Chapter C2A: Paper and Allied Products (SIC 26)

INTRODUCTION

EPA's *Detailed Industry Questionnaire*, hereafter referred to as DQ, identified five 4-digit SIC codes in the Paper and Allied Products industry (SIC 26) with at least one existing facility that operates a CWIS, holds a NPDES permit, and withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes. (Facilities with these characteristics are hereafter referred to as facilities potentially subject to the Phase III regulation or "potential Phase III facilities").

For each of the five SIC codes, Table C2A-1, following page, provides a description of the industry segment, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), the number of facilities estimated to be potentially subject to Phase III regulation based on the minimum withdrawal threshold of 2 MGD, and the number of facilities estimated to be subject to regulation under each analysis option.

CHAPTER CONTENTS:

Table C2A-1: Phase III Facilities in the Paper and Allied Products Industry (SIC 26)

SIC	SIC Description	Important Products Manufactured	Number of Phase III Facilities[a]: Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
2611	Pulp Mills	Pulp from wood or from other materials, such as rags, linters, wastepaper, and straw; integrated logging and pulp mill operations if primarily shipping pulp.	60	41	14	1	4
2621	Paper Mills	Paper from wood pulp and other fiber pulp, converted paper products; integrated operations of producing pulp and manufacturing paper if primarily shipping paper or paper products.	290	133	13	2	5
2631	Paperboard Mills	Paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fiber pulp; and converted paperboard products; integrated operations of producing pulp and manufacturing paperboard if primarily shipping paperboard or paperboard products.	190	52	13	0	1
		Total	***540***	***225***	***39***	***3***	***10***
Other Paper and Allied Products Segments							
2676	Sanitary Paper Products	Sanitary paper products from purchased paper, such as facial tissues and handkerchiefs, table napkins, toilet paper, towels, disposable diapers, and sanitary napkins and tampons.	4	2	2	0	0
2679	Converted Paper and Paperboard Products, Not Elsewhere Classified	Laminated building paper, cigarette paper, confetti, pressed and molded pulp cups and dishes, paper doilies, egg cartons, egg case filler flats, papier-mache, filter paper, foil board, gift wrap paper, wallpaper, etc.	19	3	0	0	0
		Total Other	***23***	***5***	***2***	***0***	***0***
Total Paper and Allied Products (SIC 26)							
		Total SIC Code 26	***563***	***230***	***41***	***3***	***10***

[a] Number of weighted detailed questionnaire survey respondents.
[b] Individual numbers may not add up due to independent rounding.

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

As shown in Table C2A-1, EPA estimates that out of the total of 563 facilities with a NPDES permit and operating cooling water intake structures in the Paper and Allied Products Industry (SIC 26), 41 (or 7.3%) would be subject to the 50 MGD All option, 3 (or 0.5%) would be subject to the 200 MGD All option, and 10 (or 1.8%) would be subject to the 100 MGD CWB option. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to regulation under each analysis option. Total value of shipments for the Paper And Allied Products industry from the 2004 Annual Survey of Manufactures is $81.9 billion. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because the DQ did not collect value of shipments data, these data were not available for Phase III facilities. Total revenue, as reported on the DQ, was used as a close approximation for value of shipments for these facilities. EPA estimated the total revenue of facilities in the paper industry expected to be subject to regulation under the 50 MGD, 200 MGD and 100 MGD regulatory analysis options to be about $19.1 billion, $1.2 billion, and $4.2 billion, respectively. Therefore, EPA estimates that the percentage of total production in the paper industry that occurs at facilities estimated to be subject to regulation under the 50 MGD, 200 MGD, and 100 MGD options is 23%, 1% and 5%, respectively.

The responses to the Detailed Industry Questionnaire indicate that three segments account for most of the potential Phase III facilities in the Paper and Allied Products industry: (1) Pulp Mills (SIC 2611), (2) Paper Mills (SIC 2621), and (3) Paperboard Mills (SIC 2631). The remainder of this profile therefore focuses on these three industry segments.

Table C2A-2 provides the cross-walk between SIC codes and NAICS codes for the profiled paper SIC codes. The table shows that both Pulp Mills and Paperboard Mills have a one-to-one relationship to their NAICS codes. Paper Mills correspond to two NAICS codes (322121 and 322122). NAICS 322121, classified as Paper (except newsprint) Mills, represents a large portion of SIC code 2621 (93 percent based on value of shipments).

Table C2A-2: Relationship between SIC and NAICS Codes for the Paper and Allied Products Industry (2002[a])

SIC Code	SIC Description	NAICS Code	NAICS Description	Establishments	Value of Shipments ($000)	Employment
2611	Pulp mills	322110	Pulp mills	31	3,650,916	8,043
2621	Paper mills	322121	Paper (except newsprint) mills (pt)	306	42,198,838	96,204
		322122	Newsprint mills	21	2,964,916	6,367
2631	Paperboard mills	322130	Paperboard mills	203	21,216,677	48,005

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.

C2A-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of pulp and paper firms to absorb compliance costs under each analysis option without material adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by the following two factors: (1) the extent to which the industry may be expected to shift compliance costs to its customers through price increases and (2) the financial health of the industry and its general business outlook.

❖ *Likely Ability to Pass Compliance Costs Through to Customers*

As reported in the following sections of this profile, the pulp and paper industry is relatively unconcentrated, which would suggest that firms in this industry may face difficulty in passing through to customers a significant portion of their compliance-related costs. The domestic *pulp* industry also faces significant competitive pressures from abroad, further curtailing the potential of firms in this industry to pass through to customers a significant portion of their compliance-related costs. The domestic *Paper Mills* and *Paperboard Mills* segments do not face as significant foreign competitive pressures, and, based on this factor, would have more latitude in passing through to customers any increase in production costs resulting from regulatory compliance. However, foreign pressure is likely to increase as capacity in foreign countries, particularly China, continues to grow and exert pressure on the domestic market. As discussed above, given the proportion of total value of shipments in the industry estimated to be subject to regulation under each analysis option,EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the impact analysis of existing Phase III pulp and paper facilities has not been met. For these reasons, in its analysis of regulatory impacts for the pulp and paper industry, EPA assumed that complying firms would be unable to pass compliance costs through to customers: i.e., complying facilities must absorb all compliance costs at the time of compliance (see following sections and Appendix 3, *Cost Pass-Through Analysis,* to *Chapter C3: Economic Impact Analysis for Manufacturers,* for further information).

❖ ***Financial Health and General Business Outlook***

Over the past decade, the pulp and paper industry, like other U.S. manufacturing industries, has experienced a range of economic/financial conditions, including substantial challenges. In the early 1990s, general economic weakness diminished financial performance in the domestic pulp and paper industry. Domestic market conditions were erratic in the 1990s, with financial performance peaking mid-decade, before declining again as overproduction caused a glut of product and decreasing prices. Going into 2000, the industry's financial performance had started to improve, but the subsequent recession and global economic downturn, coupled with continuing overproduction, led to declining financial results through 2003. Financial performance in 2004 and 2005, however, showed significant improvement. Going forward, the industry continues to face increased foreign competition, global and domestic overcapacity, and difficulty adapting to changing business conditions (McNutt, Cenatempo & Kinstrey, 2004). At the same time, with the ongoing improvement in U.S. economic conditions, the pulp and paper industry appears poised to achieve stronger financial performance in 2006 and later years. This should position firms to better withstand additional regulatory compliance costs without imposing significant financial impacts.

C2A-2 DOMESTIC PRODUCTION

The paper and allied products industry is one of the top ten U.S. manufacturing industries, and among the top five segments in sales of nondurable goods. Growth in the paper industry is closely tied to overall gross domestic product (GDP) growth. Although the domestic market consumes over 90 percent of total U.S. paper and allied products industry output, exports have taken on an increasingly important role, and growth in a number of key foreign paper and paperboard markets are a key factor in the health and expansion of the U.S. industry (McGraw-Hill, 2000). The industry is considered mature, with growth slower than that of the GDP, and U.S. producers have actively sought growth opportunities in overseas markets. Although exports still represent a small share of domestic shipments, they exert an important marginal influence on capacity utilization. Prices and industry profits, which are sensitive to capacity utilization, have therefore become increasingly sensitive to trends in global markets. The industry experienced relatively stable production and sales during the 1990s, but saw more volatile capacity utilization, profitability, and prices (Ince, 1999).

With the slowing of the U.S. economy in 2000, and the onset of recession in 2001, the resulting drop in demand and prices put pressure on companies in the industry to eliminate excess capacity. Through aggressive consolidation and streamlining of their operations, facilities sought to lower expenses through elimination of older and less cost efficient operations. In 2002, paper companies eliminated three million tons of capacity, with similar reductions expected in 2003 (Value Line, 2003b).

The U.S. Paper and Allied Products industry has a worldwide reputation as a high quality, high volume, and low-cost producer. The industry benefits from many key operating advantages, including a large domestic market; the world's highest per capita consumption; a modern manufacturing infrastructure; adequate raw material, water, and energy resources; a highly skilled labor force; and an efficient transportation and distribution network (Stanley, 2000). U.S. producers face growing competition from new facilities constructed overseas, however (McGraw-Hill, 2000).

The industry is a major energy user, second only to the chemicals and metals industries. However, 56 percent of total energy used in 1998-99 was self-generated (McGraw-Hill, 2000). The use of renewable resources (biomass, black liquor, hydroelectric, etc.) for energy production has increased from 40 percent of total industry energy consumption in 1972 to 56 percent in 2000, and is currently estimated to account for about 60 percent of consumption in 2004 (Paper Age, 2004a).

C2A-2.1 Output

The paper and allied products industry has experienced continued globalization and cyclical patterns in production and earnings over the last two decades. Capital investments in the 1980s resulted in significant overcapacity. U.S. producers experienced record sales in 1995. In 1996, lower domestic and foreign demand, coupled with declining prices, caused the industry's total shipments to decline by 2.2 percent. More recently, three consecutive years of increasing demand and slowly increasing prices led to better industry performance at the end of the 1990s. During these years, domestic producers controlled operating rates to allow drawdown of high inventories and to achieve higher capacity utilization. U.S. producers have also placed a greater emphasis on foreign markets both through export sales and investments in overseas facilities (McGraw-Hill, 2000). The paper products industry recorded improved sales and stronger earnings in 1999 and early 2000, but began to experience declines in sales in the second half of 2000, reflecting reduced paper and packaging demand due to the slowdown in the U.S. economy and a growth in imports (S&P, 2001). Most products were characterized by weak demand, reduced production and price reductions in 2001, due to continuing reductions in domestic demand (Paperloop Inc., 2001). Annual sales in the U.S. in 2001 dropped 1.5%, while earnings at the top 31 U.S. corporations fell by nearly 75%, partly due to a decrease in prices of up to 15% (Paun et al. 2004).

Capacity for U.S. paper and paperboard declined annually from 2001 to 2003, in contrast to annual increases in capacity for the previous two decades. Capacity declined 1.9% in 2001, 1.3% in 2002, and 0.4% in 2003, and is expected to remain unchanged from 2004 to 2006 due to increased foreign competition, mature domestic markets, and competition from other media (Paper Age, 2004b). Overcapacity has been a problem within the industry. As the world economy began to slow in the early 2000s, demand in the U.S. and abroad waned, forcing producers to limit production to prevent oversupply and keep pricing levels from dropping further (S&P, 2004b). In addition to production downtime, many older, less efficient, single mill operations were permanently closed. In 2001, pulp production decreased 7.3% to 53 million tons, while paper and paperboard production decreased 5.5% to 81 million tons (Paun et al. 2004).

For 2004, paper industry demand and prices were expected to remain at 2003 levels or increase slightly. As the economy continues to improve, demand should pick up, with better financial performance expected in 2006 and beyond, as long as the industry continues careful management of production levels and control of inventories. In addition, the weakened dollar should help to improve performance in export markets (S&P, 2004a). These improving conditions should better position firms to manage any increase in production costs resulting from regulatory compliance.

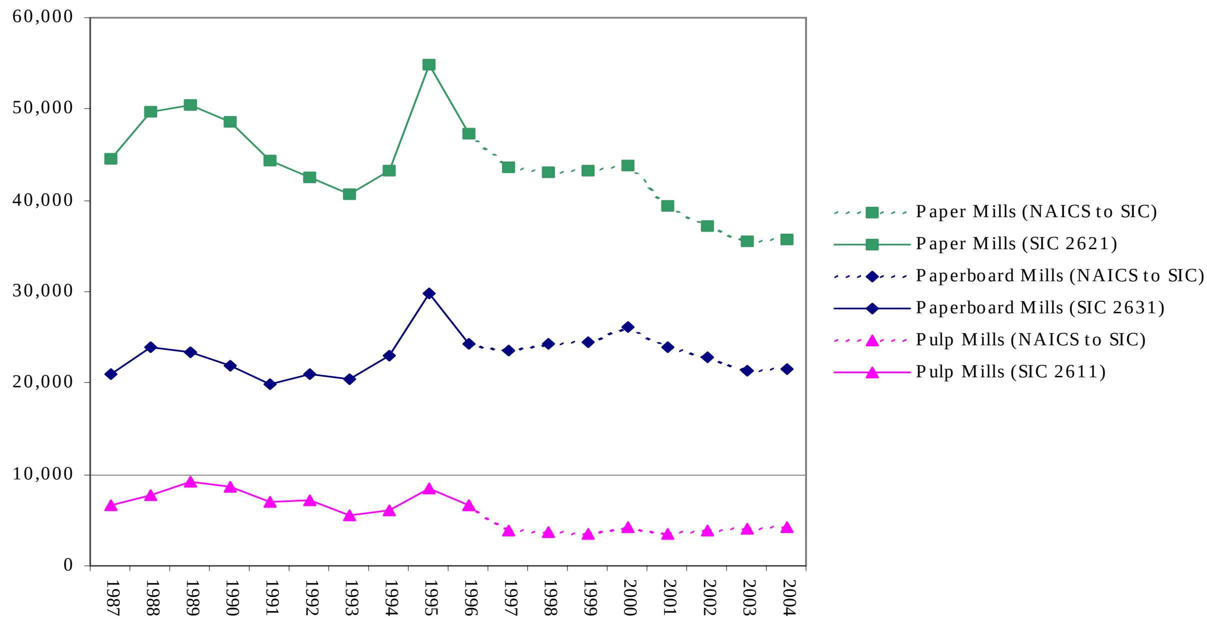
Figure C2A-1 shows the trend in constant ***value of shipments*** and ***value added*** for the three profiled segments.[1] Value of shipments and value added, two common measures of manufacturing output, provide insight into an industry's overall economic health and outlook. Value of shipments is the sum of receipts from the sale of outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added measures the value of production activity in a particular industry and is calculated as the difference between the value of shipments and the value of inputs used to make the products sold.

[1] Terms highlighted in bold and italic font are further explained in the glossary.

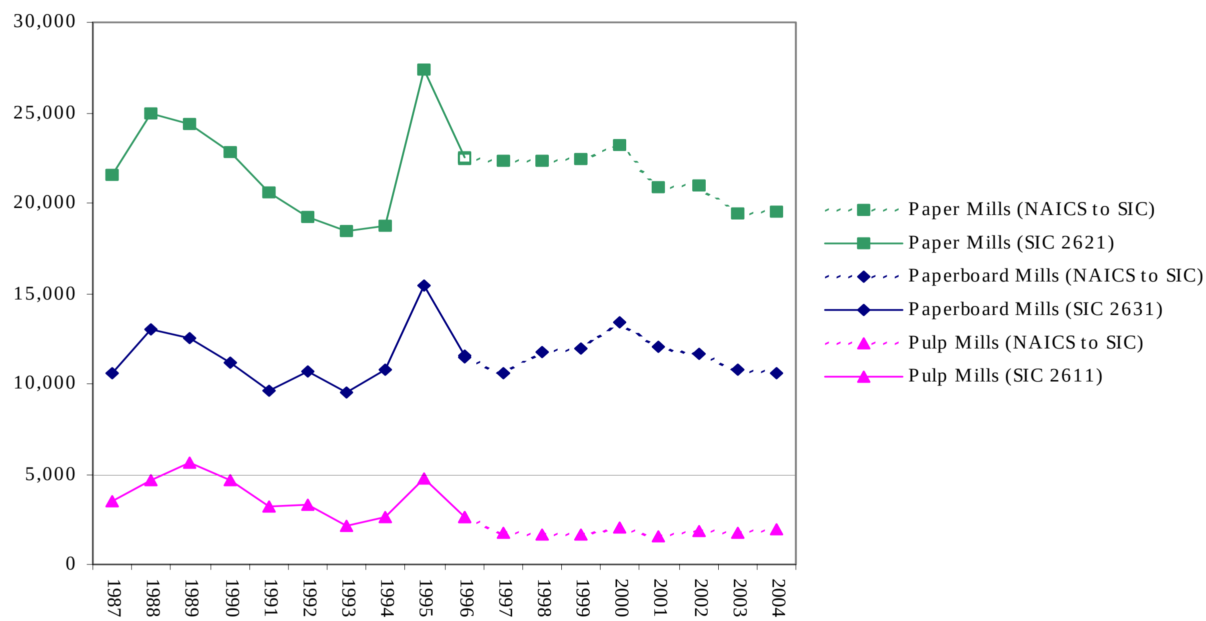
The trends over time in value of shipments and value added show that the Paper and Allied Products has performed erratically over the 1987-2004 period, with swings in shipments and value added generally following the performance trend of the aggregate U.S. economy. Of the three profiled industry segments, the Paperboard Mills segment recorded an overall increase in the total value of shipments during the 18-year analysis period, whereas both Paper Mills and Pulp Mills recorded real declines in shipments over the same period. All three industries recorded real declines in value added over the 18-year period.

Figure C2A-1: Value of Shipments and Value Added for Profiled Paper and Allied Products Segments (millions, $2005)

Value of Shipments



Value Added



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: *U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.*

Table C2A-3 provides the Federal Reserve System's index of industrial production for the profiled pulp and paper segments, which shows trends in production between 1989 and 2005. This index more closely reflects total output in physical terms, whereas value of shipments and value added reflect the economic value of production. The production index is expressed as a percentage of output in the base year, 2000. Pulp Mill industry production increased sharply between 2001 and 2002 and has been rising continuously since then (see Table C2A-9). In total, the industry experienced a 26.3 percent increase in production over 1989 to 2005. The Paper Mills industry, on the other hand, saw a continuous decrease in production between 2000 and 2003, followed by a slight increase in 2004 and 2005. Overall, however, production decreased by 13.9 percent over 1989 to 2005. Paperboard Mill production has fluctuated slightly in recent years, but the industry recorded an overall 4.8 percent increase in production over the 1989 to 2005 time period.

Table C2A-3: U.S. Pulp and Paper Industry Industrial Production Index (Annual Averages)

Year	Pulp Mills[a]		Paper Mills[b]		Paperboard Mills[c]	
	Index 2002=100	Percent Change	Index 2002=100	Percent Change	Index 2002=100	Percent Change
1989	84.1		110.9		93.4	
1990	84.0	-0.1%	108.6	-2.1%	93.8	0.4%
1991	85.3	1.6%	105.1	-3.3%	92.9	-1.0%
1992	89.7	5.2%	103.8	-1.2%	97.1	4.4%
1993	75.4	-16.0%	103.2	-0.6%	99.1	2.1%
1994	79.8	5.9%	109.0	5.6%	104.8	5.8%
1995	85.8	7.5%	112.7	3.4%	108.7	3.7%
1996	78.7	-8.3%	106.0	-5.9%	103.5	-4.8%
1997	78.3	-0.4%	105.0	-1.0%	106.2	2.6%
1998	80.4	2.7%	105.5	0.5%	107.2	1.0%
1999	81.0	0.7%	110.4	4.7%	108.6	1.3%
2000	80.1	-1.1%	109.4	-0.9%	105.1	-3.2%
2001	81.6	1.9%	101.3	-7.5%	101.3	-3.6%
2002	100.0	22.5%	100.0	-1.2%	99.9	-1.4%
2003	100.7	0.7%	92.1	-7.9%	97.1	-2.8%
2004	105.1	4.5%	95.3	3.5%	99.3	2.3%
2005[d]	106.2	1.0%	95.5	0.3%	97.9	-1.5%
Total Percent Change 1989-2005	*26.3%*		*-13.9%*		*4.8%*	
Average Annual Growth Rate	*1.5%*		*-0.9%*		*0.3%*	

[a] NAICS 32211.
[b] NAICS 32212.
[c] NAICS 32213.
[d] Average through 9 months of 2005.
Source: Economagic, 2006.

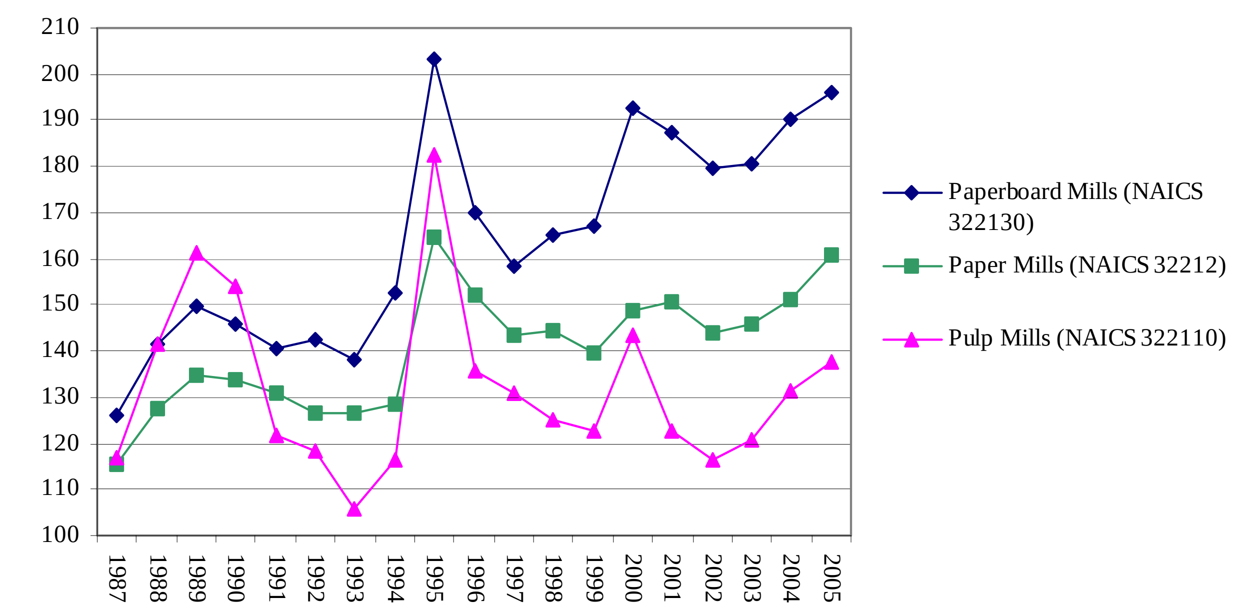
C2A-2.2 Prices

The ***producer price index*** (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

As shown in Figure C2A-2, price levels in the U.S. paper industry closely reflect domestic and foreign demand, and industry capacity and operating rates, which determine supply (S&P, 2001). Prices tend to be volatile due to mismatches between short-term supply and demand. The industry is very capital intensive, and development of new capacity requires several years. Prices therefore tend to increase when demand and capacity utilization rise, and drop sharply when demand softens or when new capacity comes on line. In the past, producers have been reluctant to cut production when demand declines because fixed capital costs are a substantial portion of total manufacturing costs; this reluctance has occasionally caused persistent oversupply. During the recent economic slowdown, however, producers appeared more willing to cut output to prevent sharp reductions in prices (Ince, 1999; S&P, 2001).

The paper industry suffered from low prices throughout the early 1990s. The depressed prices resulted from the paper boom of the late 1980s. Prices recovered in the mid 1990s before declining again in the latter part of the decade. Entering 2000, prices in the paper industry reversed course and rose, before experiencing declines in 2001 and 2002, as prices for most paper grades dropped between 5 and 15 percent (Value Line, 2003b). Faced with substantial declines in demand during those years, producers cut production, endured downtime, and closed less efficient facilities to prevent major price declines for paper products (S&P, 2001). Prices started to level off near the end of 2002, and proceeded to rise during 2003 through 2005. As demonstrated in Figure C2A-2, prices have continued to increase steadily through 2004 and 2005.

Figure C2A-2: Producer Price Indexes for Profiled Paper and Allied Products Segments



Source: BLS, 2006.

C2A-2.3 Number of facilities and firms

The Statistics of U.S. Businesses reports that the number of facilities and firms in the Pulp Mills segment decreased by 17.4 and 12.5 percent, respectively, between 1990 and 2003. One of the reasons for this decline has been the increase in the number of mills that produce de-inked recycled market pulp and thus displace demand for virgin pulp mill product. These are secondary fiber processing plants that use recovered paper and paperboard as their sole source of raw material. Producers of de-inked market pulp have experienced strong demand over the past several years in both U.S. and foreign markets. As a result, U.S. de-inked recycled market pulp capacity more than doubled between 1994 and 1998 (McGraw-Hill, 2000). Since 1994, the secondary fiber share of total papermaking fiber production has increased steadily, reaching 37 percent in 1999 (McGraw-Hill, 2000).

In contrast, the number of facilities and firms in the Paper Mills and Paperboard Mills segments declined.

While the number of facilities in the Paper Mills industry decreased by 12.2 percent between 1990 and 2003, the number of firms in the industry rose slightly. In contrast, the number of both facilities and firms in the Paperboard Mills industry declined by 2.2 and 11.8 percent, respectively. Overcapacity in the 1990s limited the construction of new facilities. In 1998 and 1999, 577,000 and 2.5 million tons of paper and paperboard capacity were removed from the capacity base. Over the same period, more than one million tons of pulp capacity were removed (Pponline, 1999). In 2001and 2002, 8.2 million tons of capacity closed, mostly in containerboard, market pulp, and print and writing papers. (Paper Age, 2004c). Table C2A-4 and Table C2A-5 present the number of facilities and firms for the three profiled paper and allied products segments between 1990 and 2003.

Table C2A-4: Number of Facilities Owned by Firms in the Profiled Paper and Allied Products Segments

Year	Pulp Mills		Paper Mills		Paperboard Mills	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	46		327		226	
1991	53	15.2%	349	6.7%	228	0.9%
1992	44	-17.0%	324	-7.2%	222	-2.6%
1993	46	4.5%	306	-5.6%	217	-2.3%
1994	52	13.0%	316	3.3%	218	0.5%
1995	53	1.9%	317	0.3%	219	0.5%
1996	62	17.0%	344	8.5%	228	4.1%
1997	41	-33.9%	259	-24.7%	214	-6.1%
1998[a]	44	7.3%	235	-9.4%	232	8.4%
1999[a]	45	2.3%	242	3.2%	233	0.4%
2000[a]	48	6.7%	240	-1.0%	238	2.1%
2001[a]	51	6.3%	238	-0.8%	247	3.8%
2002[a]	44	-13.7%	271	14.0%	231	-6.5%
2003[a]	38	-13.6%	287	5.9%	221	-4.3%
Total Percent Change 1990-2003	*-17.4%*		*-12.2%*		*-2.2%*	
Average Annual Growth Rate	*-1.5%*		*-1.0%*		*-0.2%*	

[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

Table C2A-5: Number of Firms in the Profiled Paper and Allied Products Segments						
Year	Pulp Mills		Paper Mills		Paperboard Mills	
	Number of Firms	Percent Change	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	31		158		102	
1991	37	19.4%	186	17.7%	102	0.0%
1992	29	-21.6%	161	-13.4%	95	-6.9%
1993	32	10.3%	153	-5.0%	99	4.2%
1994	37	15.6%	163	6.5%	96	-3.0%
1995	32	-13.5%	163	0.0%	93	-3.1%
1996	43	34.4%	186	14.1%	101	8.6%
1997	27	-37.2%	131	-29.6%	85	-15.8%
1998[a]	32	18.5%	124	-5.3%	95	11.8%
1999[a]	33	3.1%	133	7.2%	95	0.0%
2000[a]	36	9.1%	134	0.7%	105	10.5%
2001[a]	40	11.1%	140	4.6%	116	10.5%
2002[a]	27	-32.5%	174	23.9%	107	-7.8%
2003[a]	27	0.0%	162	-6.7%	90	-15.9
Total Percent Change 1990-2003	*-12.9%*		*2.5%*		*-11.8%*	
Average Annual Growth Rate	*-1.1%*		*0.2%*		*-1.0%*	

[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

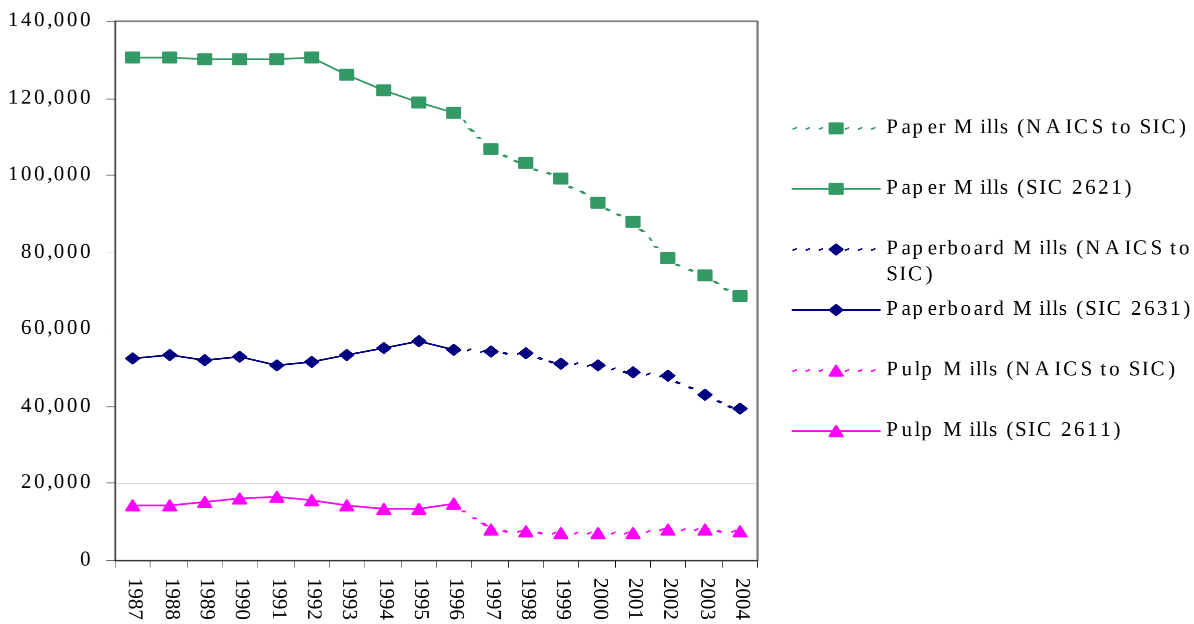
Source: U.S. SBA, 1989-2003.

C2A-2.4 Employment and productivity

The U.S. paper industry is among the most modern in the world. It has a highly skilled labor force and is characterized by large capital expenditures, which have been largely aimed at productivity improvements.

Employment in the three profiled paper industry segments remained relatively constant from 1987 through the mid 1990s. Since then, employment at Pulp Mills has dropped considerably, decreasing by 46 percent; Paper Mills have also seen a substantial reduction in the workforce of close to 48 percent. Employment in Paperboard Mills fell the least over this period, but still declined by over 24 percent. Part of this employment loss is attributable to firms closing older and higher cost facilities (McNutt, Cenatempo & Kinstrey, 2004). Figure C2A-3 presents employment for the three profiled paper segments between 1987 and 2004.

Figure C2A-3: Employment for Profiled Paper and Allied Products Segments



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2A-6 on the following page presents the change in value added per labor hour, a measure of ***labor productivity***, for each of the profiled industry segments between 1987 and 2004. The table shows that labor productivity in the Pulp Mills segment has been relatively volatile, posting several double-digit gains and losses between 1987 and 2004. These changes were primarily driven by fluctuations in value added and production levels. Overall, productivity in Pulp Mills increased by only 1.1 percent during this period, while increasing by 61 and 32 percent in the Paper Mills and Paperboard Mills, respectively.

Table C2A-6: Productivity Trends for Profiled Paper and Allied Products Segments ($2005)

Year	Pulp Mills				Paper Mills				Paperboard Mills			
	Value Added ($ mil)	Prod. Hrs. (mil)	Value Added/Hour		Value Added ($ mil)	Prod. Hrs. (mil)	Value Added/Hour		Value Added ($ mil)	Prod. Hrs. (mil)	Value Added/Hour	
			$/hr	Percent Change			$/hr	Percent Change			$/hr	Percent Change
1987	3,494	24	146		21,593	213	102		10,591	89	120	
1988	4,616	24	193	32.1%	24,982	215	116	14.4%	13,003	91	143	19.7%
1989	5,621	25	221	14.6%	24,405	214	114	-1.8%	12,557	89	141	-1.7%
1990	4,694	28	169	-23.4%	22,808	211	108	-5.0%	11,161	91	123	-12.4%
1991	3,248	28	118	-30.6%	20,592	212	97	-10.4%	9,635	87	111	-9.7%
1992	3,315	26	126	7.1%	19,269	215	90	-7.8%	10,636	88	120	8.0%
1993	2,170	23	94	-25.5%	18,408	212	87	-3.2%	9,546	90	106	-11.8%
1994	2,600	22	119	26.9%	18,727	206	91	5.1%	10,782	94	115	8.5%
1995	4,767	23	211	76.9%	27,347	201	136	49.3%	15,403	98	158	37.2%
1996	2,629	24	110	-47.8%	22,514	197	114	-16.1%	11,533	95	122	-23.0%
1997[a]	1,771	13	137	24.7%	22,365	182	123	7.9%	10,623	93	114	-6.1%
1998[a]	1,631	12	131	-4.4%	22,352	173	129	4.9%	11,749	90	130	14.2%
1999[a]	1,653	12	141	7.7%	22,389	167	134	3.8%	11,947	86	139	6.6%
2000[a]	2,048	12	172	22.0%	23,200	155	149	11.4%	13,356	86	155	11.4%
2001[a]	1,547	12	129	-25.0%	20,856	145	143	-4.0%	12,075	83	145	-6.4%
2002[a]	1,869	13	142	10.0%	20,980	129	163	13.8%	11,642	78	149	2.8%
2003[a]	1,751	13	132	-7.2%	19,397	125	155	-4.9%	10,772	74	145	-2.9%
2004[a]	1,921	13	148	12.1%	19,503	119	164	5.6%	10,625	67	158	9.3%
Total % Change 1987-2004	-45.0%	-45.6%	1.1%		-9.7%	-44.1%	61.4%		0.3%	-24.1%	32.1%	
Average Annual Growth Rate	-3.5%	-3.5%	0.1%		-0.6%	-3.4%	2.9%		0.0%	-1.6%	1.7%	

[a] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2A-2.5 Capital expenditures

The paper and allied products industry is a highly capital intensive industry. Capital-intensive industries are characterized by a large value of capital equipment per dollar value of production. ***New capital expenditures*** are needed to modernize, expand, and replace existing capacity. Consistently high levels of capital expenditures have made the U.S. paper industry one of the most modern industries in the world (Stanley, 2000). The total level of capital expenditures for the pulp, paper, and paperboard industries was $2.7 billion in 2004 (in $2005). The Paper Mills and Paperboard Mills segments accounted for approximately 93 percent of that spending (see Table C2A-7). Most of the spending is for production improvements (through existing machine upgrades, retrofits, or new installed equipment), environmental concerns, and increased recycling (McGraw Hill, 2000). The total capital expenditure for 2004 is considerably less, in real terms, than what was spent in the early 1990s, as producers became wary of adding too much capacity that might lead to oversupply and depressed prices.

The Department of Commerce estimates that environmental spending accounted for about 14 percent of all capital outlays made by the U.S. paper industry since the 1980s, and the Cluster Rule promulgated in 1998 is expected to require increased environmental expenditures (S&P, 2001).

Table C2A-7: Capital Expenditures for Profiled Paper and Allied Products Segments (millions, $2005)

Year	Pulp Mills		Paper Mills		Paperboard Mills	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	354		4,237		1,183	
1988	458	29.3%	4,887	15.3%	2,248	89.9%
1989	994	117.1%	7,473	52.9%	2,359	5.0%
1990	1,448	45.6%	5,877	-21.4%	4,090	73.3%
1991	1,316	-9.1%	4,829	-17.8%	2,857	-30.1%
1992	1,002	-23.8%	3,779	-21.8%	2,648	-7.3%
1993	540	-46.1%	3,632	-3.9%	2,084	-21.3%
1994	392	-27.5%	3,991	9.9%	2,169	4.1%
1995	562	43.6%	3,341	-16.3%	2,546	17.4%
1996	834	48.3%	3,754	12.3%	2,819	10.7%
1997[a]	405	-51.4%	3,407	-9.2%	1,897	-32.7%
1998[a]	483	19.3%	3,632	6.6%	1,620	-14.6%
1999[a]	214	-55.8%	2,694	-25.8%	1,458	-10.0%
2000[a]	265	24.2%	2,878	6.8%	1,330	-8.8%
2001[a]	211	-20.4%	2,702	-6.1%	1,127	-15.2%
2002[a]	203	-3.9%	2,272	-15.9%	878	-22.1%
2003[a]	192	-5.5%	2,212	-2.6%	807	-8.1%
2004[a]	192	-0.1%	1,591	-28.1%	956	18.5%
Total Percent Change 1987- 2004[a]	-45.9%		-62.5%		-19.2%	
Average Annual Growth Rate	-3.5%		-5.6%		-1.2%	

[a] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

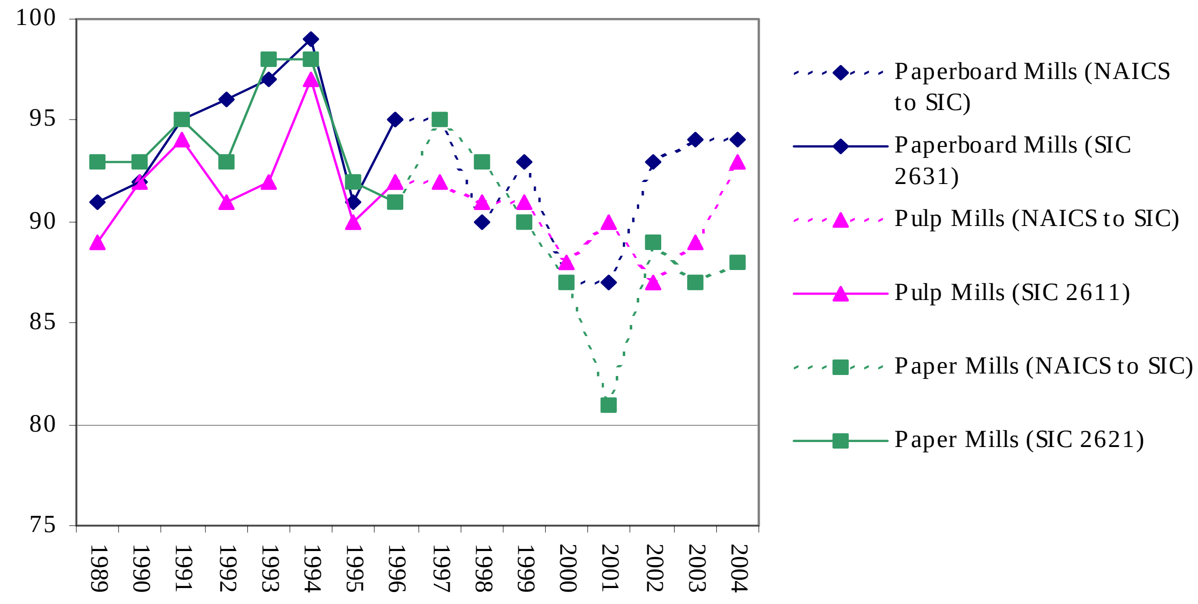
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2A-2.6 Capacity utilization

Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization provides insight into the extent of excess or insufficient capacity in an industry, and into the likelihood of investment in new capacity. According to the U.S. Industry and Trade Outlook, a utilization rate in the range of 92 to 96 percent is necessary for the Pulp Mills segment to remain productive and profitable (McGraw-Hill, 2000).

As shown in Figure C2A-4, capacity utilization fluctuated sharply in all three profiled segments over the analysis period. Capacity utilization increased between 1989 and 1994, and then fell sharply in 1995. This sharp drop resulted from an effort to reduce inventories, which had begun rising in 1995 in response to low demand and oversupply (McGraw-Hill, 2000). As inventories were sold off and global economic activity strengthened, capacity utilization began to rise again in 1996, peaked in 1997, and again declined in 1998 due to reduced demand from the Asian market (S&P, 2001). With the global economic slowdown starting in 2000, paper producers were forced to implement production cutbacks and downtime to prevent oversupply from further depressing prices. As a result, utilization rates fell farther in 2000 and 2001 to values below those observed in the prior decade. At the same time, overall capacity contracted as companies permanently closed less efficient facilities. By 2004, capacity utilization in the Paperboard Mill and Pulp Mill industries had returned to its 1990 level, while Paper Mill capacity utilization increased between 2001 and 2002 and has remained relatively constant over 2003 to 2004. The industry is expected to continue consolidating, which should aid profitability in the long run (S&P, 2004b).

Figure C2A-4: Capacity Utilization Rate (Fourth Quarter) for Pulp and Paper Industry



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1989-2004.

C2A-3 STRUCTURE AND COMPETITIVENESS

Paper and allied products companies range in size from large corporations having billions of dollars of sales, to small producers with revenue a fraction of the size of the large producers. Because all paper and allied products companies use the same base materials in their production, most manufacture more than one product. To escape the extreme price volatility of commodity markets, many smaller manufacturers have differentiated their products by offering value-added grades. The smaller markets for value-added products make this avenue less available to the larger firms (S&P, 2001).

The paper industry has consolidated through mergers and acquisitions and has closed older mills over the last few years, as a way to improve profits in a mature industry. About six percent of North American containerboard capacity was shut down (most on a permanent basis) in late 1998 and early 1999. Companies have been reluctant to invest in any major new capacity, which might result in excess capacity (S&P, 2001). In 1999, new capacity additions in the paper and allied products industry were at their lowest level of the past ten years; this caution in adding to capacity is expected to continue (Pponline.com, 2000). Another problem for the industry is the increasing capacity being brought online in foreign countries, which could result in higher U.S. import levels and increased competition for U.S. products in export markets (S&P, 2004a).

Major recent mergers include International Paper's acquisition of Champion International in 2000 and Union Camp in 1999, Georgia-Pacific's takeover of Fort James Corp. (itself a 1997 combination of James River and

Fort Howard), Weyerhaeuser's acquisition of Willamette Industries Inc., the merger of Mead and Westvaco, and Temple-Inland's takeover of Gaylord Container (S&P, 2001, 2004b).

C2A-3.1 Firm size

For SIC codes 2611, 2621, and 2631, the Small Business Administration defines a small firm as having fewer than 750 employees. The size categories reported in the Statistics of U.S. Businesses (SUSB) do not correspond with the SBA size classifications, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data. The SUSB data presented in Table C2A-8 show the following size distribution in 2003:

- 15 of 27 (56 percent) firms in the *Pulp Mills* segment had less than 500 employees. Therefore, at least 56 percent of firms were classified as small. These small firms owned 15 facilities, or 39 percent of all facilities in the segment.
- 117 of 162 (72 percent) firms in the *Paper Mills* segment had less than 500 employees. These small firms owned 124, or 43.2 percent of all Paper Mills.
- 54 of 90 (60 percent) firms in the *Paperboard Mills* segment had less than 500 employees. Therefore, at least 66 percent of paperboard mills were classified as small. These firms owned 56, or 25 percent of all Paperboard Mills.

An unknown number of the firms with more than 500 employees have less than 750 employees, and would therefore also be classified as small firms. Table C2A-8 below shows the distribution of firms and facilities for each profiled segment by employment size of the parent firm.

Table C2A-8: Number of Firms and Facilities by Size Category for Profiled Paper and Allied Products Segments in 2003[a]

Employment Size Category	Pulp Mills		Paper Mills		Paperboard Mills	
	No. of Firms	No. of Facilities	No. of Firms	No. of Facilities	No. of Firms	No. of Facilities
0-19	9	9	46	46	17	18
20-99	2	2	27	28	22	23
100-499	4	4	44	50	15	15
500+	12	23	45	163	36	165
Total	27	38	162	287	90	221

[a] Before 1998, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

C2A-3.2 Concentration ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers, with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal.[3] An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 (602 + 302 + 102). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

Table C2A-9 shows that Pulp Mills have an HHI of 1,106, Paper Mills have an HHI of 467, and Paperboard Mills have an HHI of 485. At these HHI levels, all three industry segments appear relatively unconcentrated. With the majority of the firms in this industry having small market shares, this suggests limited potential for passing through to customers any increase in production costs resulting from regulatory compliance.

The concentration ratios for the three segments remained relatively stable between 1987 and 1997. The Pulp Mills segment has the highest concentration of the three segments, with a CR4 of 59 percent and a HHI of 1,106 in 1997. Recent mergers and acquisitions have led to an increase in concentration in the Paper and Paperboard segments. In the late 1990s, the top five U.S. firms controlled 38 percent of production capacity, with higher concentrations in individual product lines due to targeted consolidation and specialization (Ince, 1999). In 2001, only four firms had greater than 11 percent of the market, with none having a share greater than 17 percent. More than half of the firms in the paper industry had market shares under 2 percent (Paun et al. 2004). The Paper Mills and Paperboard Mills segments also account for most of the production of their primary products. The Pulp Mills segment accounts for a lower percentage of all pulp shipments, with pulp also commonly produced by integrated Paper and Paperboard Mills.

Table C2A-9: Selected Ratios for Profiled Paper and Allied Products Segments, 1987, 1992, and 1997

SIC (S) or NAICS (N) Code	Year	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
S 2611	1987	26	44%	69%	99%	100%	743
	1992	29	48%	75%	98%	100%	858
N 322110	1997	24	59%	86%	100%	100%	1,106
S 2621	1987	122	33%	50%	78%	94%	432
	1992	127	29%	49%	77%	94%	392
N 32212	1997	139	34%	55%	80%	94%	467
S 2631	1987	91	32%	51%	77%	97%	431
	1992	89	31%	52%	80%	97%	438
N 322130	1997	81	34%	53%	82%	98%	485

[a] The *1997 Census of Manufactures* is the most recent concentration ratio data available.

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

[3] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of domestic production are therefore only one indicator of the extent of competition in an industry.

C2A-3.3 Foreign trade

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

Table C2A-10 presents trade statistics for the Pulp Mills, and Paper and Paperboard Mills segments. Imports and exports play a much larger role in the Pulp Mills segment than for the other two segments. Import penetration and export dependence levels for the Pulp Mills segment were an estimated 73 and 76 percent, respectively, in 2002. The Paper and Paperboard Mills segments import penetration and export dependence ratios were 16 and 9 percent, respectively, in 2002. For Pulp Mills, the large share of domestic production that is exported and domestic consumption served by imports implies the industry faces significant foreign competition, limiting the industry's ability to pass through to customers any increase in production costs resulting from regulatory compliance. For Paper and Paperboard Mills, both measures of foreign competition are well below the U.S. manufacturing averages estimated for 2001. Given just these measures, it would be reasonable to assume that this segment does not face significant foreign competitive pressures, and would have more latitude in passing through to customers any increase in production costs resulting from regulatory compliance. However, foreign pressure is likely to increase as capacity in foreign countries, particularly China, continues to grow and exert pressure on the domestic market (McNutt, Cenatempo & Kinstrey, 2004). In addition, as noted above, the HHI of the Paper and Paperboard segments is 392 and 438 respectively, suggesting firms in these segments have small market shares, which would curtail their ability to pass through any increase in production costs.

Table C2A-10: Trade Statistics for Profiled Paper and Allied Products Segments (millions, $2005)

Year	Value of Imports	Value of Exports	Value of Shipments	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
			Pulp Mills			
1989	4,354	5,199	9,157	8,312	52%	57%
1990	3,917	4,518	8,572	7,972	49%	53%
1991	2,844	3,877	7,075	6,042	47%	55%
1992	2,731	4,200	7,093	5,624	49%	59%
1993	2,370	3,148	5,432	4,653	51%	58%
1994	2,838	3,669	5,996	5,165	55%	61%
1995	4,558	5,718	8,428	7,268	63%	68%
1996	3,107	4,011	6,579	5,675	55%	61%
1997[d]	3,022	3,822	3,835	3,035	100%	100%
1998[d]	2,780	3,224	3,638	3,194	87%	89%
1999[d]	2,915	3,222	3,567	3,260	89%	90%
2000[d]	3,702	3,987	4,150	3,865	96%	96%
2001[d]	2,862	3,118	3,546	3,290	87%	88%
2002[d]	2,510	3,000	3,928	3,439	73%	76%
Total Percent Change 1989-2002	-42.3%	-42.3%	-57.1%	-58.6%		
Average Annual Growth Rate	-4%	-4%	-6%	-7%		
			Paper and Paperboard Mills			
1989	10,488	4,301	73,791	79,978	13.1%	5.8%
1990	10,126	4,739	70,403	75,791	13.4%	6.7%
1991	9,164	5,385	64,199	67,979	13.5%	8.4%
1992	8,706	5,532	63,496	66,669	13.1%	8.7%
1993	9,120	5,315	61,226	65,032	14.0%	8.7%
1994	9,114	5,978	66,303	69,440	13.1%	9.0%
1995	12,412	7,835	84,774	89,351	13.9%	9.2%
1996	10,892	7,572	71,477	74,796	14.6%	10.6%
1997[d]	10,583	7,690	67,339	70,232	15.1%	11.4%
1998[d]	11,421	7,251	67,476	71,645	15.9%	10.7%
1999[d]	11,565	6,927	67,631	72,269	16.0%	10.2%
2000[d]	12,554	7,509	69,912	74,957	16.7%	10.7%
2001[d]	11,795	6,562	63,362	68,595	17.2%	10.4%
2002[d]	10,762	5,209	59,897	65,450	16%	9%
Total Percent Change 1989-2002	2.6%	21.1%	-18.8%	-18.2%		
Average Annual Growth Rate	0.2%	1.5%	-1.6%	-1.5%		

[a] Calculated by EPA as shipments + imports - exports.

[b] Calculated by EPA as imports divided by implied domestic consumption.

[c] Calculated by EPA as exports divided by shipments.

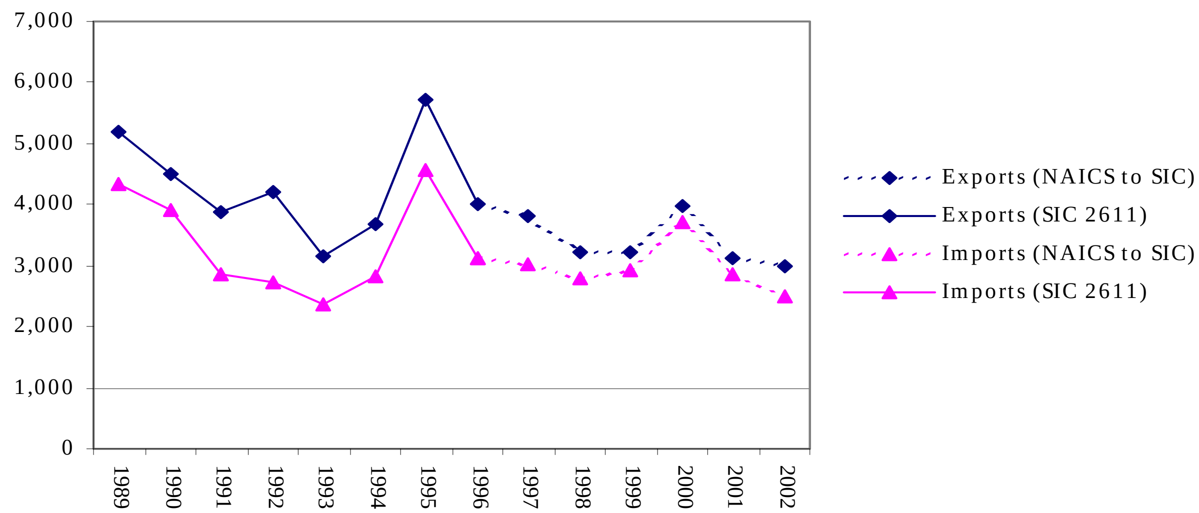
[d] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 2006; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

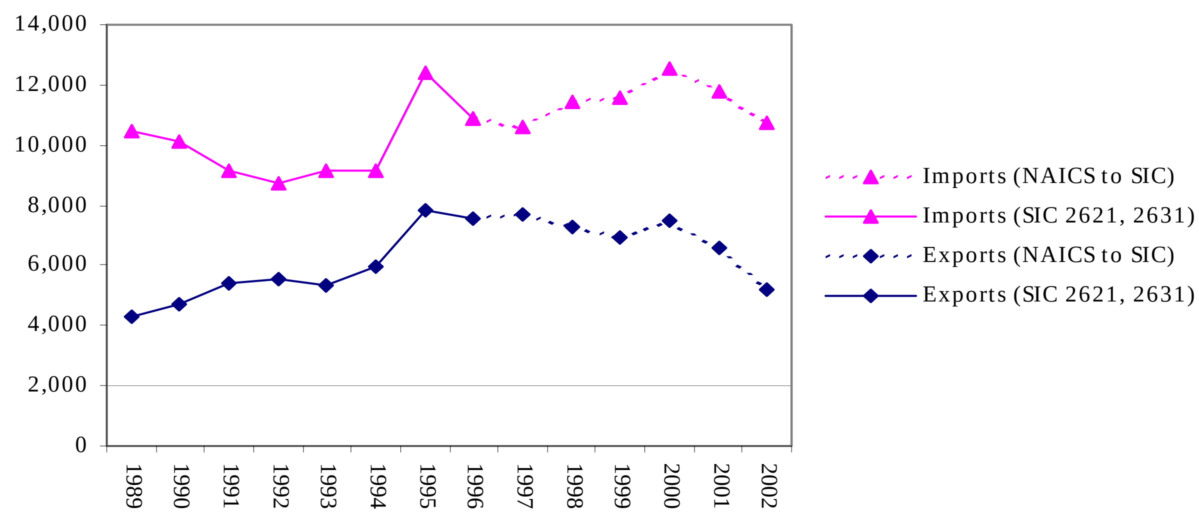
As shown in Figure C2A-1, the value of imports and exports peaked in the mid-1990s, before dropping and rebounding in 2000. As expected, values of both dropped again in 2001 and 2002, as the global economy fell into recession.

Figure C2A-5: Value of Imports and Exports for Profiled Paper and Allied Products Segments (millions, $2005)

Pulp Mills



Paper and Paperboard Mills



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 2006.

C2A-4 FINANCIAL CONDITION AND PERFORMANCE

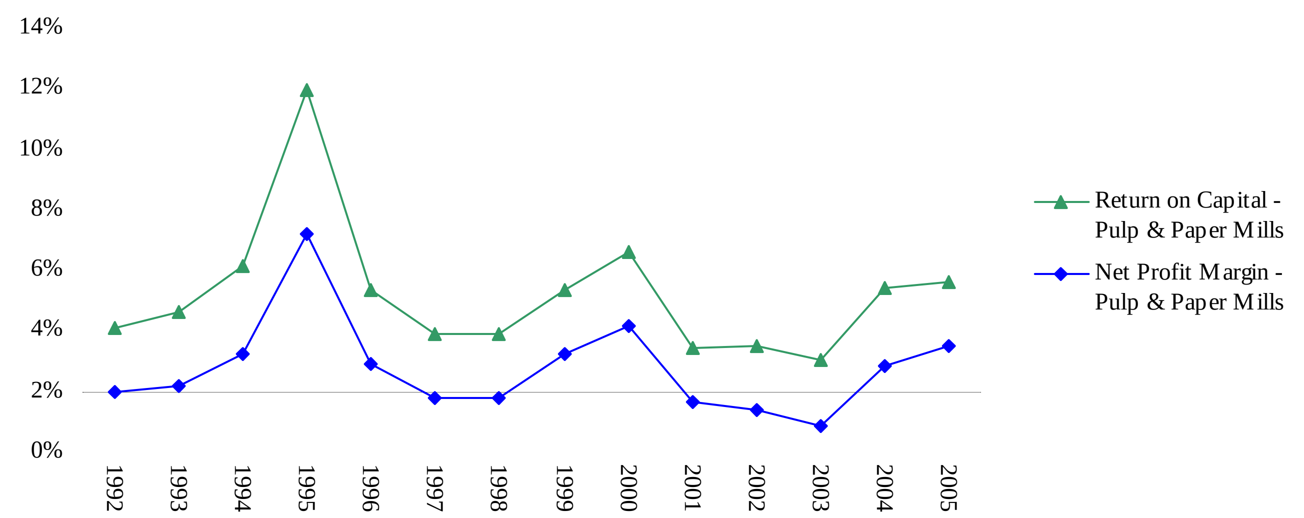
Financial performance in the paper and allied products industry is closely linked to macroeconomic cycles, both in the domestic market and those of key foreign trade partners, and the resulting levels of demand. Many pulp producers, for example, were not very profitable during most of the 1990s as chronic oversupply, cyclical demand, rapidly fluctuating operating rates, sharp inventory swings, and uneven world demand plagued the global pulp market for more than a decade (Stanley, 2000).

Net Profit Margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient positive profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the pulp and paper process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as the pulp and paper industry, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

Return on Total Capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for *net profit margin*, the firms in an industry, and the industry collectively, must generate over time a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in *net profit margin* will also be the primary sources of short-term variation in *return on total capital*.

Figure C2A-6 below shows trends in net profit margins and return on total capital for the pulp and paper industry between 1992 and 2005. The table shows considerable volatility in the trend. Profitability was low between 1988 and 1993, reflecting oversupply in world markets and decreasing shipments from U.S. producers (McGraw-Hill, 2000). By the mid-1990s, financial performance improved as demand rebounded. Financial performance weakened again in 2000 through 2003, reflecting slower growth in both the U.S. and the world economy. Coupled with overproduction in the U.S. and global markets, these factors led to deteriorating financial performance in these years. Industry analysts anticipated stronger financial performance for the pulp and paper industry for 2004 (Value Line, 2004). As expected, both net profit margins and return on capital improved in both 2004 and 2005. With continued improvement in the U.S. economy, the outlook for the industry should be stronger in subsequent years.

Figure C2A-6: Net Profit Margin and Return on Capital for Pulp and Paper Mills



Source: Value Line, 2003a; Value Line, 2006.

C2A-5 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Point source facilities that use or propose to use a cooling water intake structure that withdraws cooling water directly from a surface waterbody of the United States are potentially subject to Section 316(b) of the Clean Water Act. In 1982, the paper and allied products industry withdrew 534 billion gallons of cooling water, accounting for approximately 0.7 percent of total industrial cooling water intake in the United States. The industry ranked 5th in industrial cooling water use, behind the electric power generation industry, and the chemical, primary metals, and petroleum industries (1982 Census of Manufactures).

This section provides information for facilities in the profiled paper and allied products segments within the scope of the regulatory options. For each analysis option, existing facilities that meet all of the following conditions are potentially subject to regulation:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the United States, and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have a National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

The regulatory analysis options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses only on the facilities nationwide in the profiled paper and allied products segments that are within the scope of the regulatory options (see Table C2A-1, above for additional information on the broader set of facilities potentially subject to Phase III regulation).[5]

C2A-5.1 Waterbody and Cooling System Type

Table C2A-11, Table C2A-12, and Table C2A-13 report the distribution of Phase III facilities within the scope of the regulatory analysis options in the profiled paper and allied products segments by type of waterbody and cooling system under each primary analysis option. The tables show that most of the facilities have either a once-through system or employ a combination of a once-through and closed system.

Table C2A-11: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System for the Profiled Paper and Allied Products Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Pulp Mills									
Freshwater River/ Stream	2	100%	6	100%	4	73%	1	100%	13
Great Lake	0	0%	0	0%	2	27%	0	0%	2
Total[a]	*2*	*11%*	*6*	*38%*	*6*	*42%*	*1*	*8%*	*15*
Paper Mills									
Estuary/ Tidal River	0	0%	0	0%	1	16%	0	0%	1
Freshwater River/ Stream	0	0%	5	81%	4	61%	0	0%	9
Lake/ Reservoir	0	0%	1	19%	2	23%	0	0%	3
Total[a]	*0*	*0%*	*6*	*46%*	*7*	*54%*	*0*	*0%*	*13*
Paperboard Mills									
Freshwater River/ Stream	0	20%	3	100%	5	100%	2	38%	9
Lake/ Reservoir	0	0%	0	0%	0	0%	3	62%	3
Total[a]	*0*	*17%*	*3*	*22%*	*5*	*41%*	*4*	*36%*	*12*
Total for Profiled Paper and Allied Products Industries									
Estuary/ Tidal River	0	0%	0	0%	1	6%	0	0%	1
Freshwater River/ Stream	2	100%	13	92%	14	76%	3	51%	32
Lake/ Reservoir	0	0%	1	8%	2	9%	3	49%	6
Great Lake	0	0%	0	0%	2	9%	0	22%	2
Total[a]	*2*	*4%*	*14*	*36%*	*18*	*46%*	*6*	*14%*	*40*

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

[5] EPA applied sample weights to the sampled facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table C2A-12: Number of Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System for the Profiled Paper and Allied Products Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Pulp Mills									
Freshwater River/ Stream	0	0%	1	100%	0	0%	0	0%	1
Total[a]	*0*	*0%*	*1*	*100%*	*0*	*0%*	*0*	*0%*	*1*
Paper Mills									
Freshwater River/ Stream	0	0%	0	0%	2	100%	0	0%	2
Total[a]	*0*	*0%*	*0*	*0%*	*2*	*100%*	*0*	*0%*	*2*
Paperboard Mills									
Total[a]	*0*	*0%*	*0*	*0%*	*0*	*0%*	*0*	*0%*	*1*
Total for Profiled Paper and Allied Products Industries									
Freshwater River/ Stream	0	0%	1	100%	2	100%	0	0%	3
Total[a]	*0*	*0%*	*1*	*41%*	*2*	*59%*	*0*	*0%*	*3*

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2A-13: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System for the Profiled Paper and Allied Products Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Pulp Mills									
Freshwater River/ Stream	0	0%	1	100%	0	0%	1	100%	2
Great Lake	0	0%	0	0%	2	100%	0	0%	2
Total[a]	*0*	*0%*	*1*	*29%*	*2*	*42%*	*1*	*29%*	*4*
Paper Mills									
Freshwater River/ Stream	0	0%	2	100%	4	100%	0	0%	6
Total[a]	*0*	*0%*	*2*	*27%*	*4*	*73%*	*0*	*0%*	*6*
Paperboard Mills									
Freshwater River/ Stream	0	0%	0	0%	1	100%	0	0%	1
Total[a]	*0*	*0%*	*0*	*0%*	*1*	*100%*	*0*	*0%*	*1*
Total for Profiled Paper and Allied Products Industries									
Freshwater River/ Stream	0	0%	3	100%	6	77%	1	100%	10
Great Lake	0	0%	0	0%	2	23%	0	0%	2
Total[a]	0	0%	3	25%	7	65%	1	10%	11

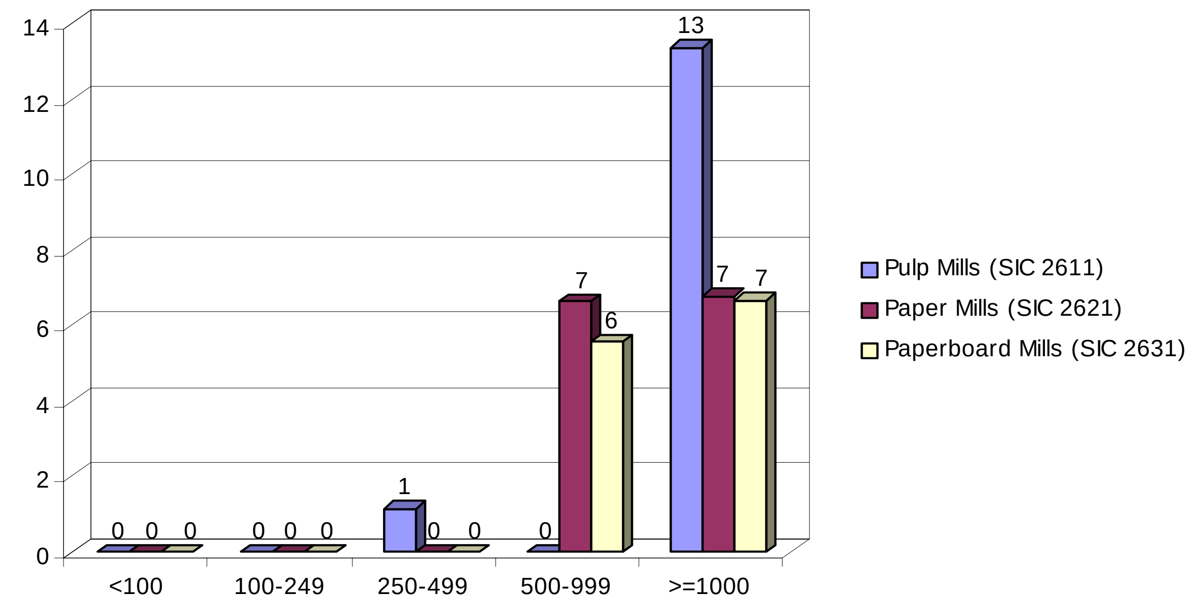
[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2A-5.2 Facility Size

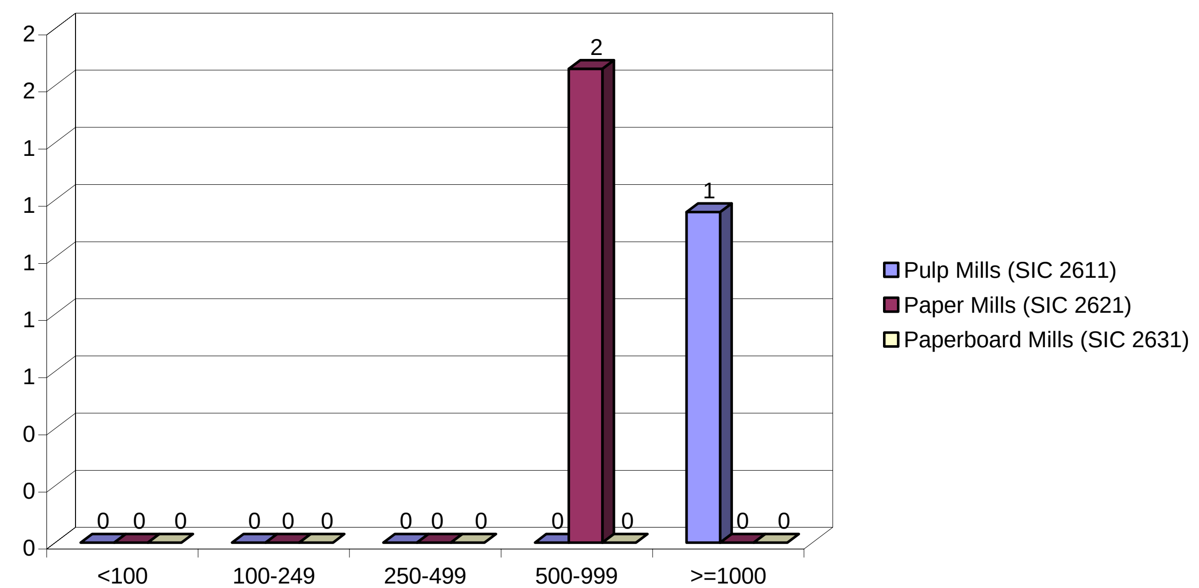
All of the pulp and paper facilities analyzed are relatively large, with no facilities employing fewer than 100 people. Figure C2A-7, Figure C2A-8, and Figure C2A-9 show the number of facilities in the profiled pulp and paper segments by employment size category for each primary analysis option.

Figure C2A-7: Number of Facilities Estimated within Scope of the 50 MGD All Option by Employment Size for Profiled Paper and Allied Products Segments



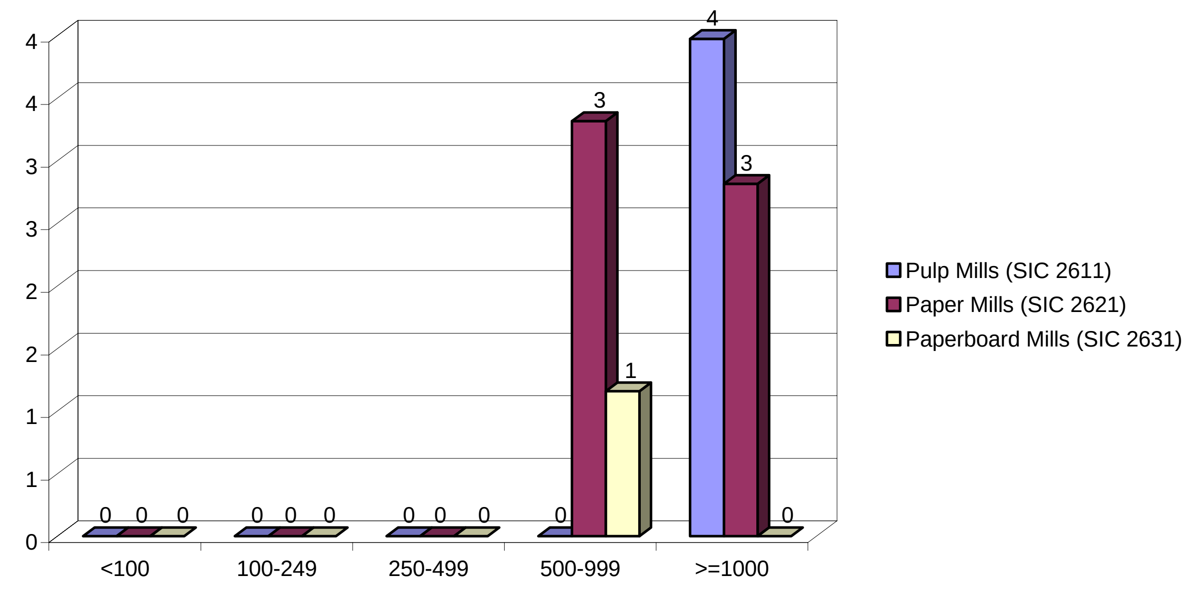
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2A-8: Number of Facilities Estimated within Scope of the 200 MGD All Option by Employment Size for Profiled Paper and Allied Products Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2A-9: Number of Facilities Estimated within Scope of the 100 MGD CWB Option by Employment Size for Profiled Paper and Allied Products Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2A-5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of facilities in the three profiled paper segments that are owned by small firms. Firms in this industry are considered small if they employ fewer than 750 people.

As shown in Table C2A-14, Table C2A-15, and Table C2A-16, large firms own all of the facilities estimated subject to regulation in this industry under the three regulatory analysis options.

Table C2A-14: Number of Facilities Estimated Subject to the 50 MGD All Option in Profiled Paper and Allied Products Segments by Firm Size

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
2611	Pulp Mills	15	100%	0	0%	15
2621	Paper Mills	13	100%	0	0%	13
2631	Paperboard Mills	12	100%	0	0%	12
Total		*40*	*100%*	*0*	*0%*	*40*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2A-15: Number of Facilities Estimated Subject to the 200 MGD All Option in Profiled Paper and Allied Products Segments by Firm Size

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
2611	Pulp Mills	1	100%	0	0%	1
2621	Paper Mills	2	100%	0	0%	2
2631	Paperboard Mills	0	0%	0	0%	0
Total		3	*100%*	*0*	*0%*	*3*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2A-16: Number of Facilities Estimated Subject to the 100 MGD CWB Option in Profiled Paper and Allied Products Segments by Firm Size

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
2611	Pulp Mills	4	100%	0	0%	4
2621	Paper Mills	6	100%	0	0%	6
2631	Paperboard Mills	1	100%	0	0%	1
Total		*11*	*100%*	*0*	*0%*	*11*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2B: Chemicals and Allied Products (SIC 28)

INTRODUCTION

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified thirteen 4-digit SIC codes in the Chemical and Allied Products Industry (SIC 28) with at least one existing facility that operates a CWIS, holds a NPDES permit, and withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes. (Facilities with these characteristics are hereafter referred to as facilities potentially subject to the Phase III regulation or "potential Phase III facilities").

For each of the fifteen SIC codes, Table C2B-1, following page, provides a description of the industry segment, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), the number of facilities estimated to be potentially subject to Phase III regulation based on the minimum withdrawal threshold of 2 MGD, and the number of facilities estimated to be subject to regulation under the three regulatory analysis options.

CHAPTER CONTENTS:

Table C2B-1: Phase III Facilities in the Chemicals and Allied Products Industry (SIC 28)

SIC	SIC Description	Important Products Manufactured	Number of Phase III facilities[a]				
			Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
Inorganic Chemicals (SIC 281)[c]							
2812	Alkalies and Chlorine	Alkalies, caustic soda, chlorine, and soda ash	28	20	16	3	11
2813	Industrial Gases	Industrial gases (including organic) for sale in compressed, liquid, and solid forms	110	4	4	0	0
2816	Inorganic Pigments	Black pigments, except carbon black, white pigments, and color pigments	26	9	0	0	0
2819	Industrial Inorganic Chemicals, Not Elsewhere Classified	Miscellaneous other industrial inorganic chemicals	271	30	6	0	1
		Total Inorganic Chemicals	***435***	***64***	***26***	***3***	***12***
Plastics Material and Resins (SIC 282)							
2821	Plastics Material and Synthetic Resins, and Nonvulcanizable Elastomers	Cellulose plastics materials; phenolic and other tar acid resins; urea and melamine resins; vinyl resins; styrene resins; alkyd resins; acrylic resins; polyethylene resins; polypropylene resins; rosin modified resins; coumarone-indene and petroleum polymer resins; miscellaneous resins	***305***	***19***	***11***	***0***	***4***
Organic Chemicals (SIC 286)[d]							
2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments	Aromatic chemicals, such as benzene, toluene, mixed xylenes naphthalene, synthetic organic dyes, and synthetic organic pigments	59	9	4	0	4
2869	Industrial Organic Chemicals, Not Elsewhere Classified	Aliphatic and other acyclic organic chemicals; solvents; polyhydric alcohols; synthetic perfume and flavoring materials; rubber processing chemicals; plasticizers; synthetic tanning agents; chemical warfare gases; and esters, amines, etc.	364	52	12	3	4
		Total Organic Chemicals	***423***	***61***	***17***	***3***	***8***
Other Chemical Segments							
2823	Cellulosic Manmade Fibers	Cellulose acetate and regenerated cellulose such as rayon by the viscose or cuprammonium process	7	1	1	0	0
2824	Manmade Organic Fibers, Except Cellulosic	Regenerated proteins, and polymers or copolymers of such components as vinyl chloride, vinylidene chloride, linear esters, vinyl alcohols, acrylonitrile, ethylenes, amides, and related polymeric materials	36	13	0	0	0
2833	Medicinal Chemicals and Botanical Products	Agar-agar and similar products of natural origin, endocrine products, manufacturing or isolating basic vitamins, and isolating active medicinal principals such as alkaloids from botanical drugs and herbs	33	2	2	0	2
2834	Pharmaceutical	Intended for final consumption, such as ampoules, tablets, capsules, vials,	91	4	0	0	0

Table C2B-1: Phase III Facilities in the Chemicals and Allied Products Industry (SIC 28)

SIC	SIC Description	Important Products Manufactured	Number of Phase III facilities[a] Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
	Preparations	ointments, medicinal powders, solutions, and suspensions					
2873	Nitrogenous Fertilizers	Ammonia fertilizer compounds and anhydrous ammonia, nitric acid, ammonium nitrate, ammonium sulfate and nitrogen solutions, urea, and natural organic fertilizers (except compost) and mixtures	60	9	0	0	0
2899	Chemicals and Chemical Preparations, Not Elsewhere Classified	Fatty acids; essential oils; gelatin (except vegetable); sizes; bluing; laundry sours; writing and stamp pad ink; industrial compounds; metal, oil, and water treating compounds; waterproofing compounds; and chemical supplies for foundries	162	4	0	0	0
		Total Other	***389***	***34***	***3***	***0***	***2***
Total Chemicals and Allied Products (SIC 28)							
		Total SIC Code 28	***1,552***	***178***	***56***	***6***	***26***

[a] Number of weighted detailed questionnaire survey respondents.
[b] Individual numbers may not add up due to independent rounding.
[c] SIC code 281 is officially titled "Industrial Inorganic Chemicals." However, to avoid confusion with SIC code 2819, "Industrial Inorganic Chemicals, Not Elsewhere Classified," this profile refers to SIC code 281 as the "Inorganic Chemicals segment."
[d] SIC code 286 is officially titled "Industrial Organic Chemicals." However, to avoid confusion with SIC code 2869, "Industrial Organic Chemicals, Not Elsewhere Classified," this profile refers to SIC code 286 as the "Organic Chemicals segment."
Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

As shown in Table C2B-1, EPA estimates that, out of the total of 1,552 facilities with a NPDES permit and operating cooling water intake structures in the Chemicals and Allied Products Industry (SIC 28), 56 (or 4%) would be subject to regulation under the 50 MGD All option, 6 (or 0.3%) would be subject to regulation under the 200 MGD All option, and 26 (or 1.7%) would be subject to regulation under the 100 MGD CWB option. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to regulation under each regulatory analysis option. Total value of shipments for the Chemicals and Allied Products Industry from the 2004 Annual Survey of Manufactures is $357.7 billion. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because the DQ did not collect value of shipments data, these data were not available for Phase III facilities. Total revenue, as reported on the DQ, was used as a close approximation for value of shipments for these facilities. EPA estimated the total revenue of facilities expected to be subject to regulation under the 50 MGD, 200 MGD and 100 MGD regulatory analysis options to be $30.2 billion, $13.8 billion, and $22.3 billion. Therefore, EPA estimates that the percentage of total production in the paper industry that occurs at facilities estimated to be subject to regulation under the 50 MGD, 200 MGD, and 100 MGD options is 8%, 4% and 6%, respectively..

The responses to the Detailed Questionnaire indicate that three chemical segments account for 95% of the chemicals industry potential Phase III facilities: (1) Inorganic Chemicals (including SIC codes 2812, 2813, 2816, and 2819); (2) Plastics Material and Resins (SIC code 2821); and (3) Organic Chemicals (including SIC codes 2865 and 2869). This profile therefore provides detailed information for these three industry groups.

Table C2B-2 on the following page provides the cross-walk between SIC codes and NAICS codes for the profiled chemical SIC codes. The table shows that alkalies and chlorine (SIC 2812), industrial gases (SIC 2813), Plastics Material and Synthetic Resins, and Nonvulcanizable Elastomers (SIC 2821) have one-to-one relationships to NAICS codes. The other SIC codes in the three profiled chemical segments correspond to two or more NAICS codes.

Table C2B-2: Relationship between SIC and NAICS Codes for the Chemicals and Allied Products Industry (2002)

SIC Code	SIC Description	NAICS Code	NAICS Description	Establishments	Value of Shipments ($000)	Employment
Inorganic Chemicals (SIC 281)						
2812	Alkalies and Chlorine	325181	Alkalies and chlorine manufacturing	41	2,809,496	6,253
2813	Industrial Gases	325120	Industrial gas manufacturing (pt)	572	5,864,978	10,654
2816	Inorganic Pigments	325131	Inorganic dye and pigment manufacturing (pt)	81	3,522,308	7,233
		325182	Carbon black manufacturing (pt)	25	1,033,515	1,665
2819	Industrial Inorganic Chemicals, Not Elsewhere Classified	325131	Inorganic dye and pigment manufacturing (pt)	81	3,522,308	7,233
		325188	All other basic inorganic chemical manufacturing (pt)	631	16,084,006	47,474
		325998	All other miscellaneous chemical product and preparation manufacturing (pt)	1188	13,404,657	36,348
		331311	Alumina refining	10	830,110	1,554
Plastics Material and Resins (SIC 282)						
2821	Plastics Material and Synthetic Resins, and Nonvulcanizable Elastomers	325211	Plastics material and resin manufacturing	690	46,825,479	67,171
Organic Chemicals (SIC 286)						
2865	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments	325110	Petrochemical manufacturing (pt)	56	21,084,070	9,380
		325132	Synthetic organic dye and pigment manufacturing	123	2,816,169	7,647
		325192	Cyclic crude and intermediate manufacturing	37	4,935,751	6,528
2869	Industrial Organic Chemicals, Not Elsewhere Classified	325110	Petrochemical manufacturing (pt)	56	21,084,070	9,380
		325120	Industrial gas manufacturing (pt)	572	5,864,978	10,654
		325188	All other basic inorganic chemical manufacturing (pt)	631	16,084,006	47,474
		325193	Ethyl alcohol manufacturing	72	2,288,305	2,265
		325199	All other basic organic chemical manufacturing (pt)	685	48,290,302	77,995

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: *U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.*

C2B-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of chemicals firms to absorb compliance costs under each primary analysis option without material adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by two factors: (1) the extent to which the industry may be expected to shift compliance costs to its customers through price increases, and (2) the financial health of the industry and its general business outlook.

Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the chemicals industry has a variable level of concentration, with some industry segments exhibiting relatively low concentration while others show somewhat higher concentration. Regardless of the domestic concentration level and its implications for market power, the U.S. chemicals industry faces increasing competitive pressure from abroad, which substantially limits any apparent ability of firms to pass a significant portion of their compliance-related costs through to customers. In addition, the relatively low share of total industry output that is estimated subject to the regulation under each analysis option also diminishes a firms' ability to shift compliance costs to customers. For these reasons, in its analysis of regulatory impacts for the chemicals industry, EPA assumed that complying firms would be unable to pass compliance costs through to customers; i.e., complying facilities must absorb all compliance costs (see following sections and Appendix 3, *Cost Pass-Through Analysis*, to *Chapter C3: Economic Impact Analysis for Manufacturers*, for further information).

Financial Health and General Business Outlook

Over the past decade, the chemicals industry, like other U.S. manufacturing industries, has experienced a range of economic/financial conditions and a number of substantial challenges. In the early 1990s, the domestic chemicals industry was affected by reduced U.S. demand as the economy entered a recessionary period. Although domestic market conditions improved by mid-decade, an oversupply of crude oil, weakness in Asian markets, along with other domestic factors, dealt a serious blow to refiners in 1998. More recently, as the U.S. economy began recovery from its economic weakness, the domestic chemicals industry is showing signs of recovery with continuous improvements in demand levels and financial performance during 2003 to 2005. Although the industry weathered difficult periods over the past few years, the strengthening of the industry's financial condition and general business outlook suggest improved ability to withstand additional regulatory compliance costs without a material financial impact.

C2B-2 DOMESTIC PRODUCTION

The U.S. chemical and allied products industry includes a large number of companies that, in total, produce more than 70,000 different chemical products. These products range from commodity materials used in other industries to finished consumer products such as soaps and detergents. The industry accounts for nearly 12 percent of U.S. manufacturing value added, and produces approximately two percent of total national gross domestic product (McGraw-Hill, 2000).

Raw materials containing hydrocarbons such as oil, natural gas, and coal are primary feedstocks for the production of organic chemicals. Inorganic chemicals are chemicals that do not contain carbon but are produced from other gases and minerals (McGraw-Hill, 2000).

The chemicals and allied products industry is highly energy intensive, accounting for seven percent of total U.S. energy consumption. Just over 50 percent of the industry's energy consumption is used as feedstock in the production of chemical products. The remainder is used to power production processes. Oil accounts for approximately 42 percent of total energy consumption by the industry. For some products, e.g., petrochemicals, energy costs account for up to 85 percent of total production costs. Overall, total energy costs represent seven percent of the value of chemical industry shipments (S&P, 2001).

C2B-2.1 Output

Figure C2B-1 shows constant dollar ***value of shipments*** and ***value added*** for the three profiled segments between 1987 and 2004[1]. Value of shipments and value added are two common measures of manufacturing output. Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added, defined as the difference between the value of shipments and the value of inputs used to make the products sold, measures the value of production activity in a particular industry.

The Organic Chemicals segment experienced a decrease in both value of shipments and value added between 1988 and 1993, followed by volatility through 1998. The mid 1990s were marked by increased competition in the global market for petrochemicals, which comprise the majority of organic chemical products. The increased competition stems from the considerable capacity expansions for these products seen in developing nations. (McGraw-Hill, 2000). Value of shipments for the segment increased through 2000, while value added remained flat. Both value of shipments and value added declined in 2001 as the segment faced decreased demand due to the economic slowdown, but have risen significantly and continuously since that year. In 2004, both value of shipments and value added were higher than during any other year in the time period analyzed.

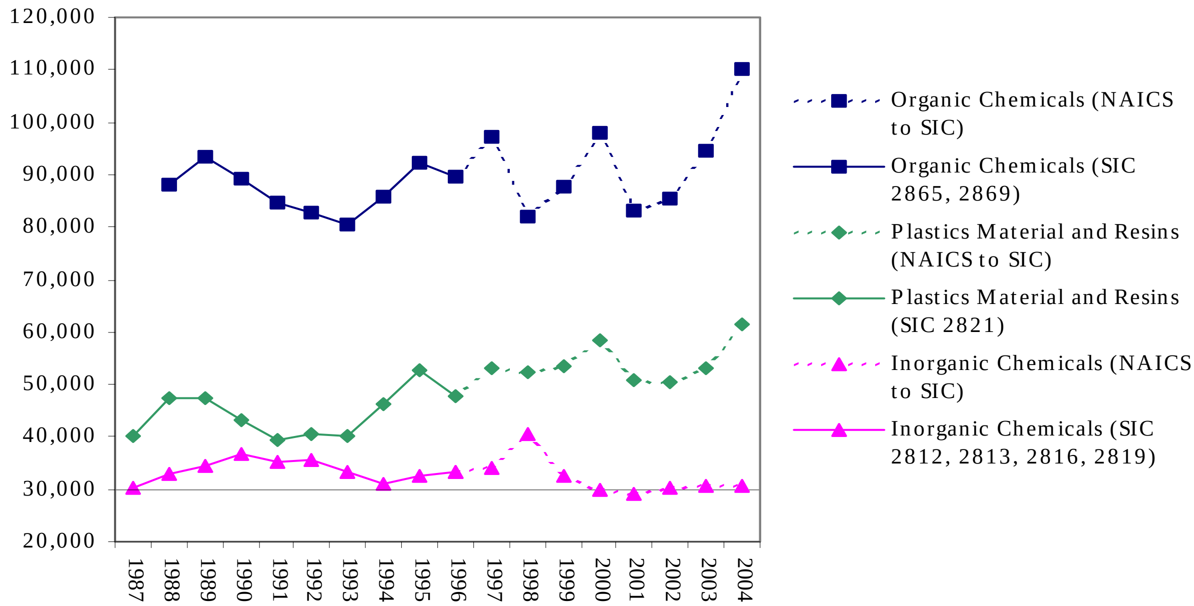
The Plastics Material and Resins and Inorganic Chemicals segments remained somewhat more stable over the period between 1987 and 2004. In the early 1990s, domestic producers benefited from the relatively weak dollar, which made U.S. products more competitive in the global market. During the later part of the 1990s, the strength of the U.S. economy bolstered domestic end-use markets, offsetting the effect of reduced U.S. export sales, which resulted from increased global competition and a strengthened dollar (McGraw-Hill, 2000). The global economic slowdown that began in 2000 led to decreased production, in particular, of chemical goods that are used in the production processes of other industries, notably steel, apparel, textiles, forest products, and technology. During 2002 to 2004, the values of shipments and value added of the Plastics Material and Resins segment increased significantly, reaching maximum levels observed in the analyzed time period by 2004. The value of shipments and value added of the Inorganic Chemicals segment, on the other hand, has remained relatively stable since 2000.

In the early 2000s, the industry struggled to maintain earnings against the global economic decline. Currently, the industry continues to face high raw material and energy costs, as well as an increase in competition from abroad. Although the U.S. economy has improved recently, the chemical industry has lagged in increasing growth of sales and earnings. This may change in the future, as the American Chemistry Council reported that the chemical industry should experience positive growth only slightly lower than GDP in 2004 (C&EN, 2003c). Recent increases in the value of shipments and value added indicate improved performance. This should better position firms to incur costs associated with regulatory compliance.

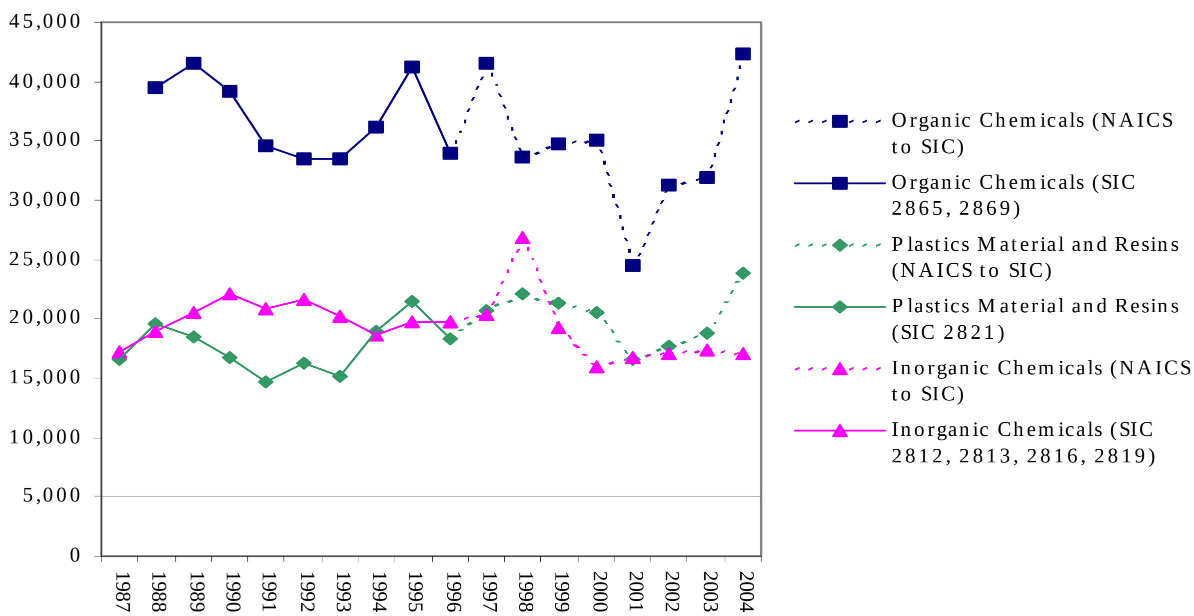
[1] Terms highlighted in bold and italic font are further explained in the glossary.

Figure C2B-1: Value of Shipments and Value Added for Profiled Chemicals Industry Segments (millions, $2005)

Value of Shipments



Value Added



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2B-3 provides the Federal Reserve System's index of industrial production for the three profiled segments, which shows trends in production since 1989. This index reflects total output in physical terms, whereas value of shipments and value added reflects the value of output in economic terms. Table C2B-3 shows varying trends in the three segments since 1989, but sharp declines in production in all three segments in 2000 or 2001. These declines were caused by the marked slowdown in the U.S. economy, which affected demand in major chemical-using segments such as steel, apparel, textiles, forest products, and the technology sectors (Chemical Marketing Reporter, 2001).

Production continued to decline through 2001 and has fluctuated annually since that year. In 2002, production increased somewhat before dipping again in 2003. The decline was followed by gains in 2004, and yet more declines in 2005. Between 1989 and 2005, the Basic Inorganic Chemicals and Organic Chemicals segments saw overall production declines of 5.3 and 3.3 percent, respectively, while the Plastics Materials and Resins segment saw an overall 28.5 percent production increase.

Table C2B-3: Chemicals Industry Industrial Production Index (Annual Averages)

Year	Basic Inorganic Chemicals[a]		Plastics Material and Resins[b]		Organic Chemicals[c]	
	Index 2002=100	Percent Change	Index 2002=100	Percent Change	Index 2002=100	Percent Change
1989	101.3		74.3		102.4	
1990	103.8	2.4%	75.0	1.0%	108.9	6.4%
1991	99.3	-4.3%	72.1	-3.8%	103.8	-4.7%
1992	100.9	1.6%	78.4	8.7%	104.4	0.6%
1993	97.9	-3.0%	76.9	-1.9%	99.4	-4.8%
1994	103.2	5.5%	87.8	14.1%	94.1	-5.4%
1995	102.5	-0.7%	88.5	0.8%	95.0	1.0%
1996	102.0	-0.5%	85.7	-3.2%	95.4	0.4%
1997	113.4	11.2%	94.3	10.1%	97.4	2.1%
1998	103.8	-8.5%	102.0	8.2%	101.4	4.1%
1999	111.6	7.5%	105.9	3.8%	103.1	1.7%
2000	110.3	-1.2%	105.1	-0.8%	95.7	-7.1%
2001	95.1	-13.7%	95.4	-9.2%	91.7	-4.2%
2002	100.0	5.1%	100.0	4.9%	100.0	9.0%
2003	98.4	-1.6%	94.9	-5.1%	98.7	-1.3%
2004	105.9	7.5%	100.8	6.2%	100.7	2.1%
2005[d]	96.0	-4.0%	95.4	-4.6	99.0	-1.0
Total Percent Change 1989-2005	*-5.3%*		*28.5%*		*-3.3%*	
Average Annual Growth Rate	*-0.3%*		*1.6%*		*-0.2%*	

[a] Includes NAICS 32512-8.
[b] Includes NAICS 325211.
[c] Includes NAICS 32511,9.
[d] Value for Plastics Materials and Resins through 11 months of 2005.
Source: Economagic, 2006.

C2B-2.2 Prices

The ***producer price index*** (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

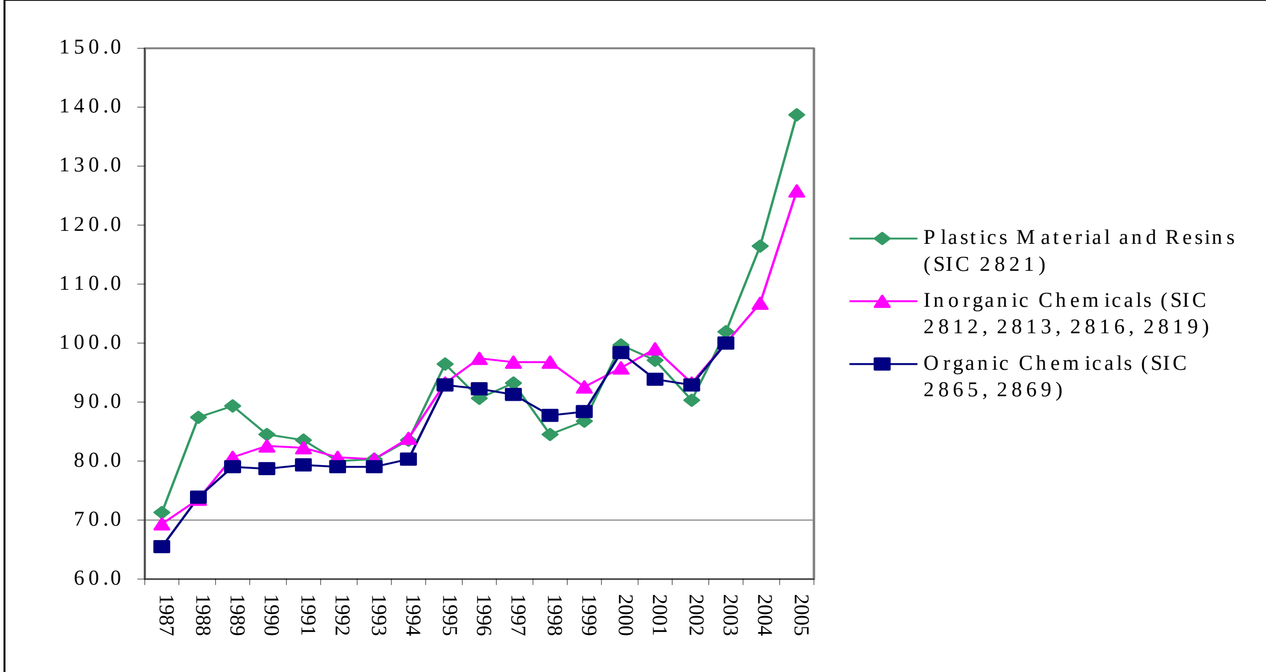
Figure C2B-2 shows the producer price index for the profiled chemical segments. Selling prices for the products of the Organic and Inorganic Chemicals segments increased from 1987 to 1989 and remained stable through 1994. Between 1994 and 1995, prices increased sharply, followed by a period of relatively stable prices through 1999. The sharp price rises for Organic Chemicals and Plastics Material and Resins in 2000 resulted in part from increases in the price of natural gas, which is the feedstock for 70 percent of U.S. ethylene production. High natural gas prices put U.S. organic chemicals and, to a lesser extent, plastic resin producers at a disadvantage relative to foreign producers who rely on naphta and gas oil as a feedstock. Natural gas prices declined, however, in 2001 easing pressure on U.S. producers (Chemical Marketing Reporter, 2001). Price increases for Plastics Material and Resins also reflected a shift by U.S. producers away from production of commodity resins to specialty and higher-value-added products (McGraw-Hill, 2000). Prices for Plastics Material and Resins followed a trend similar to the other two chemical industry segments but with larger fluctuations (see Figure C2B-2). (C&EN, 2003c). Prices for all three chemical segments declined slightly in 2002 before rising steeply through 2003 to 2005.[2]

Chemical and plastics prices fluctuate in large part as a result of varying energy prices. Basic petrochemicals, which comprise the majority of organic chemical products, depend heavily on energy commodities as inputs to the production process – energy input costs may account for up to 85 percent of total product costs. The prices of natural gas and oil therefore influence the production costs and the selling price for these products. High basic petrochemical prices affect prices for chemical intermediates and final end products, including organic chemicals and plastics.

Another factor influencing prices for commodity chemical products is the cyclical nature of market supply and demand conditions. The Plastics, Organic Chemicals, and Inorganic Chemicals segments are characterized by large capacity additions that can lead to fluctuations in prices in response to imbalances in supply and demand.

[2] Note that data 2004 and 2005 price data were only available for the Plastics Materials and Resins and Inorganic Chemicals segments.

Figure C2B-2: Producer Price Indexes for Profiled Chemicals Industry Segments



Note: For Inorganic Chemicals and Organic Chemicals, data presented are the average of PPI values for the corresponding SIC/NAICS codes of the industry segments. Data for 2004 and 2005 was collected by corresponding NAICS code(s) and appended to SIC code data for Plastics Materials and Resins and Inorganic Chemicals after converting all data to a common base year. Data comparability issues between SIC code and NAICS code data did not allow the same methodology for Organic Chemicals. Therefore, SIC code data for Organic Chemicals is presented through 2003, after adjusting to the same base year (12/03) as the other industry segments.

Source: BLS, 2006.

C2B-2.3 Number of Facilities and Firms

According to the Statistics of U.S. Businesses, the number of facilities in the Inorganic Chemicals segment remained relatively stable between 1989 and 1997, followed by four consecutive years of decreases in the number of facilities. Although the number of facilities increased slightly in 2003, the Inorganic Chemicals segment experienced an overall 13.7 percent decline in the number of facilities over the 1990 to 2003 time period. The other two segments saw overall increases in the number of facilities over the 1989 to 2003 time period, though the Organic Chemicals segment saw declines in 1999 through 2002. The Plastics Material and Resins segment saw significant increases in the number of facilities reported between 1993 and 1996, reflecting growth in the demand for plastics in a number of end-uses (McGraw-Hill, 2000). Table C2B-4 shows the downward trend in the number of facilities producing inorganic chemical products following a peak in 1991. The decrease is partly attributable to the consolidation within the Inorganic Chemicals segment (S&P, 2001).

Table C2B-4: Number of Facilities for Profiled Chemical Segments[a]

Year	Inorganic Chemicals		Plastics Material and Resins		Organic Chemicals	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	1,421		517		837	
1991	1,508	6.1%	529	2.3%	851	1.7%
1992	1,466	-2.8%	460	-13.0%	888	4.3%
1993	1,476	0.7%	502	9.1%	908	2.3%
1994	1,460	-1.1%	499	-0.6%	902	-0.7%
1995	1,425	-2.4%	558	11.8%	907	0.6%
1996	1,396	-2.0%	630	12.9%	868	-4.3%
1997	1,414	1.3%	593	-5.9%	945	8.9%
1998[b]	1,310	-7.3%	565	-4.7%	1,093	15.6%
1999[b]	1,309	-0.1%	586	3.7%	1,076	-1.5%
2000[b]	1,300	-0.7%	597	1.9%	1,072	-0.4%
2001[b]	1,266	-2.6%	621	4.0%	1,064	-0.7%
2002[b]	1,182	-6.6%	695	11.9%	1,052	-1.2%
2003[b]	1,227	3.7%	802	15.4%	1,074	2.1%
Total Percent Change 1990-2003	*-13.7%*		*55.1%*		*28.3%*	
Average Annual Growth Rate	*-1.1%*		*3.4%*		*1.9%*	

[a] The Statistics of U.S. Business is derived from Census County Business Patterns data, and reports somewhat different numbers of firms and facilities than other Census data sources.

[b] Before 1998, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

The trend in the number of firms between 1989 and 2003 is similar to the number of facilities. The number of firms in the Inorganic Chemicals segment peaked in 1992, and then declined continuously during 1993 to 2002, before increasing slightly in 2003. The Organic Chemicals segment showed more volatility before peaking in 1998 with 710 firms. The number of firms in this segment declined slightly over 1999 to 2002, before reaching a new high of 717 firms in 2003. The number of firms in the Plastics Material and Resins segment increased substantially between 1993 and 1996, from 284 to 403 firms, before decreasing in the next two years. Starting in 1999, the Plastics Material and Resins segment showed five years of positive growth in the number of firms.

Table C2B-5 on the following page shows the number of firms in the three profiled chemical segments between 1990 and 2003.

Table C2B-5: Number of Firms for Profiled Chemical Segments[a]

Year	Inorganic Chemicals		Plastics Material and Resins		Organic Chemicals	
	Number of Firms	Percent Change	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	640		301		579	
1991	678	5.9%	319	6.0%	584	0.9%
1992	699	3.1%	255	-20.1%	611	4.6%
1993	683	-2.3%	284	11.4%	648	6.1%
1994	677	-0.9%	295	3.9%	644	-0.6%
1995	657	-3.0%	343	16.3%	644	0.0%
1996	625	-4.9%	403	17.5%	596	-7.5%
1997	611	-2.2%	358	-11.2%	674	13.1%
1998[b]	618	1.1%	322	-10.1%	710	5.3%
1999[b]	609	-1.3%	337	4.7%	684	-3.6%
2000[b]	611	0.2%	352	4.5%	683	-0.1%
2001[b]	606	-0.8%	375	6.5%	692	1.3%
2002[b]	552	-8.9%	443	18.1%	685	-1.0%
2003[b]	592	7.3%	554	25.1%	717	4.7%
Total Percent Change 1990-2003	*-7.5%*		*84.1%*		*23.9%*	
Average Annual Growth Rate	*-0.6%*		*4.8%*		*1.7%*	

[a] The Statistics of U.S. Business is derived from Census County Business Patterns data, and reports somewhat different numbers of firms and facilities than other Census data sources.

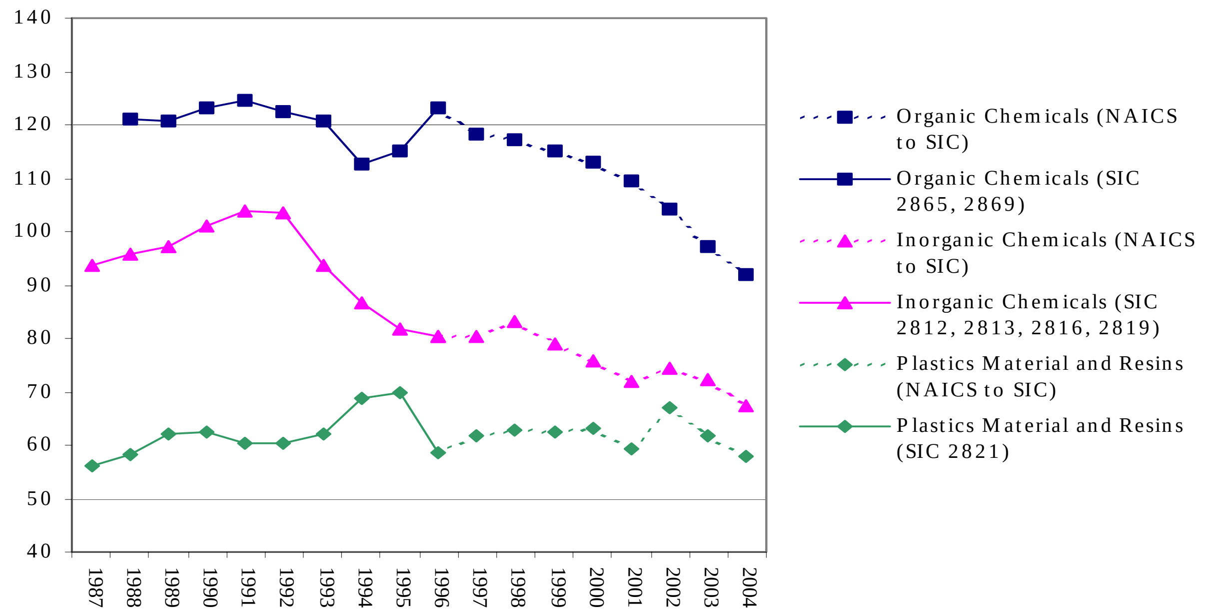
[b] Before 1998, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. SBA, 1989-2003.

C2B-2.4 Employment and Productivity

Figure C2B-3 below provides information on ***employment*** from the Annual Survey of Manufactures. With the exception of minor short-lived fluctuations, employment in the Organic Chemicals and Plastics Material and Resins segments remained relatively stable between 1988 and 2000 before seeing declines of greater than 4.5 percent in 2001. Slight increases in employment in 2002 were followed by further declines during 2003 to 2004. The Inorganic Chemicals segment, however, experienced a significant decrease in employment from 103,400 to 80,200 employees over the 1992 to 1996 period. This decrease reflects the industry's restructuring and downsizing efforts intended to reduce costs in response to competitive challenges. Employment in this segment remained fairly constant over the next two years before experiencing three years of employment declines greater than 4 percent. A brief increase in employment in 2002 was followed by further declines in both 2003 and 2004. From 1987 to 2004, the Inorganic Chemicals segment had the largest overall decrease in employment at 28 percent. The Organic Chemicals segment employment declined 24 percent, while the Plastics Material and Resins segment was the only segment to increase employment, which rose by 2.6 percent for the period.

Figure C2B-3: Employment for Profiled Chemical Segments (000s)



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2B-6 presents the change in value added per labor hour, a measure of ***labor productivity***, for each of the profiled industry segments between 1988 and 2004. The trends in each segment show considerable volatility through the 1990s into the 2000s. The gains in productivity in the Inorganic Chemicals segment reflect firms' attempts to reduce costs by restructuring production and materials handling processes in response to maturing domestic markets and increased global competition (S&P, 2001). Over the 1988 to 2004 period, all three segments saw significant increases in productivity.

Table C2B-6: Productivity Trends for Profiled Chemical Segments ($2005)

Year	Inorganic Chemicals				Plastics Material and Resins				Organic Chemicals			
	Value Added ($mill.)	Prod. Hours (mill.)	Value Added/Hour $/hr.	Value Added/Hour Percent Change	Value Added ($mill.)	Prod. Hours (mill.)	Value Added/Hour $/hr.	Value Added/Hour Percent Change	Value Added ($mill.)	Prod. Hours (mill.)	Value Added/Hour $/hr	Value Added/Hour Percent Change
1988	19,020	114	168		19,547	80	245		39,548	152	261	
1989	20,550	109	189	12.8%	18,540	84	222	-9.6%	41,520	155	269	3.1%
1990	22,120	115	193	2.2%	16,756	83	203	-8.3%	39,120	156	251	-6.5%
1991	20,875	121	173	-10.6%	14,620	81	181	-10.9%	34,622	156	222	-11.6%
1992	21,686	120	180	4.4%	16,215	79	207	14.2%	33,541	155	216	-2.8%
1993	20,134	108	186	3.4%	15,163	81	187	-9.3%	33,469	156	215	-0.5%
1994	18,703	101	186	-0.5%	19,009	89	213	13.4%	36,148	146	248	15.6%
1995	19,808	100	198	6.6%	21,429	92	234	10.1%	41,191	148	279	12.4%
1996	19,789	97	204	3.3%	18,289	81	227	-3.1%	33,979	158	215	-23.0%
1997[a]	20,377	91	224	9.4%	20,710	84	248	9.2%	41,575	150	277	28.7%
1998[a]	26,790	92	293	30.8%	22,162	83	266	7.5%	33,665	147	230	-17.0%
1999[a]	19,203	88	219	-25.2%	21,302	84	252	-5.4%	34,780	143	244	6.2%
2000[a]	15,961	94	171	-22.0%	20,582	87	236	-6.3%	34,987	138	253	3.7%
2001[a]	16,694	87	191	12.2%	16,516	80	206	-12.9%	24,482	135	181	-28.4%
2002[a]	16,989	86	197	2.8%	17,723	91	195	-5.3%	31,192	133	235	29.9%
2003[a]	17,344	82	212	7.8%	18,745	87	215	10.2%	31,966	130	247	4.9%
2004 [a]	16,992	77	222	4.6%	23,844	82	290	35.0%	42,251	122	346	40.4%
Total Percent Change 1988-2004	-10.7%	-32.5%	32.4%		22.0%	3.1%	18.3%		6.8%	-19.7%	33.0%	
Average Annual Percent Change	-0.7%	-2.4%	1.8%		1.2%	0.2%	1.1%		0.4%	-1.4%	1.8%	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2B-2.5 Capital Expenditures

The chemicals industry is relatively capital-intensive. According to the Census's *2001 Annual Survey of Manufactures*, facilities in NAICS 325, which includes the entire profiled chemical SIC codes, had aggregate capital spending of almost $19 billion in 2001. Capital-intensive industries are characterized by large, technologically complex manufacturing facilities, which reflect the economies of scale required to manufacture products efficiently. ***New capital expenditures*** are needed to extensively modernize, expand, and replace existing capacity to meet growing demand. All three profiled chemical industry segments experienced substantial increases in capital expenditures through the 1990s. Table C2B-7 on the following page shows that capital expenditures in the Inorganic Chemicals segment increased, in real terms, from $1.216 billion in 1987 to $2.803 billion in 1998. Although the following five years saw declines in capital expenditures, the Inorganic Chemicals segment increased capital expenditures by 14.8 percent from 1987 to 2004. The Plastics segment more than doubled its capital expenditures from 1987 through 1999, before significant reductions occurred in the subsequent two years. The Organic Chemicals segment peaked in 1996, and has seen its capital expenditures decline continuously until 2004, when expenditures increased slightly. Overall, capital expenditures in this segment declined by almost 33 percent from 1988 to 2004. Much of the growth in capital expenditures was driven by investment in capacity expansions to meet the increase in global demand for chemical products. Domestically, the continued substitution of synthetic materials for other basic materials and rising living standards caused consistent growth in the demand for chemical commodities (S&P, 2001). As the economy slowed in 2000, chemical industry firms curtailed capital expenditures in the face of weakening financial performance. As the economy picked up steam, an early 2003 survey of 19 chemical companies found that businesses sought to start increasing capital projects in 2003 (C&EN, 2003b).

Table C2B-7: Capital Expenditures for Profiled Chemical Segments (in millions, $2005)

Year	Inorganic Chemicals		Plastics Material and Resins		Organic Chemicals	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	1,216		1,910		n/a	
1988	1,242	2.1%	2,378	24.5%	4,713	
1989	1,909	53.7%	2,806	18.0%	5,807	23.2%
1990	1,826	-4.3%	3,348	19.3%	7,022	20.9%
1991	1,827	0.1%	2,989	-10.7%	6,972	-0.7%
1992	2,017	10.4%	2,216	-25.9%	6,174	-11.4%
1993	1,496	-25.8%	2,443	10.3%	5,109	-17.2%
1994	1,620	8.3%	3,150	28.9%	4,358	-14.7%
1995	2,079	28.3%	2,829	-10.2%	5,953	36.6%
1996	2,391	15.0%	3,325	17.6%	7,457	25.3%
1997[a]	2,347	-1.9%	3,435	3.3%	6,832	-8.4%
1998[a]	2,803	19.5%	3,987	16.0%	5,804	-15.0%
1999[a]	2,373	-15.3%	4,286	7.5%	5,340	-8.0%
2000[a]	2,320	-2.2%	2,516	-41.3%	5,129	-4.0%
2001[a]	2,193	-5.5%	2,017	-19.8%	3,860	-24.7%
2002[a]	1,514	-31.0%	2,225	10.3%	3,611	-6.5%
2003[a]	1,210	-20.1%	1,586	-28.7%	2,981	-17.4%
2004[a]	1,397	15.4%	1,882	18.7%	3,169	6.3%
Total Percent Change 1987(8)-2004	14.8%		-1.5%		-32.8%	
Average Annual Growth Rate	0.8%		-0.1%		-2.4%	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2B-2.6 Capacity Utilization

Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization reflects excess or insufficient capacity in an industry and is an indication of whether new investment is likely. To take advantage of economies of scale, chemical commodities are typically produced in large facilities. Capacity additions in this industry are often made on a relatively large scale and can substantially affect the industry’s capacity utilization rates. Figure C2B-4 presents the capacity utilization index from 1989 to 2004 for specific 4-digit SIC codes within each of the profiled segments in the chemicals industry. Capacity utilization in the Organic Chemicals segment remained the most stable through this time period with only moderate fluctuations between 1989 and 1999, followed by decreased utilization rates in 2000 and 2001, before rebounding in 2002. Plastics Material and Resins capacity utilization showed a downward trend, as the production of many commodity resins shifted overseas. U.S. producers responded by emphasizing the manufacture of specialty and higher-value-added products and by rationalizing capacity to improve profitability (McGraw-Hill, 2000).

Overall, the Inorganic Chemicals segment demonstrated the most volatility in capacity utilization between 1989 and 2002. The chlor-alkali industry (SIC code 2812) experienced an almost consistent decline in capacity utilization since its high of 96 percent from 1992 through 1994. This decrease reflects the enactment of treaties and legislation designed to reduce the emission of chlorinated compounds into the environment. These regulations decreased the demand for chlorine, which, together with caustic soda, accounts for more than 75 percent of production by this segment. The significant increase in capacity utilization in the industrial gases segment (SIC code 2813) in the mid 1990s reflects the expansion of key intermediate purchasers of chemical commodities such as the primary metals and electronics industries. As these markets and the economy in general started to slow, utilization rates declined as well. Similarly, capacity utilization in the pigments and other inorganic chemicals segments (SIC codes 2816 and 2819) remained relatively stable between 1989 and 1998, before dropping in the early 2000s. Capacity utilization in the inorganic pigments industry increased significantly in 2002 before declining again over 2003 to 2004; no such rebound is evident in the industrial inorganic chemicals segment, where capacity utilization has been declining each year since 1998. The stability in these segments through 1999 reflects the fact that these are essentially mature markets where the demand for products tends to track growth in gross domestic product (GDP) (McGraw-Hill 2000). As the economy continued its sluggish performance in the early 2000s, utilization within this segment dampened, as demand for product decreased.

Figure C2B-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Chemical Segments

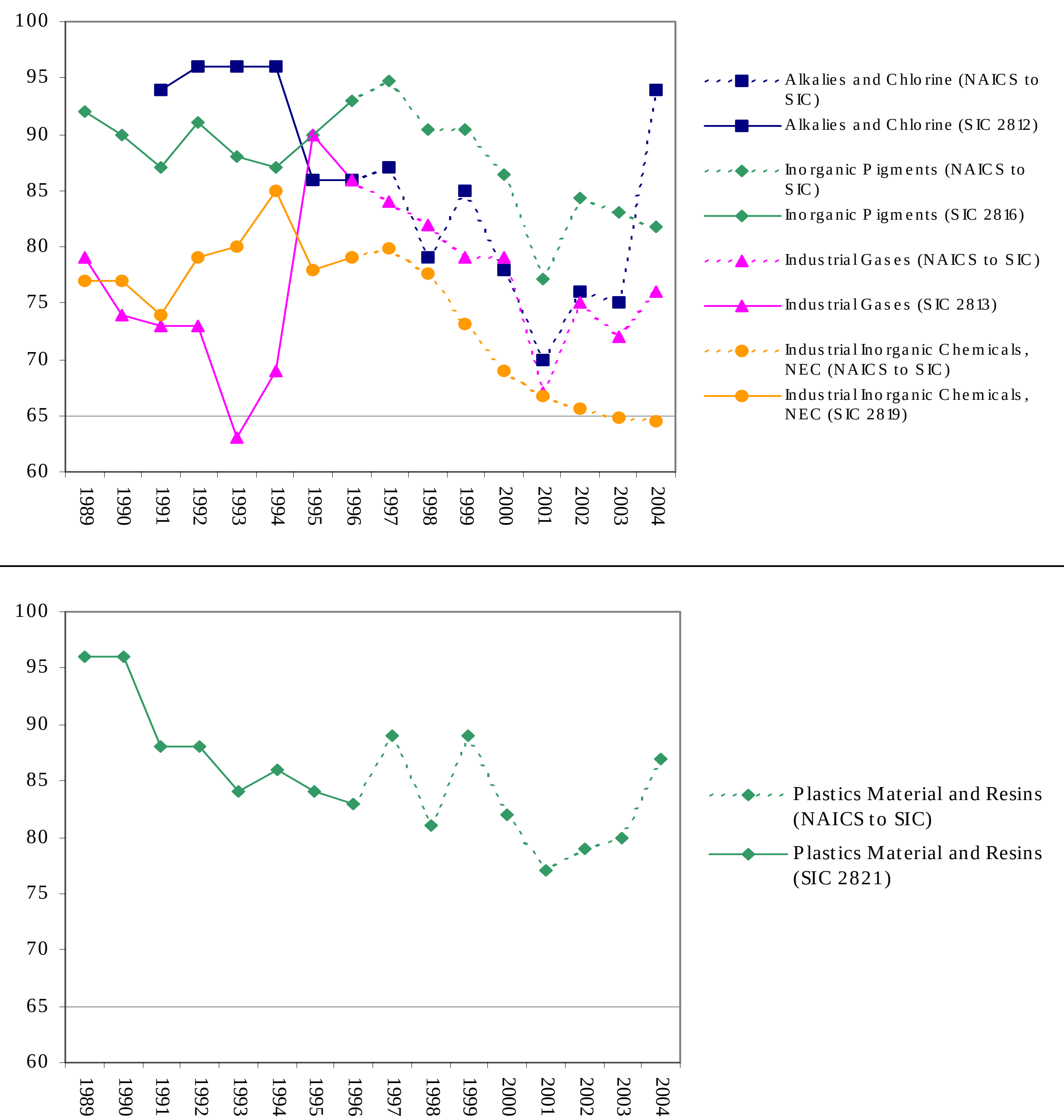
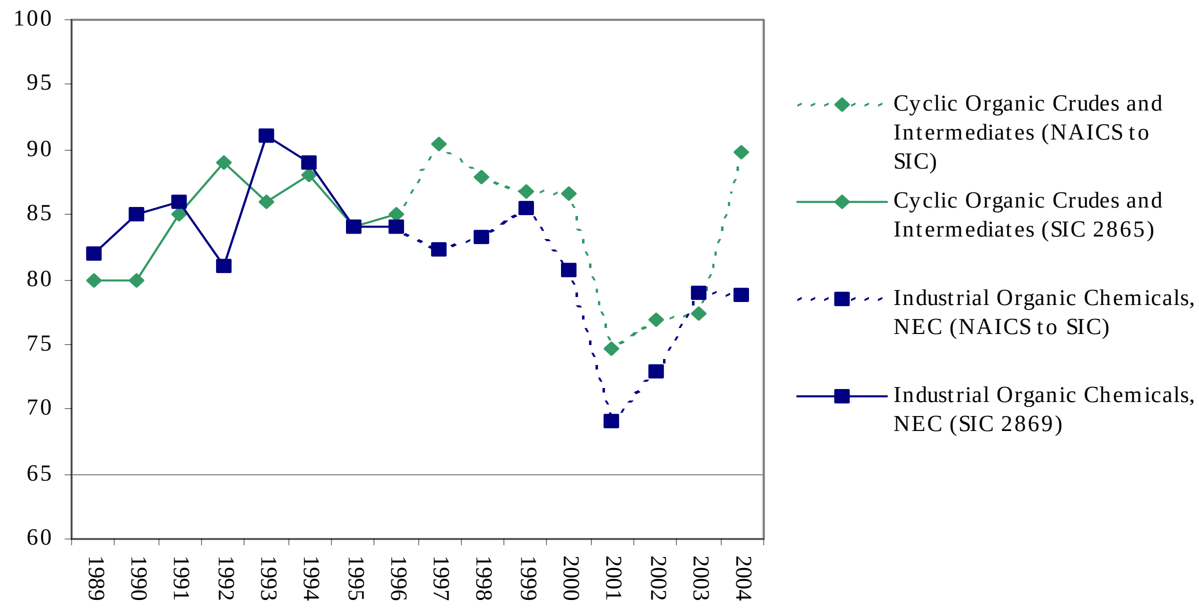


Figure C2B-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Chemical Segments



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1989-2004.

C2B-3 Structure and Competitiveness

The chemicals industry continues to restructure and reduce costs in response to competitive challenges, including global oversupply for commodities. In the early 1990s, the chemical industry's cost cutting came largely from restructuring and downsizing. The industry has taken steps to improve productivity, and consolidated to cut costs. Companies seeking growth within these relatively mature industry segments have made acquisitions to achieve production or marketing efficiencies. The Plastics Material and Resins segment, for example, experienced sizable consolidations in the late 1990s into 2000 (S&P, 2001).

C2B-3.1 Firm Size

The Small Business Administration (SBA) defines small firms in the chemical industries according to the firm's number of employees. Firms in the Inorganic Chemicals segment (SIC codes 2812, 2813, 2816, 2819) and in Industrial Organic Chemicals, NEC (SIC code 2869) are defined as small if they have 1,000 or fewer employees; firms in Plastics Material and Resins (SIC 2821) and Cyclic Organic Crudes and Intermediates (SIC code 2865) are defined as small if they have 750 or fewer employees. The size categories reported in the Statistics of U.S. Businesses (SUSB) do not correspond with the SBA size classifications, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data.

The SUSB data presented in Table C2B-8 show that in 2003, 474 of 592 firms in the Inorganic Chemicals segment had less than 500 employees. Therefore, at least 80 percent of firms in this segment were classified as small. These small firms owned 555 facilities, or 45 percent of all facilities in the segment. In the Plastics and Resins Industry segment, 455 of 554 firms, or 82 percent, had less than 500 employees in 2003. These small firms owned 493 of 802 facilities (61 percent) in the segment. In the Organic Chemicals segment, 76 percent of firms (546 of 717) had fewer than 500 employees, owning 55 percent of all facilities in that segment.

Table C2B-8 below shows the distribution of firms, facilities, and receipts in the Inorganic Chemicals, Plastics Material and Resins, and Organic Chemicals segments by the employment size of the parent firm.

Table C2B-8: Number of Firms and Facilities by Firm Size Category for Profiled Chemical Segments, 2003[a]

Employment Size Category	Inorganic Chemicals		Plastics Material and Resins		Organic Chemicals	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	261	261	228	230	289	291
20-99	143	171	171	176	174	184
100-499	70	123	56	87	83	117
500+	118	672	99	309	172	483
Total	*592*	*1,227*	*554*	*802*	*717*	*1,074*

[a] Before 1998, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. SBA, 1989-2003.

C2B-3.2 Concentration Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal[3]. An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 (602 + 302 + 102). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

Of the profiled chemicals and allied products segments, as shown in Table C2B-9, only Alkalies and Chlorine (SIC 2812), Industrial Gases (SIC 2813), Inorganic Pigments (SIC 2816), and Cyclic Crudes and Intermediates (SIC 2865) would be considered concentrated based on their CR4 and HHI values. In contrast, Industrial Inorganic Chemicals, NEC (SIC 2819), Plastics Material and Resins (SIC 2821), and Industrial Organic Chemicals, NEC (SIC 2869) would be considered competitive. The diversity of products in some of the profiled segments, however, makes generalizations about concentration less reliable than in industries with a more limited

[3] The measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of domestic production are therefore only one indicator of the extent of competition in an industry.

product slate. That is, within a single SIC code, the numbers of producers may vary substantially by individual product – firms may possess relatively high market power in products with a smaller number of competing producers even though the total SIC code would appear to have a relatively low concentration. On the basis of concentration information, some industry segments would therefore appear to be moderately concentrated; accordingly, firms in these segments might possess a moderate degree of market power and thus the ability to pass compliance costs through to customers as price increases. However, as discussed above and more specifically in the following section, competition from foreign producers in both domestic and export markets, increasingly restrains any discretionary pricing power of U.S. firms in the profiled industry segments.

Table C2B-9: Selected Ratios for SIC and NAICS Codes Within The Profiled Chemical Segments in 1987, 1992, and 1997[a]

SIC (S) or NAICS (N) Code	Year	Concentration Ratios				
		4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
Inorganic Chemicals						
S 2812	1987	72%	93%	99%	100%	2,328
	1992	75%	90%	99%	100%	1,994
N 325181	1997	80%	92%	100%	100%	2,870
S 2813	1987	77%	88%	95%	98%	1,538
	1992	78%	91%	96%	99%	1,629
N 325120	1997	64%	85%	96%	99%	1,225
S 2816	1987	64%	76%	94%	99%	1,550
	1992	69%	79%	93%	99%	1,910
N 325131[b]	1997	67%	79%	95%	100%	1,848
S 2819	1987	38%	49%	68%	84%	468
	1992	39%	50%	68%	85%	677
N 325188[c]	1997	31%	42%	63%	82%	394
Plastics Material and Resins						
S 2821	1987	20%	33%	61%	89%	248
	1992	24%	39%	63%	90%	284
N 325211	1997	26%	39%	64%	89%	304
Organic Chemicals						
S 2865	1987	34%	50%	77%	96%	542
	1992	31%	45%	72%	94%	428
N 325132[c]	1997	42%	59%	83%	97%	700
N 325192[d]	1997	62%	79%	98%	100%	1701
S 2869	1987	31%	48%	68%	86%	376
	1992	29%	43%	67%	86%	336
N 325199[b]	1997	25%	38%	57%	80%	256

[a] The 1997 Census of Manufactures is the most recent concentration ratio data available.

[b] NAICS code represents largest percentage of facilities and value of shipments within this SIC based on *1997 Bridge Between SIC and NAICS*

[c] NAICS code represents largest percentage of facilities within this SIC based on *1997 Bridge Between SIC and NAICS*

[d] NAICS code represents largest percentage of value of shipments within this SIC based on *1997 Bridge Between SIC and NAICS*

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

C2B-3.3 Foreign Trade

The chemicals industry is the largest exporter in the United States. The industry generates more than 10 percent of the nation's total exports, and overseas sales constitute a growing share of U.S. chemical company revenues. The major U.S. producers still derive 50 percent or more of their revenue from domestic sales, however (S&P, 2001).

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

Table C2B-10 presents trade statistics for each of the profiled chemical segments. Both export dependence and import penetration experienced increases in each of these segments between 1989 and 2001.

Globalization of markets has become a key factor in the Inorganic Chemicals segment, with both import penetration and export dependence growing substantially over the 14-year analysis period. During this period, imports rose by just over 6 percent, while exports climbed 0.4 percent. The greater growth in imports underscores the increasing competition from foreign producers in domestic markets.

Increased globalization has also affected the Plastics Material and Resins segment. Imports and exports of plastics and resins have increased significantly over the time period, reflecting the continued growth in the global market. Of the three profiled chemical segments, this segment has shown the largest overall increases in values of imports and exports with total growth of 174 percent and 67 percent, respectively, from 1989 through 2002. Import penetration grew more quickly than export dependence in this segment due to declining export opportunities and increased competition from new foreign capacity. The United States remained a net exporter of plastics and resins, despite these trends. The market for organic chemicals, particularly petrochemicals, has become increasingly competitive. Significant capacity expansions for petrochemicals worldwide increased competition in domestic markets from imports and began to limit export opportunities for U.S. producers. Through 1999, the segment still exported more than it imported. This balance recently changed though as imports exceeded exports during 2000 through 2002. From 1989 through 2002, imports in this segment grew by 161 percent, while export growth was at 39 percent.

In 2002, the Inorganic Chemicals segment's import penetration ratio was 24.7 percent, while the Organic Chemicals segment's import penetration ratio was slightly higher at 24.8 percent. Both segments likely face strong competition from foreign firms in U.S. markets. The Plastics Material and Resins segment had an import penetration ratio of 14.0 percent in 2002, suggesting this segment does not presently face strong competition from foreign firms' presence in U.S. markets. However, the import penetration ratio nearly doubled in the decade from 1991 to 2001, which could indicate that foreign firms have begun aggressive pursuit of these U.S. markets. In 2002, the export dependence ratio was 26 percent for the Inorganic Chemicals segment, 26 percent for the Plastics Material and Resins segment, and 23 percent for the Organic Chemicals segment. All three segments likely face significant competitive pressure in retaining these positions in export markets. Given these levels of exposure to competition from foreign firms in domestic and export markets, the profiled chemicals industry segments likely have little discretionary power to recover compliance costs through price increases.

Recent trends in international chemicals markets imply that U.S. producers will continue to face strong competition from foreign producers. The industry's trade balance declined in 2000, due to increased imports from Western Europe, encouraged by the strong U.S. dollar relative to the Euro, and growth in the petrochemical industry in the Middle East. Declines in the dollar relative to the Euro improved export performance somewhat, but decline in the global economy resulted in mixed trade performance in 2001 (Chemical Market Reporter, 2001). In 2002, the chemical industry's traditional trade surplus reversed, reaching a deficit of around $4 billion (C&EN, 2003a). After nine months of 2003, the deficit had ballooned to $7.7 billion (C&EN, 2003c).

Table C2B-10: Trade Statistics for Profiled Chemical Segments

Year	Value of imports (millions, $2005)	Value of exports (millions, $2005)	Value of shipments (millions, $2005)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
Inorganic Chemicals, Except Pigments						
1989	6,035	6,852	30,090	29,274	20.6%	22.8%
1990	5,941	6,405	32,270	31,806	18.7%	19.8%
1991	5,687	6,625	31,294	30,357	18.7%	21.2%
1992	5,407	6,658	31,214	29,963	18.0%	21.3%
1993	5,123	6,117	29,255	28,262	18.1%	20.9%
1994	5,846	6,477	26,924	26,293	22.2%	24.1%
1995	6,825	7,520	28,538	27,843	24.5%	26.3%
1996	7,466	7,613	28,993	28,846	25.9%	26.3%
1997[d]	6,166	7,326	29,817	28,658	21.5%	24.6%
1998[d]	6,188	6,493	36,250	35,946	17.2%	17.9%
1999[d]	6,167	6,178	28,705	28,694	21.5%	21.5%
2000[d]	7,035	7,065	26,186	26,157	26.9%	27.0%
2001[d]	6,750	7,196	25,510	25,063	26.9%	28.2%
2002[d]	6,407	6,882	26,423	25,948	24.7%	26.0%
Total Percent Change 1989-2002	6.2%	0.4%	-12.2%	-11.4%	19.8%	14.4%
Average Annual Growth Rate	0.5%	0.0%	-1.0%	-0.9%	1.4%	1.0%
Plastics Material and Resins						
1989	2,216	7,878	47,461	41,800	5.3%	16.6%
1990	2,488	8,605	43,040	36,924	6.7%	20.0%
1991	2,356	9,802	39,252	31,807	7.4%	25.0%
1992	2,676	9,094	40,626	34,208	7.8%	22.4%
1993	3,194	9,109	40,015	34,100	9.4%	22.8%
1994	4,074	10,467	46,336	39,943	10.2%	22.6%
1995	4,971	12,582	52,889	45,278	11.0%	23.8%
1996	4,988	12,646	47,897	40,239	12.4%	26.4%
1997[d]	5,163	12,759	53,139	45,543	11.3%	24.0%
1998[d]	5,250	11,940	52,327	45,637	11.5%	22.8%
1999[d]	5,528	11,957	53,300	46,871	11.8%	22.4%
2000[d]	6,462	13,892	58,537	51,106	12.6%	23.7%
2001[d]	6,143	13,004	50,770	43,910	14.0%	25.6%
2002[d]	6,071	13,121	50,407	43,358	14.0%	26.0%
Total Percent Change 1989-2002	173.9%	66.6%	6.2%	3.7%	164.1%	56.8%
Average Annual Growth Rate	8.1%	4.0%	0.5%	0.3%	7.8%	3.5%

Table C2B-10: Trade Statistics for Profiled Chemical Segments

Year	Value of imports (millions, $2005)	Value of exports (millions, $2005)	Value of shipments (millions, $2005)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
Organic Chemicals, Except Gum & Wood						
1989	8,300	14,134	93,226	87,392	9.5%	15.2%
1990	8,619	13,452	89,380	84,546	10.2%	15.1%
1991	8,742	13,445	84,596	79,894	10.9%	15.9%
1992	9,400	13,083	82,834	79,151	11.9%	15.8%
1993	9,300	13,258	80,601	76,643	12.1%	16.4%
1994	10,751	15,386	85,959	81,325	13.2%	17.9%
1995	12,862	19,011	92,397	86,247	14.9%	20.6%
1996	13,779	16,956	89,426	86,249	16.0%	19.0%
1997[d]	18,370	21,306	97,285	94,349	19.5%	21.9%
1998[d]	17,702	19,269	81,847	80,281	22.1%	23.5%
1999[d]	19,153	20,040	87,599	86,711	22.1%	22.9%
2000[d]	23,504	22,517	97,856	98,843	23.8%	23.0%
2001[d]	21,988	20,189	83,041	84,840	25.9%	24.3%
2002[d]	21,653	19,641	85,421	87,434	24.8%	23.0%
Total Percent Change 1989-2002	160.9%	39.0%	-8.4%	0.0%	160.8%	51.7%
Average Annual Growth Rate	7.7%	2.6%	-0.7%	0.0%	7.7%	3.3%

[a] Calculated by EPA as shipments + imports - exports.

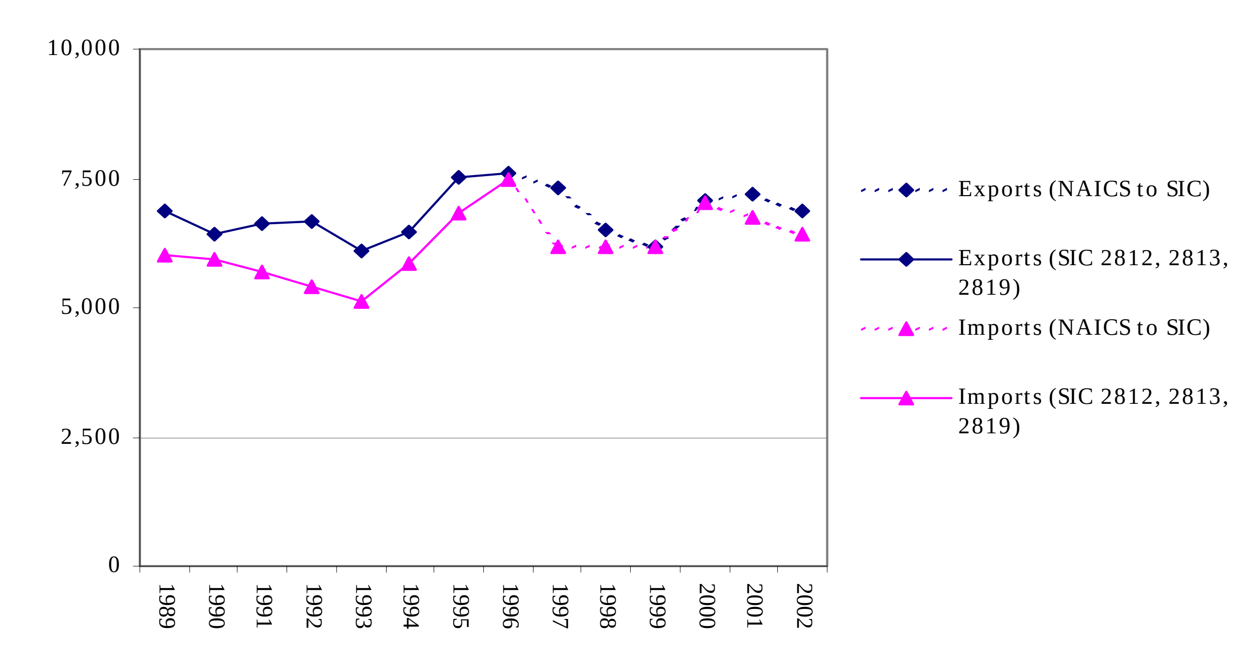
[b] Calculated by EPA as imports divided by implied domestic consumption.

[c] Calculated by EPA as exports divided by shipments.

[d] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 2006; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Figure C2B-5: Value of Imports and Exports for Profiled Chemicals Industry Segments



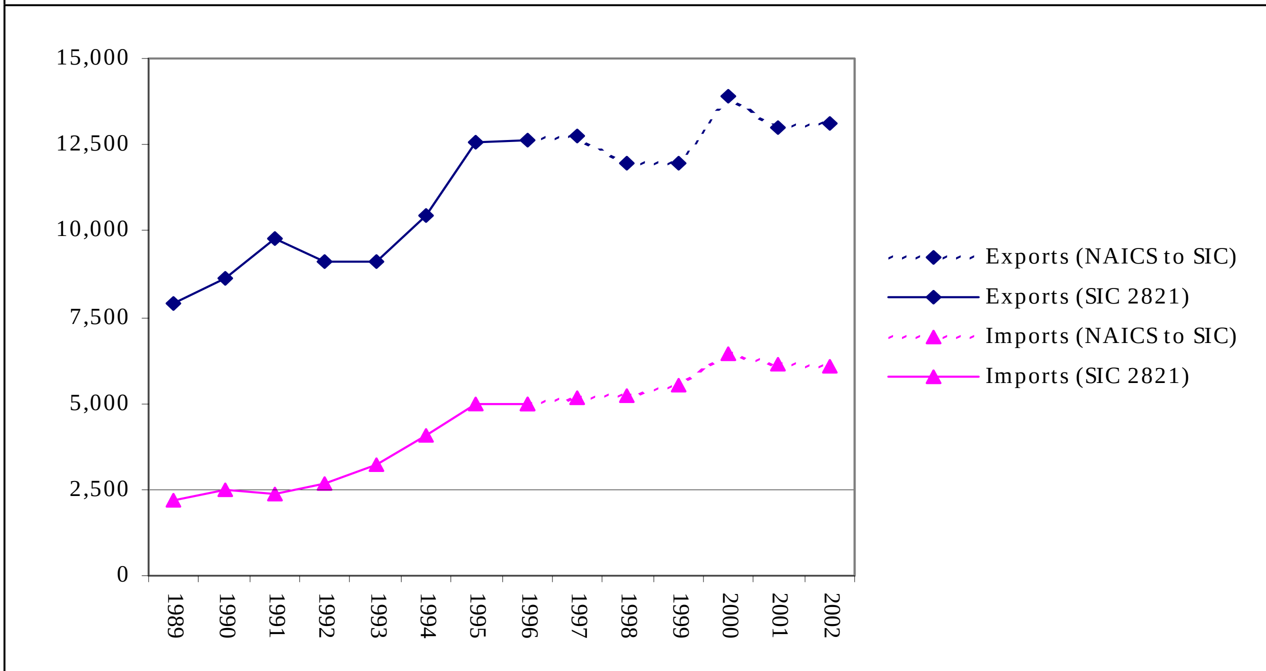
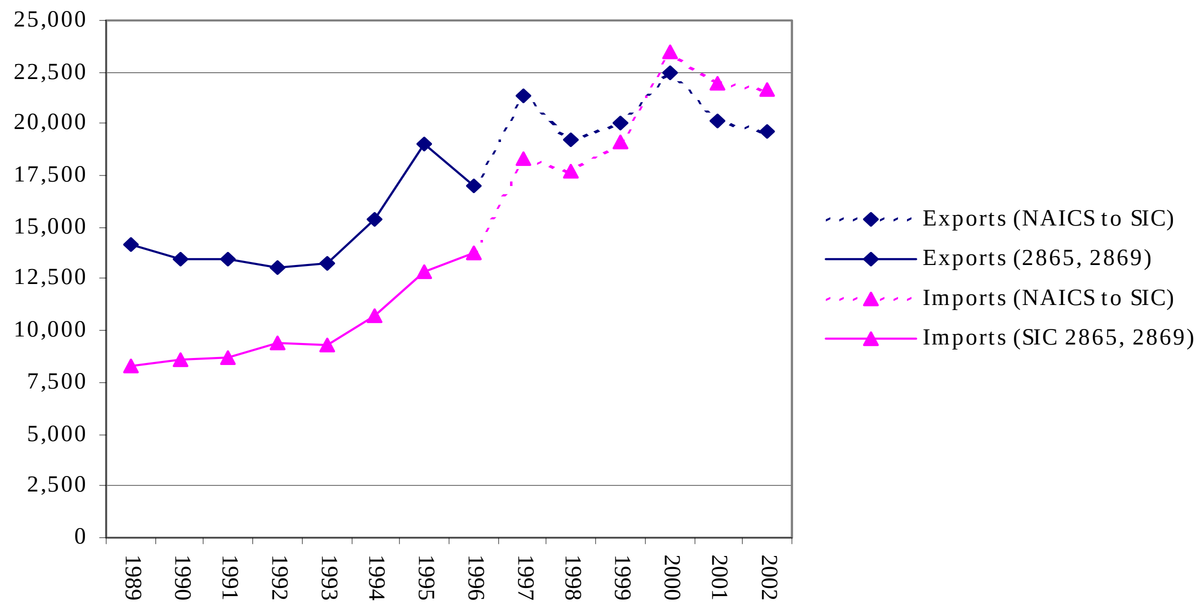


Figure C2B-5: Value of Imports and Exports for Profiled Chemicals Industry Segments



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 2006.

C2B-4 FINANCIAL CONDITION AND PERFORMANCE

The financial performance and condition of the chemical industry are important determinants of its ability to withstand the costs of regulatory compliance without material, adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 14-year period, 1992-2005: net profit margin and return on total capital. EPA calculated these measures as a revenue-weighted index of measure values for public reporting firms in the respective industries, using data from the Value Line Investment Survey. Financial performance in the most recent financial reporting period (2005) is obviously not a perfect indicator of conditions at the time of regulatory compliance. However, examining the trend, and deviation from the trend, through the most recent reporting period gives insight into where the industry *may be*, in terms of financial performance and condition, at the time of compliance. In addition, the volatility of performance against the trend, in itself, provides a measure of the *potential* risk faced by the industry in a future period in which compliance requirements are faced: all else equal, the more volatile the historical performance, the more likely the industry *may* be in a period of relatively weak financial conditions at the time of compliance.

Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenues, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient positive profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the chemical process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as the chemical and allied products industry, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

Return on total capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for *net profit margin*, the firms in an industry, and the industry collectively, must generate over time a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in *net profit margin* will also be the primary sources of short-term variation in *return on total capital*.

Figure C2B-6 presents net profit margin and return on total capital for public-reporting firms in two chemical industry segments – (1) Industrial Chemicals and (2) Plastics and Synthetic Fibers – for the 14-year period, 1992 and 2005. The Industrial Chemicals segment corresponds approximately to the Organic Chemicals and Inorganic Chemicals profiled industry segments; the Plastics and Synthetic Fibers segment corresponds approximately to the Plastics Material and Resins profiled industry segment. The financial performance information reported in Figure C2B-6 confirms the trends and performance discussed above in this section.

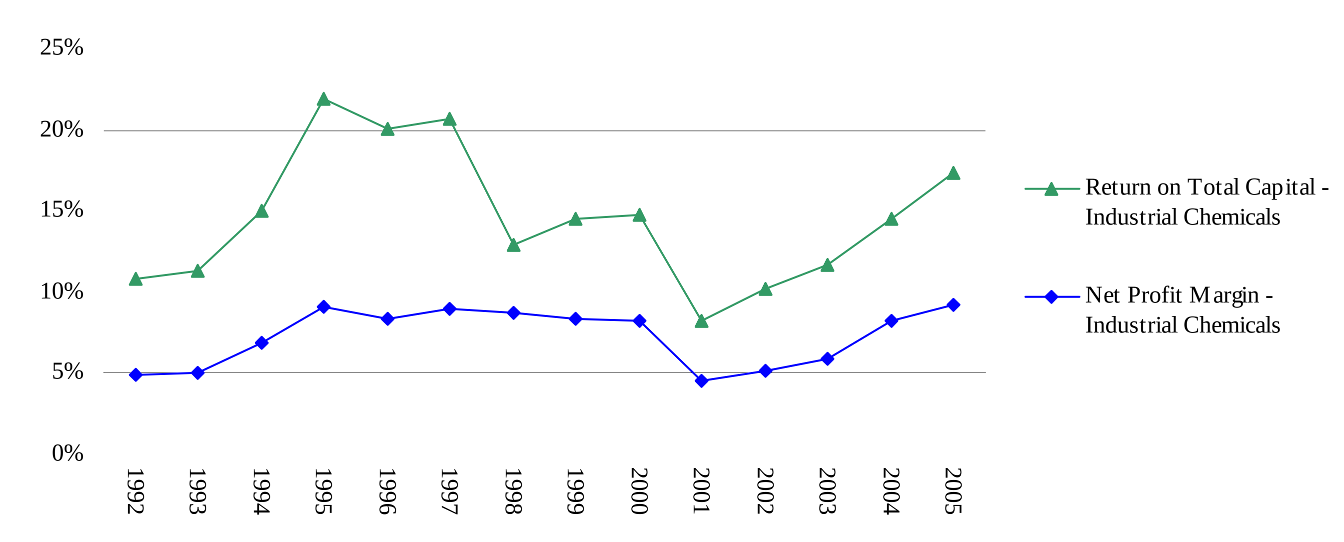
As shown in Figure C2B-6, the Industrial Chemicals (Organic Chemicals and Inorganic Chemicals) segment has seen moderate volatility of financial performance over the analysis period. Return on total capital moved off a post-recession low near 10 percent in 1992 to achieve levels in excess of 20 percent during 1995-1997. Recovery of demand accompanied by industry restructuring and downsizing accounted for the upturn in performance. During the latter part of the decade, though, increased competition from foreign producers and demand weakness in Asian markets eroded this performance. As a result, return on capital fell below 15 percent in 1998, and remained at this lower level through 2000. In 2001, a series of factors – high energy and raw material prices at the start of the year, overcapacity, the terrorist attacks, and slowing U.S. and global economies at the end of the year – led to a further sharp decline in return on capital performance of approximately 8 percent. Starting in 2002, however, return on total capital has shown steady improvement, increasing to more than 15 percent by 2005. Net profit margin shows a similar, though less volatile, trend, with declines in 2000 through 2001, followed by steady improvement between 2002 and 2005. In 2005, net profit margin reached the highest values observed during the entire 1992 to 2005 time period.

The same factors largely influenced performance in the Plastics and Synthetic Fibers (Plastics Material and Resins) segment over the 14-year period. Performance in this segment followed a similar, but less volatile, pattern to that of the Industrial Chemicals segment. Return on total capital rose from a low near 10 percent in 1993 to a period high of 15 percent in 1995. Since then, performance trended down to reach a period low of approximately 9 percent in 2001. This segment achieved steady, though moderate improvement during 2002 to 2005. Net profit margin again shows a similar, though less volatile, trend compared to return on capital.

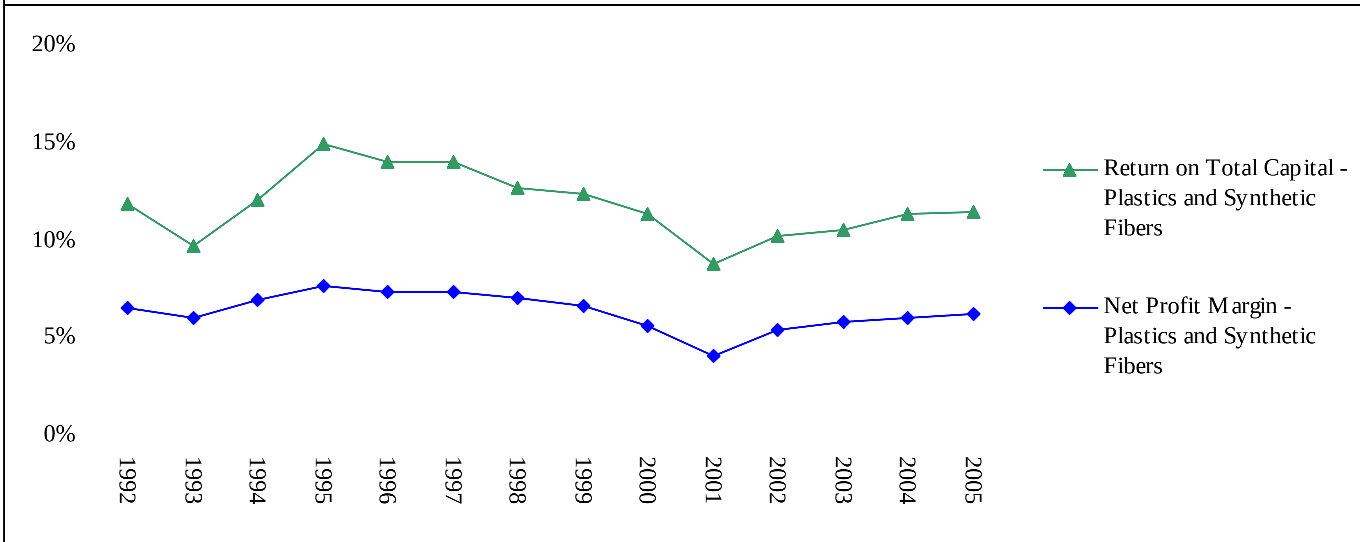
Overall, the profiled segments of the chemical industry remain at weaker levels of financial performance than achieved during the mid 1990s but appear to be recovering from the sharp weakness of 2001-2002. Continued recovery in 2006 and beyond suggests improved ability to withstand additional regulatory compliance costs without imposing significant financial impacts.

Figure C2B-6: Net Profit Margin and Return in Total Capital for the Chemical Industry

Industrial Chemicals (Organic and Inorganic)



Plastics and Synthetic Fibers



Source: Value Line, 2003; Value Line, 2006.

C2B-5 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Section 316(b) of the Clean Water Act applies to point source facilities that use or propose to use a cooling water intake structure that withdraws cooling water directly from a surface waterbody of the United States. In 1982, the chemical and allied products industry withdrew 2,797 billion gallons of cooling water, accounting for approximately 3.6 percent of total industrial cooling water intake in the United States[4]. The industry ranked 2nd in industrial cooling water use behind the electric power generation industry (1982 Census of Manufactures).

[4] Data on cooling water use are from the *1982 Census of Manufactures*. 1982 was the last year in which the Census of Manufactures reported cooling water use.

This section provides information for facilities in the profiled chemical and allied products segments estimated to be subject to regulation under the regulatory analysis options. Existing facilities that meet all of the following conditions could have been subject to regulation under the three regulatory analysis options:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the United States, and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have a National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

The regulatory analysis options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses on the facilities nationwide in the profiled chemical and allied products segments that are estimated to be subject to regulation under the DIF applicability thresholds defined by the regulatory analysis options (see Table C2B-1, above for additional information on the broader set of facilities potentially subject to Phase III regulation).[5]

C2B-5.1 Waterbody and Cooling System Type

Table C2B-11 show the distribution of Phase III facilities in the profiled chemical segments by type of waterbody and cooling system for each analysis option. The tables show that most of the Phase III facilities either have a once-through system or employ a combination of a once through and a recirculating system. The majority of existing facilities draw water from a freshwater stream or river.

[5] EPA applied sample weights to the sampled facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table C2B-11: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System for the Profiled Chemical Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Inorganic Chemicals									
Estuary/ Tidal River	0	0%	4	100%	1	7%	0	0%	5
Freshwater River/ Stream	0	0%	0	0%	7	40%	0	0%	7
Great Lake	0	0%	0	0%	4	26%	4	100%	9
Ocean	0	0%	0	0%	4	27%	0	0%	4
Total[a]	*0*	*0%*	*4*	*17%*	*16*	*66%*	*4*	*17%*	*25*
Plastics Material and Resins									
Freshwater River/ Stream	0	0%	9	84%	0	0%	0	0%	9
Lake/ Reservoir	0	0%	2	16%	0	0%	0	0%	2
Total[a]	*0*	*0%*	*10*	*100%*	*0*	*0%*	*0*	*0%*	*10*
Organic Chemicals									
Freshwater River/ Stream	0	0%	0	0%	9	100%	9	100%	18
Total[a]	*0*	*0%*	*0*	*0%*	*9*	*51%*	*9*	*41%*	*18*
Total Profiled Chemicals Industries									
Estuary/ Tidal River	0	0%	4	30%	1	5%	0	0%	5
Freshwater River/ Stream	0	0%	9	59%	16	61%	9	67%	33
Great Lake	0	0%	0	0%	4	17%	4	33	9
Lake/ Reservoir	0	0%	2	11%	0	0%	0	0%	2
Ocean	0	0%	0	0%	4	17%	0	0%	4
Total[a]	***0***	***0%***	***15***	***28%***	***25***	***48%***	***13***	***25%***	***53***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2B-12: Number of Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System for the Profiled Chemical Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Inorganic Chemicals									
Estuary/ Tidal River	0	0%	0	0%	1	50%	0	0%	1
Freshwater River/ Stream	0	0%	0	0%	1	50%	0	0%	1
Total[a]	*0*	*0%*	*0*	*0%*	*2*	*100%*	*0*	*0%*	*2*
Plastics Material and Resins									
Total[a]	*0*	*0%*	*0*	*0%*	*0*	*0%*	*0*	*0%*	*0*
Organic Chemicals									
Estuary/ Tidal River	0	0%	0	0%	1	20%	0	0%	1
Freshwater River/ Stream	0	0%	0	0%	2	80%	0	0%	2
Total[a]	*0*	*0%*	*0*	*0%*	*3*	*100%*	*0*	*0%*	*3*
Total Profiled Chemicals Industries									
Estuary/ Tidal River	0	0%	0	0%	2	33%	0	0%	2
Freshwater River/ Stream	0	0%	0	0%	3	67%	0	0%	3
Total[a]	***0***	***0%***	***0***	***0%***	***5***	***100%***	***0***	***0%***	***5***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2B-13: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System for the Profiled Chemical Segments

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Inorganic Chemicals									
Estuary/ Tidal River	0	0%	40	100%	1	15%	0	0%	5
Freshwater River/ Stream	0	0%		0%	7	85%	0	0%	7
Total[a]	*0*	*0%*	*0*	*36%*	*9*	*64%*	*0*	*0%*	*12*
Plastics Material and Resins									
Freshwater River/ Stream	0	0%	*4*	100%	0	0%	0	0%	4
Total[a]	*0*	*0%*	*4*	*100%*	*0*	*0%*	*0*	*0%*	*4*
Organic Chemicals									
Estuary/ Tidal River	0	0%	0	0%	1	7%	0	0%	1
Freshwater River/ Stream	0	0%	0	0%	8	93%	0	0%	8
Total[a]	*0*	*0%*	*0*	*0%*	*9*	*100%*	*0*	*0%*	*9*
Total Profiled Chemicals Industries									
Estuary/ Tidal River	0	0%	4	50%	2	11%	0	0%	6
Freshwater River/ Stream	0	0%	4	50%	14	89%	0	0%	19
***Total*[a]**	***0***	***0%***	**9**	**35%**	**16**	**65%**	***0***	***0%***	***25***

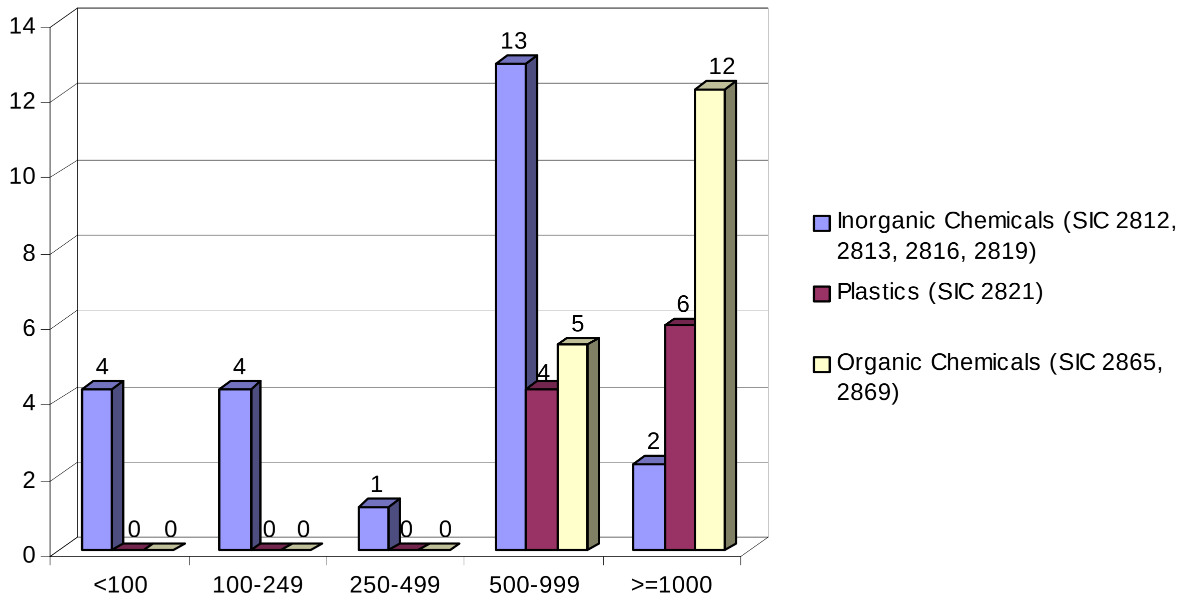
[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2B-5.2 Facility Size

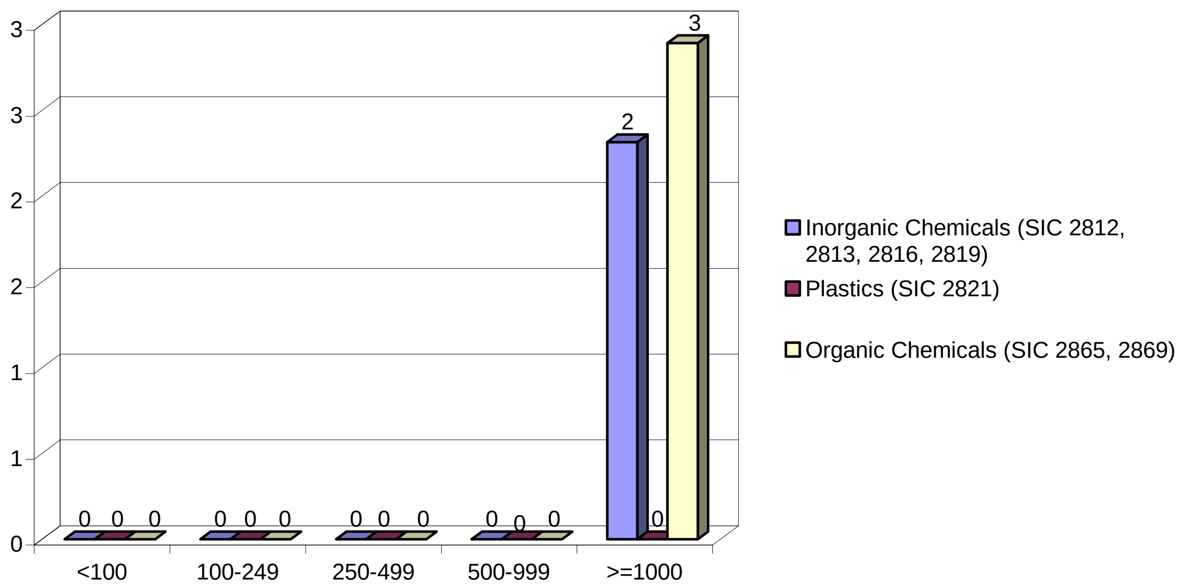
The facilities in the Inorganic Chemicals, Plastics Materials and Resins and Organic Chemicals segments that are estimated subject to regulation under each analysis option are relatively large, with the vast majority of facilities employing more than 100 employees. Figure C2B-7 show the number of facilities in the profiled chemical segments by employment size category for each analysis option.

Figure C2B-7: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for Profiled Chemicals Industry Segments



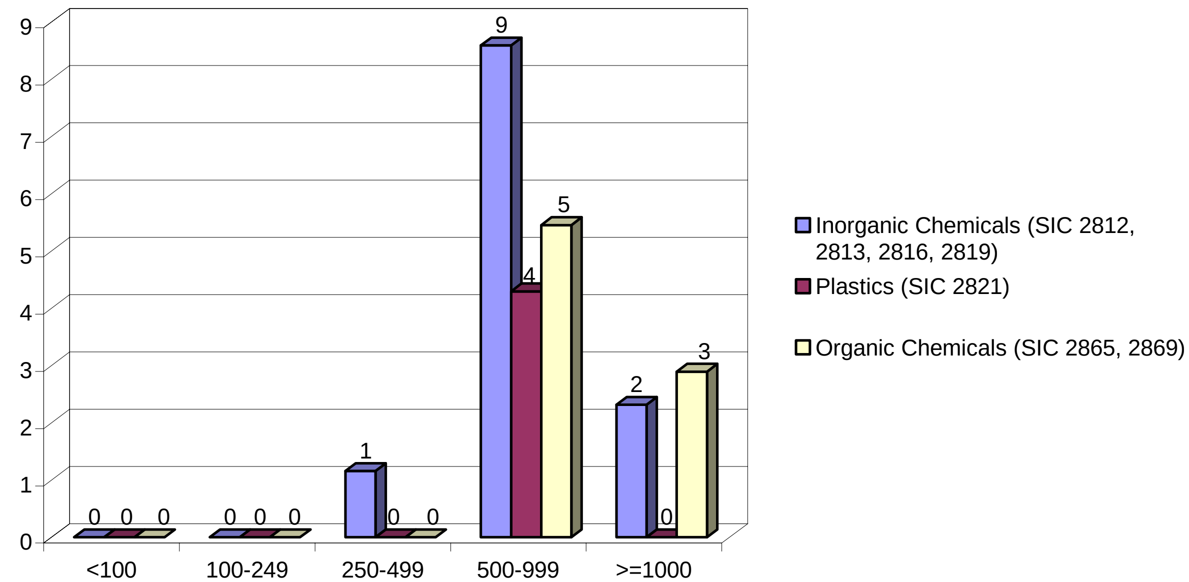
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2B-8: Number of Facilities Estimated Subject to the 200 MGD All Option by Employment Size for Profiled Chemicals Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2B-9: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size for Profiled Chemicals Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2B-5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of facilities in the three profiled chemical segments that are owned by small firms. Firms in the Inorganic Chemicals segment (SIC codes 2812, 2813, 2816, 2819) and in Industrial Organic Chemicals, NEC (SIC code 2869) are defined as small if they have 1,000 or fewer employees; firms in Plastics Material and Resins (SIC 2821) and Cyclic Organic Crudes and Intermediates (SIC code 2865) are defined as small if they have 750 or fewer employees.

As shown in Table C2B-14Table C2B-16, Table C2B-15, and Table C2B-16, large firms own all of the facilities estimated subject to the Phase III final regulation in this industry, regardless of the option.

Table C2B-14: Number of Facilities Estimated Subject to the 50 MGD All Option by Firm Size for Profiled Chemical Segments

SIC Code	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
Inorganic Chemicals					
2812	15	100%	0	0%	15
2813	4	100%	0	0%	4
2816	0	0%	0	0%	0
2819	5	100%	0	0%	5
Total	*25*	*100%*	*0*	*0%*	*25*
Plastics Material and Resins					
2821	10	100%	0	0%	10
Organic Chemicals					
2865	4	100%	0	0%	4
2869	13	100%	0	0%	13
Total	*18*	*100%*	0	*0%*	*18*
Total for Profiled Chemical Facilities					
Total	***53***	***100%***	***0***	***0%***	***53***

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2B-15: Number of Facilities Estimated Subject to the 200 MGD All Option by Firm Size for Profiled Chemical Segments

SIC Code	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
Inorganic Chemicals					
2812	2	100%	0	0%	2
2813	0	0%	0	0%	0
2816	0	0%	0	0%	0
2819	0	0%	0	0%	0
Total	*2*	*100%*	*0*	*0%*	*2*
Plastics Material and Resins					
2821	0	0%	0	0%	0
Organic Chemicals					
2865	0	0	0	0%	0
2869	3	100%	0	0%	3
Total	3	*100%*	0	*0%*	*3*
Total for Profiled Chemical Facilities					
Total	***5***	***100%***	***0***	***0%***	***5***

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2B-16: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size for Profiled Chemical Segments

SIC Code	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
Inorganic Chemicals					
2812	11	100%	0	0%	11
2813	0	0%	0	0%	0
2816	0	0%	0	0%	0
2819	1	100%	0	0%	1
Total	*12*	*100%*	*0*	*0%*	*12*
Plastics Material and Resins					
2821	4	100%	0	0%	4
Organic Chemicals					
2865	4	100%	0	0%	4
2869	4	100%	0	0%	4
Total	8	*100%*	0	*0%*	*8*
Total for Profiled Chemical Facilities					
Total	***24***	***100%***	***0***	***0%***	***24***

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2C: Petroleum Refining (SIC 2911)

INTRODUCTION

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified the Petroleum Refining Industry (SIC 2911) with at least one existing facility that operates a CWIS, holds a NPDES permit, and withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes. (Facilities with these characteristics are hereafter referred to as facilities potentially subject to the Phase III regulation or "potential Phase III facilities").

Table C2C-1, below, provides a description of the industry segment, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), the number of facilities estimated to be potentially subject to Phase III regulation based on the minimum withdrawal threshold of 2 MGD, and the number of facilities estimated to be subject to regulation under each primary analysis option.

CHAPTER CONTENTS

Table C2C-1: Phase III Facilities in the Petroleum Refining Industry (SIC 29)

SIC	SIC Description	Important Products Manufactured	Number of Phase III Facilities[a]				
			Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
2911	Petroleum Refining	Gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other processes; aliphatic and aromatic chemicals as byproducts	*163*	*36*	*17*	*4*	*8*

[a] Number of weighted detailed questionnaire survey respondents.

[b] Individual numbers may not add up due to independent rounding.

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

As shown in Table C2C-1, EPA estimates that, out of the total of 163 facilities with a NPDES permit and operating cooling water intake structures in the Chemicals and Allied Products Industry (SIC 28), 17 (or 10%) would be subject to regulation under the 50 MGD All option, 4 (or 2.5%) would be subject to regulation under the 200 MGD All option, and 8 (or 4.9%) would be subject to regulation under the 100 MGD CWB option.. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to regulation under each analysis option. Total value of shipments for the Paper and Allied Products Industry from the 2004 Annual Survey of Manufactures is $288.1 billion. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because the DQ did not collect value of shipments data, these data were not available for Phase III facilities. Total revenue, as reported on the DQ, was used as a close approximation for value of shipments for these facilities. EPA estimated the total revenue of facilities expected to be subject to regulation under the 50 MGD, 200 MGD, and 100 MGD option to be $25.4 billion, $9.3 billion, and $15.3 billion, respectively. Therefore, EPA estimates that the percentage of total production in the petroleum industry that occurs at facilities estimated to be subject to regulation under the 50 MGD, 200 MGD, and 100 MGD options is 9%, 3% and 5%, respectively.

Table C2C-2 provides the crosswalk between SIC codes and NAICS codes for the profiled petroleum SIC codes. For the Petroleum Refining segment, the translation of NAICS-reported data to the SIC framework is straightforward as these frameworks have a simple one-to-one match for Petroleum Refining: SIC code 2911 and NAICS code 324110.

Table C2C-2: Relationship between SIC and NAICS Codes for the Petroleum Refining Industry (2002[a])

SIC Code	SIC Description	NAICS Code	NAICS Description	Establishments	Value of Shipments ($000)	Employment
2911	Petroleum Refining	324110	Petroleum Refineries	203	193,547,214	61,585

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.

C2C-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of Petroleum Refining firms absorb compliance costs under each analysis option without material, adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by the following two factors: (1) the extent to which the industry may be expected to shift compliance costs to its customers through price increases and (2) the financial health of the industry and its general business outlook.

Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the Petroleum Refining segment is relatively unconcentrated, which suggests that firms in this industry would have less power to pass a significant portion of their compliance-related costs through to customers. As discussed above, given the small proportion of total value of shipments in the industry estimated to be subject to regulation under each option, EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the impact analysis of potential Phase III refineries has not been met. Even though the Petroleum Refining segment is not characterized by high competitive pressure from foreign markets, the low market concentration leads EPA to believe that the market power held by individual firms is likely to be quite small. For these reasons, in its analysis of regulatory impacts for the Petroleum Refining segment, EPA assumed that complying firms would be unable to pass compliance costs through to customers: i.e., complying facilities must absorb all compliance costs at the time of compliance (see following sections and Appendix 3, *Cost Pass-Through Analysis*, to *Chapter C3: Economic Impact Analysis for Manufacturers*, for further information).

Financial Health and General Business Outlook

Over the past decade, Petroleum Refining, like other U.S. manufacturing industries, has experienced a range of economic/financial conditions, including substantial challenges. In the early 1990s, the domestic Petroleum Refining segment was affected by reduced U.S. demand as the economy entered a recessionary period. Although domestic market conditions improved by mid-decade, oversupply of crude oil, weakness in Asian markets, along with other domestic factors, materially weakened refiners' financial performance in 1998. As petroleum producing countries reduced crude oil supply and refiners cut production, prices rebounded in the late 1990's and into 2000, before another U.S. recession, the attacks of 9/11, and global economic downturn again had a negative effect on petroleum refiners. More recently, as the U.S. economy began recovery from its economic weakness, domestic petroleum refineries have appeared to recuperate, with continuous improvements in demand levels and financial performance during 2003 to 2005. Although the industry has weathered difficult periods over the past few years, the strengthening of the industry's financial condition and general business outlook suggest improved ability to withstand additional regulatory compliance costs without imposing significant financial impacts.

C2C-2 DOMESTIC PRODUCTION

The Petroleum Refining segment accounts for about 4 percent of the value of shipments of the U.S. entire manufacturing sector and 0.4 percent of the manufacturing sector's labor supply (U.S. DOE, 1999a). According to the Annual Survey of Manufactures, in 2001, Petroleum Refineries achieved shipments of approximately $206 billion dollars ($2003) and employed 63,251 people. Petroleum products constitute approximately 40 percent of the total energy used in the United States, including virtually all of the energy consumed in transportation (U.S. DOE, 1999a).

U.S. DOE Energy Information Administration (EIA) data report that there were 149 operable Petroleum Refineries in the U.S. as of January 2003, of which 145 were operating and four were idle (U.S. DOE, 2004)[1]. Some data reported in this profile are taken from EIA publications. Readers should note that the Census data

[1] In addition, there was one operating and one idle refinery in Puerto Rico and one operating refinery in the Virgin Islands.

reported for SIC 2911 cover a somewhat broader range of facilities than do the U.S. DOE/EIA data, and the two data sources are therefore not entirely comparable.[2]

The petroleum industry includes exploration and production of crude oil, refining, transportation, and marketing. Petroleum refining is a capital-intensive process that converts crude oil into a variety of refined products. Refineries range in complexity, depending on the types of products produced. Nearly half of all U.S. refinery output is motor gasoline.

The number of U.S. refineries has declined by almost half since the early 1980s. The remaining refineries have improved their efficiency and flexibility to process heavier crude oils by adding "downstream" capacity[3]. While the number of refineries has declined, the average refinery capacity and utilization has increased, resulting in an increase in domestic refinery production overall.

C2C-2.1 Output

Table C2C-3 shows trends in production of petroleum refinery products from 1990 through 2004. In general, output of refined products grew over this period, reflecting growth in transportation demand and other end-uses. Output fell in 1991 due to the domestic economic recession, and the early years of the 2000s experienced little or negative growth due to the downturn of the U.S. economy and events of 9/11 (API, 2003). At the beginning of 2002, petroleum products were in excess supply in the world market, and the focus was on the elimination of excess supplies and stabilization of prices (U.S. DOE, 2004). In 2003, the industry rebounded, with refinery processing increasing 2 percent, producing record or near record levels of gasoline and distillate (API, 2004). Petroleum demand in 2004 is expected to increase 1.1 percent. As the U.S. and global economy improves, Petroleum Refining firms should continue to see improving results in their markets and earnings. This should place companies in a better position to incur any costs associated with regulatory compliance.

[2] For comparison, preliminary 1997 Census data included 244 establishments for NAICS 3241/SIC 2911, whereas U.S. DOE/EIA reported 164 operable refineries as of January 1997.

[3] The first step in refining is atmospheric distillation, which uses heat to separate various hydrocarbon components in crude oil. Beyond this basic step are more complex operations (generally referred to as "downstream" from the initial distillation) that increase the refinery's capacity to process a wide range of crude oils and increase the yield of lighter (low-boiling point) products such as gasoline. These downstream operations include vacuum distillation, cracking units, reforming units, and other processes (U.S. DOE, 1999a).

Table C2C-3: U.S. Petroleum Refinery Product Production (million barrels per day)

Year	Motor Gasoline	Distillate Fuel Oil	Jet Fuel	Residual Fuel Oil	Other Products[a]	Total Output	Percent Change in Total Output
1990	6.96	2.93	1.49	0.95	0.78	15.27	n/a
1991	6.98	2.96	1.44	0.93	0.76	15.26	-0.1%
1992	7.06	2.97	1.40	0.89	0.80	15.40	0.9%
1993	7.30	3.13	1.42	0.84	0.78	15.79	2.5%
1994	7.18	3.20	1.45	0.83	0.79	15.79	0.0%
1995	7.46	3.16	1.42	0.79	0.78	15.99	1.3%
1996	7.57	3.32	1.52	0.73	0.76	16.32	2.1%
1997	7.74	3.39	1.55	0.71	0.84	16.76	2.7%
1998	7.89	3.42	1.53	0.76	0.89	17.03	1.6%
1999	7.93	3.40	1.57	0.70	0.84	16.99	-0.2%
2000	7.95	3.58	1.61	0.70	0.79	17.24	1.5%
2001	8.02	3.70	1.53	0.72	0.73	17.29	0.3%
2002	8.18	3.59	1.51	0.60	0.77	17.27	-0.1%
2003	8.19	3.71	1.50	0.66	0.78	17.49	1.3%
2004	8.23	3.82	1.55	0.65	0.83	17.77	1.6%
Total Percent Change 1990-2004	*18.2%*	*30.4%*	*4.0%*	*-31.6%*	*6.4%*	*16.4%*	
Average Annual Growth Rate	*1.2%*	*1.9%*	*0.3%*	*-2.7%*	*0.4%*	*1.1%*	

[a] Kerosene, lubricants, petrochemical feedstocks, waxes, and miscellaneous products.

Source: U.S. DOE, 2005

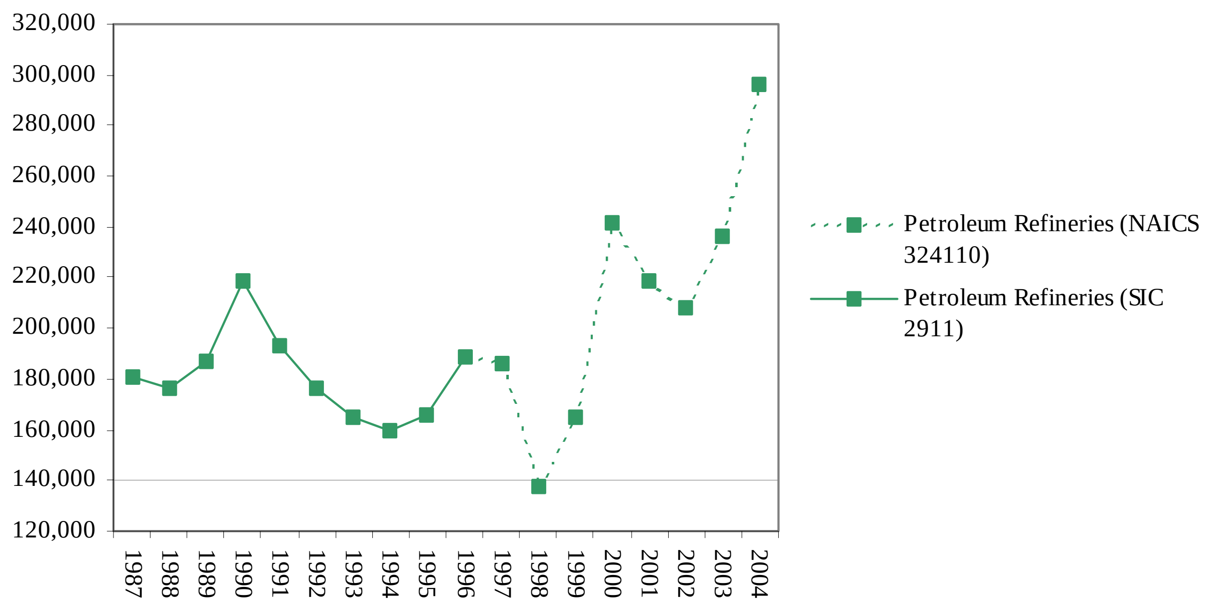
Value of shipments and ***value added*** are two common measures of manufacturing output[4]. They provide insight into the overall economic health and outlook for an industry. Value of shipments is the sum of the receipts a manufacturer earns from the sale of its outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added measures the value of production activity in a particular industry. It is the difference between the value of shipments and the value of inputs used to make the products sold.

Figure C2C-1 on the following page shows value of shipments and value added for petroleum products from 1987 to 2004. Value of shipments rose through 1990; however, during and following the recession of 1991, value of shipments fell through 1994. This was followed by some volatility in value over the next few years until experiencing a sharp drop in 1998, when a range of factors led to a dramatic decrease in petroleum prices. Increased production quotas by OPEC, increased production from Iraq through the "oil-for-food" program, weak demand in Asia due to their financial crisis, and a warm winter in the U.S. all increased the supply of petroleum products (U.S. DOE, 1999c). Estimates of worldwide petroleum supply exceeding demand during 1998 range from 1.47 millions barrels per day to 2.4 million barrels per day (World Oil, 1999). As crude oil producers and refiners cutback on production, the industry rebounded with significant improvements in 1999 and 2000, before the latest recession and global economic slowdown and weakening demand decreased the value of shipments in 2001. In 2003 and 2004, however, the value of shipments increased significantly, peaking at nearly $300 billion in 2004. Value added generally followed the path of value of shipments over this time period, though it did not quite have the volatility of the value of shipments.

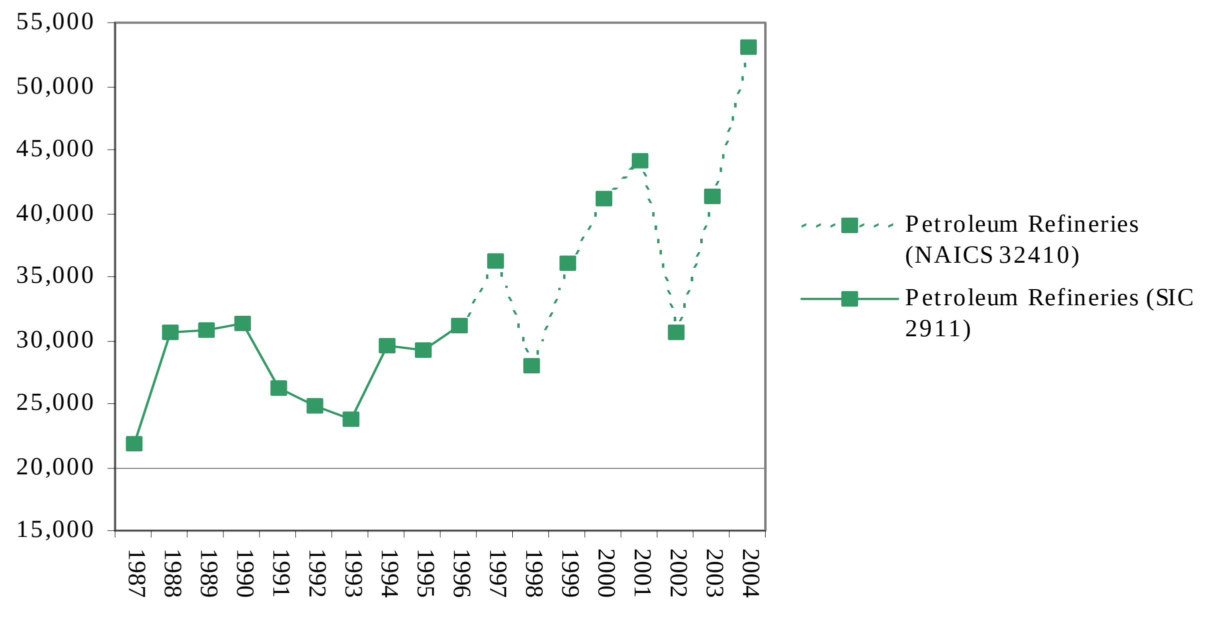
[4] Terms highlighted in bold and italic font are further explained in the glossary.

Figure C2C-1: Value of Shipments and Value Added for Petroleum Refineries (millions, $2005)

Value of Shipments



Value Added



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

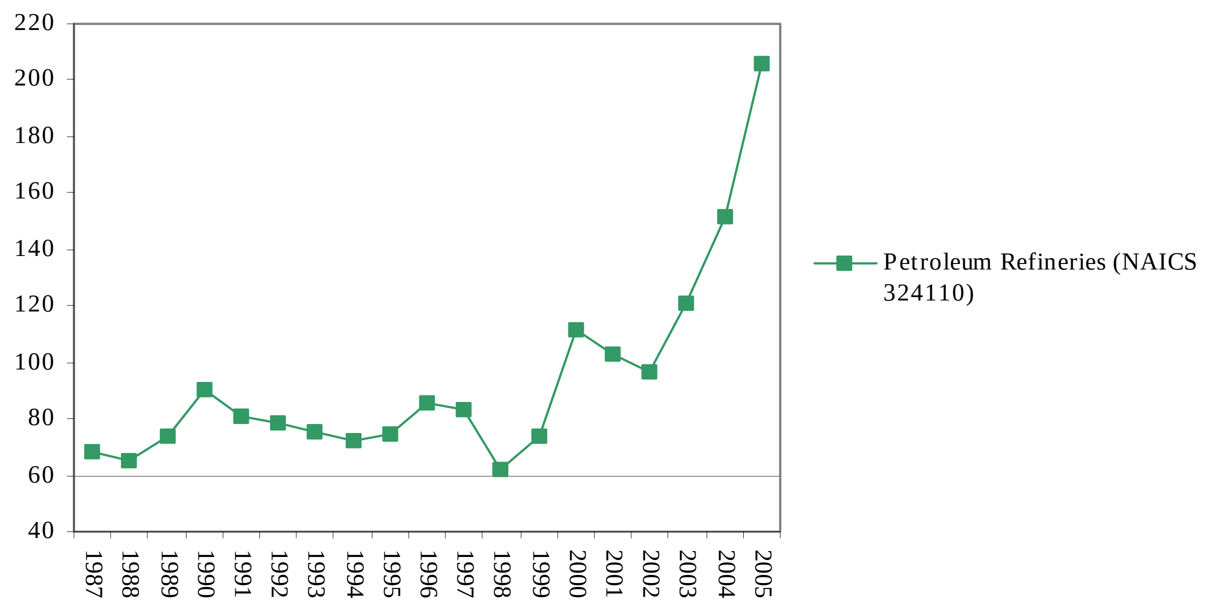
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2C-2.2 Prices

The ***producer price index*** (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

Figure C2C-2 shows substantial fluctuations in petroleum product prices between 1987 and 2002. Through the early 1990s, refiners faced declining prices due to the effects of the 1991 recession and weak demand before rebounding somewhat in the mid 1990s. Prices plummeted in 1998 as a massive oversupply of petroleum products coupled with decreased demand led to significant drops in petroleum prices. As the subsequent production cutbacks took hold and the glut of supply dwindled, prices recovered in 1999 and 2000, as shown in Figure C2C-2. The higher prices reflect low refinery product inventories and higher crude oil input prices (Value Line, 2001). Excess supply, the global recession, impacts from 9/11, and the relatively warm winter of 2001-2002 led to decreases in prices in subsequent years (U.S. DOE, 2004). During 2003 to 2005, however, prices rose dramatically. By 2005, the price of petroleum products was nearly double the price seen in 2000, the previous peak year during the 1987 to 2005 time period.

Figure C2C-2: Producer Price Index for Petroleum Refineries



Source: BLS, 2006.

C2C-2.3 Number of Facilities and Firms

The number of operable refineries fell substantially during the 1980s, with a more gradual reduction in refineries continuing through the 1990s and into the 2000s. This decrease resulted in part from the elimination of the Crude Oil Entitlements Program in the early 1980s. The Entitlements Program encouraged smaller refineries to add capacity throughout the 1970s. After the program was eliminated, surplus capacity and falling profit margins led to the closure of less efficient capacity (U.S. DOE, 1999a). The decrease in the number of refineries continued, as the industry consolidated to improve margins. After peaking in the early 1980s, refining capacity decreased throughout the rest of the decade. Refining capacity has remained relatively stable since the decrease in the 1980s, with a slight upward trend occurring in the latter part of the 1990s into the 2000s. This trend is expected to continue, with no new "greenfield" refineries likely to be built in the United States, but continuing capacity expansion at existing facilities (S&P, 2001).

Table C2C-4 presents the numbers of refinery facilities and firms from 1990 to 2003 based on Statistics of U.S. Businesses for SIC 2911. As shown in the table, despite some gains in the early 2000s, the number of refinery facilities and the number of firms reporting Petroleum Refining as their primary business both declined since 1990.

Table C2C-4: Number of Firms and Facilities for Petroleum Refineries

Year	Firms		Facilities	
	Number	Percent Change	Number	Percent Change
1990	215		340	
1991	215	0.0%	346	1.8%
1992	185	-14.0%	303	-12.4%
1993	148	-20.0%	251	-17.2%
1994	161	8.8%	265	5.6%
1995	150	-6.8%	251	-5.3%
1996	173	15.3%	275	9.6%
1997	128	-26.0%	248	-9.8%
1998[a]	155	21.1%	304	22.6%
1999[a]	145	-6.5%	292	-3.9%
2000[a]	162	11.7%	298	2.1%
2001[a]	165	1.9%	302	1.3%
2002[a]	202	22.4%	349	15.6%
2003[a]	142	-29.7%	274	-21.5%
Total Percent Change 1990 - 2003	*-34.0%*		*-19.4%*	
Average Annual Growth Rate	*-3.1%*		*-1.6%*	

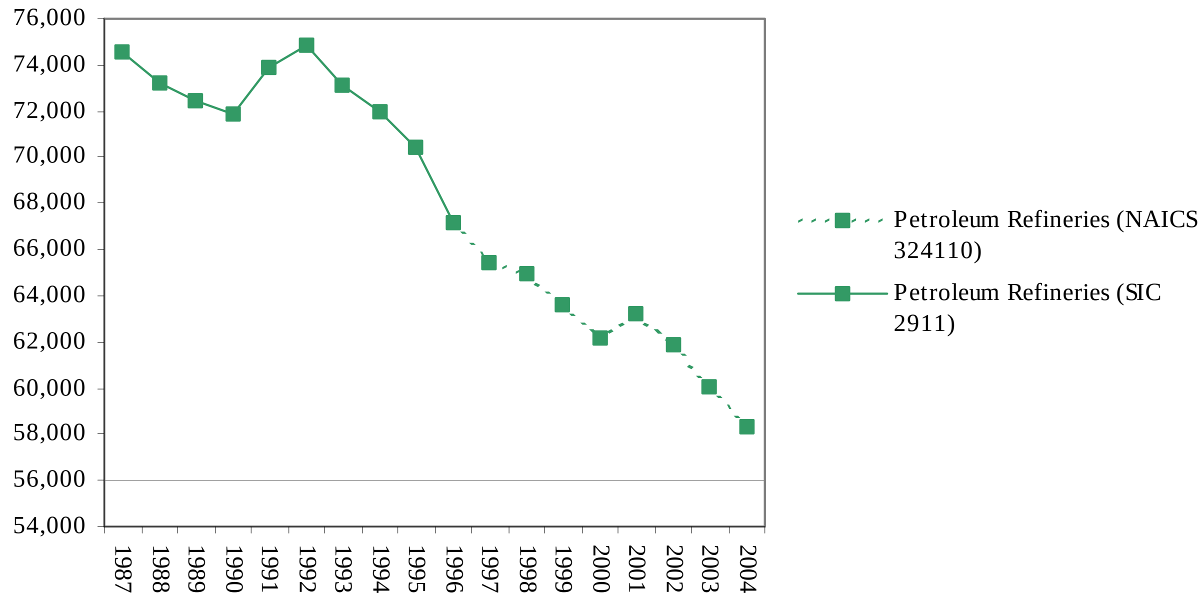
[a] Before 1998, these data were compiled in the Standard Industrial Classification (SIC) system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*.

Source: U.S. SBA, 1989-2003.

C2C-2.4 Employment and Productivity

Employment in the Petroleum Refining segment declined by 22 percent between 1987 and 2004, from 74,600 to 58,331 employees, as shown in Figure C2C-3. After increasing in the early 1990s, employment at Petroleum Refineries declined almost continuously through 2004, reflecting overall industry consolidation.

Figure C2C-3: Employment for Petroleum Refineries



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997 these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2C-5 shows substantial year-to-year changes in ***labor productivity***, measured by value added per production hour. These fluctuations reflect volatility in value added, which in turn reflect variations in the relationship between input prices (primarily crude oil) and refinery product prices. Changes in production hours from year to year were less volatile, with a net reduction over the period 1987 to 2004. Value added, however, was not affected as it more than doubled over the same period.

Table C2C-5: Productivity Trends for Petroleum Refineries ($2005)

Year	Value Added (millions)	Production Hours (millions)	Value Added/Hour ($/hr)	Value Added/Hour % Change in Value Added/ Hour
1987	21,779	103	211	
1988	30,642	103	298	41.2%
1989	30,797	105	294	-1.1%
1990	31,357	106	296	0.7%
1991	26,281	107	247	-16.7%
1992	24,789	109	227	-8.1%
1993	23,734	107	223	-1.7%
1994	29,569	110	269	20.6%
1995	29,185	107	274	1.8%
1996	31,065	103	303	10.7%
1997[a]	36,281	100	363	20.0%
1998[a]	27,917	98	285	-21.4%
1999[a]	36,103	94	384	34.4%
2000[a]	41,069	92	445	15.9%
2001[a]	44,145	94	472	6.1%
2002[a]	30,533	85	361	-23.5%
2003[a]	41,240	86	482	33.3%
2004[a]	53,070	85	621	29.0%
Total Percent Change 1987-2004	143.7%	-17.3%	194.7%	
Annual Average Growth Rate	5.4%	-1.1%	6.6%	

[a] Before 1997, these data were compiled in the Standard Industrial Classification (SIC) system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2C-2.5 Capital Expenditures

Petroleum industry capital expenditures increased substantially between 1987 and 1993, generally decreased afterwards through 2000, then increased significantly in 2001, as shown in Table C2C-6. During 2001 through 2004, capital expenditures fluctuated somewhat, peaking at nearly 8 billion in 2002 before declining in both 2003 and 2004. In 2004, the industry spent about $6.7 billion ($2005), as compared with $3.1 billion ($2005) in 1988, representing a 115 percent increase in expenditures during this time period. Much recent investment in Petroleum Refineries has been to expand and de-bottleneck units downstream from distillation, partially in response to environmental requirements. Changes in refinery configurations have included adding catalytic cracking units, installing additional sulfur removal hydrotreaters, and using manufacturing additives such as oxygenates. These process changes have resulted from two factors:

- processing of heavier crudes with higher levels of sulfur and metals; and
- regulations requiring gasoline reformulation to reduce volatiles in gasoline and production of diesel fuels with reduced sulfur content (U.S. EPA, 1996b).

Environmentally related investments have also accounted for a substantial part of capital expenditures. In the future, substantial capital investments by refineries will be required to comply with: product quality regulations, including EPA's Tier 2 Gasoline Sulfur Rule requiring reductions in the sulfur content of gasoline; reductions or elimination of the use of MTBE in gasoline; and, proposed sulfur reductions in highway diesel fuel (NPC, 2000).

Table C2C-6: Capital Expenditures for Petroleum Refineries ($2005)

Year	Capital Expenditures (millions)	% Change
1987	3,117	
1988	3,446	10.6%
1989	4,263	23.7%
1990	5,247	23.1%
1991	7,436	41.7%
1992	7,968	7.2%
1993	7,593	-4.7%
1994	6,862	-9.6%
1995	7,140	4.1%
1996	6,208	-13.1%
1997[a]	4,987	-19.7%
1998[a]	4,845	-2.9%
1999[a]	4,517	-6.8%
2000[a]	5,252	16.3%
2001[a]	7,463	42.1%
2002[a]	7,956	6.6%
2003[a]	7,268	-8.6%
2004[a]	6,710	-7.7%
Total Percent Change 1987-2004	115.3%	
Average Annual Growth Rate	4.6%	

[a] Before 1997, these data were compiled in the Standard Industrial Classification (SIC) system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2C-2.6 Capacity Utilization

Refinery capacity is frequently measured in terms of crude oil distillation capacity. EIA defines refinery capacity utilization as input divided by calendar day capacity, which is the maximum amount of crude oil input that can be processed during a 24-hour period with certain limitations. Some downstream refinery capacities are measured in terms of "stream days," which is the amount a unit can process when running full capacity under optimal crude and product mix conditions for 24 hours (U.S. DOE, 1999a). Downstream capacities are reported only for specific units or products, and are not summed across products, since not all products could be produced at the reported levels simultaneously.

Figure C2C-4 below shows the fluctuation in utilization rates over the period 1989-2002, based Census Bureau data. Capacity utilization fluctuated over a relatively lower range between 1989-1992, followed by an increase in utilization rates for five straight years, concluding in 1997. After decreasing in 1998, utilization rates climbed until 2000, before excess supply, recession, and other factors led to decreases in rates in the early 2000s. The industry appears to be recovering, however, as capacity utilization increased to 93 percent in 2004. Overall refinery utilization has remained high over this entire time period. Capacity utilization for production of specific products may vary, however, as the industry adjusts to changes in the desired product mix and characteristics.

Figure C2C-4: Capacity Utilization Rates (Fourth Quarter) for Petroleum Refineries

Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 1989-2004.

C2C-3 Structure and Competitiveness

The Petroleum Refining segment in the United States is made up of integrated international oil companies, integrated domestic oil companies, and independent domestic refining/marketing companies. In general, the petroleum industry is highly integrated, with many firms involved in more than one stage of petroleum industry operations. Large companies, referred to as the "majors," are fully integrated across crude oil exploration and production, refining, and marketing. Smaller, nonintegrated companies, referred to as the "independents," generally specialize in one segment of the industry.

Like the oil business in general, refining was dominated in the 1990s by integrated internationals, specifically a few large companies such as Exxon Corporation, Mobil Corporation, and Chevron Corporation. These three ranked in the top ten of Fortune's 500 sales during this time period. Substantial diversification by major petroleum companies into other energy and non-energy segments was financed by high oil prices in the 1970s and 1980s. With lower profitability in the 1990s, the major producers began to exit unconventional energy operations (e.g., oil shale) as well as coal and non-energy operations in the 1990s. Some have recently ceased chemical production.

During the 1990s and into the early 2000s, several mergers, acquisitions, and joint ventures occurred in the Petroleum Refining segment in an effort to cut cost and increase profitability. This consolidation has taken place among the largest firms (as illustrated by the acquisition of Amoco Corporation by British Petroleum in 1999, the merger of Chevron and Texaco in 2001, the merger of Conoco and Phillips in 2002, and the mega-merger of Exxon and Mobil Corporation in 1998) as well as among independent refiners and marketers (e.g., the independent refiner/marketer Ultramar Diamond Shamrock (UDS) acquired Total Petroleum North America in 1997) (U.S. DOE, 1999b, 2004). Merger activity seems to have slowed since 2002, however, possibly as companies seek to address financial issues or wait to see that the recent positive economic growth continues (U.S. DOE, 2004).

C2C-3.1 Firm Size

For SIC 2911, the Small Business Administration defines a small firm as having 1,500 or fewer employees. The size categories reported in the Statistics of U.S. Businesses (SUSB) do not correspond with the SBA size classifications, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data. Table C2C-7 below shows the distribution of firms and establishments in SIC 2911 by the employment size of the parent firm. The SUSB data show that 163 of the 274 SIC 2911 establishments reported for 2003 (59 percent) are owned by larger firms (those with 500 employees or more), some of which may still be defined as small under the SBA definition, and 111 (41 percent) are owned by small firms (those with fewer than 500 employees).

Table C2C-7: Number of Firms and Establishments for Petroleum Refineries by Firm Employment Size Category, 2003

Employment Size Category	Number of Firms	Number of Establishments
0-19	59	60
20-99	21	25
100-499	21	26
500+	41	163
Total	*142*	*274*

Note: Based on NAICS 324110

Source: U.S. SBA, 1989-2003.

C2C-3.2 Concentration Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers, with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal[6]. An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the

[6] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of domestic production are therefore only one indicator of the extent of competition in an industry.

market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 (602 + 302 + 102). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

As shown in Table C2C-15, the CR4 and the HHI for SIC 2911 are both below the benchmarks of 50 percent and 1,000, respectively. For the Petroleum Refining segment, the HHI is 422, suggesting the sector is unconcentrated. With the majority of the firms in this industry having small market shares, this suggests limited potential for passing through to customers any increase in production costs resulting from regulatory compliance.

Table C2C-8: Selected Ratios for Petroleum Refineries

SIC (S) or NAICS (N) Code	Year	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
S 2911	1987	200	32%	52%	78%	95%	435
	1992	132	30%	49%	78%	97%	414
N 324110	1997	122	29%	49%	82%	98%	422

[a] The *1997 Census of Manufactures* is the most recent concentration ratio data available.

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

C2C-3.3 Foreign Trade

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

Table C2C-9 presents trade statistics for the profiled Petroleum Refining segment from 1989 to 2002. The table shows that while export dependence has been relatively stable, import penetration decreased during the economic weakness of the early 1990s, before leveling off through the mid 1990s. Import penetration increased steadily through 2000 and then dropped slightly in 2001. This cycle follows the growth in the U.S. economy of the late 1990s, followed by the subsequent economic slowdown arriving in the latter half of 2000 into 2001. Mexico received the largest amount of U.S. exported refined petroleum products in 2001, followed by Canada and Japan. Imports of refined petroleum products increased 47.3 percent from 1989 to 2001, with 46.6 percent of total imports coming from OPEC countries (U.S. DOE, 2003).

The import penetration ratio for facilities in the Petroleum Refining segment in 2002 was only 15 percent, well below the U.S. manufacturing segment average of 22 percent. The export dependence ratio for petroleum refiners in 2001 was only four percent compared to the U.S. manufacturing average of 15 percent. Thus, based on the lack of competitive pressures from foreign markets/firms, the petroleum industry appears to be in a position to pass-through to consumers a significant portion of compliance-related costs associated with the Phase III regulation. However, given the low HHI for this industry EPA believes that existing market competition among domestic firms most likely nullifies any favorable influence the lack of foreign competitors would have on increasing the market power of firms in this industry.

Table C2C-9: Foreign Trade Statistics for Petroleum Refining ($2005)

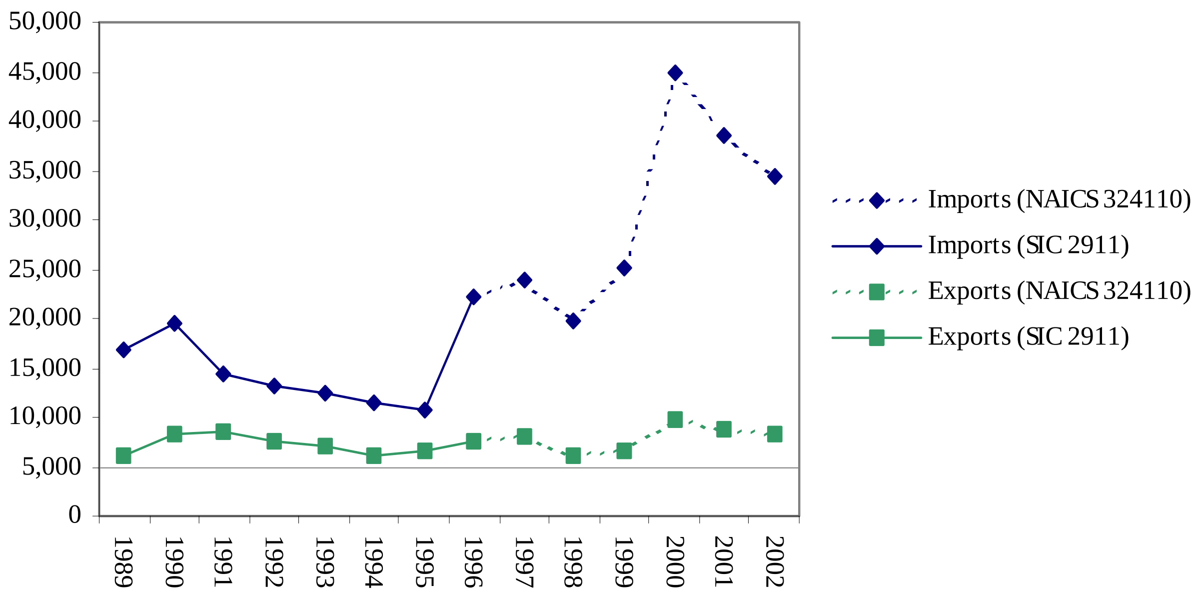
Year	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
1989	16,837	6,162	187,227	197,902	9%	3%
1990	19,605	8,227	219,025	230,403	9%	4%
1991	14,458	8,438	193,023	199,042	7%	4%
1992	13,218	7,474	176,809	182,553	7%	4%
1993	12,358	7,155	164,853	170,055	7%	4%
1994	11,519	6,158	159,839	165,200	7%	4%
1995	10,668	6,491	165,743	169,920	6%	4%
1996	22,111	7,526	188,817	203,402	11%	4%
1997[d]	24,009	8,087	186,428	202,351	12%	4%
1998[d]	19,825	6,027	137,306	151,104	13%	4%
1999[d]	25,071	6,602	165,289	183,759	14%	4%
2000[d]	44,920	9,784	241,662	276,797	16%	4%
2001[d]	38,456	8,839	218,854	248,471	15%	4%
2002[d]	34,278	8,322	208,236	234,192	15%	4%
Total Percent Change 1989-2002	103.6%	35.0%	11.2%	18.3%		
Average Annual Growth Rate	5.6%	2.3%	0.8%	1.3%		

[a] Calculated by EPA as shipments + imports - exports.
[b] Calculated by EPA as imports divided by implied domestic consumption.
[c] Calculated by EPA as exports divided by shipments.
[d] Before 1997, these data were compiled in the Standard Industrial Classification (SIC) system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.
Source: U.S. DOC, 2006; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

The United States consumes more petroleum than it produces, requiring net imports of both crude oil and refined products to meet domestic demand. In 2002, the U.S. imported 9.05 million barrels per day (MBD) of crude oil and 2.31 MBD of refined products. These refined product imports represented roughly 12 percent of the 19.65 MBD of refined products supplied to U.S. consumers. The U.S. exported 0.97 MBD of refined products in 2002 (U.S. DOE, 2003).

Imports of refined petroleum products have fluctuated since 1985. Imports rose to 2.3 MB in the early 1980s, due to rapid growth in oil consumption, especially consumption of light products, which exceeded the growth in U.S. refining capacity. Imports then declined as a result of the 1990/91 recession and increased upgrading of refinery capacity resulting primarily from the 1990 Clean Air Act Amendments and other environmental requirements (U.S. DOE, 1997). Since the 1995 low point, imports steadily increased through 2000 with the exception of 1998, before dropping again, due to general economic weakness, in 2001 and 2002 (see Figure C2C-5).

Figure C2C-5: Value of Imports and Exports for Petroleum Refining (millions, $2005)



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 2006.

Petroleum exports include heavy products such as residual fuel oil and petroleum coke, which are produced as co-products with motor gasoline and other light products. Production of these heavier products often exceeds U.S. demand, and foreign demand absorbs the excess. Petroleum coke is the leading petroleum export product, accounting for 35 percent of petroleum exports in 2002, followed by residual fuel oil (18 percent of exports) and motor gasoline (almost 13 percent) (U.S. DOE, 2003). Exports generally reflect foreign demand, but other factors influence exports as well. For example, exports of motor gasoline increased due to high prices in Europe at the time of the 1990 Persian Gulf War. U.S. refiners and marketers have gained experience in marketing to diverse world markets, and U.S. products are now sold widely abroad (U.S. DOE, 1997). As reported by the International Trade Administration and shown in Figure C2C-5, the real value of petroleum exports has fluctuated between $5 and $10 billion during the years 1989 and 2002.

C2C-4 FINANCIAL CONDITION AND PERFORMANCE

The financial performance and condition of the Petroleum Refining segment are important determinants of its ability to withstand the costs of regulatory compliance without material adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 14-year period, 1992-2005: net profit margin and return on total capital. EPA calculated these measures as a revenue-weighted index of measure values for public reporting firms in the respective industries, using data from the Value Line Investment Survey. Financial performance in the most recent financial reporting period (2005) is obviously not a perfect indicator of conditions at the time of regulatory compliance. However, examining the trend, and deviation from the trend, through the most recent reporting period gives insight into where the industry *may be*, in terms of financial performance and condition, at the time of compliance. In addition, the volatility of performance against the trend, in itself, provides a measure of the *potential* risk faced by the industry in a future period in which compliance requirements are faced: all else equal, the more volatile the historical performance, the more likely the industry *may* be in a period of relatively weak financial conditions at the time of compliance.

Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient positive profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the petroleum refining process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as Petroleum Refining, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

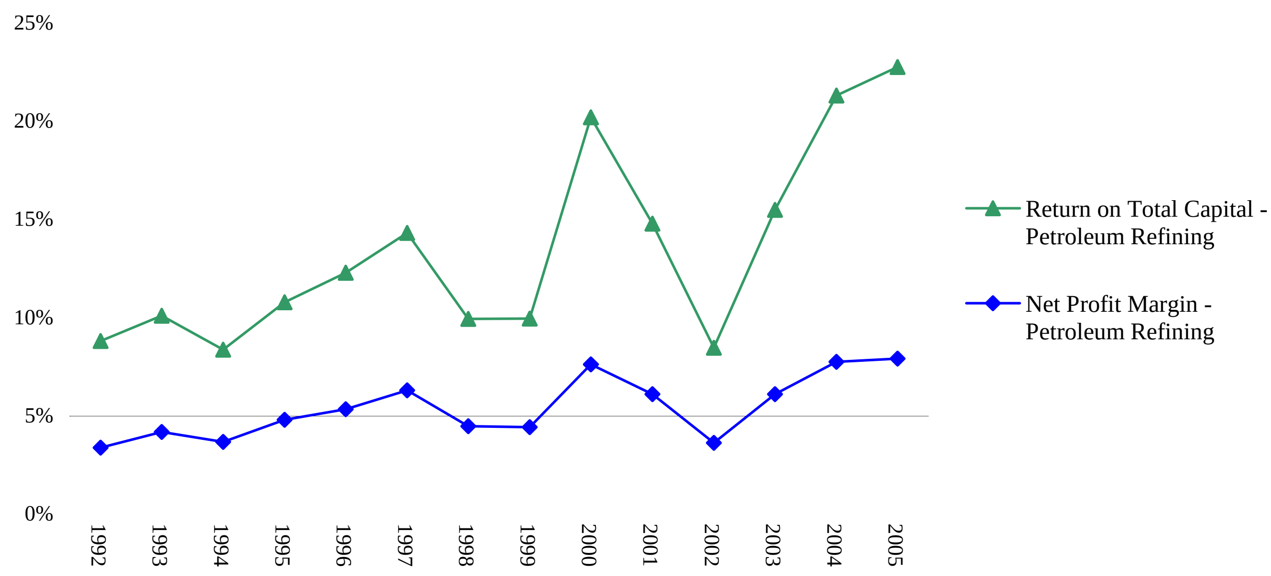
Return on total capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for *net profit margin*, the firms in an industry, and the industry collectively, must generate, over time, a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in *net profit margin* will also be the primary sources of short-term variation in *return on total capital*.

Figure C2C-6 below shows trends in net profit margins and return on total capital for the Petroleum Refining segment between 1992 and 2005. Through the first half of the 1990s, unusually low product margins, low profitability, and substantial restructuring characterized the petroleum industry. These low profit margins resulted from three supply-side factors – (1) increases in operating costs as a result of governmental regulations; (2) expensive upgrading of processing units to accommodate lower-quality crude oils;[7] and (3) upgrading of

[7] Crude oils processed by U.S. refineries have become heavier and more contaminated with materials such as sulfur. This trend reflects reduced U.S. dependence on the more expensive high gravity ("light") and low sulfur ("sweet") crude oils produced in the Middle East, and greater reliance on crude oil from Latin America (especially Mexico and Venezuela), which is relatively heavy and contains higher sulfur ("sour") (U.S. DOE, 1999a).

operations to adapt to changes in demand for refinery products[8] – coupled with lower product prices, resulting from competitive pressures (API, 1999). In the late 1990s, the petroleum industry pursued cost-cutting measures throughout their operations (Rodekohr, 1999)[9]. These cost-cutting measures, along with increases in the prices of petroleum refining products, resulted in significantly improved financial performance in the Petroleum Refining segment. Refinery profits remained high in 2000 and the first half of 2001, due to low product inventories and high operating rates. The latter half of 2001 and 2002 saw the effects of the global recession, the attacks of 9/11, and a mild winter. These factors, coupled with world supply in excess of demand, led to decreases in refiner margins, as crude oil prices increases and petroleum product prices decreased. In 2003, as the U.S. economy began recovery from its economic weakness, the domestic Petroleum Refining segment returned to relatively strong financial performance. The segment's performance continued to improve in 2004 and 2005, reaching the highest return on total capital and net profit margin observed over the time period analyzed by 2005.

Figure C2C-6: Net Profit Margin and Return on Total Capital for Petroleum Refining



Source: Value Line, 2003; Value Line, 2006.

C2C-5 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Section 316(b) of the Clean Water Act applies to point source facilities that use, or propose to use, a cooling water intake structure that withdraws cooling water directly from a surface waterbody of the United States. In 1982, the Petroleum and Coal Products industry (SIC 29) withdrew 590 billion gallons of cooling water, accounting for

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8 Demand for lighter products such as gasoline and diesel fuel has increased, and demand for heavier products has decreased.

9 Reductions in costs resulted from:

< divesting marginal refineries and gasoline outlets;
< divesting less profitable activities (e.g., gasoline credit cards);
< reducing corporate overhead costs, including eliminating redundancies through restructuring;
< outsourcing some administrative activities; and
< use of new technologies requiring less labor.

approximately 0.8 percent of total industrial cooling water intake in the United States[10]. The industry ranked 4th in industrial cooling water use, behind the electric power generation industry and the chemical and primary metals industries (1982 Census of Manufactures).

This section provides information for facilities in the petroleum segment estimated to be subject to regulation for the regulatory analysis options. Existing facilities that meet all of the following conditions are expected to be subject to regulation:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the United States, and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have a National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

The regulatory analysis options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses on the facilities nationwide in the petroleum segment that are estimated to be subject to regulation under the DIF applicability thresholds defined by the regulatory analysis options (see Table C2C-1, above for additional information on the broader set of facilities potentially subject to regulation).[5]

C2C-5.1 Waterbody and Cooling System Type

Table C2C-10 show the distribution of Phase III facilities by type of water body and cooling system for each option.

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[10] Data on cooling water use are from the *1982 Census of Manufactures*. 1982 was the last year in which the Census of Manufactures reported cooling water use.

[5] EPA applied sample weights to the sampled facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table C2C-10: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System for the Petroleum Refining Segment

Water Body Type	Cooling System						Total
	Recirculating		Combination		Once-Through		
	Number	% of Total	Number	% of Total	Number	% of Total	
Estuary/ Tidal River	0	0%	3	35%	2	40%	5
Freshwater Stream/ River	2	100%	4	41%	2	40%	8
Great Lake	0	0%	2	24%	0	0%	2
Ocean	0	0%	0	0%	1	20%	1
Total [a]	***2***	***13%***	***9***	***56%***	***5***	***32%***	***17***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2C-11: Number of Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System for the Petroleum Refining Segment

Water Body Type	Cooling System						Total
	Recirculating		Combination		Once-Through		
	Number	% of Total	Number	% of Total	Number	% of Total	
Estuary/ Tidal River	0	0%	2	68%	1	100%	3
Freshwater Stream/ River	0	0%	1	32%	0	0%	1
Total [a]	***0***	***0%***	***3***	***76%***	***1***	***24%***	***4***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2C-12: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System for the Petroleum Refining Segment

Water Body Type	Cooling System						Total
	Recirculating		Combination		Once-Through		
	Number	% of Total	Number	% of Total	Number	% of Total	
Estuary/ Tidal River	0	0%	2	40%	1	100%	3
Freshwater Stream/ River	1	100%	2	39%	0	0%	3
Great Lake	0	0%	1	21%	0	0%	1
Total [a]	***1***	***14%***	***5***	***72%***	***1***	***14%***	***8***

[a] Individual numbers may not add up to total due to independent rounding.

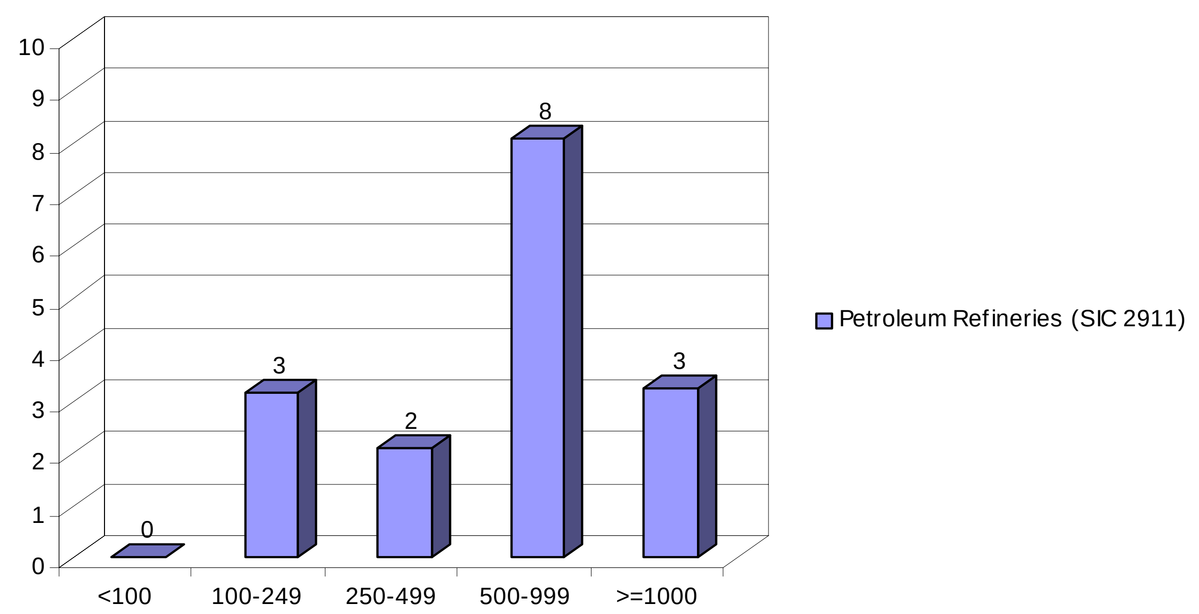
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

According to the American Petroleum Institute and EPA, water use at Petroleum Refineries has been declining because facilities are increasing their reuse of water (U.S. EPA, 1996a).

C2C-5.2 Facility Size

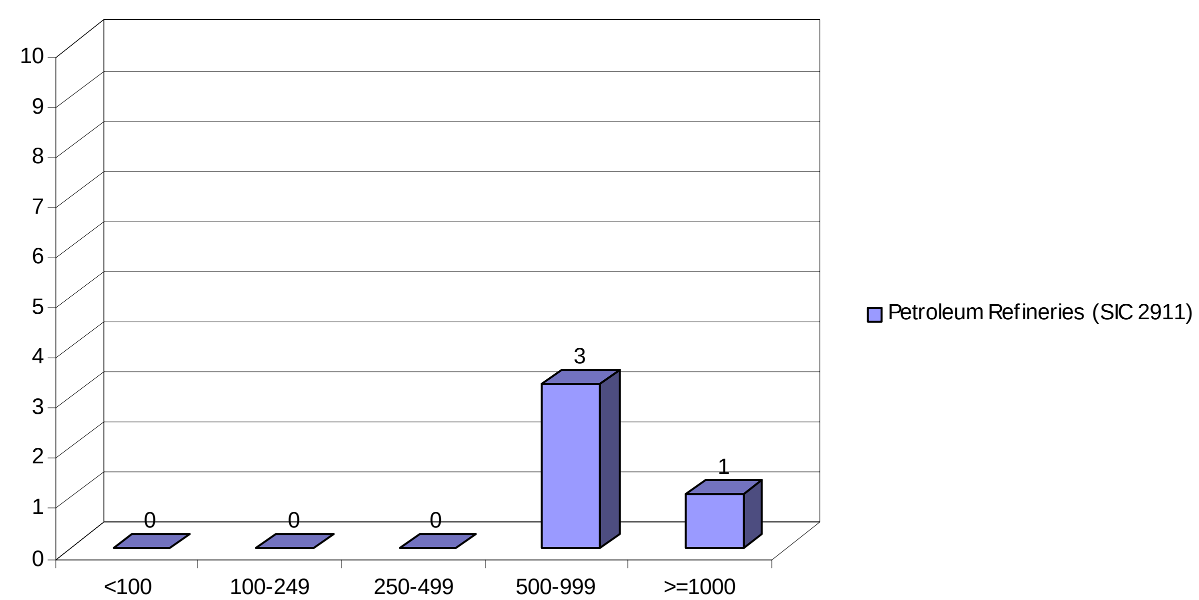
All petroleum refinery facilities that are estimated to be subject to regulation under the regulatory analysis options are relatively large. Figure C2C-7 show the number of potential Phase III facilities by employment size category for the regulatory analysis options.

Figure C2C-7: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for the Petroleum Refinery Segment



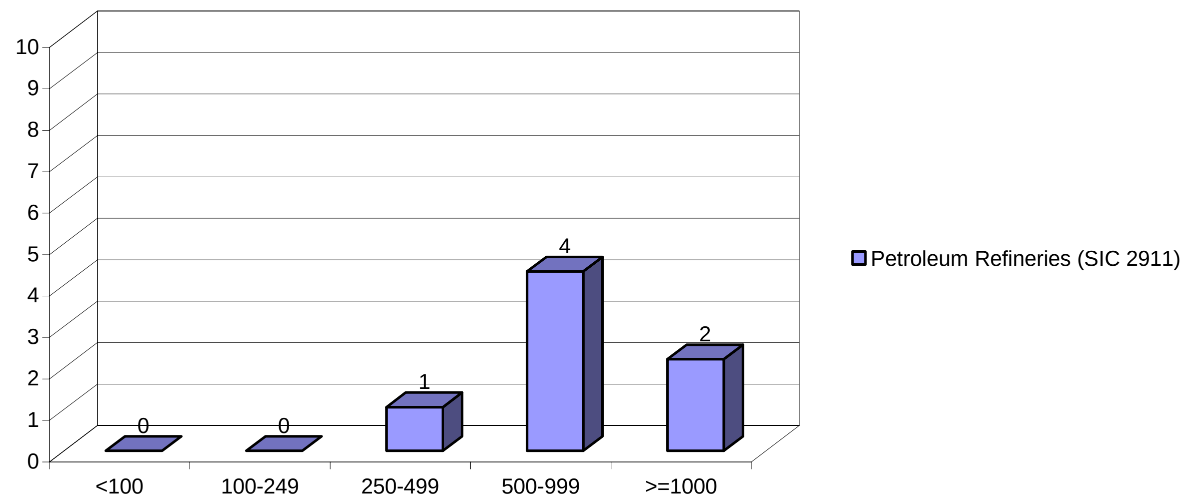
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2C-8: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for the Petroleum Refinery Segment



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2C-9: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size for the Petroleum Refinery Segment



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2C-5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity thresholds to determine the number of facilities in the petroleum-refining segment that owned by small firms. Firms in this industry are considered small if they employ fewer than 1,500 people. As shown in Table C2C-13, Table C2C-14, and Table C2C-15, all of the facilities that are estimated to be subject to regulation are owned by large business, regardless of the option.

Table C2C-13: Number of Facilities Estimated Subject to the 50 MGD All Option by Firm Size for the Petroleum Refinery Segment

SIC	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
2911	17	100%	0	0%	17

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2C-14: Number of Facilities Estimated Subject to the 200 MGD All Option by Firm Size for the Petroleum Refinery Segment

SIC	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
2911	4	100%	0	0%	4

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2C-15: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size for the Petroleum Refinery Segment

SIC	Large		Small		Total
	No.	% of SIC	No.	% of SIC	
2911	8	100%	0	0%	8

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2D: Steel (SIC 331)

INTRODUCTION

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified five 4-digit SIC codes in the Steel Works, Blast Furnaces, and Rolling and Finishing Mills Industries (SIC 331) with at least one existing facility that operates a CWIS, holds a NPDES permit, and withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes (facilities with these characteristics are hereafter referred to as facilities potentially subject to the Phase III regulation or "potential Phase III facilities").

For each of the five SIC codes, Table C2D-1, following page, provides a description of the industry segment, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), the number of facilities estimated to be potentially subject to Phase III regulation based on the minimum withdrawal threshold of 2 MGD, and the number of facilities estimated to be subject to regulation for the regulatory analysis options.

CHAPTER CONTENTS

Table C2D-1: Phase III Facilities in the Steel Industry (SIC 331)

SIC	SIC Description	Important Products Manufactured	Number of Phase III Facilities[a]				
			Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
Steel Mills (SIC 3312)							
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	Hot metal, pig iron, and silvery pig iron from iron ore and iron and steel scrap; converting pig iron, scrap iron, and scrap steel into steel; hot-rolling iron and steel into basic shapes, such as plates, sheets, strips, rods, bars, and tubing; merchant blast furnaces and byproduct or beehive coke ovens	***161***	***46***	***21***	***14***	***19***
Steel Products (SICs 3315, 3316, 3317)							
3315	Steel Wiredrawing and Steel Nails and Spikes	Drawing wire from purchased iron or steel rods, bars, or wire; further manufacture of products made from wire; steel nails and spikes from purchased materials	122	7	3	0	0
3316	Cold-Rolled Steel Sheet, Strip, and Bars	Cold-rolling steel sheets and strip from purchased hot-rolled sheets; cold-drawing steel bars and steel shapes from hot-rolled steel bars; producing other cold finished steel	57	10	0	0	0
3317	Steel Pipe and Tubes	Production of welded or seamless steel pipe and tubes and heavy riveted steel pipe from purchased materials	130	5	1	0	1
		Total Steel Products	***309***	***21***	***5***	***0***	***1***
Other Segments							
3313	Electrometallurgical Products, Except Steel	Ferro and nonferrous metal additive alloys by electrometallurgical or metallothermic processes, including high percentage ferroalloys and high percentage nonferrous additive alloys	***6***	***2***	***2***	***0***	***0***
Total Steel (SIC 331)							
		Total SIC Code 331	***476***	***68***	***27***	***14***	***20***

[a] Number of weighted detailed questionnaire survey respondents.

[b] Individual numbers may not add up due to independent rounding.

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

As shown in Table C2D-1, EPA estimates that, out of the total of 476 facilities with a NPDES permit and operating cooling water intake structures in the Steel Industry (SIC 331), 27 (or 4%) would be subject to regulation under the 50 MGD All option, 14 (or 2.9%) would be subject to regulation under the 200 MGD All option, and 20 (or 4.2%) would be subject to regulation under the 100 MGD CWB option. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to regulation for each primary analysis option. Total value of shipments for the steel industry from the 2004 Annual Survey of Manufacturers is $92.8 billion. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because the DQ did not collect value of shipments data, these data were not available for Phase III facilities. Total revenue, as reported on the DQ, was used as a close approximation for value of shipments for these facilities. EPA estimated the total revenue of facilities expected to be subject to regulation under the 50 MGD, 200 MGD and 100 MGD to be $32 billion, $24.3 billion, and $26.8 billion, respectively. Therefore, EPA estimates that the percentage of total production in the steel industry that occurs at facilities estimated to be subject to regulation under the 50 MGD, 200 MGD, and 100 MGD options is 34%, 26%, and 29%, respectively..

The responses to the Detailed Questionnaire indicate that two main steel segments account for the largest numbers of potential Phase III facilities: (1) Steel Mills (SIC code 3312) and (2) Steel Products (SIC codes 3315, 3316, and 3317). The remainder of the steel industry profile therefore focuses on these two industry segments

Table C2D-2 provides the crosswalk between SIC codes and the new NAICS codes for the profiled steel SIC codes. The table shows that both cold finishing of steel shapes (SIC 3316) and steel pipe and tubes (SIC 3317) have a one-to-one relationship to NAICS codes. The other SIC codes in the profiled steel segments correspond to two NAICS codes.

Table C2D-2: Relationships between SIC and NAICS Codes for the Steel Industries (2002)

SIC Code	SIC Description	NAICS Code	NAICS Description	Number of Establishments	Value of Shipments ($1000)	Employment
3312	Blast furnaces and steel mills	324199	All other petroleum and coal products manufacturing (pt)	82	1,895,666	3,191
	Blast furnaces and steel mills	331111	Iron and steel mills (pt)	379	46,221,417	117,016
3313	Electrometallurgical products	331112	Electrometallurgical ferroalloy product manufacturing	22	819,311	2,333
	Electrometallurgical products	331492	Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum) (pt)	235	2,686,875	9,669
3315	Steel wire and related products	331222	Steel wire drawing	338	3,905,687	18,576
	Steel wire and related products	332618	Other fabricated wire product manufacturing (pt)	1,672	42,314	5,879,897
3316	Cold finishing of steel shapes	331221	Rolled steel shape manufacturing	147	5,004,079	12,202
3317	Steel pipe and tubes	331210	Iron and steel pipes and tubes manufacturing from purchased steel	183	6,240,489	21,858

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.

C2D-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of steel industry firms to absorb compliance costs under each primary analysis option without material adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by two factors: (1) the extent to which the industry may be expected to shift compliance costs to its customers through price increases and (2) the financial health of the industry and its general business outlook.

Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the steel industry is relatively unconcentrated, which would suggest that firms in this industry would have difficulty in passing a significant portion of their compliance-related costs through to customers. In addition, the domestic steel industry faces high competition from imports into the U.S. market, further curtailing the potential of firms in this industry to pass through to customers a significant portion of their compliance-related costs. As discussed above, given the relatively small proportion of total value of shipments in the industry estimated subject to regulation under the primary analysis options, EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the impact analysis of existing Phase III steel facilities has not been met. For these reasons, in its analysis of regulatory impacts for the steel industry, EPA assumed that complying firms would be unable to pass compliance costs through to customers: i.e., complying facilities must absorb all compliance costs at the time of compliance (see following sections and Appendix 3, *Cost Pass-Through Analysis*, to *Chapter C3: Economic Impact Analysis for Manufacturers*, for further information).

Financial Health and General Business Outlook

Over the past decade, the steel industry, like other U.S. manufacturing industries, experienced a range of economic/financial conditions, including substantial challenges. The U.S. steel industry went through a difficult restructuring process in the 1980s and early 1990s, including the closing of a number of inefficient mills, substantial investment in new technologies, and reductions in the labor force. Although U.S. demand for steel was strong in the late 1990s, low-priced imports increased substantially in 1998, which caused a number of U.S. steel bankruptcies and steelworker layoffs. The increased imports resulted from the Asian financial crisis, with the associated decline in Asian demand for steel and currency devaluations. Tariffs provided temporary relief through 2002; however, all tariffs were removed by the end of 2003. The steel industry was also negatively affected by economic recession in 2000 and 2001 and has been slow to recover. In 2004, however, the industry's financial performance improved significantly, with 2004, followed by 2005, showing the highest financial performance over the survey timeframe. The industry has weathered difficult periods over the past few years and may be in position for better performance with continued strengthening of the U.S. economy. However, until such improvement manifests more concretely, the industry's relatively weak financial condition suggest a lower ability (among the industries subject to the 316(b) regulation) to withstand additional regulatory compliance costs without imposing significant financial impacts.

C2D-2 DOMESTIC PRODUCTION

Steel is one of the most important products of the U.S. industrial metals industry. For most of the twentieth century, the U.S. steel industry consisted of a few large companies utilizing an integrated steelmaking process to produce the raw steel used in a variety of commodity steel products. The integrated process requires a large capital investment to process coal, iron ore, limestone, and other raw materials into molten iron, which is then transformed into finished steel products (S&P, 2001). In recent decades, the integrated steel industry has undergone a dramatic downsizing as a result of increased steel imports, decreased consumption by the auto industry, and the advent of "minimills" (S&P, 2001). While the traditional integrated facilities using basic oxygen furnaces (BOF) still account for a substantial percent of U.S. steel mill product production, the share of electric arc furnace (EAF) facilities using scrap steel as an input has grown steadily[1]. By 2002, about 72 companies operating about 107 steelmaking plants used the EAF steelmaking process; these non-integrated, minimill facilities produced 46.1 million metric tons of steel, an increase of about eight percent compared with that of 2001, and accounted for 50.4 percent of total steelmaking (USGS, 2002). The range of products produced by EAFs has also expanded over time. Initially, EAFs produced primarily lower-quality structural materials.

[1] Production from open hearth furnaces, which dominated production until the early 1950s, ended in 1991. BOF facilities have traditionally been referred to as integrated producers, because they combined iron-making from coke, production of pig iron in a blast furnace, and production of steel in the BOF. In recent years, some facilities have closed their coke ovens. These BOF facilities are no longer fully integrated.

Starting in the 1990s, EAFs began producing higher quality sheet products as well. All recent capacity additions have been at EAF facilities.

Basic steel mill products include carbon steel, steel alloys, and stainless steel. Steel forming and finishing operations may take place at facilities co-located with steelmaking or at separate facilities. These operations take steel (in the form of blooms, billets, and slabs) and use heating, rolling or drawing, pickling, cleaning, galvanizing, and electroplating processes in various combinations to produce finished bars, wire, sheets, and coils (semifinished steel products). Establishments that produce hot rolled products, along with basic BOF and EAF steelmaking facilities, are included in SIC 3312. SIC codes 3315, 3316, and 3317 perform additional processing of steel bars, wires, sheets, and coils (including cold-rolling of sheets) to produce steel products for a variety of end-uses (U.S. EPA, 1995).

The steel industry is the fourth largest energy-consuming industry in the U.S. economy. Energy costs account for approximately 17 percent of the total manufacturing cost (AISI, 2000). Steelmakers use coal, oil, electricity, and natural gas to fire furnaces and run process equipment. Minimill producers require large quantities of electricity to operate the electric arc furnaces used to melt and refine scrap metal, while integrated steelmakers depend on coal for up to 60 percent of their total energy requirements (McGraw-Hill, 1998).

C2D-2.1 Output

Steel mill products are sold to service centers (which buy finished steel, often process it further, and sell to a variety of fabricators, manufacturers, and construction industry clients), to vehicle producers, and to the construction industry. The rapid growth in sales of heavy sports utility vehicles contributed to increased U.S. steel consumption in the 1990s. Efforts to increase the fuel efficiency of vehicles have eroded steel's position in the automotive market as a whole, however, as aluminum and plastic have replaced steel in many automotive applications. Other end-uses for steel include a wide range of agricultural, industrial, appliance, transportation, and container applications. Use of steel in beverage cans has been largely replaced by aluminum.

Table C2D-3 shows trends in production from the two major groups of steel producers: BOF and EAF facilities.

Table C2D-3: U.S. Steel Production by Type of Producer

Year	Steel Production		Percent from BOF	Percent from EAF
	Million MT	% Change		
1990[a]	89.7		59.1%	37.3%
1991[b]	79.7	-11.15%	60.0%	38.4%
1992	84.3	5.77%	62.0%	38.0%
1993	88.8	5.34%	60.6%	39.4%
1994	91.2	2.70%	60.7%	39.3%
1995	95.2	4.39%	59.6%	40.4%
1996	95.5	0.32%	57.4%	42.6%
1997	98.5	3.14%	56.2%	43.8%
1998	98.6	0.10%	54.9%	45.1%
1999	97.4	-1.22%	53.7%	46.3%
2000	102	4.72%	53.0%	47.0%
2001	90.1	-11.67%	52.6%	47.4%
2002	91.6	1.66%	49.6%	50.4%
2003	93.7	2.29%	49.0%	51.0%
2004	99.7	6.40%	47.8%	52.2%
2005[c]	92.4	-7.32%	44.9%	55.1%
Total Percent Change 1990-2005	*3.0%*			
Average Annual Growth Rate	*0.2%*			

[a] 3.5 percent of 1990 production was from open hearth furnaces.
[b] 1.6 percent of 1991 production was from open hearth furnaces.
[c] Estimated.

Source: AISI, 2001b; USGS, 1997;USGS, 2001; USGS 2004; USGS, 2006; USGS, Iron and Steel Statistical Compendium.

This table shows the cyclical nature of the U.S. steel industry, with variations in growth from year to year reflecting general U.S. and world economic conditions, persistent excess production capacity worldwide, the competitive strength of imports, and trends in steel's share of the automotive and other end-use markets for steel. The U.S. steel industry went through a difficult restructuring process in the 1980s and early 1990s, including the closing of a number of inefficient mills, substantial investment in new technologies, and reductions in the labor force. The U.S. became a world leader in low-cost production, lead by the minimill producers. Although U.S. demand for steel was strong in the late 1990s, low-priced imports increased substantially in 1998, which led to a number of U.S. steel bankruptcies and steelworker layoffs. The increased imports resulted from the Asian financial crisis, with the associated decline in Asian demand for steel and currency devaluations. The U.S. government initiated the Steel Action Program in response to the crisis, focusing on strong enforcement of trade laws through the World Trade Organization and bilateral efforts to address market-distorting practices abroad[2]. The industry began to show signs of recovery in the second half of 1999, and by early 2000 capacity utilization recovered to above 90 percent and earnings were up for most major steel companies (U.S. DOC, 2000). However, beginning in 2000, the weakening of the U.S. economy significantly reduced steel demand and total U.S. steel production fell by nearly 12 percent in 2001. In March 2002, the U.S. steel industry received temporary relief under Section 201 of the 1974 Trade Act with 3 years of tariffs ranging up to 30 percent on certain steel

[2] World steel trade is characterized by noncompetitive practices in a number of countries, which have resulted in substantial friction over trade issues since the late 1960s. Since 1980, almost 40 percent of the unfair trade practice cases investigated in the U.S. have been related to steel products (U.S. DOC, 2000).

imports. Relief from imports was nullified to some extent when the U.S. Department of Commerce exempted 727 imported steel products from the tariff in June 2002. By year-end, 2002 was the fourth highest steel import year in U.S. history (USGS, 2002). Removal of all tariffs occurred on December 4, 2003 (S&P, 2004).

The steel industry is recovering, but slowly, from the import penetration in the late 90's followed by the economic recession in 2001. In 2003, the integrated steel industry had poor operating results, as high raw material costs outweighed increased sales and higher volumes. As a result, most domestic steel producers instituted a raw material surcharge to offset sharply rising costs for raw materials such as scrap, iron ore and coke. Additionally, worldwide capacity remains in excess of long-term needs. Imports will most likely rise in 2004 after the removal of tariffs. However, to the extent that imports put downward pressure on prices, they may force the shutdown of marginal capacity currently operating. These capacity reductions will reduce domestic supply, and may set the stage for better financial performance in later years (S&P, 2004).

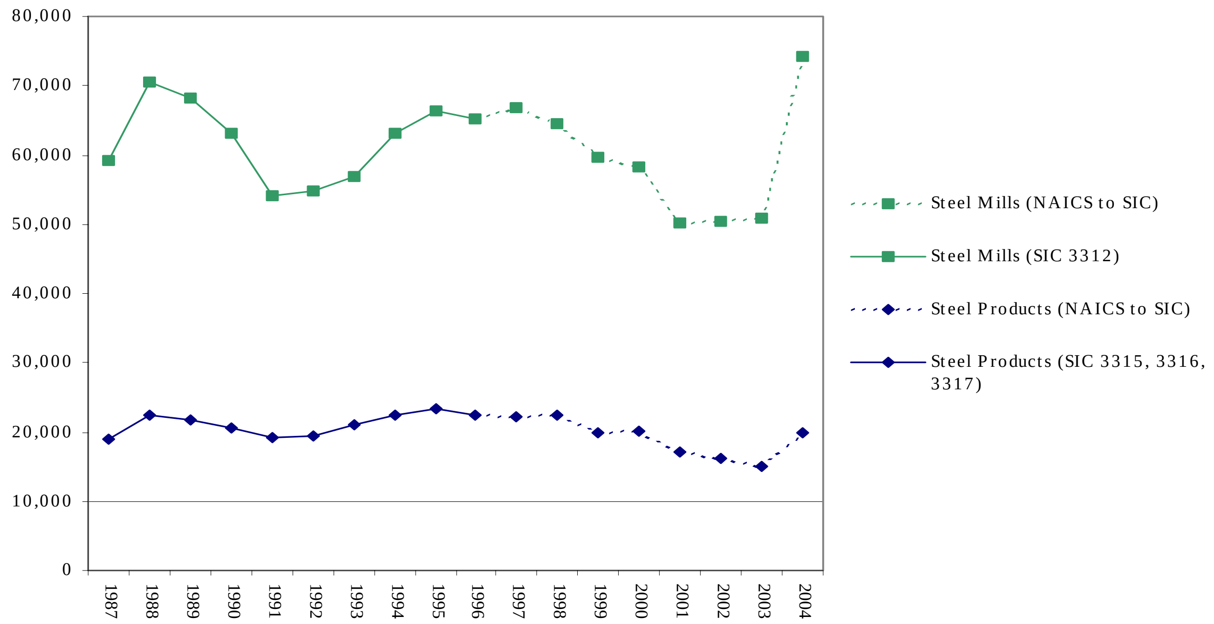
Value of shipments and ***value added*** are two common measures of manufacturing output[3]. Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added, defined as the difference between the value of shipments and the value of inputs used to make the products sold, measures the value of production activity in a particular industry.

Figure C2D-1 presents trends in constant-dollar value of shipments and value added for Steel Mills and Steel Products. Value of shipments and value added from Steel Mills declined in the early 1990s, and recovered through 1997, prior to the 1998 import crisis and the later U.S. economic recession. The segment’s value of shipments continued to decline through 2001, but has risen continuously since 2002, peaking at nearly $75 billion in 2004. Steel Mills value added, on the other hand, continued to decline until 2003, increasing slightly in 2004. Value of shipments and value added for Steel Products were less volatile, increasing gradually over 1990 through 1997. Value added stayed relatively constant through 2004, while value of shipments declined until 2003, then increased slightly in 2004.

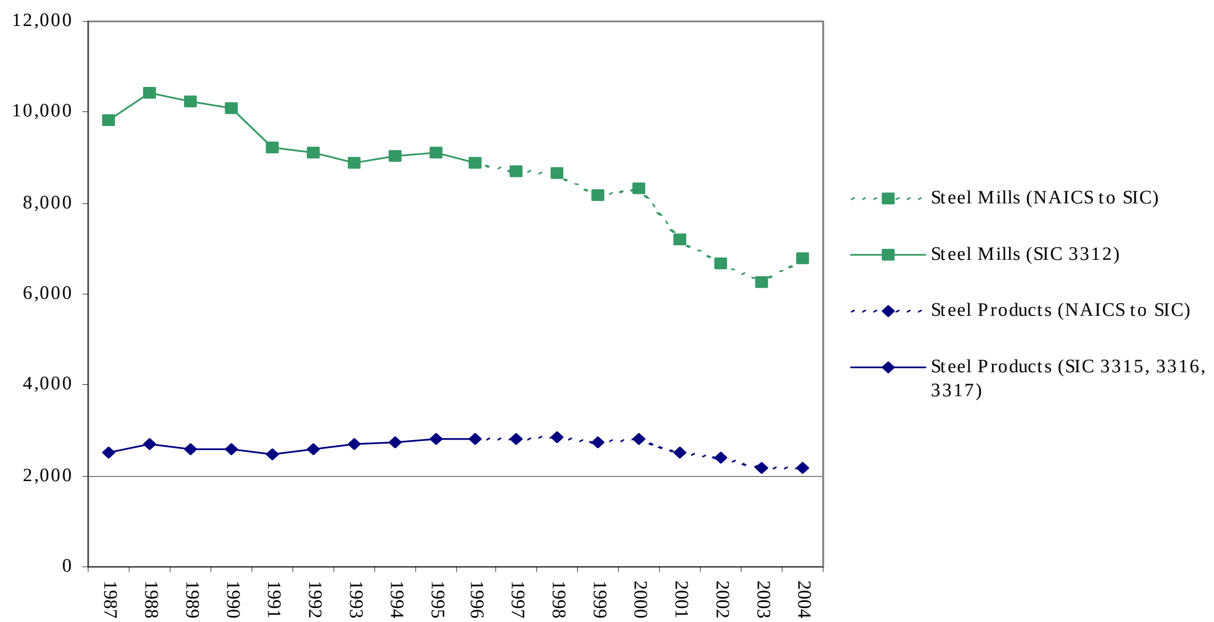
[3] Terms highlighted in bold and italic font are further explained in the glossary.

Figure C2D-1: Value of Shipments and Value Added for Profiled Steel Industry Segments (millions, $2005)

Value of Shipments



Value Added



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

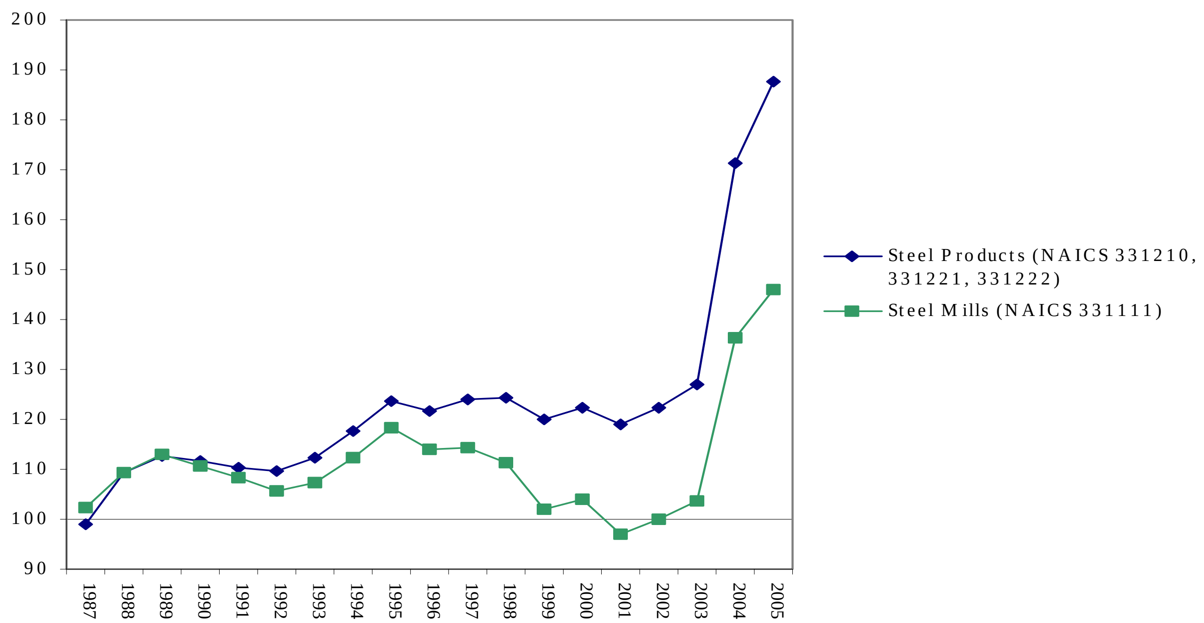
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

B2D-2.2 Prices

The ***producer price index*** (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

Figure C2D-2 below shows that prices increased from 1987 to 1989 and then decreased in the early 1990s, due to a depressed domestic economy and the resulting decline in the demand for steel. Prices rebounded sharply through 1995 before eroding again, due to the global oversupply and increases in exports discussed above. Basic steel prices declined sharply with the growth of imports in the late 1990s, recovered in 2000, but dropped again in 2001 with the decline in steel demand (S&P, 2001; AISI, 2001a). Prices began to rise in 2002 with the beginning of economic recovery, and then proceeded to increase dramatically during 2003 to 2005. In 2005, both Steel Products and Steel Mills segments recorded the highest prices observed during the 1987 to 2005 time period.

Figure C2D-2: Producer Price Index for Profiled Steel Industry Segments



Note: Data for 2005 were preliminary at the time of this writing. The NAICS values shown in this figure match the historical values of the profiled SIC codes. As data by SIC were only available through 2003, the representative NAICS codes are presented for evaluation through 2005.

Source: BLS, 2006.

B2D-2.3 Number of Facilities and Firms

The number of operating Steel Mills fluctuated significantly between 1990 and 2003, as the U.S. industry underwent a substantial restructuring. Table C2D-4 shows substantial decreases in the number of facilities in 1992 and 1993 due to a significant decrease in global demand for Steel Products and resulting overcapacity. This decrease was followed by a significant recovery in 1995 and 1996. The number of facilities continued to rise through 2001, with the largest increase around 1999. This increase may have resulted in part from the advent of minimills, as discussed above. The import crisis in 1998 ultimately led to bankruptcy for a number of U.S. producers, including LTV and Bethlehem Steel (S&P, 2001). Additionally, 7 major bankruptcies occurred over 2002 and early 2003, including Bayou Steel Corp, Kentucky Electric Steel Inc, Slater Steel Inc, and Weirton Steel

Corp (USGS, 2004). Nonetheless, the Steel Mills segment saw an overall 74 percent increase in the number of facilities during 1990 to 2003.

In contrast to the volatility in the number of Steel Mills, the number of facilities in the Steel Products segment has remained relatively stable between 1990 and 2003, with decreases towards the end of the period.

Table C2D-4: Number of Facilities in the Profiled Steel Industry Segments

Year	Steel Mills		Steel Products	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	497		776	
1991	531	6.8%	807	4.0%
1992	412	-22.4%	831	3.0%
1993	343	-16.7%	833	0.2%
1994	339	-1.2%	804	-3.5%
1995	391	15.3%	791	-1.6%
1996	483	23.5%	770	-2.7%
1997	297	-38.5%	727	-5.6%
1998[a]	398	34.0%	865	19.0%
1999[a]	685	72.1%	919	6.2%
2000[a]	981	43.2%	1,026	11.7%
2001[a]	1,352	37.9%	1,028	0.2%
2002[a]	1,249	-7.6%	953	-7.3%
2003[a]	866	-30.7%	918	-3.6%
Total Percent Change 1990-2003	*74.2%*		*18.3%*	
Average Annual Growth Rate	*4.4%*		*1.3%*	

[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. SBA, 1989-2003.

The trend in the number of firms over the period between 1990 and 2003 is similar to the trend in the number of facilities in both industry segments. The number of firms in the Steel Mill segment decreased to a period-low of 216 in 1997, before increasing significantly over 1998 to 2001. This rise in the number of Steel Mill firms was followed by slight declines in 2002 and 2003. Overall, however, the number of Steel Mill firms increased by just over 83 percent between 1990 and 2003. The number of firms in the Steel Products segment also decreased from 1992 to 1998, before rising steadily through 2001, then declining slightly in 2002 and 2003.

Table C2D-5 shows the number of firms in the two profiled steel segments between 1990 and 2003.

Table C2D-5: Number of Firms in the Profiled Steel Industry Segments

Year	Steel Mills		Steel Products	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	408		597	
1991	433	6.1%	635	6.4%
1992	321	-25.9%	661	4.1%
1993	261	-18.7%	641	-3.0%
1994	258	-1.1%	618	-3.6%
1995	309	19.8%	607	-1.8%
1996	397	28.5%	583	-4.0%
1997	216	-45.6%	544	-6.7%
1998[a]	314	45.3%	666	22.4%
1999[a]	593	89.0%	716	7.4%
2000[a]	885	49.2%	810	13.2%
2001[a]	1,254	41.6%	811	0.1%
2002[a]	1,140	-9.0%	757	-6.7%
2003[a]	748	-34.4%	767	1.4%
Total Percent Change 1990-2003	*83.3%*		*28.5%*	
Average Annual Growth Rate	*4.8%*		*1.9%*	

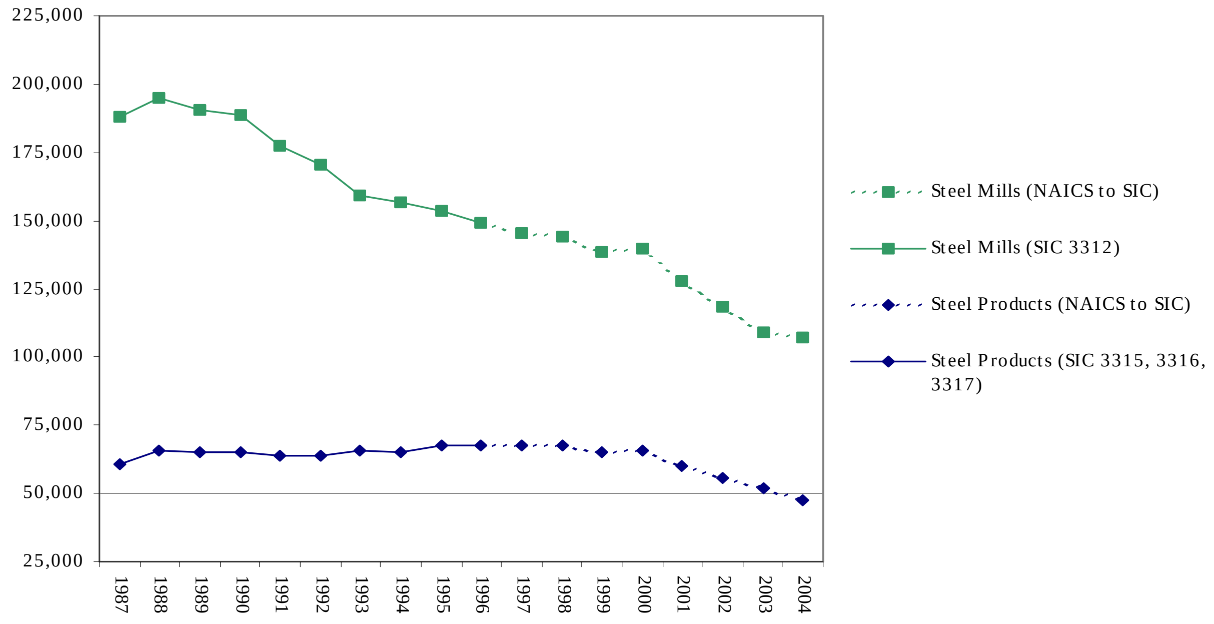
[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

C2D-2.2 Employment and Productivity

Figure C2D-3, following page, provides information on ***Employment*** from the Annual Survey of Manufactures for the Steel Mills and Steel Products segments. As shown in the figure, employment levels in the Steel Mills segment decreased by a total of 43 percent between 1987 and 2004. Employment is a significant cost component for steelmakers, accounting for approximately 30 percent of total costs (McGraw-Hill, 1998). Labor cost reductions enabled Steel Mills to improve profitability and competitiveness in the face of limited opportunity for price increase in the highly competitive market for Steel Products. The steady decline in employment reflects the smaller number of Steel Mill facilities and firms, in conjunction with aggressive efforts to improve worker productivity in order to cut labor costs and improve profits (McGraw-Hill, 1998). Employment declined further as a result of the 1998 import crisis, with almost 26,000 U.S. steelworkers reportedly losing their jobs (AISI, 2001a). Employment in the Steel Products segment over the period 1987-2001 remained fairly constant, before experiencing moderate declines in the subsequent three years.

Figure C2D-3: Employment for Profiled Steel Industry Segments



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2D-6 presents the change in value added per labor hour, a measure of ***labor productivity***, for the Steel Mill and Steel Products segments between 1987 and 2004. Labor productivity at Steel Mills increased slightly over this period. Value added per labor hour increased around 14.4 percent between 1987 and 2004. Much of this increase in labor productivity can be attributed to the restructuring of the U.S. steel industry and the increased role of minimills in production. Minimills are capable of producing rolled steel from scrap with substantially lower labor needs than integrated mills (McGraw-Hill, 1998). Labor productivity in the Steel Products segment has also fluctuated, but increased by 17.8 percent overall from 1987 to 2004.

Table C2D-6: Productivity Trends for the Profiled Steel Industry Segments ($2005)

Year	Steel Mills				Steel Products			
	Value Added (millions)	Production Hours (millions)	Value Added/Hour $/hr	Value Added/Hour Percent Change	Value Added (millions)	Production Hours (millions)	Value Added/Hour $/hr	Value Added/Hour Percent Change
1987	9,836	306	32		2,499	108	23	
1988	10,418	324	32	-0.2%	2,706	94	29	24.4%
1989	10,219	348	29	-8.5%	2,597	112	23	-19.9%
1990	10,069	315	32	8.9%	2,595	93	28	21.0%
1991	9,213	279	33	3.3%	2,485	106	23	-16.7%
1992	9,131	277	33	-0.3%	2,573	87	30	26.9%
1993	8,880	268	33	0.7%	2,707	109	25	-16.1%
1994	9,050	266	34	2.4%	2,729	91	30	20.9%
1995	9,130	263	35	2.3%	2,809	114	25	-17.7%
1996	8,902	260	34	-1.6%	2,806	134	21	-15.1%
1997[a]	8,708	252	35	1.2%	2,806	110	25	21.1%
1998[a]	8,669	245	35	2.0%	2,867	113	25	-0.1%
1999[a]	8,186	237	35	-2.1%	2,747	108	26	0.5%
2000[a]	8,315	241	34	-0.4%	2,803	109	26	0.4%
2001[a]	7,200	283	25	-26.1%	2,516	97	26	1.3%
2002[a]	6,660	194	34	35.3%	2,404	91	27	2.1%
2003[a]	6,251	180	35	0.9%	2,186	85	26	-2.9%
2004[a]	6,780	184	37	6.0%	2,162	79	27	6.4%
Total Percent Change 1987-2004	*-31.1%*	*-39.8%*	*14.4%*		*-13.5%*	*-26.5%*	*17.8%*	
Average Annual Growth Rate	*-2.2%*	*-2.9%*	*0.8%*		*-0.8%*	*-1.8%*	*1.0%*	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2D-2.3 Capital Expenditures

Steel production is a capital intensive process. The integrated production process requires a capital investment of approximately $2,000 per ton of capacity for plants and equipment. The nonintegrated process employed in minimills is significantly less capital intensive with capital costs of approximately $500 per ton of capacity (McGraw-Hill, 1998).

New capital expenditures are needed to modernize, expand, and replace existing capacity to meet growing demand. Capital expenditures in the Steel Mills and the Steel Products segments between 1987 and 2004 are presented in Table C2D-7, following page. The table shows that capital expenditures in both the Steel Products and the Steel Mills dropped significantly between 1987 and 2004. Capital outlays increased in the late 1980s and early 1990s, rising by a total of 112 percent from 1987 to 1991. This substantial increase coincides with the advent of thin slab casting, a technology that allowed minimills to compete in the market for flat rolled sheet steel. The significant decreases in capital expenditures by Steel Mills that followed this expansion reflect the bottoming out of the demand for Steel Products in the early 1990s. The recovery in capital expenditures in the mid 1990s reflected increased demand and higher utilization rates (McGraw-Hill, 1998). However, the import crisis of the late 1990s and later weakening of the U.S. economy put pressure on the domestic industry, and expenditures for new capacity decreased steadily since 1997 (McGraw-Hill, 2000). In 2004, however, capital expenditures in both the Steel Mills and Steel Products sectors rose by 45 and 11 percent, respectively.

Table C2D-7: Capital Expenditures for the Profiled Steel Industry Segments (millions, $2005)

Year	Steel Mills		Steel Products	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	1,869		831	
1988	2,804	50.0%	633	-23.8%
1989	3,566	27.2%	719	13.5%
1990	3,509	-1.6%	718	-0.1%
1991	3,965	13.0%	511	-28.8%
1992	2,869	-27.6%	527	3.0%
1993	2,256	-21.4%	575	9.2%
1994	3,246	43.9%	664	15.4%
1995	3,348	3.2%	648	-2.4%
1996	3,366	0.5%	698	7.7%
1997[a]	3,046	-9.5%	642	-8.0%
1998[a]	2,993	-1.7%	613	-4.5%
1999[a]	2,537	-15.2%	518	-15.6%
2000[a]	2,308	-9.0%	538	3.9%
2001[a]	1,675	-27.4%	412	-23.4%
2002[a]	1,452	-13.3%	457	10.9%
2003[a]	1,006	-30.7%	454	-0.7%
2004[a]	1,459	45.0%	503	10.8%
Total Percent Change 1987-2004	*-21.9%*		*-39.4%*	
Average Annual Growth Rate	*-1.4%*		*-2.9%*	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2D-2.4 Capacity Utilization

Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization provides insight into the extent of excess or insufficient capacity in an industry, and into the likelihood of investment in new capacity. Figure C2D-4 presents the capacity utilization index from 1989 to 2004 for the 4-digit SIC codes that make up the Steel Mill and Steel Products segments. As shown in the figure, the index follows similar trends in each segment. For all segments, capacity utilization peaked in 1994 and decreased through 2001. Capacity utilization remained relatively constant through 2003 and 2004 for both segments, though the Steel Mills segment showed slight declines during both years. This trend reflects the over-capacity in the U.S. steel industry, which has followed the substantial capacity additions in the late 1980s and early 1990s and increased imports throughout the 1990s. Worldwide capacity remains in excess of long-term needs (S&P, 2004).

Figure C2D-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Steel Industry Segments

Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1989-2004.

C2D-3 Structure and Competitiveness

The companies that manufacture steel operate in a highly capital intensive industry. The Steel Mill segment is comprised of two different kinds of facilities, integrated mills and minimills. The integrated steelmaking process requires expensive plant and equipment purchases that will support production capacities ranging from two million to four million tons per year. Until the early 1960s, integrated steelmaking was the dominant method of U.S. steel manufacturing. Since then, the integrated steel business underwent dramatic downsizing due to competition from minimills and imports. These trends reduced the number of integrated steelmakers (S&P, 2001). Minimills vary in size, from capacities of 150,000 tons at small facilities to larger facilities with annual capacities of between 400,000 tons and two million tons. Integrated companies have significant capital costs of approximately $2,000 per ton of capacity compared with minimills' $500 per ton. Because minimills do not require as much investment in capital equipment as integrated steelmakers, minimills have been able to lower prices, driving integrated companies out of many of the commodity steel markets (S&P, 2001). The advent of minimills, with their lower initial capital investments, has made it easier for new producers to enter the market.

C2D-3.1 Firm Size

For both Steel Mills and Steel Products, the Small Business Administration defines a small firm as having 1,000 or fewer employees. The size categories reported in the Statistics of U.S. Businesses (SUSB) do not correspond with the SBA size classifications, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data. Table C2D-8 below shows the distribution of firms, facilities, and receipts by the employment size of the parent firm. The SUSB data presented in Table C2D-8 show that in 2003, 674 of 748 firms in the Steel Mills segment had less than 500 employees. Therefore, at least 90 percent of firms in this segment were classified as small. These small firms owned 691 facilities, or 80 percent of all facilities in the segment.

Of the 767 firms with facilities that manufacture Steel Products, 677, or 88 percent, employ fewer than 500 employees, and are therefore considered small businesses. Small firms own 78 percent of facilities in the industry.

Table C2D-8: Number of Firms and Facilities by Employment Size Category in the Profiled Steel Industry Segments, 2003[a]

Employment Size Category	Steel Mills		Steel Products	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	491	494	413	413
20-99	120	122	156	161
100-499	63	75	108	140
500+	74	176	91	204
Total	*748*	*866*	*767*	*918*

[a] Before 1998, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

C2D-3.2 Concentration Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal[4]. An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 ($60^2 + 30^2 + 10^2$). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

Table C2D-9 shows that Steel Mills have an HHI of 445 and that Steel Products, comprised of SIC 3315, 3316, and 3317, have HHIs of 223, 631, and 200, respectively. The Steel Mills and Steel Products segments are considered competitive, based on standard measures of concentration. The CR4 and the HHI for the relevant SIC codes are below the benchmarks of 50 percent and 1,000, respectively. Moreover, the table shows that each of the industry segments generally became more competitive between 1987 and 1997. The relatively low concentration

[4] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of production are therefore only one indicator of the extent of competition in an industry.

values suggest that this factor would not increase the industry's overall ability to pass through compliance costs as price increases to customers.

Table C2D-9: Selected Ratios for the Profiled Steel Industry Segments

SIC (S) or NAICS (N) Code	Year	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
Steel Mills							
S 3312	1987	271	44%	63%	81%	94%	607
	1992	135	37%	58%	81%	96%	551
N 331111[b]	1997	191	33%	53%	75%	94%	445
Steel Products							
S 3315	1987	274	21%	34%	54%	78%	212
	1992	271	19%	32%	54%	80%	201
N 331222	1997	199	21%	36%	56%	80%	223
S 3316	1987	156	45%	62%	82%	95%	654
	1992	158	43%	60%	81%	96%	604
N 331221[b]	1997	153	44%	60%	81%	96%	631
S 3317	1987	155	23%	34%	58%	85%	242
	1992	166	19%	31%	53%	80%	194
N 331210	1997	166	20%	30%	52%	82%	200

[a] The *1997 Census of Manufactures* is the most recent concentration ratio data available.

[b] NAICS code represents largest percentage of facilities and value of shipments within this SIC based on *1997 Bridge Between SIC and NAICS*

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

C2D-3.3 Foreign Trade

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

The global market for steel continues to be extremely competitive. From 1945 until 1960, the U.S. steel industry enjoyed a period of tremendous prosperity and was a net exporter until 1959. However, by the early 1960s, foreign steel industries had thoroughly recovered from World War II and had begun construction of new plants that were more advanced and efficient than the U.S. integrated steel mills. Foreign producers also enjoyed lower labor costs, allowing them to take substantial market share from U.S. producers. This increased competition from foreign producers, combined with decreased consumption in some key end use markets, served as a catalyst for the restructuring and downsizing of the U.S. steel industry. The industry emerged from this restructuring considerably smaller, more technologically advanced and internationally competitive (S&P, 2001).

Table C2D-10 presents trade statistics for the profiled steel industry segments from 1990 to 2002. The table shows that while the trend in export dependence has been relatively stable, import penetration increased almost continuously from the early 1990s until 1998 and fluctuated annually during 1999 to 2002. Historically, the U.S. steel industry has exported a relatively small share of shipments compared to the steel industries of other developed nations (McGraw-Hill, 2000). U.S. exports rose in 1995 to the highest level since 1941, and remained relatively high through 2002. Imports penetration rose to 21 percent in 1998, after hovering around 15 percent in the early 1990s. This increase in imports reflected excess steel capacity worldwide and the competitiveness of foreign steel producers, as described previously. Canada received the largest amount of U.S. exported steel in 2003, followed by Mexico. Imports of steel mill products increased 8.4 percent from 2001 to 2002. Brazil, Canada, the EU, Japan, the Republic of Korea, Mexico, Russia, and Turkey were major sources of steel mill product imports (USGS, 2002).

The steel industry's import penetration ratio was 18.2 percent in 2002, implying that the industry currently faces moderate competition from foreign firms in setting prices for U.S. sales. However, as noted above, the removal of temporary import restrictions will leave the industry more exposed to competition from foreign producers. The steel industry's export dependence ratio in 2002 was 7.3 percent; therefore, the industry will not likely be affected by competitive pressures from abroad in export sales. This finding implies that competitive pressures from foreign firms/markets do not characterize the steel industry and thus market power and cost pass through potential are not diminished by export penetration. However, it is questionable that firms in an industry will have a comparatively high cost pass-through potential simply because firms in that industry are not active in export markets. From the standpoint of firms gaining market power, EPA believes that the finding of low export dependence diminishes the importance of export competition as indicator of market power. Thus, other indicators must be relied upon to gauge the amount of market power firms in the steel industry are expected to hold. On balance, the U.S. steel industry is subject to significant international competitive pressure, largely manifesting though the penetration of foreign product into domestic markets. Although the U.S. industry's competitiveness against foreign producers improved in recent years, the industry remains substantially vulnerable to foreign competition, indicating a low likelihood that steel industry producers subject to the 316(b) regulation would be able to pass a material share of compliance costs through to customers.

Table C2D-10: Import Penetration and Export Dependence: Steel Mill Products ($2005)

Year	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
1989	13,710	4,259	87,290	96,742	14.2%	4.9%
1990	12,253	4,064	85,638	93,827	13.1%	4.7%
1991	11,076	5,134	75,827	81,769	13.5%	6.8%
1992	11,040	4,141	75,383	82,282	13.4%	5.5%
1993	11,794	3,789	75,925	83,930	14.1%	5.0%
1994	16,696	3,980	82,449	95,166	17.5%	4.8%
1995	15,709	5,953	87,314	97,070	16.2%	6.8%
1996	16,547	5,191	87,487	98,842	16.7%	5.9%
1997[d]	17,440	6,105	90,133	101,468	17.2%	6.8%
1998[d]	20,886	5,747	86,768	101,908	20.5%	6.6%
1999[d]	16,173	5,249	81,817	92,740	17.4%	6.4%
2000[d]	18,479	5,883	80,551	93,147	19.8%	7.3%
2001[d]	14,044	5,496	69,930	78,479	17.9%	7.9%
2002[d]	14,593	5,132	70,535	79,997	18.2%	7.3%
Total Percent Change 1989-2002	*6.4%*	*20.5%*	*-19.2%*	*-17.3%*		
Average Annual Growth Rate	*0.5%*	*1.4%*	*-1.6%*	*-1.5%*		

[a] Calculated by EPA as shipments + imports - exports.

[b] Calculated by EPA as imports divided by implied domestic consumption.

[c] Calculated by EPA as exports divided by shipments.

[d] Before 1997, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 2006; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2D-4 FINANCIAL CONDITION AND PERFORMANCE

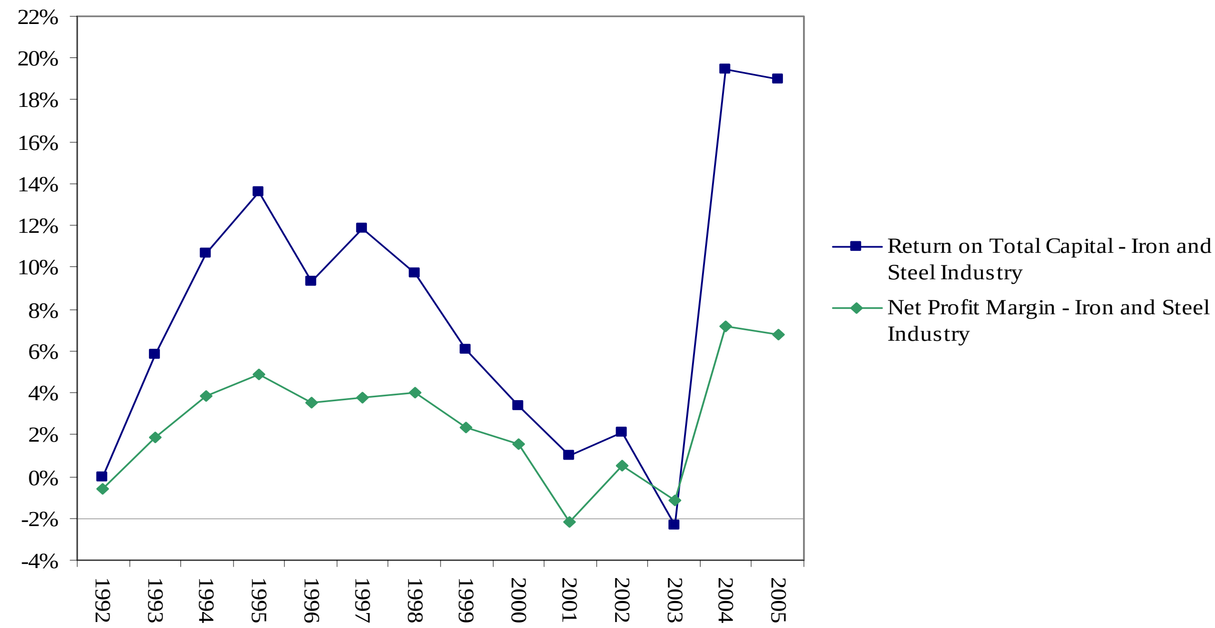
The financial performance and condition of the steel industry are important determinants of its ability to withstand the costs of regulatory compliance without material, adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 14-year period, 1992-2005: net profit margin and return on total capital. EPA calculated these measures as a revenue-weighted index of measure values for public reporting firms in the respective industries, using data from the Value Line Investment Survey. Financial performance in the most recent financial reporting period (2005) is obviously not a perfect indicator of conditions at the time of regulatory compliance. However, examining the trend, and deviation from the trend, through the most recent reporting period gives insight into where the industry *may be*, in terms of financial performance and condition, at the time of compliance. In addition, the volatility of performance against the trend, in itself, provides a measure of the *potential* risk faced by the industry in a future period in which compliance requirements are faced: all else equal, the more volatile the historical performance, the more likely the industry *may* be in a period of relatively weak financial conditions at the time of compliance.

Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient positive profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the steel production process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as the steel industry, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

Return on total capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for *net profit margin*, the firms in an industry, and the industry collectively, must generate over time a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in *net profit margin* will also be the primary sources of short-term variation in *return on total capital*.

Figure C2D-5, following page, presents trends in net profit margins and return on total capital for the steel industry between 1992 and 2003. The graph shows considerable volatility in the trend over this period. After registering improvement in financial performance in the first half of the 1990s, steel industry financial performance declined markedly from 1997/1998 forward to 2003, due first to increasing imports and later to general economic weakness. Measures of financial performance improved in 2002 when the U.S. steel industry received temporary relief with tariffs ranging up to 30 percent on certain steel imports, but in 2003 the integrated steel industry again had poor operating results, as high raw material costs outweighed increased sales and higher volumes. In 2004, the industry rebounded, with returns on both total capital and net profit margins reaching the highest values observed during the entire analysis period. In 2005, the industry saw a slight weakening in financial performance. However, overall financial performance remained substantially higher than in the prior years of the analysis period.

Figure C2D-5: Net Profit Margin and Return on Total Capital for the Iron and Steel Industry



Source: Value Line, 2003; Value Line, 2006.

C2D-5 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Section 316(b) of the Clean Water Act applies to point source facilities that use or propose to use a cooling water intake structure that withdraws cooling water directly from a surface waterbody of the United States. In 1982, the Primary Metals industries as a whole (including Nonferrous and Steel producers) withdrew 1,312 billion gallons of cooling water, accounting for approximately 1.7 percent of total industrial cooling water intake in the United States[5]. The industry ranked 3rd in industrial cooling water use, behind the electric power generation industry, and the chemical industry (1982 Census of Manufactures).

This section provides information for facilities in the profiled steel segments estimated to be subject to regulation under the primary analysis options. Existing facilities that meet all of the following conditions would have been subject to regulation under the three regulatory analysis options:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the U.S., and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have an National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

[5] Data on cooling water use are from the *1982 Census of Manufactures*. 1982 was the last year in which the Census of Manufactures reported cooling water use.

The analysis options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses on the facilities nationwide in the profiled steel segments that are estimated to be subject to regulation under the DIF applicability thresholds defined by the primary analysis options (see Table C2D-1, above for additional information on the broader set of facilities potentially subject to Phase III regulation).[6]

C2D-5.1 Waterbody and Cooling System Type

Minimills use electric-arc-furnaces (EAF) to make steel from ferrous scrap. The electric-arc-furnace is extensively cooled by water, which is in turn recycled through cooling towers (U.S. EPA, 1995). This is important to note since most new steel facilities are minimills.

Table C2D-11, Table C2D-12, and Table C2D-16 show the distribution of Phase III facilities in the profiled steel segments by type of water body and cooling system for each analysis option. The tables show that most of the Phase III facilities employ a combination of a once-through and recirculating systems or an "other" system. The largest proportion of existing facilities draws water from a freshwater stream or river.

Table C2D-11: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System for the Profiled Steel Industry Segments

Water Body Type	Cooling Systems								
	Recirculating		Combination		Once-Through		Other		Total
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Steel Mills									
Freshwater Stream/ River	1	100%	3	29%	1	50%	4	100%	10
Great Lake	0	0%	9	71%	1	50%	0	0%	10
Total[a]	***1***	***6%***	***12***	***61%***	***2***	***12%***	***4***	***22%***	***20***
Steel Products									
Freshwater Stream/ River	0	0%	3	73%	0	0%	0	0%	3
Lake/Reservoir	0	0%	1	27%	0	0%	0	0%	1
Total[a]	***0***	***0%***	***4***	***100%***	***0***	***0%***	***0***	***0%***	***4***
Total for Profiled Steel Industries									
Freshwater Stream/ River	1	100%	7	40%	1	50%	4	100%	13
Great Lake	0	0%	9	53%	1	50%	0	0%	10
Lake/Reservoir	0	0%	1	7%	0	0%	0	0%	1
Total[a]	***1***	***5%***	***16***	***68%***	***2***	***10%***	***4***	***18%***	***24***

[a] Individual numbers may not add up to total due to independent rounding.

Source: *U.S. EPA, 2000; U.S. EPA analysis, 2006.*

[6] EPA applied sample weights to the sampled facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table C2D-12: Number of Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System for the Profiled Steel Industry Segments

Water Body Type	Cooling Systems								Total
	Recirculating		Combination		Once-Through		Other		
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Steel Mills									
Freshwater Stream/ River	0	0%	1	12%	0	0	3	100%	4
Great Lake	0	0%	9	88%	0	0	0	0%	9
Total[a]	***0***	***0%***	10	76%	0	0%	3	24%	***13***
Steel Products									
Freshwater Stream/ River	0	0%	3	100%	0	0%	0	0%	3
Total[a]	***0***	***0%***	3	100%	***0***	***0%***	***0***	***0%***	***3***
Total for Profiled Steel Industries									
Freshwater Stream/ River	0	0%	4	33%	0	0	3	100%	7
Great Lake	0	0%	9	67%	0	0	0	0%	9
Total[a]	***0***	***0%***	13	80%	0	0%	3	20%	***16***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2D-13: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System for the Profiled Steel Industry Segments

Water Body Type	Cooling Systems								Total
	Recirculating		Combination		Once-Through		Other		
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Steel Mills									
Freshwater Stream/ River	1	100%	2	21%	0	0%	4	100%	8
Great Lake	0	0%	9	79%	1	100%	0	0%	10
Total[a]	1	7%	11	62%	1	7%	4	25%	***17***
Steel Products									
Freshwater Stream/ River	0	0%	3	73%	0	0%	0	0%	3
Lake/Reservoir	0	0%	1	27%	0	0%	0	0%	1
Total[a]	***0***	***0%***	4	100%	***0***	***0%***	***0***	***0%***	***4***
Total for Profiled Steel Industries									
Freshwater Stream/ River	1	100%	5	36%	0	0%	4	100%	11
Great Lake	0	0%	9	57%	1	100%	0	0%	10
Lake/Reservoir	0	0%	1	8%	0	0%	0	0%	1
Total[a]	1	5%	15	70%	1	5%	4	20%	***22***

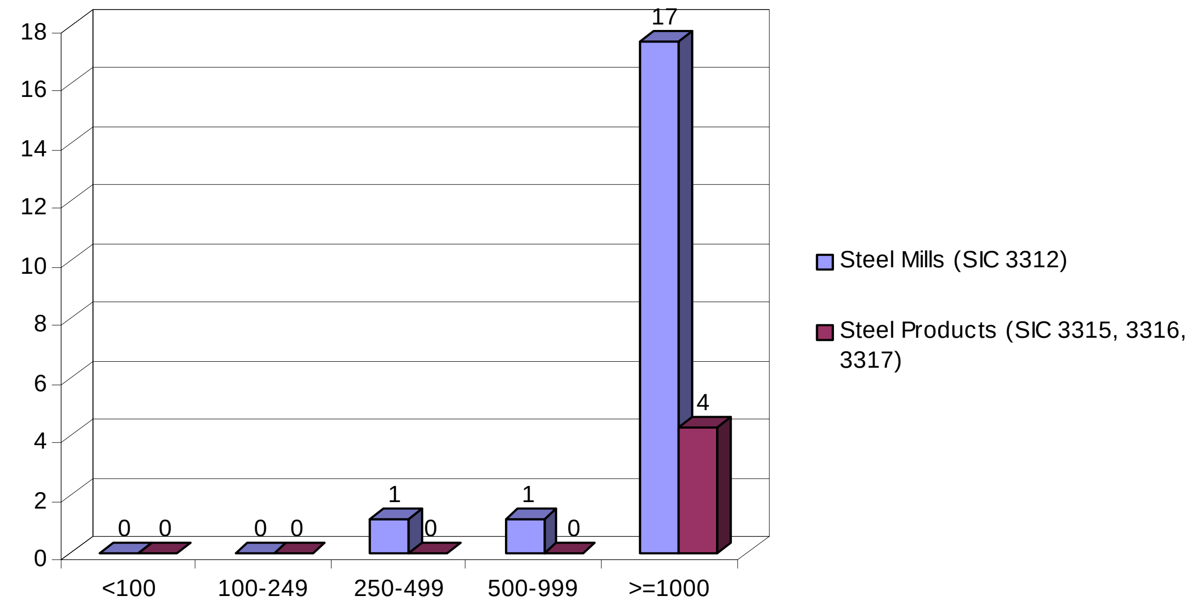
[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2D-5.2 Facility Size

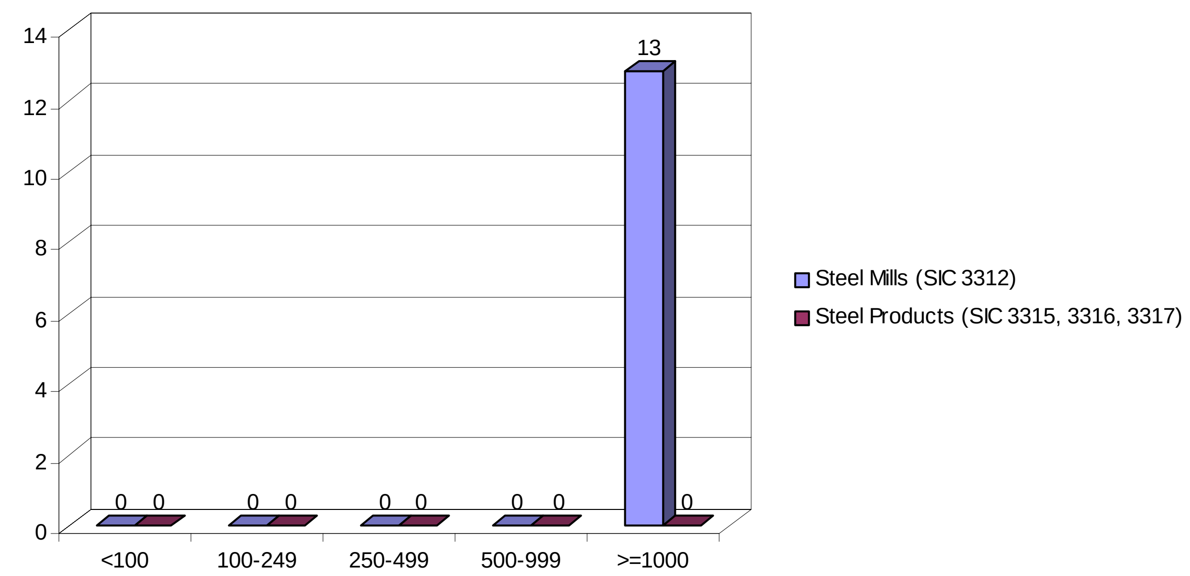
The facilities in the Steel Mills and Steel Products segments that are estimated subject to regulation are relatively large, with no facilities employing fewer than 250 people. Figure C2D-6 show the number of Phase III facilities by employment size category.

Figure C2D-6: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for Profiled Steel Industry Segments



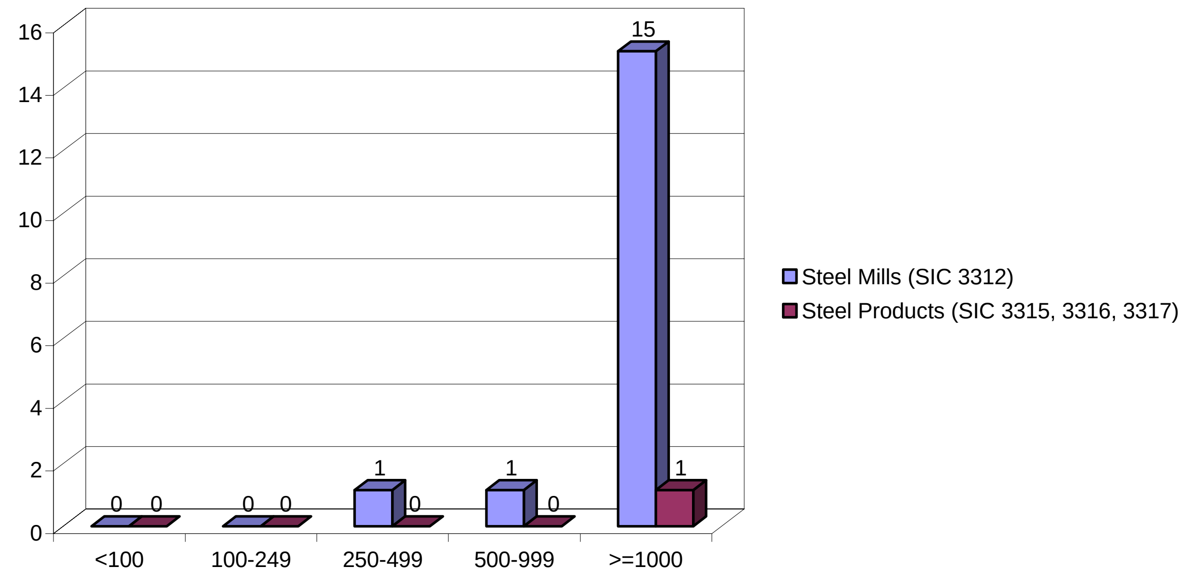
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2D-7: Number of Facilities Estimated Subject to the 200 MGD All Option by Employment Size for Profiled Steel Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2D-8: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size for Profiled Steel Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2D-5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of Section 316(b) profiled steel industry facilities owned by small firms. Firms in the Steel Mills and Steel Products segments are defined as small if they have 1000 or fewer employees. As shown in Table C2D-14, Table C2D-15, and Table C2D-16, large firms own all of the Steel Mill and Steel Products facilities estimated subject to the regulation under the three primary analysis options.

Table C2D-14: Number of Facilities Estimated Subject to the 50 MGD All Option by Firm Size for the Profiled Steel Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
Steel Mills					
3312	20	100%	0	0%	20
Steel Products					
3315	3	100%	0	0%	3
3316	0	0%	0	0%	0
3317	1	100%	0	0%	1
Total	***4***	***100%***	***0***	0%	***4***
Total for Profiled Steel Facilities					
Total[a]	***24***	***100%***	***0***	***0%***	***24***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2D-15: Number of Facilities Estimated Subject to the 200 MGD All Option by Firm Size for the Profiled Steel Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
Steel Mills					
3312	13	100%	0	0%	13
Steel Products					
3315	0	0%	0	0%	0
3316	0	0%	0	0%	0
3317	0	0%	0	0%	0
Total	***0***	***0%***	***0***	0%	***0***
Total for Profiled Steel Facilities					
Total[a]	***13***	***100%***	***0***	***0%***	***13***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2D-16: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size for the Profiled Steel Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
Steel Mills					
3312	17	100%	0	0%	17
Steel Products					
3315	0	0%	0	0%	0
3316	0	0%	0	0%	0
3317	1	100%	0	0%	1
Total	***0***	***0%***	***0***	0%	***0***
Total for Profiled Steel Facilities					
Total[a]	***18***	***100%***	***0***	***0%***	***18***

[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2E: Aluminum (SIC 333/5)

INTRODUCTION

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified two 4-digit SIC codes in the Nonferrous Metals industries (SIC codes 333/335) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes (facilities with these characteristics are hereafter referred to as facilities potentially subject to the Phase III regulation or "potential Phase III facilities").

For these two SIC codes, Table C2E-1, below, provides a description of the industry segment, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), the number of facilities estimated to be potentially subject to regulation based on the minimum withdrawal threshold of 2 MGD, and the number of facilities estimated to be subject to the regulatory analysis options.

CHAPTER CONTENTS

Table C2E-1: Phase III Facilities in the Aluminum Industries (SIC 333/335)

SIC	SIC Description	Important Products Manufactured	Number of Facilities[a]				
			Total	Potentially Regulated Facilities[b]	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
3334	Primary Production of Aluminum	Producing aluminum from alumina and in refining aluminum by any process	31	11	1	1	1
3353	Aluminum Sheet, Plate, and Foil	Flat rolling aluminum and aluminum-base alloy basic shapes, such as rod and bar, pipe and tube, and tube blooms; producing tube by drawing	57	10	3	0	0
		Total	***88***	***21***	***5***	***1***	***1***

[a] Number of weighted detailed questionnaire survey respondents.
[b] Individual numbers may not add up due to independent rounding.
Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

As shown in Table C2E-1, EPA estimates that, out of the total of 88 facilities with a NPDES permit and operating cooling water intake structures in the Aluminum Industries (SIC 333/335), 5 (or 6%) facilities are estimated to be subject to the 50 MGD option, while 1 or (1.1%) facility is expected to be subject to each of the other two regulatory analysis options. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to the regulatory analysis options. Total value of shipments for the Aluminum Industries (SIC 333/335) from the 2004 Annual Survey of Manufacturers is $18.3 billion. Value of shipments, a measure of the dollar value of production, was selected for the basis of this estimate. Because value of shipments data were not collected using the DQ, these data were not available for the sample of Phase III manufacturing facilities potentially subject to the regulatory analysis options. Total revenue, as reported on the DQ, was used as a close approximation for value of shipments for these facilities. EPA estimates the total revenue of facilities in the aluminum industry subject to the 50 MGD, 200 MGD, and 100 MGD options is $5.3 billion, $0.5 billion, and $0.5 billion, respectively. Therefore, EPA estimates that the percentage of total domestic aluminum production that occurs at facilities estimated to be subject to the 50 MGD, 200 MGD, and 100 MGD options is 29%, 3%, and 3%, respectively.

Table C2E-2 provides the crosswalk between SIC codes and the new NAICS codes for the profiled aluminum SIC codes. The table shows that both of the profiled 4-digit SIC codes in the aluminum industry have a one-to-one relationship to NAICS codes.

Table C2E-2: Relationships between SIC and NAICS Codes for the Aluminum Industries (2002[a])

SIC Code	SIC Description	NAICS Code	NAICS Description	Number of Establishments	Value of Shipments ($1000)	Employment
3334	Primary aluminum	331312	Primary aluminum production	40	4,748,435	12,197
3353	Aluminum sheet, plate, and foil	331315	Aluminum sheet, plate, and foil manufacturing	103	11,964,636	19,362

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.

C2E-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of aluminum industry firms to absorb compliance costs under the regulatory analysis options without material adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by two factors: (1) the extent to which the industry can shift compliance costs to its customers through price increases, and (2) the financial health of the industry and its general business outlook.

Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the aluminum industry is moderately concentrated. This potentially supports the notion that firms in this industry may be able to pass a significant portion of their compliance-related costs through to consumers. However, the domestic Primary Aluminum Production segment faces significant competition from imports into the U.S. market. In addition, facilities in the Aluminum Sheet, Plate, and Foil segment have a notable reliance on sales into foreign markets. The substantial competitive pressure from abroad weakens the potential of firms in this industry to pass through to customers a significant portion of their compliance-related costs. As discussed above, given the relatively small proportion of total value of shipments in the industry potentially subject to regulation under the regulatory analysis options, EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the impact analysis of existing

Phase III aluminum facilities has not been met. For these reasons, in its analysis of regulatory impacts for the aluminum industry, EPA assumed that complying firms would be unable to pass compliance costs through to customers: i.e., complying facilities must absorb all compliance costs at the time of compliance (see following sections and Appendix 3, *Cost Pass-Through Analysis*, to *Chapter C3: Economic Impact Analysis for Manufacturers*, for further information).

Financial Health and General Business Outlook

Over the past decade, the aluminum industry, like other U.S. manufacturing industries, has experienced a range of economic/financial conditions, including substantial challenges. In the early 1990s, the domestic aluminum industry was adversely affected by reduced U.S. demand and the dissolution of the Soviet Union, which resulted in substantially increased Russian aluminum exports. Although domestic market conditions improved by mid-decade, weakness in Asian markets, along with growing Russian exports, dampened performance during the latter half of the 1990s. Demand for aluminum industry products declined again in 2000 through 2002, reflecting weakness in both the U.S. and world economies, and again resulted in oversupply and declining financial performance. More recently, as the U.S. economy began recovering from economic weakness, the domestic aluminum industry is showing signs of recovery with higher demand levels and improving financial performance over the course of 2004 and 2005. Although the industry has weathered difficult periods over the past few years, the strengthening of the industry's financial condition and general business outlook suggest improved ability to withstand additional regulatory compliance costs without imposing significant financial impacts.

C2E-2 DOMESTIC PRODUCTION

Commercial production of aluminum using the electrolytic reduction process, known as the Hall-Heroult process, began in the late 1800s. The production of primary aluminum involves mining bauxite ore and refining it into alumina, one of the feedstocks for aluminum metal. Direct electric current is used to split the alumina into molten aluminum metal and carbon dioxide. The molten aluminum metal is then collected and cast into ingots. Technological improvements over the years have improved the efficiency of aluminum smelting, with a particular emphasis on reducing energy requirements. Currently, no commercially viable alternative exists to the electrometallurgical process (Aluminum Association, 2001).

In 2003, aluminum recovered from purchased scrap was about 2.8 million tons, of which about 60% came from new (manufacturing) scrap and 40% from old scrap (discarded aluminum products). Aluminum recovered from old scrap was equivalent to about 17% of apparent consumption (USGS, 2004a). Recycling consists of melting used beverage cans and scrap generated from operations. Recycling saves approximately 95% of the energy costs involved in primary smelting from bauxite (S&P, 2001). In contrast to the steel industry, aluminum minimills have had limited impact on the profitability of traditional integrated aluminum producers. Aluminum minimills are not able to produce can sheet of the same quality as that produced by integrated facilities. As a result, they are able to compete only in production of commodity sheet products for the building and distributor markets, which are considered mature markets. According to Standard & Poor's (2001), construction of new minimill capacity is unlikely given the potential that added capacity would drive down prices in the face of slow growth in the markets for minimill products. No secondary smelters (included, along with secondary smelting of other metals, in SIC code 3341) were reported in EPA's *Detailed Industry Questionnaire*. These facilities are therefore not addressed in this profile.

Facilities in SIC code 3353 produce semi-fabricated products from primary or secondary aluminum. Examples of semi-fabricated aluminum products include (Aluminum Association, undated):

- sheet (cans, construction materials, and automotive parts);
- plate (aircraft and spacecraft fuel tanks);

- foil (household aluminum foil, building insulation, and automotive parts);
- rod, bar, and wire (electrical transmission lines); and
- extrusions (storm windows, bridge structures, and automotive parts).

U.S. aluminum companies are generally vertically integrated. The major aluminum companies own large bauxite reserves, mine bauxite ore and refine it into alumina, produce aluminum ingot, and operate the rolling mills and finishing plants used to produce semi-fabricated aluminum products (S&P, 2001).

As noted, the production of primary aluminum is an electrometallurgical process, which is extremely energy intensive. Electricity accounts for approximately 30% of total production costs for primary aluminum smelting. The aluminum industry is therefore a major industrial user of electricity, spending more than $2 billion annually. The industry has pursued opportunities to reduce its use of electricity as a means of lowering costs. In the last 50 years, the average amount of electricity needed to make a pound of aluminum has declined from 12kilowatt hours to approximately 7 kilowatt hours (Aluminum Association, undated).

C2E-2.1 Output

The largest single source of demand for aluminum is the transportation segment, primarily the manufacture of motor vehicles. Demand for lighter, more fuel-efficient vehicles has increased demand for aluminum in auto manufacturing, at the expense of steel (S&P, 2001). Until 1996, containers were the largest U.S. market for aluminum. Production of beverage cans is a major use of aluminum sheet, and aluminum has entirely replaced steel in the beverage can market. Other major uses of aluminum include construction (including aluminum siding, windows, and gutters) and consumer durables (USGS, 2001a).

Demand for aluminum reflects the overall state of the domestic and world economies, as well as long-term trends in materials use in major end-use sectors. Because aluminum production involves large fixed investments and capacity adapts slowly to fluctuations in demand, the industry has experienced alternating periods of excess capacity and tight supplies. The early 1980s was a period of oversupply, high inventories, and excess capacity. By 1986, excess capacity was closed, inventories were low, and demand increased substantially. The early 1990s were affected by reduced U.S. demand and the dissolution of the Soviet Union, resulting in large increases in Russian exports of aluminum. By the mid-1990s, global production declined, demand rebounded, and aluminum prices rose. Subsequent increased production reflected an overall increase in the demand for aluminum with stronger domestic economic growth, driven by increased consumption by the transportation, container, and construction segments. The economic crises in Asian markets in the later 1990s, along with growing Russian exports, again resulted in a period of oversupply, although U.S. demand for aluminum remained strong. Demand declined again in 2000 through 2002 due to slower growth in both the U.S. and the world economy, resulting in oversupply. The surplus was mitigated somewhat as demand in the automotive and housing markets remained relatively high through mid-2003. In addition, the California energy crisis in 2000 and 2001 reduced production from primary smelters located in the Pacific Northwest (Aluminum Association, 1999; USGS, 1999c; USGS, 1998; USGS, 1994c; Value Line, 2001). Production in China increased during this period, and although increased Chinese consumption helped reduce the surplus slightly, the country switched from being a net importer to a net exporter. Additionally, interest rates are likely to increase which may decrease U.S. demand for aluminum from major industrial end markets (aerospace, automotive, home-construction, and commercial-construction). However, with the economy showing signs of recovery the aluminum industry saw higher demand levels in 2003. If the economy remains strong, demand is expected to continue at 2003 levels (Value Line, 2003a, 2003b; S&P 2004).

Table C2E-3 shows trends in output of aluminum by Primary Aluminum producers and recovery of aluminum from old and new scrap. Secondary production grew from 24% to just over 30% of total domestic production over the period from 1991 to 2005. Primary production of aluminum recorded a net decrease over the 15-year period, with a particularly sharp decline in 2001. As noted above, this decrease reflects reduced domestic and world demand for aluminum, and curtailed production at a number of Pacific Northwest mills caused by the California energy crisis (S&P 2001; USGS, 2001a). Production remained fairly constant for the final four years of the period.

Table C2E-3: U.S. Aluminum Production

Year	Aluminum Ingot					
	Primary Production		Secondary Production (from old scrap)		Total Production	
	Thousand MT	% Change	Thousand MT	% Change	Thousand MT	% Change
1991	4,121		1,320		5,441	
1992	4,042	-1.9%	1,610	22.0%	5,652	3.9%
1993	3,695	-8.6%	1,630	1.2%	5,325	-5.8%
1994	3,299	-10.7%	1,500	-8.0%	4,799	-9.9%
1995	3,375	2.3%	1,510	0.7%	4,885	1.8%
1996	3,577	6.0%	1,580	4.6%	5,157	5.6%
1997	3,603	0.7%	1,530	-3.2%	5,133	-0.5%
1998	3,713	3.1%	1,500	-2.0%	5,213	1.6%
1999	3,779	1.8%	1,570	4.7%	5,349	2.6%
2000	3,688	-2.4%	1,370	-12.7%	5,058	-5.4%
2001	2,637	-28.5%	1,210	-11.7%	3,847	-23.9%
2002	2,707	2.7%	1,170	-3.3%	3,877	0.8%
2003	2,703	-0.1%	1,070	-8.5%	3,773	-2.7%
2004	2,516	-6.9%	1,160	8.4%	3,676	-2.6%
2005[a]	2,500	-0.6%	1,100	-5.2%	3,600	-2.1%
Total percent change 1991-2005	-39.3%		-16.7%		-33.8%	
Average annual growth rate	-3.5%		-1.3%		-2.9%	

Source: USGS 1995a, 1999a, 2002a, 2006a

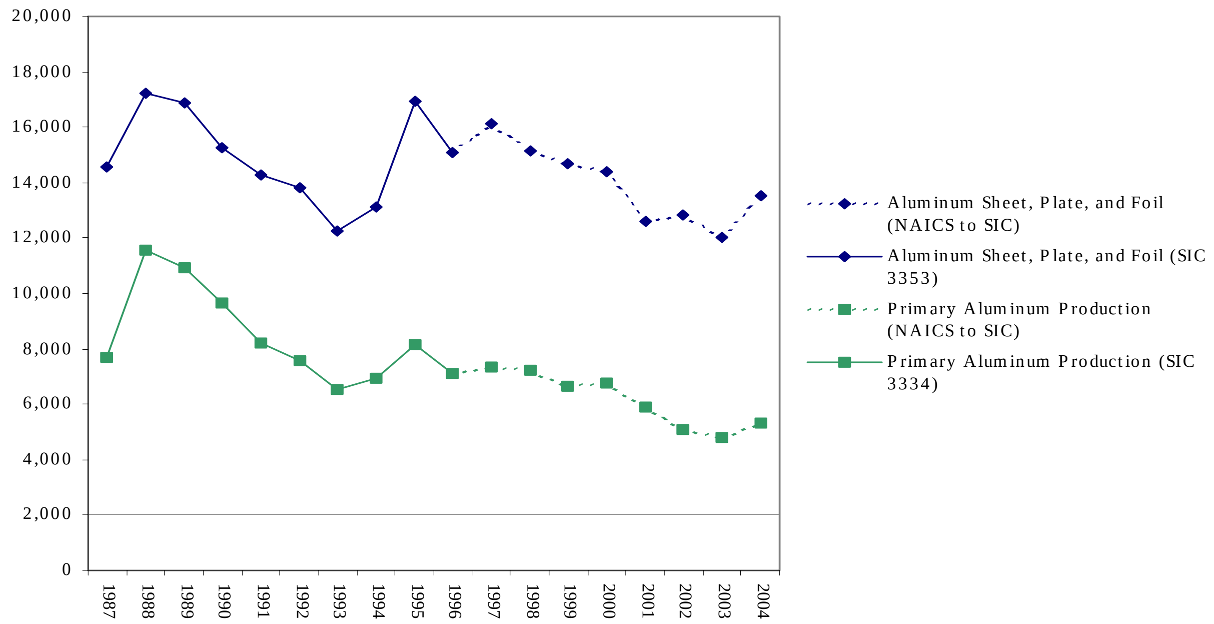
Value of shipments and ***value added*** are two common measures of manufacturing output[1]. Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added, defined as the difference between the value of shipments and the value of inputs used to make the products sold, measures the value of production activity in a particular industry.

Figure C2E-1 reports constant dollar value of shipments and value added for the Primary Aluminum, and Aluminum Sheet, Plate, and Foil segments between 1987 and 2004.

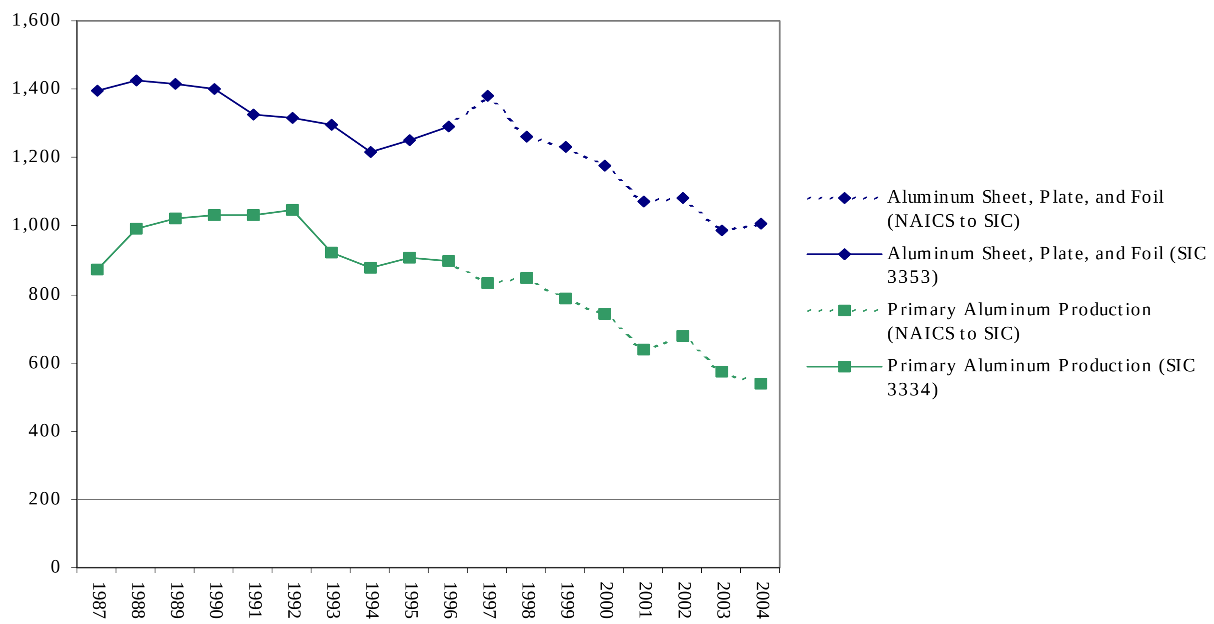
[1] Terms highlighted in bold and italic font are further explained in the glossary.

Figure C2E-1: Value of Shipments and Value Added for Profiled Aluminum Industry Segments (millions, $2005)

Value of Shipments



Value Added



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

The value of Primary Aluminum shipments shows generally the same pattern as the quantity data shown in Table C2E-3. Trends in production over 1990 to 2004 reflect trends in demand for aluminum; both production and value of shipments have fallen with increases n the percentage of domestic demand provided by imports, and in the secondary production of aluminum, which substitutes in some but not all markets for primary production. Value added by aluminum production excludes the value of purchased materials and services (including electricity), and shows less fluctuation since 1990 than value of shipments.

Demand for semi-finished aluminum products reflects demand from the transportation, container, and building industries. Real value of shipments of Aluminum Sheet, Plate, and Foil declined from the late 1980s through 1993, and then recovered by mid-decade, before turning down again in the late 1990s. Demand for semi-finished products has been affected by strong growth in both the container and packaging segment and the auto segment (S&P, 2001).

Both industry segments show lower values for the constant dollar value of shipments and value added at the end of the 18-year analysis period than at the beginning of the period. These declining values reflect the overall maturity of the aluminum production industry and the increasing role of foreign production in meeting total U.S. demand.

C2E-2.2 Prices

The producer price index (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

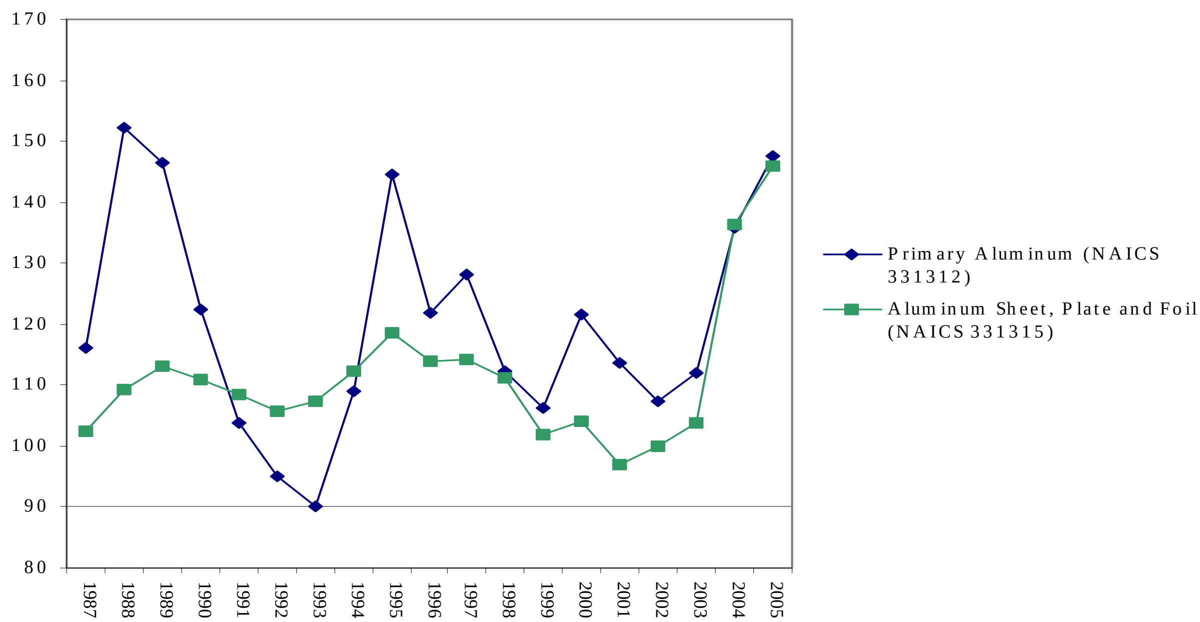
The price trends shown for Primary Aluminum in Figure C2E-2 reflect the fluctuations in world supply and demand discussed in the previous section. During the early 1980s, the aluminum industry experienced oversupply, high inventories, excess capacity, and weak demand, resulting in falling prices for aluminum. By 1986, much of the excess capacity had been permanently closed, inventories had been worked down, and worldwide demand for aluminum increased strongly. This resulted in price increases through 1988, as shown in Figure C2E-2.

In the early 1990s, the dissolution of the Soviet Union had a major impact on aluminum markets. Large quantities of Russian aluminum that formerly had been consumed internally, primarily in military applications, were sold in world markets to generate hard currency. At the same time, world demand for aluminum was decreasing. The result was increasing inventories and depressed aluminum prices.

The United States and five other primary aluminum producing nations signed an agreement in January 1994 to curtail global output, in response to the sharp decline in aluminum prices. At the time of the agreement, there was an estimated global overcapacity of 1.5 to 2.0 million metric tons per year (S&P, 2000).

By the mid-1990s, production cutbacks, increased demand, and declining inventories led to a sharp rebound of prices. Prices declined again during the late 1990s, however, when the economic crises in Asian markets reduced the demand for aluminum (USGS, 2001b). During 2000, prices rebounded sharply despite the continuing trend of high Russian production and exports. However, economic recession caused prices to fall again through 2002(S&P, 2001-2004). Prices seen by both segments increased sharply in 2003, and continued to rise in 2004 and 2005, reaching peak levels for the Aluminum Sheet, Plate and Foil segment.

Figure C2E-2: Producer Price Indexes for Profiled Aluminum Industry Segments



Note: Data for 2005 was preliminary at the time of this writing. The NAICS values shown in this figure match the historical values of the profiled SIC codes. As data by SIC were only available through 2003, the representative NAICS codes are presented for evaluation through 2005.

Source: BLS, 2006.

C2E-2.3 Number of Facilities and Firms

U.S. Geological Survey data indicate that the number of Primary Aluminum facilities and the number of firms that own them remained fairly constant over the period 1995 through 2005, as shown in Table C2E-4. The number of domestic companies and plants sharply declined in 2002 and dropped again in 2004. Furthermore, in 2002, the 10 domestic producers had a total of 7 smelters that were either temporarily or permanently idled. The bulk of the idled capacity resulted from curtailed production at a number of Pacific Northwest mills caused by the California energy crisis. Most of the smelters outside of this region continued to operate at or near their engineered capacities (S&P 2001; USGS, 2001a; USGS, 2002c).

Table C2E-4: Primary Aluminum Production - Number of Companies and Plants

Year	Number of Companies	Number of Plants
1995	13	22
1996	13	22
1997	13	22
1998	13	23
1999	12	23
2000	12	23
2001	12	23
2002	7	16
2003	7	15
2004	6	14
2005	6	15

Source: USGS, 1995a-2006a

Statistics of U.S. Businesses covers a larger number of facilities classified under SIC 3334 than do the USGS data, and also provide data on SIC 3353 (Aluminum Sheet, Plate, and Foil). These data, shown in Table C2E-5 and Table C2E-6, show more fluctuation in the number of establishments and the number of firms.

Table C2E-5 shows that the number of Primary Aluminum facilities decreased by 30 percent between 1991 and 1995, with the majority of this decrease, 27 percent, occurring between 1991 and 1993. The number of facilities in the Aluminum Sheet, Plate, and Foil segment showed a more consistent trend, increasing each year except in 1993. In 1998, the number of facilities decreased in both segments. Since then, the number of Primary Aluminum facilities has continuously grown, while the number of Aluminum Sheet, Plate, and Foil facilities showed some fluctuation.

Table C2E-5: Number of Facilities for Profiled Aluminum Industry Segments

Year	Primary Aluminum Production		Aluminum Sheet, Plate, and Foil	
	Number of Establishments	Percent Change	Number of Establishments	Percent Change
1990	54		64	
1991	57	5.6%	73	14.1%
1992	52	-8.8%	73	0.0%
1993	44	-15.4%	63	-13.7%
1994	41	-6.8%	69	9.5%
1995	40	-2.4%	76	10.1%
1996	51	27.5%	81	6.6%
1997	34	-33.3%	91	12.3%
1998[a]	28	-17.6%	79	-13.2%
1999[a]	29	3.6%	93	17.7%
2000[a]	32	10.3%	103	10.8%
2001[a]	38	18.8%	111	7.8%
2002[a]	50	31.6%	95	-14.4%
2003[a]	54	8.0%	99	4.2%
Total Percent Change 1989-2003	*0.0%*		*54.7%*	
Average Annual Growth Rate	*0.0%*		*3.4%*	

[a] Before 1998, these data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

The trend in the number of firms over the period between 1990 and 2003 is similar to the trend in the number of facilities in both industry segments. Table C2E-6 on the following page presents SUSB information on the number of firms in each segment between 1990 and 2003.

Table C2E-6: Number of Firms for Profiled Aluminum Industry Segments

Year	Primary Aluminum Production		Aluminum Sheet, Plate, and Foil	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	38		43	
1991	41	7.9%	53	23.3%
1992	36	-12.2%	53	0.0%
1993	33	-8.3%	45	-15.1%
1994	30	-9.1%	47	4.4%
1995	30	0.0%	51	8.5%
1996	40	33.3%	56	9.8%
1997	23	-42.5%	66	17.9%
1998[a]	19	-17.4%	56	-15.2%
1999[a]	20	5.3%	66	17.9%
2000[a]	22	10.0%	73	10.6%
2001[a]	28	27.3%	82	12.3%
2002[a]	43	53.6%	74	-9.8%
2003[a]	43	0.0%	76	2.7%
Total Percent Change 1990-2003	*13.2%*		*76.7%*	
Average Annual Growth Rate	*1.0%*		*4.5%*	

[a] Before 1998, these data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

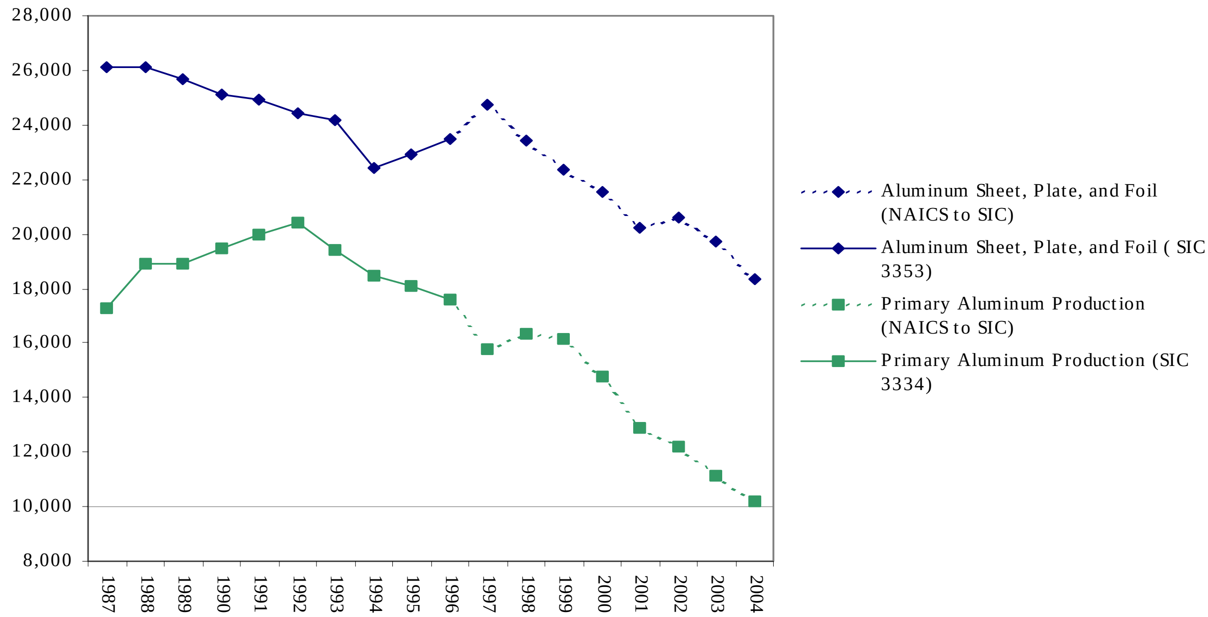
Source: U.S. SBA, 1989-2003.

C2E-2.4 Employment and Productivity

Figure C2E-3, below, provides information on employment from the Annual Survey of Manufactures for the Primary Aluminum and Aluminum Sheet, Plate, and Foil segments. Trends in Primary Aluminum facility employment reflect trends in both production and producers' efforts to compete with less labor-intensive minimills through improvements in labor productivity (McGraw-Hill, 2000). The figure shows that employment in the Primary Aluminum segment has declined steadily since 1992, even in years of increased production.

Employment in the Aluminum Sheet, Plate, and Foil segment declined from 1987 through 1994, but rose between 1995 and 1997, before declining again during 1997 to 2004. Employment in the Primary Aluminum Production segment increased during the 1987 to 1992 period, but fell persistently over the remainder of the 1990s and through 2004.

Figure C2E-3: Employment for Profiled Aluminum Industry Segments



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2E-7 presents the change in value added per labor hour, a measure of labor productivity, for the Primary Aluminum Production and Aluminum Sheet, Plate, and Foil segments between 1987 and 2004. The trend in labor productivity in both segments showed volatility over this period, reflecting variations in capacity utilization. Value added per hour in the Primary Aluminum segment showed a 0.4 percent net increase over the entire period 1987 and 2004. Value added per hour in the Aluminum Sheet, Plate, and Foil segment, however, saw an 11.6 percent decrease over the whole period between 1987 and 2001.

Table C2E-7: Productivity Trends for Profiled Aluminum Segments ($2005)

Year	Primary Production of Aluminum				Aluminum Sheet, Plate, and Foil			
	Value Added (millions)	Production Hours (millions)	Value Added/Hour ($/hour)	Value Added/Hour Percent Change	Value Added (millions)	Production Hours (millions)	Value Added/Hour ($/hour)	Value Added/Hour Percent Change
1987	871	28	31	n/a	1,397	40	35	n/a
1988	991	32	31	-1.5%	1,427	41	35	-0.4%
1989	1,023	30	34	9.1%	1,417	41	35	0.3%
1990	1,031	32	32	-4.9%	1,403	40	35	1.7%
1991	1,031	32	32	0.0%	1,327	39	34	-4.4%
1992	1,046	32	32	0.8%	1,316	40	33	-2.3%
1993	923	29	32	-1.7%	1,298	39	34	2.0%
1994	878	27	33	2.5%	1,219	37	33	-0.7%
1995	907	28	32	-1.8%	1,250	38	33	-1.7%
1996	896	29	31	-1.9%	1,289	39	33	1.5%
1997[a]	831	26	32	1.4%	1,381	41	34	0.8%
1998[a]	849	27	32	0.0%	1,259	39	33	-2.6%
1999[a]	788	26	30	-4.9%	1,229	37	34	2.7%
2000[a]	743	24	30	0.4%	1,178	35	34	1.4%
2001[a]	638	19	33	8.0%	1,071	32	33	-1.8%
2002[a]	678	19	35	7.2%	1,080	33	33	-1.5%
2003[a]	574	18	32	-10.6%	986	32	31	-7.3%
2004[a]	540	17	32	0.2%	1,007	33	31	0.5%
Total Percent Change 1987-2004	*-38.0%*	*-38.3%*	*0.4%*		*-28.0%*	*-18.5%*	*-11.6%*	
Average Annual Growth Rate	*-2.8%*	*-2.8%*	*0.0%*		*-1.9%*	*-1.2%*	*-0.7%*	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2E-2.5 Capital Expenditures

Aluminum production is a highly capital-intensive process. Capital expenditures are needed to modernize, replace, and when market conditions warrant, expand capacity. Environmental requirements also require major capital expenditures.

Capital expenditures in the Primary Aluminum Production and Aluminum Sheet, Plate, and Foil segments between 1987 and 2004 are presented in Table C2E-8. The table shows that capital expenditures in the Primary Aluminum segment increased throughout the early 1990s, reaching a high in 1992 and again in 1998. In between these two periods of increased capital investment there was a significant decrease of 46 percent between 1992 and 1994. These decreases resulted from the production cutbacks and capacity reductions implemented in response to oversupply conditions prevalent in the market for aluminum. Capital expenditures declined between 1999 and 2003, but increased significantly in 2004.

Capital expenditures in the Aluminum Sheet, Plate, and Foil segment also fluctuated considerably between 1987 and 2004, with the highest values occurring in 1990, two years earlier than in the Primary Aluminum segment. Producers of Aluminum Sheet, Plate, and Foil reduced capital expenditures by approximately 50 percent between 1988 and 1997. Outlays increased by 62 percent in 2001, but declined again in both 2002 and 2003.

Table C2E-8: Capital Expenditures for Profiled Aluminum Segments (millions, $2005)

Year	Primary Aluminum Production		Aluminum Sheet, Plate, and Foil	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	266	n/a	673	n/a
1988	217	-18.2%	776	15.4%
1989	260	19.4%	788	1.5%
1990	258	-0.6%	936	18.8%
1991	276	6.8%	753	-19.6%
1992	279	1.2%	543	-27.9%
1993	212	-24.0%	306	-43.6%
1994	150	-29.2%	340	11.1%
1995	185	23.0%	461	35.5%
1996	247	34.0%	478	3.7%
1997[a]	376	52.2%	389	-18.5%
1998[a]	458	21.8%	369	-5.3%
1999[a]	403	-12.2%	373	1.2%
2000[a]	393	-2.3%	389	4.1%
2001[a]	283	-28.0%	630	62.0%
2002[a]	160	-43.3%	310	-50.8%
2003[a]	90	-44.0%	207	-33.2%
2004[a]	129	43.4%	207	0.1%
Total Percent Change 1987-2004	*-51.5%*		*-69.2%*	
Average Annual Growth Rate	*-4.2%*		*-6.7%*	

[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

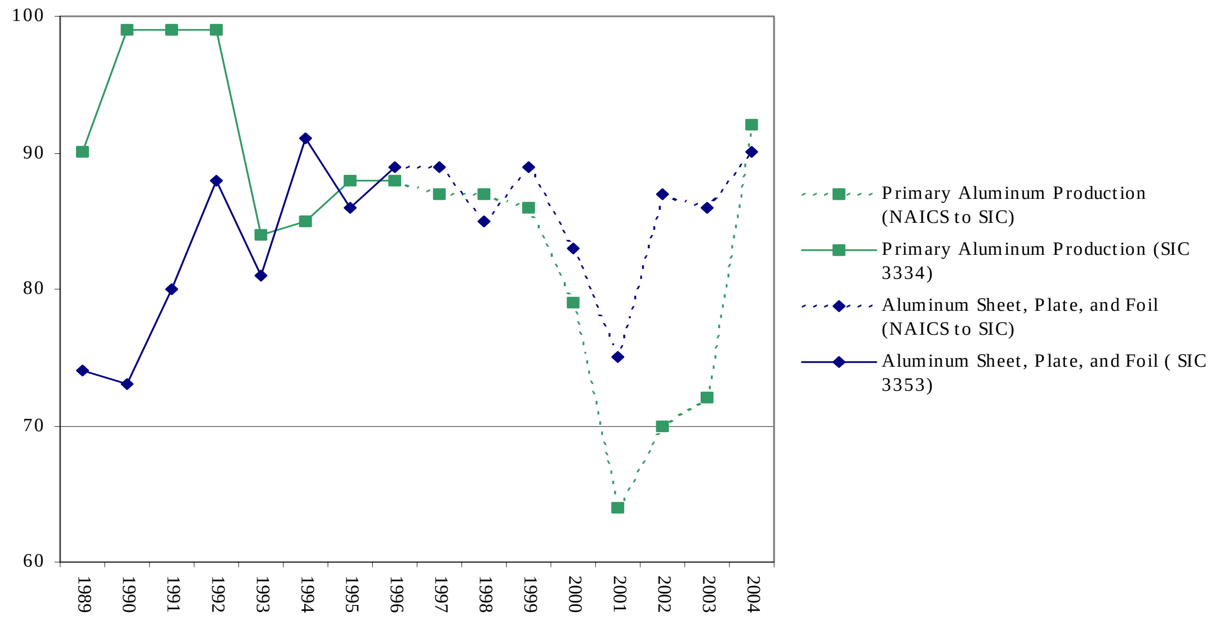
C2E-2.6 Capacity Utilization

Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization reflects excess or insufficient capacity in an industry and is an indication of whether new investment is likely. Capacity utilization is also closely linked to financial performance for industries with substantial fixed costs, such as the aluminum industry. Like integrated steel mills, the aluminum manufacturing process requires a large capital base to transform raw material into finished product. Because of the resulting high fixed costs of production, earnings can be very sensitive to production levels, with high output levels relative to capacity needed for plants to remain profitable.

Figure C2E-4 shows capacity utilization from 1989 to 2004 for the Primary Aluminum Production and Aluminum Sheet, Plate, and Foil segments. The figure shows that for most of the 1990s, the Primary Aluminum segment was characterized by excess capacity. Although capacity utilization for this segment was in the high 90 percent range between 1990 and 1992, domestic utilization fell sharply in 1993 as large amounts of Russian aluminum entered the global market for the first time (McGraw-Hill, 1999). Capacity utilization remained at this lower level through 1999. In 2000 and 2001, capacity utilization fell again reflecting the general weakening of product demand during the Asian economic crisis and later, general economic weakness in the U.S. and world economies. Reflecting the economic recovery, product demand increased and capacity utilization rose during 2002 through 2004. In 2004, capacity utilization for the Primary Aluminum segment was above 90 percent.

Although also experiencing year-to-year fluctuation, capacity utilization in the Aluminum Sheet, Plate, and Foil segment grew overall between 1989 and 1998. This growth resulted largely from the continued strength of rolled aluminum products, which account for more than 50 percent of all shipments from the aluminum industry. Increased consumption by the transportation segment, the largest end-use segment for aluminum sheet, plate, and foil, is responsible for bringing idle capacity into production (McGraw-Hill, 1999) However, falling demand in these segments after 1998 and through 2001, led to a marked fall-off in capacity utilization. Again, reflecting the economic recovery that began in 2002, capacity utilization in this segment had risen substantially by 2004.

Figure C2E-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Aluminum Segments



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1989-2004.

C2E-3 STRUCTURE AND COMPETITIVENESS

Aluminum production is a highly-concentrated industry. A number of large mergers among aluminum producers have increased the degree of concentration in the industry. For example, Alcoa (the largest aluminum producer) acquired Alumax (the third largest producer) in 1998 and Reynolds (the second largest producer) in May 2000. Alcan acquired Algroup in 2000 and Pechiney in 2004. Three companies now account for just over 50 percent of global aluminum output (S&P, 2004). Some sources speculate that, with increased consolidation resulting from mergers, aluminum producers might refrain from returning idle capacity to production as demand for aluminum grows, which could reduce the cyclical volatility in production and aluminum prices that has characterized the industry in the past (S&P, 2000).

C2E-3.1 Firm Size

The Small Business Administration (SBA) defines a small firm for SIC codes 3334 and 3353 as a firm with 1,000 or fewer and 750 or fewer employees, respectively. The Statistics of U.S. Businesses (SUSB) provide employment data for firms with 500 or fewer employees and do not specify data for companies with 500-750 employees for SIC 3353 and 500-1000 for SIC 3334. Therefore, based on 2001 data for firms with up to 500 employees,

- 34 of the 43 firms in the Primary Aluminum Production segment had less than 500 employees. Therefore, at least 79 percent of this segment's firms are classified as small. These small firms owned 35 facilities, or 65 percent of all facilities in the segment.
- 61 of the 76 firms in the Aluminum Sheet, Plate and Foil segment had less than 500 employees. Therefore, at least 80 percent of this segment's firms are classified as small. These small firms owned 62 facilities, or 63 percent of all facilities in the segment.

Table C2E-9 below shows the distribution of firms and facilities in SIC 3334 and 3353 by the employment size of the parent firm.

Table C2E-9: Number of Firms and Facilities by Employment Size Category for the Profiled Aluminum Industry Segments, 2003[a]

Employment Size Category	Primary Aluminum Production		Aluminum Sheet, Plate, and Foil	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	26	26	39	39
20-99	5	6	14	14
100-499	3	3	8	9
500+	9	19	15	37
Total	*43*	*54*	*76*	*99*

[a] Before 1998, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

C2E-3.2 Concentration Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers with more concentrated industries generally having higher barriers.

The four-firm concentration ratio (CR4) and the Herfindahl-Hirschman Index (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal[2]. An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 ($60^2 + 30^2 + 10^2$). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI

[2] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of domestic production are therefore only one indicator of the extent of competition in an industry.

is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

Table C2E-10 shows that Primary Aluminum has an HHI of 1231 and Aluminum Sheet, Plate and Foil has an HHI of 1447. The Primary Aluminum and Aluminum Sheet, Plate, and Foil segments, with HHI values of 1231 and 1447, respectively, appear to be moderately concentrated. Thus, based on this factor, firms in the aluminum industry enjoy moderate amounts of market power, which may enable them to pass-through costs at a more than negligible rate. However, an accurate assessment of the cost pass-through potential of firms in the Aluminum industry must be considered in conjunction with other measures of market power.

The four largest firms in Primary Aluminum Production accounted for 59 percent of total U.S. primary capacity in 1997. Consolidation in the industry since the early 1990s has increased concentration. With the merger of Alcoa, Inc. and Reynolds in May 2000, the single merged company accounted for 50 percent of domestic primary aluminum capacity, and the four largest U.S. producers control 72 percent of the domestic capacity (Alcoa Inc. for 50 percent, Century Aluminum Co. for almost 10 percent, and Noranda Aluminum Inc. and Ormet Primary Aluminum Corp. for 6 percent each) reported at the end of 2002 (USGS, 2002c).

Table C2E-10: Selected Ratios for the Profiled Aluminum Segments, 1987, 1992, and 1997

SIC (S) or NAICS (N) Code	Year	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
S 3334	1987	34	74%	95%	99%	100%	1,934
	1992	30	59%	82%	99%	100%	1,456
N 331312	1997	13	59%	82%	100%	N/A	1,231
S 3353	1987	39	74%	91%	99%	100%	1,719
	1992	45	68%	86%	99%	100%	1,633
N 331315	1997	41	65%	85%	98%	100%	1,447

Note: The *1997 Census of Manufactures* is the most recent concentration ratio data available.

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

C2E-3.3 Foreign Trade

This profile uses two measures of foreign competition: export dependence and import penetration.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

Table C2E-11 reports export dependence and import penetration for both the Primary Aluminum Production and the Aluminum Sheet, Plate, and Foil segments, since 1993. Imports of Primary Aluminum rose dramatically in 1994, primarily due to the large exports from Russian producers. Representatives of major aluminum producing countries met in late 1993 and 1994 to address the excess global supply of primary aluminum. Those discussions resulted in the Russian Federation's agreement to reduce production by 500,000 MTs per year, and plans for other producers to cut their production and to assist Russian producers to improve their environmental performance and stimulate the development of internal demand for the Russian production (USGS, 1994c). Nonetheless, imports have continued to represent a substantial and growing proportion of U.S. demand, reaching an estimated 41 percent in 2002 for Primary Aluminum Production. By 2002, Canada was the largest supplier of imports, supplying more than one-half of total imports. Russia continued to be the second largest supplier of aluminum materials to the U.S. (USGS, 2002c). The majority of U.S. exports (two-thirds) are shipped to Canada and Mexico.

As discussed previously, the import penetration ratio for the Primary Aluminum Production segment in 2002 was 41 percent, which is nearly twice the U.S. manufacturing segment average of 22 percent. The export ratio for Primary Aluminum Production in 2001 was eight percent; therefore, competitive pressures from abroad in export sales are less likely to affect this segment. On balance, the U.S. Primary Aluminum Production segment is subject to significant international competitive pressure, largely manifesting though the penetration of foreign product into domestic markets. This finding indicates a low likelihood that Primary Aluminum producers subject to the 316(b) regulation would be able to pass a material share of compliance costs through to customers.

In 2002, the import penetration ratio for facilities in the Aluminum Sheet, Plate, and Foil segment was 11 percent, which is one-half of the U.S. manufacturing segment average of 22 percent. In 2002, the export dependence ratio for this segment was 13 percent, or just below the average for U.S. manufacturers. This industry segment appears to face lower competition from foreign producers in domestic markets than the Primary Aluminum Production segment, but this segment competes more vigorously in foreign markets, where it is more exposed to foreign competition than the Primary Aluminum Production segment. On balance, this industry segment is likely to face moderate competitive pressure from foreign producers, whether in domestic or export markets, in attempting to recover regulation-induced increases in production costs through price increase.

Overall, the competitive pressure from foreign firms/markets may offset the finding, stated above, that the aluminum industry would appear to possess market power from being a moderately concentrated industry. As a result, from a total market perspective, the industry is not likely to possess any substantial market power advantage in being able to pass compliance costs through to customers as price increases.

Table C2E-11: Import Share and Export Dependence for the Profiled Aluminum Segments ($2005)

Year	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
Primary Aluminum Production						
1993[d]	2,727	686	7,667	9,708	28.1%	9.0%
1994[d]	4,322	666	11,563	15,220	28.4%	5.8%
1995[d]	4,491	840	10,905	14,557	30.9%	7.7%
1996[d]	3,631	815	9,664	12,481	29.1%	8.4%
1997[d]	4,176	738	8,230	11,669	35.8%	9.0%
1998[e]	4,387	643	7,591	11,335	38.7%	8.5%
1999[e]	4,547	702	6,559	10,403	43.7%	10.7%
2000[e]	4,817	714	6,933	11,036	43.6%	10.3%
2001[e]	4,472	511	8,128	12,090	37.0%	6.3%
2002[e]	4,507	464	7,087	11,130	40.5%	6.5%
Total Percent Change 1993-2002	*65.2%*	*-32.4%*	*-7.6%*	*14.6%*		
Average Annual Percent Change	*5.7%*	*-4.3%*	*-0.9%*	*1.5%*		
Aluminum Sheet, Plate, and Foil						
1993[d]	1,062	1,879	14,547	13,730	7.7%	12.9%
1994[d]	1,344	2,294	17,251	16,301	8.2%	13.3%
1995[d]	2,000	3,188	16,869	15,681	12.8%	18.9%
1996[d]	1,533	2,845	15,281	13,968	11.0%	18.6%
1997[d]	1,504	2,865	14,302	12,942	11.6%	20.0%
1998[e]	1,616	2,698	13,820	12,738	12.7%	19.5%
1999[e]	1,650	2,552	12,269	11,367	14.5%	20.8%
2000[e]	1,816	2,576	13,138	12,378	14.7%	19.6%
2001[e]	1,579	2,231	16,912	16,260	9.7%	13.2%
2002[e]	1,693	1,945	15,101	14,849	11.4%	12.9%
Total Percent Change 1993-2002	*59.5%*	*3.5%*	*3.8%*	*8.1%*		
Average Annual Percent Change	*5.3%*	*0.4%*	*0.4%*	*0.9%*		

[a] Calculated by EPA as shipments + imports - exports.

[b] Calculated by EPA as imports divided by implied domestic consumption.

[c] Calculated by EPA as exports divided by shipments.

[d] As no ITA data is available before 1997, Export and Import values are taken from USGS Mineral Yearbooks for years 1993-1997. "Metals and Alloys, Crude" represent SIC 3334 and "Plate, Sheets, Bars, Strip, etc." is equivalent to SIC 3353.

[e] Before 1998, the Department of Commerce compiled data in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: USGS 1993c-1997c; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002; U.S. DOC, 2006.

Table C2E-12 shows trends in exports and imports separately for aluminum metal and alloys and for semi-finished products separately. U.S. aluminum companies have a large overseas presence, which makes it difficult to analyze import data. Reported import data may reflect shipments from an overseas facility owned by a U.S. firm. The import data therefore do not provide a completely accurate picture of the extent to which foreign companies have penetrated the domestic market for aluminum. This table shows that imports have grown substantially in both categories between 1993 and 2004. Exports of primary aluminum have generally declined, with some fluctuation over the period. Exports of semi-finished aluminum products rose steadily until 1999, before declining during 2000 to 2003. Exports did, however, rebound in 2004.

Table C2E-12: Trade Statistics for Aluminum and Semi-fabricated Aluminum Products (Quantities in thousand metric tons; Values in $millions)

Year	Metals and Alloys, Crude				Plate, Sheets, Bars, Strip, etc.			
	Import[a]		Export[b]		Import[a]		Export[b]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1993	1,840	2,150	400	541	400	837	594	1,481
1994	2,480	3,480	339	536	507	1,082	719	1,847
1995	1,930	3,690	369	690	622	1,643	812	2,619
1996	1,910	3,040	417	682	498	1,283	760	2,382
1997	2,060	3,500	352	606	562	1,519	882	2,746
1998	2,400	3,660	265	449	649	1,715	893	2,723
1999	2,650	3,760	318	515	735	1,777	907	2,564
2000	2,490	4,030	273	468	791	2,088	845	2,380
2001	2,560	3,930	192	320	683	1,762	751	2,120
2002	2,790	4,040	206	337	796	1,922	706	1,880
2003	2,870	4,270	214	351	653	1,510	690	1,900
2004	3,250	5,880	298	565	724	1,950	795	2,380
Total Percent Change 1993-2004	*76.6%*	*173.5%*	*-25.5%*	*4.4%*	*81.0%*	*133.0%*	*33.8%*	*60.7%*
Average Annual Growth Rate	*5.3%*	*9.6%*	*-2.6%*	*0.4%*	*5.5%*	*8.0%*	*2.7%*	*4.4%*

Source: USGS 1994c-2004c.

[a] *Table 10: U.S. Imports for Consumption of Aluminum, by Class*

[b] *Table 9: U.S. Exports of Aluminum, by Class*

C2E-4 FINANCIAL CONDITION AND PERFORMANCE

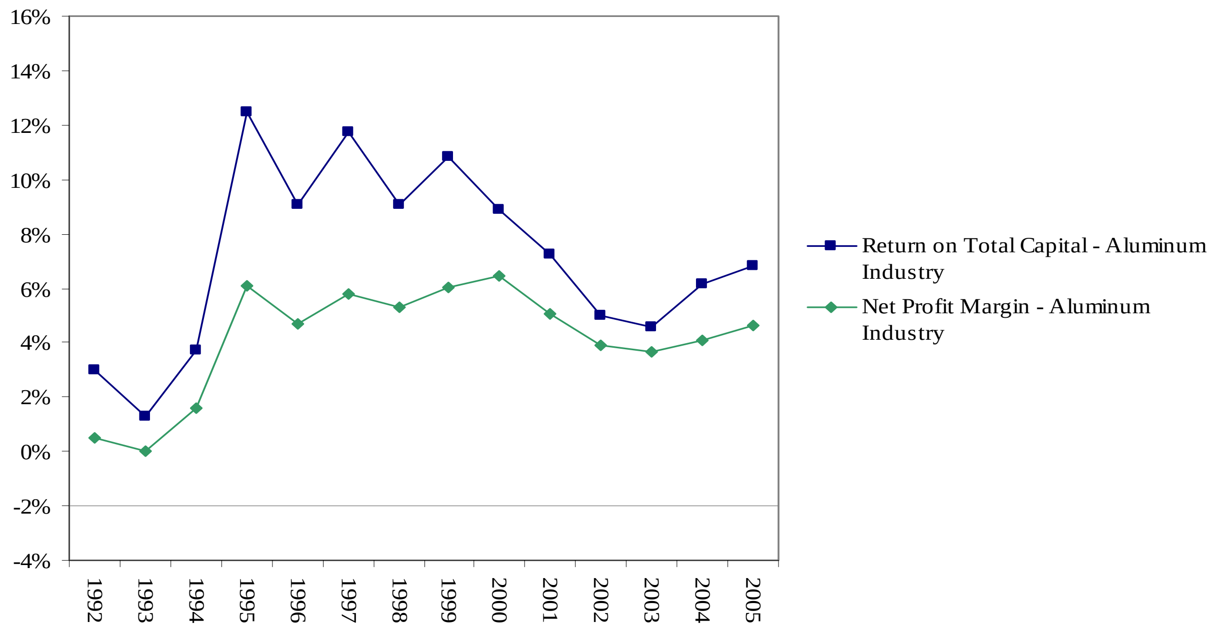
The financial performance and condition of the aluminum industry are important determinants of its ability to withstand the costs of regulatory compliance without material, adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 14-year period, 1992-2005: net profit margin and return on total capital. EPA calculated these measures as a revenue-weighted index of measure values for public reporting firms in the respective industries, using data from the Value Line Investment Survey. Financial performance in the most recent financial reporting period (2005) is obviously not a perfect indicator of conditions at the time of regulatory compliance. However, examining the trend, and deviation from the trend, through the most recent reporting period gives insight into where the industry *may be*, in terms of financial performance and condition, at the time of compliance. In addition, the volatility of performance against the trend, in itself, provides a measure of the potential risk faced by the industry in a future period in which compliance requirements are faced: all else equal, the more volatile the historical performance, the more likely the industry *may be* in a period of relatively weak financial conditions at the time of compliance.

Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenues, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient positive profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from a several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the aluminum production process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as the aluminum industry, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

Return on total capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for net profit margin, the firms in an industry, and the industry collectively, must generate over time a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in net profit margin will also be the primary sources of short-term variation in return on total capital.

Figure C2E-5, following page, shows net profit margin and return on total capital for the aluminum industry between 1992 and 2005. The graph shows considerable volatility. Performance was very low between 1988 and 1993, reflecting general economic weaknesses and oversupply in the market (McGraw-Hill, 2000). By the mid-1990s, performance improved as demand recovered and aluminum prices increased. Performance declined again though in 2000 through 2002, reflecting economic downturn in both the U.S. and world economies. By 2003, financial performance began to level off compared to the significant declines experienced in the three prior years and by 2004, had begun to improve. The industry saw further improvements in financial performance in 2005. These results point to improving financial performance in 2006 and beyond as U.S. economic conditions continue to strengthen.

Figure C2E-5: Net Profit Margin and Return on Total Capital for the Aluminum Industry



Source: Value Line, 2003c; Value Line, 2006.

C2E-5 Facilities Operating Cooling Water Intake Structures

Section 316(b) of the Clean Water Act applies to point source facilities that use or propose to use a cooling water intake structure that withdraws cooling water directly from a surface waterbody of the United States. In 1982, the Primary Metals industries as a whole (including Steel and Non-ferrous producers) withdrew 1,312 billion gallons of cooling water, accounting for approximately 1.7 percent of total industrial cooling water intake in the United States[3]. The industry ranked 3rd in industrial cooling water use, behind the electric power generation industry, and the chemical industry (1982 Census of Manufactures).

This section provides information for facilities in the profiled aluminum segments estimated to be subject to regulation under the regulatory analysis options. Existing facilities that meet all of the following conditions would have been subject to the regulation under the three regulatory analysis options:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the U.S., and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have an National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

[3] Data on cooling water use are from the *1982 Census of Manufactures*. 1982 was the last year in which the Census of Manufactures reported cooling water use.

The regulatory options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses on the facilities nationwide in the profiled steel segments that are estimated to be subject to regulation based on the design intake flow and waterbody applicability criteria set forth in the regulatory analysis options (see Table C2E-1, above for additional information on the broader set of facilities potentially subject to regulation).[4]

C2E-5.1 Waterbody and Cooling System Type

Table C2E-13, Table C2E-14, and Table C2E-18 show the distribution of Phase III facilities in the profiled aluminum segment by type of water body and cooling system. The table shows that the majority of the potential Phase III facilities use a once-through cooling system. None of the facilities withdraw from an estuary, the most sensitive type of water body.

Table C2E-13: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System for the Profiled Aluminum Segments

Water Body Type	Cooling System				
	Recirculating		Once-Through		Total
	Number	% of Total	Number	% of Total	
Primary Production of Aluminum					
Lake or Reservoir	1	100%	0	0%	1
Aluminum Sheet, Plate, and Foil					
Great Lake	0	0%	3	100%	3
Total for Profiled Aluminum Facilities					
Lake or Reservoir	1	100%	0	0%	1
Great Lake	0	0%	3	100%	3
Total	***1***	***27%***	***3***	***73%***	***4***

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

[4] EPA applied sample weights to the sampled facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table C2E-14: Number of Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System for the Profiled Aluminum Segments

Water Body Type	Cooling System				
	Recirculating		Once-Through		Total
	Number	% of Total	Number	% of Total	
Primary Production of Aluminum					
Lake or Reservoir	1	100%	0	0%	1
Aluminum Sheet, Plate, and Foil					
Total	0	0%	0	0%	0
Total for Profiled Aluminum Facilities					
Lake or Reservoir	1	100%	0	0%	1
Total	***1***	***100%***	***0***	***0%***	***1***

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2E-15: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System for the Profiled Aluminum Segments

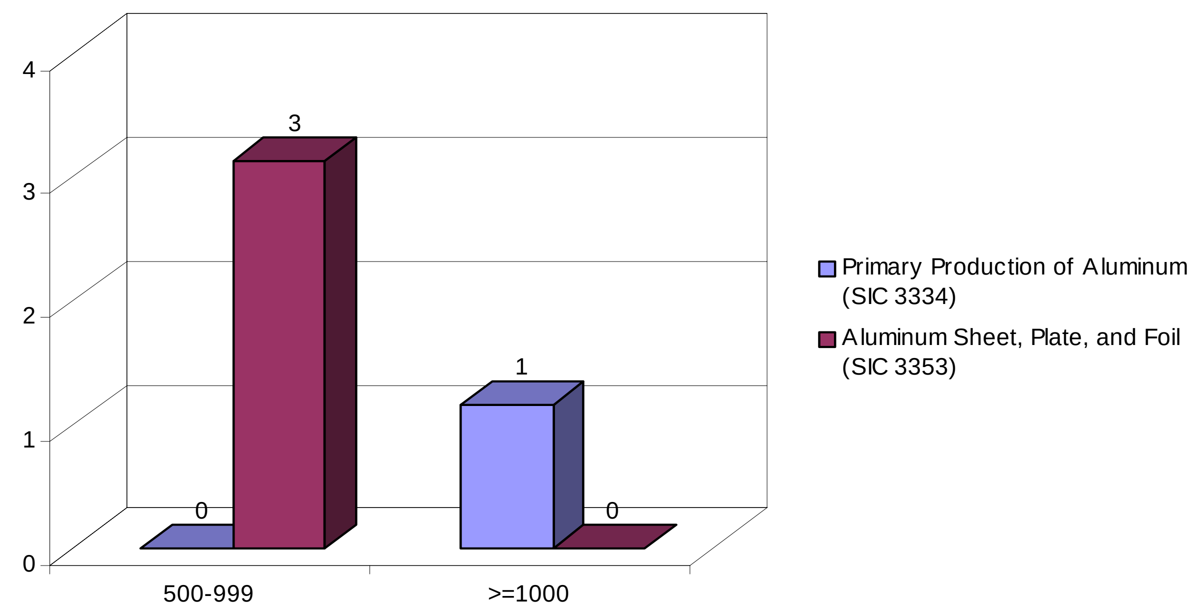
Water Body Type	Cooling System				
	Recirculating		Once-Through		Total
	Number	% of Total	Number	% of Total	
Primary Production of Aluminum					
Lake or Reservoir	1	100%	0	0%	1
Aluminum Sheet, Plate, and Foil					
Total	0	0%	0	0%	0
Total for Profiled Aluminum Facilities					
Lake or Reservoir	1	100%	0	0%	1
Total	***1***	***100%***	***0***	***0%***	***1***

Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2E-5.2 Facility Size

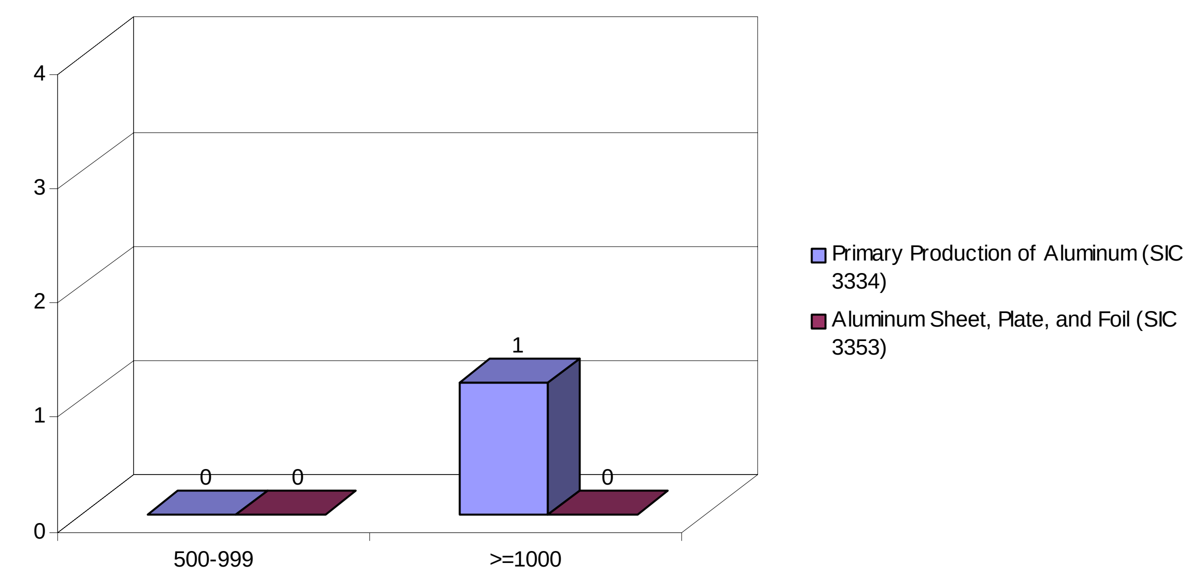
The 316(b) facilities in the aluminum industry are relatively large. The single Primary Aluminum producer employs at least 1,000 people, while all three Aluminum Sheet, Plate and Foil manufacturers have between 500 and 999 employees. Figure C2E-6 show the number of Phase III facilities by employment size category.

Figure C2E-6: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for the Profiled Aluminum Segments



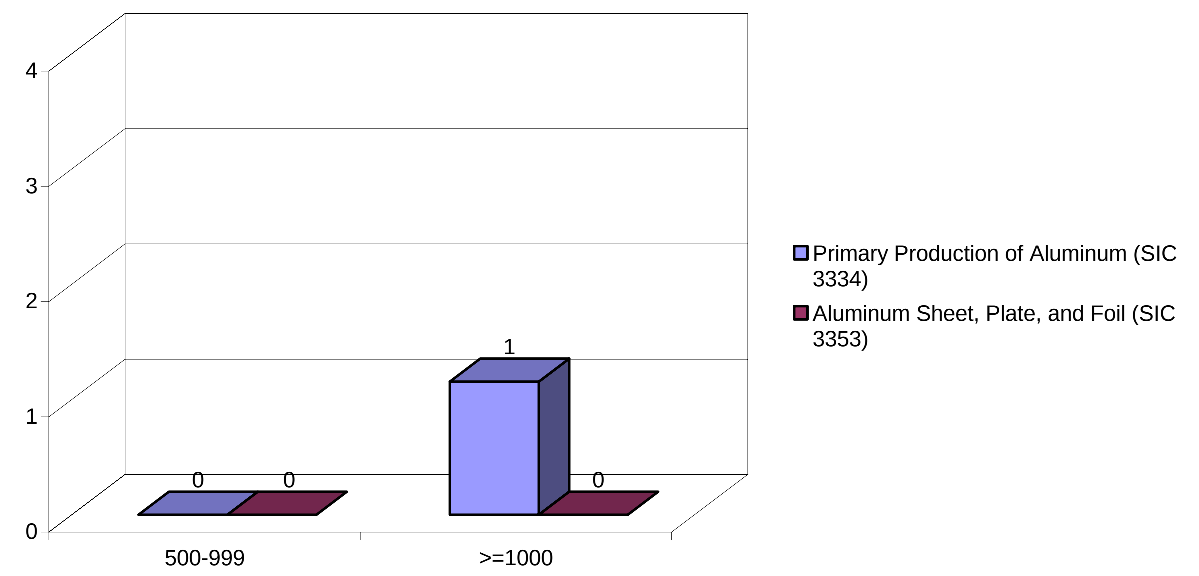
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2E-7: Number of Facilities Estimated Subject to the 200 MGD All Option by Employment Size for the Profiled Aluminum Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2E-8: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size for the Profiled Aluminum Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2E-5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of Section 316(b) profiled aluminum industry facilities owned by small firms. Firms in the Primary Production of Aluminum segment are defined as small if they have 1000 or fewer employees; firms in the Aluminum Sheet, Plate, and Foil segment are defined as small if they have 750 or fewer employees. Table C2E-16, Table C2E-17, and Table C2E-18 show that large firms own all of the aluminum facilities estimated subject to regulation under the regulatory analysis options.

Table C2E-16 Number of Facilities Estimated Subject to the 50 MGD All Option by Firm Size for the Profiled Aluminum Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
3334	1	100%	0	0%	1
3353	3	100%	0	0%	3
Total	*4*	*100%*	*0*	*0%*	*4*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2E-17: Number of Facilities Estimated Subject to the 200 MGD All Option by Firm Size for the Profiled Aluminum Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
3334	1	100%	0	0%	1
3353	0	0%	0	0%	0
Total	*1*	*100%*	*0*	*0%*	*1*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2E-18: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size for the Profiled Aluminum Segments

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
3334	1	100%	0	0%	1
3353	0	0%	0	0%	0
Total	*1*	*100%*	*0*	*0%*	*1*

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2F: Profile of Food and Kindred Products Industry (SIC 20)

CHAPTER CONTENTS

INTRODUCTION

In framing its analysis and data gathering for the section 316(b) Regulation for Phase III Facilities, EPA initially focused on the electric power industry and five manufacturing industries – Paper, Chemicals, Petroleum, Aluminum, Steel (the "Primary Manufacturing Industries") – that were estimated to account for over 90 percent of cooling water usage, according to Census of Manufactures data. Accordingly, EPA targeted its *Detailed Industry Questionnaire* (the "DQ") to these industries. Although the DQ was targeted to these industries, EPA received 22 questionnaires from in-scope facilities with operations in industries other than these major cooling-water intensive industries (these industries are referred to as the "Other Industries"). These questionnaires were received as part of the non-utility electric power generators sample frame; however, further inspection found these facilities to be cooling water-dependent facilities whose primary operations lie in businesses outside the electric power industry or Primary Manufacturing Industries.

These 22 questionnaires represent eight 2-digit SIC industries: Agriculture Production - Crops (SIC 01); Metal Mining (SIC 10); Mining and Quarrying of Nonmetallic Minerals, except fuels (SIC 14); Food and Kindred Products (SIC 20); Textile Mill Products (SIC 22); Lumber and Wood Products, except furniture (SIC 24); Fabricated Metal Products, except machinery and transportation equipment (SIC 34); and Transportation Equipment (SIC 37). However, over half (12)of the 22 questionnaires received were from facilities in the Food and Kindred Products industry (SIC 20). Moreover, from the 1982 Census of Manufactures (the most recent Economic Census to report data on cooling water use by industrial sector), the Food and Kindred Products sector was the fifth largest user of cooling water – i.e., the next 2-digit SIC sector behind the Primary Manufacturing Industries (both Aluminum and Steel fall under the 2-digit SIC 33 for primary metal industries). Given the substantial number of questionnaires received from in-scope facilities in the Food and Kindred Products industry, and its relatively high reliance on cooling water, EPA prepared an industry profile for the Food and Kindred Products industry.

EPA used the cooling water usage-based multiplier of 3.11, as documented at NODA and in the public record of the Phase III final regulation, to estimate the industry-level costs and impacts of Phase III regulatory compliance for the Food and Kindred Products industry. Therefore, these 12 sampled facilities represent 37 facilities in the Food and Kindred Products Industry. Table C2F-1, following page, lists the five 4-digit SIC codes from which the 22 Food and Kindred Products industry surveys were received, the number of potentially regulated facilities (based on a minimum applicability threshold of two MGD), and the number of facilities estimated to be subject to regulation under the regulatory analysis options. Although the questionnaires received fall in only five of the forty-eight 4-digit SIC codes within the Food and Kindred Products industry, EPA knows of no basis to exclude any of the remaining 4-digit codes from consideration in this profile. Accordingly, this profile focuses on the entirety of SIC 20, Food and Kindred Products.

Table C2F-1: Phase III Facilities in the Food and Kindred Products Industry (SIC 20)

SIC	SIC Description	Important Products Manufactured	Potentially Regulated Facilities	Subject to 50 MGD All Option	Subject to 200 MGD All Option	Subject to 100 MGD CWB Option
2046	Wet Corn Milling	Corn oil cake and meal; corn starch; corn syrup; dextrose, fructose; glucose; high fructose syrup; starches	12	6	3	3
2061	Cane sugar, except refining	Cane sugar; molasses; granulated sugar; powdered sugar; raw sugar; cane syrup (all made from sugarcane)	2	0	0	0
2062	Cane sugar refining	Molasses, blackstrap; granulated sugar; powdered sugar; refined sugar; syrup (all made from purchased raw cane or sugar syrup)	12	0	0	0
2063	Beet sugar	Beet sugar; molasses; granulated sugar; liquid sugar; powdered sugar; syrup (all made from sugar beets)	6	0	0	0
2085	Distilled and blended liquors	Distilled and blended liquors, except brandy; gin; rum; vodka; whiskey; cocktails; cordials; eggnog; grain alcohol for medicinal and beverage purposes	3	3	0	3
		Total SIC Code 20	**37**	9	3	6

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2006.

The Food and Kindred Products industry includes facilities that process or manufacture food and beverages for human consumption, feed for animals, and other related products. Statistics for the industry were previously recorded under the Standard Industry Classification (SIC) code of 20, for Food and Kindred Products. SIC 20 included 9 industry groups at the 3-digit SIC level, and 48 industries at the 4-digit SIC level. Under the SIC system, beverage manufacturing was included in SIC 20, the Food and Kindred Products sector. In 1997, the U.S. Census Bureau began reporting economic activity in the North American Industry Classification System (NAICS), which replaced the SIC system (U.S. DOC, 1997a). Under NAICS, the previous SIC 20 sector is recorded in two 3-digit NAICS sectors: (1) NAICS 311, Food Manufacturing, and (2) NAICS 312, Beverage and Tobacco Product Manufacturing. This profile focuses on NAICS 311, Food Manufacturing, and NAICS 3121, the Beverage Manufacturing subsector within NAICS 312, and excludes consideration, to the extent possible, of the tobacco-manufacturing sector. Because the analysis period for this profile extends across the SIC-to-NAICS transition, most of the data series presented in the profile include data from both the SIC system and NAICS: for years before 1997, data are from the SIC system; for 1997 and after, data are from NAICS. Table C2F-2, following page, summarizes the relationship between SIC and NAICS codes used for this profile and provides summary information on the relevant NAICS sectors from the 2002 Economic Census.

Table C2F-2: Relationship between SIC and NAICS Codes for the Food Manufacturing and Beverage Manufacturing Segments (2002[a])

SIC Code	SIC Description	NAICS Code	NAICS Description	Establishments	Value of Shipments ($000)	Employment
20-- (excluding 2082, 2084, 2085, 2086, and 2097)	Food and Kindred Products	311	Food Manufacturing	27,897	456,586,656	1,505,776
2082	Malt Beverages	3121	Beverage Manufacturing	2,903	65,153,490	136,074
2084	Wines, Brandy, and Brandy Spirits					
2085	Distilled and Blended Liquors					
2086	Bottled and Canned Soft Drinks and Carbonated Waters					
2097	Manufactured Ice					

[a] Industry data for relevant NAICS codes from the 2002 Economic Census.

Source: U.S. DOC, 1997; U.S. DOC, 1987, 1992, 1997, and 2002.

C2F-1 SUMMARY INSIGHTS FROM THIS PROFILE

A key purpose of this profile is to provide insight into the ability of firms in the Food and Kindred Products industry to absorb compliance costs from the regulatory analysis options without material adverse economic/financial effects. The industry's ability to withstand compliance costs is primarily influenced by two factors: (1) the extent to which the industry may be expected to shift compliance costs to its customers through price increases and (2) the financial health of the industry and its general business outlook.

Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the Food Manufacturing and Beverage Manufacturing segments face somewhat limited foreign competitive pressures, and, based on this factor, would have some latitude to pass through to customers any increase in production costs resulting from regulatory compliance. However, within the U.S. market, the Food Manufacturing and Beverage Manufacturing segments have relatively low concentrations. Although niche product and/or regional segments are likely to face lighter overall competition, the lack of industry concentration, as described later in this profile, suggests that firms in this industry may have little ability to recover compliance costs through increased prices – particularly if the increased costs do not occur in a relatively uniform way throughout the industry. Given the likelihood that only a relatively small subset of facilities and firms in this industry will face additional costs as a result of the regulatory options considered for the section 316(b) Phase III regulation, EPA believes that a conservative assumption of no-cost-pass-through is appropriate for analysis of the impact on this industry. For the facility impact analysis, EPA therefore assumed that Food and Kindred Products facilities would not be able to pass on to customers any increases in production costs incurred through compliance with the regulatory options considered for the section 316(b) Phase III regulation – i.e., the firms would absorb all regulatory compliance costs.

Financial Health and General Business Outlook

Unlike the more cyclical sectors in the Primary Manufacturing Industries, the Food and Kindred Products industry, being a consumer staples industry, was not as strongly affected by the economic downturn that occurred in the early 2000s. The industry was able to maintain a moderate level of positive financial performance over the data period, and recent trends suggest the industry should be able to continue the moderate, steady growth, accompanied by moderate financial performance, that it has historically achieved. In an effort to increase sales, profits, and market share, Food and Kindred Products industry firms have pursued mergers and acquisitions, looked into foreign market opportunities, reduced costs, and introduced new products (Harris, 2002). In addition, the industry has exhibited substantially less fluctuation in capacity utilization and financial performance than more cyclical industries, such as the five Primary Manufacturing Industries. Though foreign competition is growing, the industry also experiences less international competition than firms in the Primary Manufacturing Industries, as indicated by the industry's lower reliance on export sales and the lower extent of import penetration in domestic markets. On the whole, the Food and Kindred Products industry has maintained a steadily increasing level of capital expenditures over the data period and has correspondingly recorded moderately increasing labor productivity. These factors suggest that the industry's capital equipment base has been maintained and regularly improved over the analysis period, and that the business faces no inordinate needs for capital expenditure due, for example, to offset a period in which capital expenditure substantially retrenched because of declining business performance. Within the broader Food and Kindred Products industry, the Food Manufacturing segment has generally achieved more stable growth and financial performance than the Beverage segment. Nevertheless, the general financial health and outlook for the overall industry appear positive. Favorable product demand trends, efficient production capability, and effective management of production costs and supply chains all point to a favorable industry outlook, both near and longer term. As a result, EPA concludes that the Food and Kindred Products industry should be able to withstand the cost of section 316(b) Phase III compliance requirements under the regulatory options without material adverse financial impact. Indeed, EPA judges overall that the Food and Kindred Products industry is currently in better economic/financial condition overall than the Primary Manufacturing Industries.

C2F-2 DOMESTIC PRODUCTION

The Food and Kindred Products industry is one the largest manufacturing industries in the United States, with the Food Manufacturing and Beverage segments accounting for approximately one-sixth of U.S. industrial activity (McGraw-Hill, 2000). The Food Manufacturing segment alone accounts for over 10 percent of all manufacturing shipments (U.S. DOC, undated). The industry is considered mature, however, and firms are seeking new avenues for increased sales. With total food industry shipments growing more slowly than GDP, U.S. producers have actively sought growth opportunities in overseas markets. Although exports still represent a small share of domestic shipments, changes in global food consumption could lead to increased demand and trade for processed food products. As developing countries experience growth in income, the demand for higher quality food products, such as meat products, present an opportunity for U.S. firms to increase exports. In developed countries, consumer demand for food is based more on tastes, quality, convenience, and value added, again providing an avenue for firms to expand sales (U.S. DOC, undated).

C2F -2.1 Output

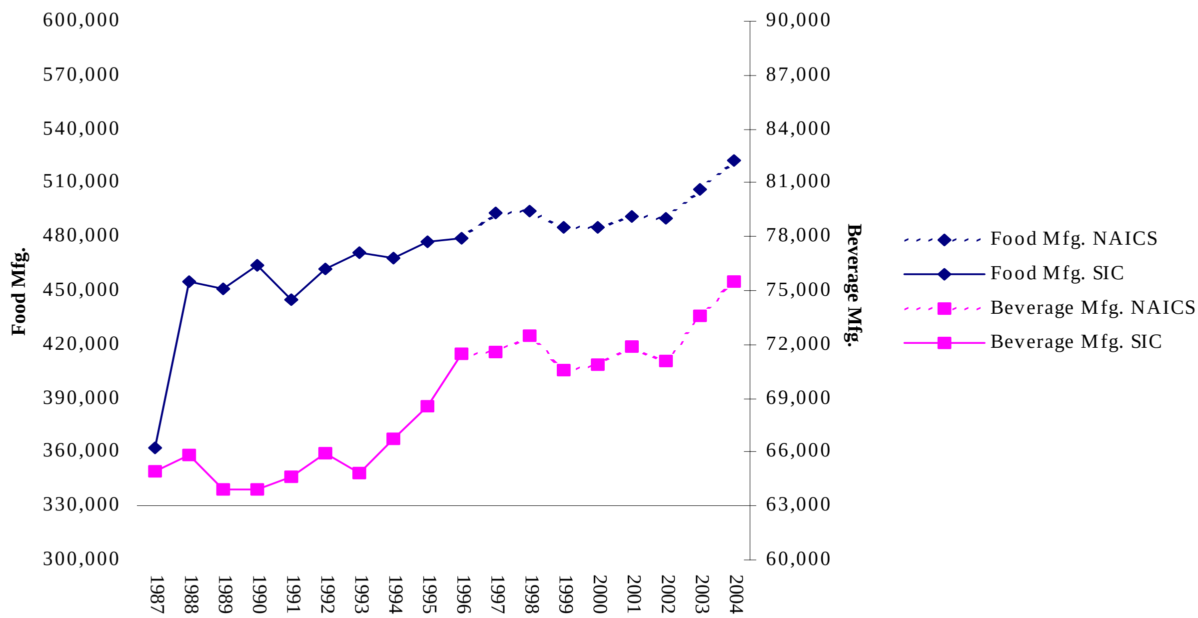
Figure C2F-1 and Figure C2F-2, following pages, show trends in constant dollar ***value of shipments*** and ***value added*** for the Food Manufacturing and Beverage Manufacturing segments.[1] Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall size of a market or the size of a firm in relation to its market or competitors. Value added, defined as the difference between the value of shipments and the value of inputs used to make the products sold, measures the value of production activity in a particular industry.

The trends over time in value of shipments and value added show that both the Food Manufacturing and Beverage Manufacturing segments have achieved generally stable performance over the 1987-2004 period: these industries

[1] Terms highlighted in bold and italic font are further explained in the glossary.

have not been substantially affected by fluctuations in the performance trend of the aggregate U.S. economy. The lack of major swings in shipments and value added results largely from the consumer staple-character of the industry. Over the 1987-2004 period, both segments ended with a higher total value of shipments and value added (in inflation-adjusted dollars) than in 1987. In 2003, 40 percent of respondents to Food Engineering's *State of Food Manufacturing Survey* expected output to increase by over 6 percent, with almost 20 percent forecasting an increase of up to 6 percent in output (Higgins, 2003). In 2004, the value of shipments rose by 3.1 and 2.5 percent for the Food Manufacturing and Beverage Manufacturing industries, respectively. Over the 18-year time period analyzed, Food Manufacturing and Beverage Manufacturing segments increased their value of shipments by 44 percent and 16 percent, respectively. Increases in value added over the period were 89 percent for Food Manufacturing, and 33 percent for Beverage Manufacturing. The general trends suggest that firms in these industries have been able to increase shipments and value added, a sign that the industries are able to find ways to expand their market and continue to grow.

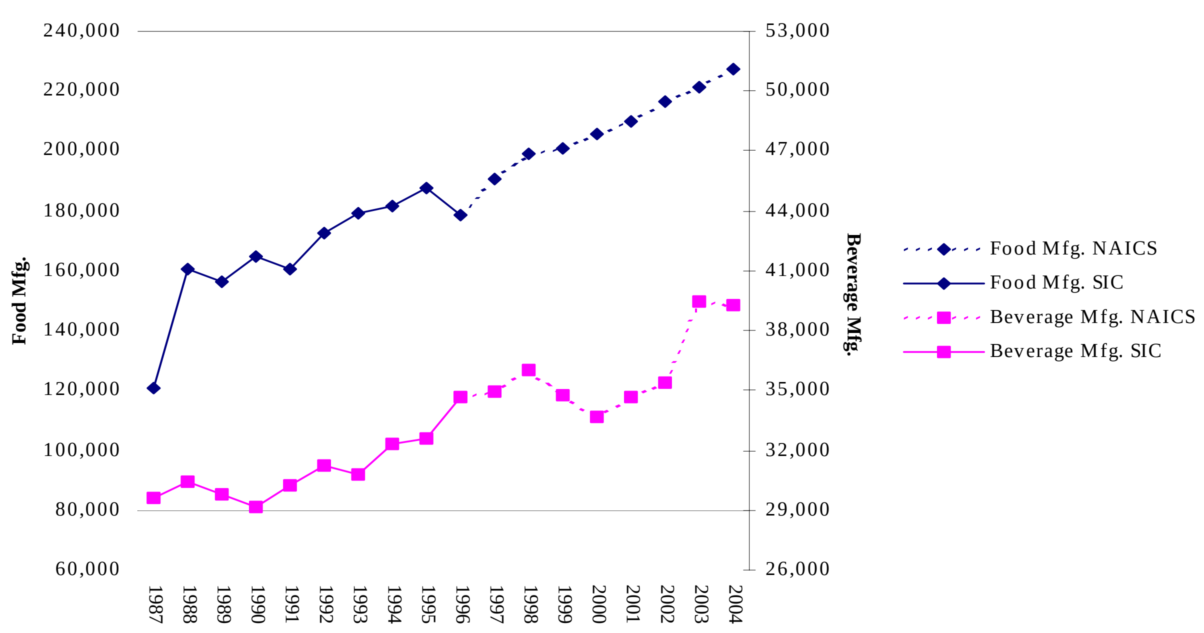
Figure C2F-1: Value of Shipments for Food Manufacturing and Beverage Manufacturing Segments (millions, $2005)



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Figure C2F-2: Value Added for Food Manufacturing and Beverage Manufacturing Segments (millions, $2005)



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2F-3, following page, provides the Federal Reserve System's index of industrial production for the profiled Food Manufacturing and Beverage Manufacturing segments, showing trends in production between 1989 and 2005. This index more closely reflects total output in physical terms, whereas value of shipments and value added reflect the economic value of production. The production index is expressed as a percentage of output in the base year, 2002. With the exception of modest decreases in production during 1995 to 1996 and 2002 to 2003, the Food Manufacturing segment has seen year-to-year production increases over the period, with an overall increase in production of approximately 30 percent from 1989 to 2005. The Beverage Manufacturing segment, on the other hand, saw production mostly rising from 1989 through the 1990s, before hitting a peak in 1998 and decreasing slightly for the next few years. Production then rebounded in 2002, and has since continued to increase. Over the entire period, the segment achieved an increase in production of over 23 percent. Going forward, businesses in these sectors are turning towards automation of plant processes to increase production (Higgins, 2004).

Table C2F-3: U.S. Food and Beverage Manufacturing Industry Industrial Production Index

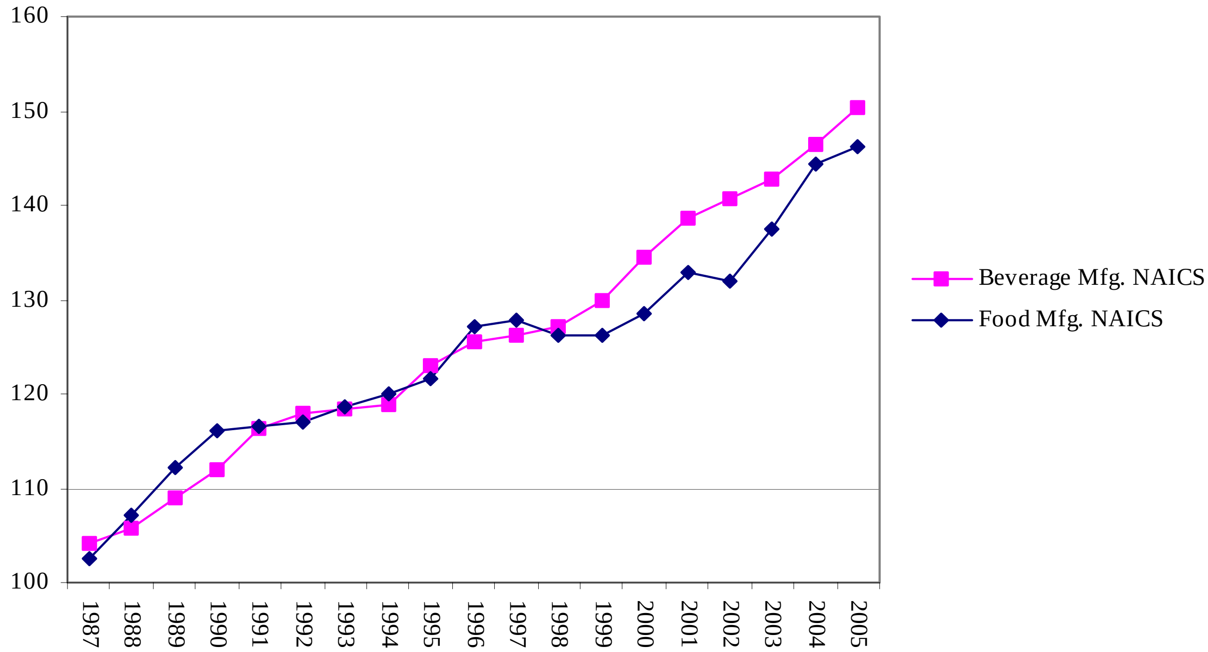
Year	Food Manufacturing (NAICS 311)		Beverage Manufacturing (NAICS 3121)	
	Index 2002=100	Percent Change	Index 2002=100	Percent Change
1989	79.7		89.7	
1990	82.1	3.1%	90.9	1.3%
1991	83.6	1.8%	92.1	1.3%
1992	85.2	1.9%	92.6	0.6%
1993	87.5	2.7%	92.4	-0.2%
1994	88.0	0.6%	96.3	4.2%
1995	90.2	2.6%	96.9	0.7%
1996	88.4	-2.1%	101.2	4.4%
1997	90.8	2.8%	102.8	1.6%
1998	94.8	4.4%	104.3	1.5%
1999	95.8	1.0%	99.1	-5.0%
2000	97.5	1.7%	98.9	-0.3%
2001	97.5	0.1%	98.8	-0.1%
2002	100.0	2.5%	100.0	1.3%
2003	99.6	-0.4%	101.7	1.7%
2004	100.8	1.3%	104.6	2.8%
2005	103.3	2.5%	110.5	5.7%
Total Percent Change 1989-2005	29.6%		23.2%	
Average Annual Growth Rate	1.6%		1.3%	

Source: Economagic, 2006

The ***producer price index*** (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

As shown in Figure C2F-3, price levels in the U.S. Food Manufacturing and Beverage Manufacturing Segments have risen steadily from 1987 to 2005, with both segments seeing a Compound Annual Growth Rate of approximately 2%. It is estimated that consumers spend only 10 percent of their disposable income on food purchases. Of this 10 percent, 6 percent is for food to be consumed in the home and 4 percent for food consumed away from home. As disposable income rises with sustained economic growth, consumer demand is also expected to increase (U.S. DOC, undated).

Figure C2F-3: Producer Price Indexes for Food Manufacturing and Beverage Manufacturing Segments



Source: BLS, 2006.

C2F -2.2 Number of Facilities and Firms

As reported in the *Statistics of U.S. Businesses*, the number of facilities in the Food Manufacturing segment increased by 19% between 1990 and 2003. The number of firms in this segment grew by about 24% during this time period. In the Beverage Manufacturing segment, the number of facilities and number of firms increased even more dramatically. Between 1990 and 2001, the number of facilities in the Beverage Manufacturing segment grew by just over 40%, from 2,200 facilities in 1990 to 3,082 facilities in 2003. The number of firms in Beverage Manufacturing grew more rapidly, with an increase of 44% over the analysis period. Table C2F-4, and Table C2F-5, following page, present the number of facilities and firms for the Food Manufacturing and Beverage Manufacturing segments between 1990 and 2003.

Table C2F-4: Number of Facilities Owned by Firms in the Food and Beverage Manufacturing Segments

Year	Food Manufacturing		Beverage Manufacturing	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	16,740		2,200	
1991	16,790	0.3%	2,211	0.5%
1992	17,824	6.2%	2,287	3.4%
1993	18,114	1.6%	2,281	-0.3%
1994	17,795	-1.8%	2,293	0.5%
1995	17,726	-0.4%	2,333	1.7%
1996	18,587	4.9%	2,576	10.4%
1997	18,558	-0.2%	2,660	3.3%
1998[a]	20,088	8.2%	2,601	-2.2%
1999[a]	19,954	-0.7%	2,671	2.7%
2000[a]	19,902	-0.3%	2,748	2.9%
2001[a]	20,340	2.2%	3,033	10.4%
2002[a]	19,136	-5.9%	3,099	2.2%
2003[a]	19,873	3.9%	3,082	-0.5%
Total Percent Change 1990-2003	18.7%		40.1%	
Average Annual Growth Rate	1.3%		2.6%	

[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. SBA, 1989-2003.

Table C2F-5: Number of Firms in the Food and Beverage Manufacturing Segments

Year	Food Manufacturing		Beverage Manufacturing	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	13,346		1,789	
1991	13,418	0.5%	1,818	1.6%
1992	14,409	7.4%	1,875	3.1%
1993	14,698	2.0%	1,867	-0.4%
1994	14,378	-2.2%	1,893	1.4%
1995	14,330	-0.3%	1,954	3.2%
1996	15,189	6.0%	2,192	12.2%
1997	15,189	0.0%	2,235	2.0%
1998[a]	16,656	9.7%	2,137	-4.4%
1999[a]	16,559	-0.6%	2,196	2.8%
2000[a]	16,533	-0.2%	2,267	3.2%
2001[a]	16,960	2.6%	2,558	12.8%
2002[a]	15,796	-6.9%	2,616	2.3%
2003[a]	16,561	4.8%	2,576	-1.5%
Total Percent Change 1990-2003	24.1%		44.0%	
Average Annual Growth Rate	1.7%		2.8%	

[a] Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. SBA, 1989-2003.

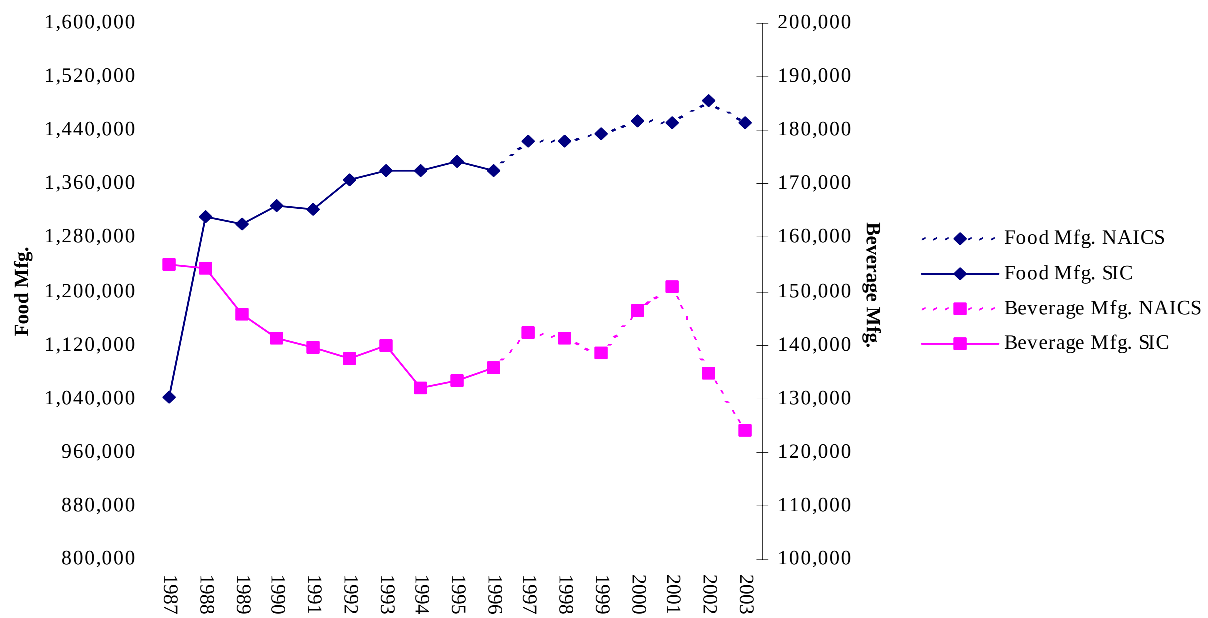
C2F -2.3 Employment and Productivity

The U.S. Food and Kindred Products industry is among the most modern in the world. A steady trend of industry growth and accompanying capital outlays have both increased production capacity and led to installation of increasingly modern and more efficient, higher technology, production equipment (see Section C2F -2.4, below). The higher technology production equipment requires a more skilled labor force (Higgins, 2003). At the same time, the higher technology equipment reduces the number of employees needed per dollar of production (Higgins, 2004).

Employment has followed different profiles in the two segments between 1987 and 2003. After a sharp increase from 1987 to 1988, Food Manufacturing segment employment followed a relatively stable profile from year to year, decreasing by no more than 2.5 percent and increasing by no more than 3.5 percent. Over the entire period, segment employment increased by 37 percent. The Beverage Manufacturing segment, however, has experienced more volatility over the period, with both a year-to-year increase and decrease in employment of greater than 5 percent at times. Overall, the Beverage Manufacturing segment faced decreasing employment almost every year from 1987 through 1994, before reversing course and experiencing gains from 1994 through 2001. These gains, however, were followed by consecutive declines in 2002 and 2003, with 11 and 8 percent decreases, respectively. This most recent two-year period alone has largely accounted for the total decline of 21% in the Beverage Manufacturing segment over the entire period. Recent trends towards more automated production and out-sourcing of some tasks could lead to even further reduced employment in these segments in future years (Higgins, 2004).

Figure C2F-4 presents employment for the two profiled segments between 1987 and 2001.

Figure C2F-4: Employment for Food Manufacturing and Beverage Manufacturing Segments



Note: Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census Bridge Between NAICS and SIC.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

Table C2F-6, following page, presents the change in value added per labor hour, a measure of ***labor productivity***, for the two profiled industry segments between 1987 and 2004. As shown in the table, labor productivity in the Food Manufacturing segment has generally grown steadily and at a modest rate, with only four years showing declines in productivity between 1987 and 2004. Similarly, the Beverage Manufacturing segment also experienced four years in which productivity declined. However, year-to-year changes have shown greater volatility, with both increases and decreases in productivity nearing 12 percent at several points during the 1987 to 2004 time period. Overall, productivity in both Food Manufacturing and Beverage Manufacturing increased by 29 and 48 percent over the observed time period, respectively, with substantial gains occurring in the years since 2001. Technology improvement in the industry is playing an important role in increasing production, as automation allows output levels to increase without significant increases in employment (U.S. DOC, undated).

Table C2F-6: Productivity Trends for Food and Beverage Manufacturing Segments ($2005)

Year	Food Manufacturing				Beverage Manufacturing			
	Value Added ($ millions)	Production Hours (millions)	Value Added/Hour $/hr	Value Added/Hour Percent Change	Value Added ($ millions)	Production Hours (millions)	Value Added/Hour $/hr	Value Added/Hour Percent Change
1987	120,746	1,522	79	n/a	29,624	148	200	n/a
1988	160,316	1,916	84	5.5%	30,410	145	209	4.6%
1989	156,284	1,917	82	-2.6%	29,797	142	211	0.7%
1990	164,558	1,999	82	1.0%	29,134	140	208	-1.3%
1991	160,577	1,996	80	-2.3%	30,240	139	217	4.5%
1992	172,835	2,105	82	2.0%	31,231	140	223	2.7%
1993	179,335	2,133	84	2.4%	30,800	144	214	-4.0%
1994	181,319	2,161	84	-0.2%	32,301	138	234	9.1%
1995	187,669	2,181	86	2.6%	32,604	139	235	0.4%
1996	178,850	2,162	83	-3.9%	34,711	139	250	6.5%
1997[a]	190,869	2,200	87	4.9%	34,947	149	235	-6.0%
1998[a]	199,089	2,232	89	2.8%	35,991	148	244	3.7%
1999[a]	200,928	2,270	89	-0.7%	34,758	140	248	1.9%
2000[a]	205,427	2,284	90	1.6%	33,641	153	220	-11.4%
2001[a]	209,742	2,266	93	2.9%	34,642	150	231	5.2%
2002[a]	216,737	2,261	96	3.6%	35,399	139	255	10.1%
2003[a]	221,351	2,262	98	2.1%	39,420	138	285	11.9%
2004[a]	227,654	2,229	102	4.4%	39,315	133	295	3.6%
Total Percent Change, 1987-2004	88.5%	46.4%	28.7%		32.7%	-10.1%	47.6%	
Average Annual Growth Rate	3.8%	2.3%	1.5%		1.7%	-0.6%	2.3%	

[a] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2F -2.4 Capital Expenditures

The Food Manufacturing and Beverage Manufacturing industries are capital intensive, and need to invest in new machinery, retrofit older equipment, or expand their plants in order to increase production (Higgins, 2002). Capital-intensive industries are characterized by a large value of capital equipment per dollar value of production. In order to modernize, expand, and replace existing capacity, new ***capital expenditures*** are needed. In 2004, the total level of capital expenditures for the Food Manufacturing and Beverage Manufacturing segments was $14 billion ($2005). Approximately 82% of that spending (see Table C2F-7) occurred in the Food Manufacturing segment.

From 1987 to 2004, capital expenditures in the Food Manufacturing increased by almost 58 percent, with a high of $14.5 billion ($2005) in 1999. In the years that followed, expenditures decreased substantially, at nearly 7% a year on average, before eventually increasing again in 2004. The Beverage Manufacturing segment has also seen substantial growth in the level of capital expenditures. Over the same time period, expenditures in this segment increased by nearly 42 percent, with a peak of $3.3 billion in 2002. Expansion or retrofitting of facilities is a priority to keep production trending upward (Higgins, 2002). In 2003, food manufacturers operated at capacities above 80 percent, the Institute for Supply Management's threshold indicating need for increased capital investment (Higgins, 2003). Recent years have seen increased capital expenditure budgets, with budgeting for 2004 being the strongest in several years (Higgins, 2004).

Table C2F-7: Capital Expenditures for Food and Beverage Manufacturing Segments (millions, $2005)

Year	Food Manufacturing		Beverage Manufacturing	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	7,293	n/a	1,839	n/a
1988	9,194	26.1%	1,904	3.6%
1989	9,939	8.1%	1,839	-3.4%
1990	10,554	6.2%	1,617	-12.0%
1991	10,478	-0.7%	1,825	12.8%
1992	10,967	4.7%	1,880	3.0%
1993	10,254	-6.5%	1,655	-11.9%
1994	10,601	3.4%	1,936	16.9%
1995	12,294	16.0%	2,226	15.0%
1996	11,827	-3.8%	2,170	-2.5%
1997[a]	12,600	6.5%	2,799	29.0%
1998[a]	13,286	5.4%	2,582	-7.7%
1999[a]	14,496	9.1%	2,617	1.4%
2000[a]	13,434	-7.3%	2,946	12.6%
2001[a]	12,525	-6.8%	2,750	-6.6%
2002[a]	11,677	-6.8%	3,311	20.4%
2003[a]	11,234	-3.8%	2,501	-24.5%
2004[a]	11,499	2.4%	2,605	4.2%
Total Percent Change 1987- 2004[a]	57.7%		41.7%	
Average Annual Growth Rate	2.7%		2.1%	

[a] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

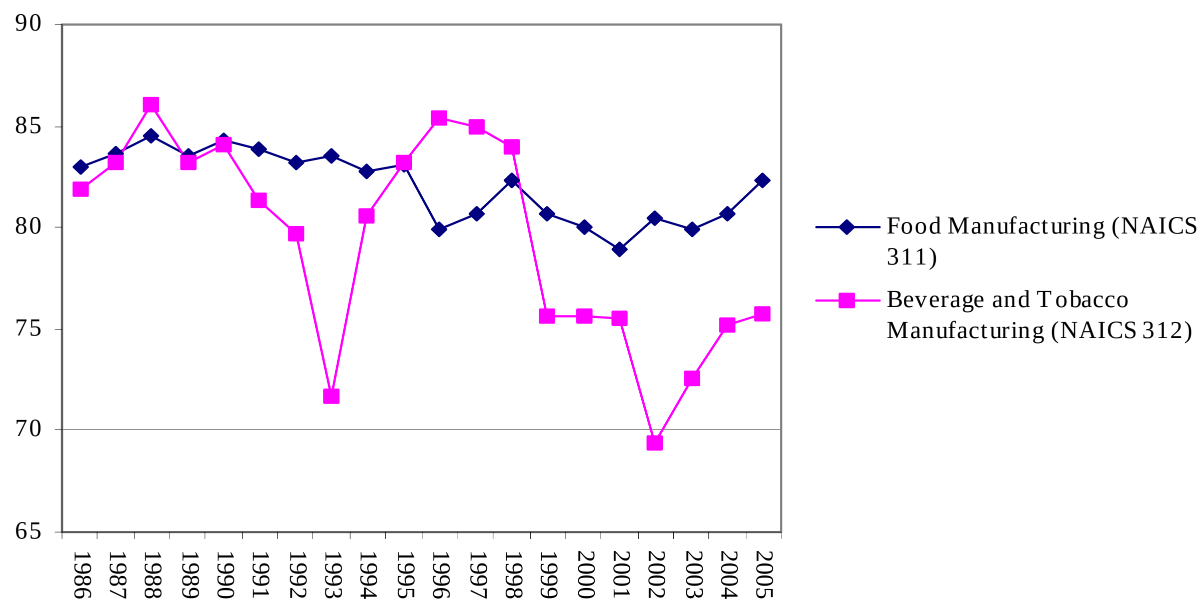
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

C2F -2.5 Capacity Utilization

Capacity utilization measures output as a percentage of total potential output from available capacity. Capacity utilization reflects excess or insufficient capacity in an industry and is an indication of whether new investment is likely. The degree of fluctuation in capacity utilization is also an indicator of the relative stability of demand and business conditions in an industry.

As shown in Figure C2F-5, following page, capacity utilization in the Food Manufacturing and Beverage and Tobacco Manufacturing[2] industries has generally trended downward over the period 1986 to 2005[3]. The food manufacturing industry, however, has not experienced the volatility that the beverage and tobacco manufacturing industry has experienced over this period. Food manufacturing capacity utilization rates have generally remained between 80 and 85 percent, while the beverage and tobacco industry has experienced a high of roughly 85 percent in 1996, followed by a significant decline to below 70 percent by 2002. Looking at both segments together, after peaking in 1988 at about 85 percent, capacity utilization generally trended downward to a low of approximately 77 percent in 2002. Over the following two years, capacity utilization increased significantly, rising to nearly 81 percent by 2004. The recent uptrend in utilization suggests overall improving financial performance in these industries. At the same time, the fact that capacity utilization has remained at a moderate level – lows 70s to mid 80s percent –implies that the industries do not face requirements for large outlays near-term to increase production capacity.

Figure C2F-5: Capacity Utilization for Food Manufacturing and Beverage and Tobacco Manufacturing[a]



[a] The Federal Reserve provides capacity utilization data for the combined NAICS 312 (Beverage and Tobacco Manufacturing) sectors. The Federal Reserve does not provide capacity utilization data for just the Beverage Manufacturing sector.

Source: Federal Reserve Board, 2005.

[2] The Federal Reserve provides capacity utilization data for the combined NAICS 312 (Beverage and Tobacco Manufacturing) sector. The Federal Reserve does not provide capacity utilization data for just the Beverage Manufacturing sector.

[3] More recent capacity utilization data is available than for other metrics, and is therefore presented to the latest complete year of available data.

C2F-3 STRUCTURE AND COMPETITIVENESS

Food Manufacturing and Beverage Manufacturing companies range in size from multi-billion dollar corporations to small producers with revenues a fraction of the size of the large producers. Many of the companies in these segments are diversified producers of multiple food or beverage products. Since food is a necessary purchase, demand is less affected by the ups and downs of the economy than for other industries.

The Food Manufacturing and Beverage Manufacturing segments have consolidated over the profile time period as companies moved to diversify their product offerings and gain market share. The segments have also looked abroad to tap into the emerging markets of foreign countries. In the Food Manufacturing industry, 415 merger and acquisition transactions were reported in 2003, down from a high of 813 in 1998. These acquisitions and mergers permit companies to acquire more efficient manufacturing plants, close inefficient plants, expand product lines, and increase market share in a mature market (U.S. DOC, undated). Some recent mega-mergers in the Food Manufacturing segment include the Kraft Foods' acquisition of Nabisco, General Mills' acquisition of Pillsbury, and Tyson's bringing beef and pork firm IBP into its lineup. One aspect of current consumption trends that might be beneficial to the Food Manufacturing firms is the fact that consumers are cooking less, with half of every food dollar being spent on food away from home. Devoting resources to products geared towards restaurants, vending machines, and other food service providers could reward firms with higher profit margins (Yahoo, 2005b).

The Beverage Manufacturing segment has also recorded a number of acquisitions and mergers. Pepsi added the Quaker Oats Company and Gatorade. Cadbury Schweppes acquired the Snapple line, following the industry trend towards non-carbonated beverages, the area of the market that non-alcoholic manufacturers are looking to for growth opportunities (Value Line, 2004). Product differentiation is a key strategy for larger firms to increase brand awareness and market share (Yahoo, 2005a). As sales in the United States slow, firms in the non-alcoholic beverage industry are seeing their largest gains from non-U.S. markets (Value Line, 2004).

Alcoholic beverage manufacturers have also consolidated during this time period. Anheuser-Busch lost the rank of world's largest brewer due to the merger of Inbrew and Brazil's Ambev. The merger between Adolph Coors and Molson further consolidated the industry. Brewers are also looking for acquisitions in China, which is seen as an untapped market. Spirits and wine manufacturers have also moved to consolidate, with Constellation Brands purchasing The Robert Modavi Corporation, a leader in wine making, as well as working in a joint venture with the French vintner Domaines Barons de Rothschild. Diageo and France's Pernod Ricard bought Seagrams Company, after outbidding the tandem of Bacardi and Brown-Forman (Yahoo, 2005a).

C2F -3.1 Firm and Facility Size

For almost all NAICS codes in the Food Manufacturing and Beverage Manufacturing segments, the Small Business Administration defines a small firm as having fewer than 500 employees. The exceptions are NAICS codes 311221, 311312, 311313, 311821, and 312140, which are considered small if the firm has fewer than 750 employees, and NAICS codes 311223, 311225, 311230, and 311422, which are deemed small if the firm employs fewer than 1,000 employees. The size categories reported in *Statistics of U.S. Businesses* (SUSB) do not correspond with the SBA size classifications, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data. Table C2F-8, following page, reports the size distribution of firms and facilities in the Food Manufacturing and Beverage Manufacturing segments for 2003. As shown in the table, small establishments dominate both segments:

- 15,448 of 16,561 (93%) firms in the *Food Manufacturing* segment had fewer than 500 employees. These small firms owned 16,105 facilities, or 81% of all facilities in the segment.
- 2,500 of 2,576 (97%) firms in the *Beverage Manufacturing* segment had fewer than 500 employees. These small firms owned 2,587 facilities, or 84% of all Beverage Manufacturing facilities.

Because some six-digit NAICS codes within the Food Manufacturing and Beverage Manufacturing segments have small business size thresholds of greater than 500 employees, the reported numbers and percentages of businesses with fewer than 500 employees represent lower bounds of the number and percentage of small businesses in these industry segments.

Comparing the two sectors to manufacturing industries in general, the percentage of small firms in the food and beverage industry is comparable to the percentage of small firms in all manufacturing industries combined. In 2003, approximately 94 percent of the firms in NAICS 311 and 3121 had fewer than 500 employees, compared to almost 99 percent for all manufacturing firms (U.S. SBA, 2002). However, compared to the Primary Manufacturing Industries, the Food Manufacturing and Beverage Manufacturing industries have a significantly higher percentage of firms within the industry identified as small. As noted below, however, the larger companies within each segment dominate in terms of producing the majority of shipments for each segment, with the 50 largest firms in Food Manufacturing accounting for 51 percent of shipments, while the 50 largest companies in Beverage Manufacturing producing an even greater share of shipments, at 79 percent of the total (see Table C2F-8, following page).

Table C2F-8: Number of Firms and Facilities by Size Category for Food and Beverage Manufacturing Segments, 2003[a]

Employment Size Category	Food Manufacturing (NAICS 311)		Beverage Manufacturing (NAICS 3121)	
	No. of Firms	No. of Facilities	No. of Firms	No. of Facilities
0-19	10,519	10,548	1,934	1,936
20-99	3,509	3,703	435	464
100-499	1,420	1,854	131	187
500+	1,113	3,768	76	495
Total	***16,561***	***19,873***	***2,576***	***3,082***

[a] Before 1998, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. SBA, 1989-2003.

C2F -3.2 Concentration Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry barriers, with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal.[4] An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 (3,600 +

[4] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios based on share of domestic production are therefore only one indicator of the extent of competition in an industry.

900 + 100). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1000 are considered unconcentrated, markets in which the HHI is between 1000 and 1800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 are considered to be concentrated.

As shown in Table C2F-9, following page, the Food Manufacturing segment has an HHI of 91, and the Beverage Manufacturing segment has an HHI of 532. At these HHI levels, the two industry segments, especially the Food Manufacturing segment, appear quite unconcentrated. With relatively low concentration in the affected industries, firms are unlikely to possess the market power to recover regulatory compliance costs through price increases, particularly if those costs do not apply relatively uniformly and broadly throughout the industry.

The concentration ratios also show that each segment operates in unconcentrated markets. The Beverage Manufacturing segment has the higher concentration of the two segments, with a CR4 of 41 percent. This is slightly lower than the 50 percent threshold, which would begin to indicate concentration in the market. The CR4 for the Food Manufacturing segment is considerably lower at only 14 percent. In this segment, the top 50 companies control roughly half of the market, indicating a rather unconcentrated market segment. As noted above, however, mergers and acquisitions are occurring in both segments, which will likely lead to increased concentration. Also, certain subsectors within each segment can be highly concentrated. For example, within the soft drink market, Coca-Cola claims around 50% of the global market, followed by Pepsi with roughly 21% and Cadbury-Schweppes with 7% (Yahoo, 2005a).

Table C2F-9: Selected Concentration Ratios for Food Manufacturing and Beverage Manufacturing Segments, 1997[a]

NAICS Code	Year	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm CR50)	Herfindahl-Hirschman Index
311	1997	21,958	14%	22%	35%	51%	91
3121	1997	2,169	41%	52%	66%	79%	532

[a] The *1997 Census of Manufactures* is the most recent concentration ratio data available by NAICS code.

Source: U.S. DOC, 1987, 1992, 1997, and 2002.

C2F -3.3 Foreign trade

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***.

Import penetration measures the extent to which domestic firms are exposed to foreign competition in domestic markets. Import penetration is calculated as total imports divided by total value of domestic consumption in that industry: where domestic consumption equals domestic production plus imports minus exports. Theory suggests that higher import penetration levels will reduce market power and pricing discretion because foreign competition limits domestic firms' ability to exercise such power. Firms belonging to segments in which imports account for a relatively large share of domestic sales would therefore be at a relative disadvantage in their ability to pass-through costs because foreign producers would not incur costs as a result of the Phase III regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2001 is 22 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 22 percent would more likely face stiff competition from foreign firms and thus be less likely to succeed in passing compliance costs through to customers.

Export dependence, calculated as exports divided by value of shipments, measures the share of a segment's sales that is presumed subject to strong foreign competition in export markets. The Phase III regulation would not increase the production costs of foreign producers with whom domestic firms must compete in export markets. As a result, firms in industries that rely to a greater extent on export sales would have less latitude in increasing prices to recover cost increases resulting from regulation-induced increases in production costs. The estimated export dependence ratio for the entire U.S. manufacturing sector for 2001 is 15 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with export ratios close to or above 15 percent are at a relatively greater disadvantage in potentially recovering compliance costs through price increases since export sales are presumed subject to substantial competition from foreign producers.

Table C2F-10, following page, presents trade statistics for the combined Food Manufacturing and Beverage Manufacturing segments. Due to data limitations, it is not possible to accurately separate the two segments; therefore, they are presented together. Imports and exports play a small role in these two segments, with import penetration and export dependence ratios of 6.2 and 6.3 percent, respectively, in 2001. Both measures of foreign competition are well below the U.S. manufacturing averages for 2001. Given just these measures, it would be reasonable to assume that these segments do not face significant foreign competitive pressures, and would have more latitude in passing through to customers any increase in production costs resulting from regulatory compliance. However, as noted above, the HHI of the Food Manufacturing and Beverage Manufacturing segments is 91 and 532 respectively, suggesting firms in these segments have low market power, limiting their ability to pass through any increase in production costs.

Table C2F-10: Trade Statistics for Combined Food and Beverage Manufacturing Segments

Year	Value of Imports (millions, $2005)	Value of Exports (millions, $2005)	Value of Shipments (millions, $2005)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
1989	20,426	20,917	451,370	450,879	4.5%	4.6%
1990	21,177	21,191	463,736	463,722	4.6%	4.6%
1991	19,893	22,437	445,213	442,669	4.5%	5.0%
1992	20,723	24,833	462,462	458,352	4.5%	5.4%
1993	20,019	25,312	470,713	465,420	4.3%	5.4%
1994	21,243	27,846	468,573	461,970	4.6%	5.9%
1995	22,044	30,604	477,200	468,640	4.7%	6.4%
1996	24,652	31,071	479,552	473,132	5.2%	6.5%
1997[a]	26,188	32,229	493,238	487,196	5.4%	6.5%
1998[d]	27,241	30,511	494,083	490,813	5.6%	6.2%
1999[d]	29,082	28,779	485,511	485,815	6.0%	5.9%
2000[d]	30,036	29,728	484,977	485,284	6.2%	6.1%
2001[d]	30,539	30,749	491,424	491,214	6.2%	6.3%
2002[d]	32,661	28,822	489,876	493,715	7.0%	6.0%
Total Percent Change 1989-2002	59.9%	37.8%	8.5%	9.5%		
Compound Annual Growth Rate	3.7%	2.5%	0.6%	0.7%		

[a] Calculated by EPA as shipments + imports - exports.

[b] Calculated by EPA as imports divided by implied domestic consumption.

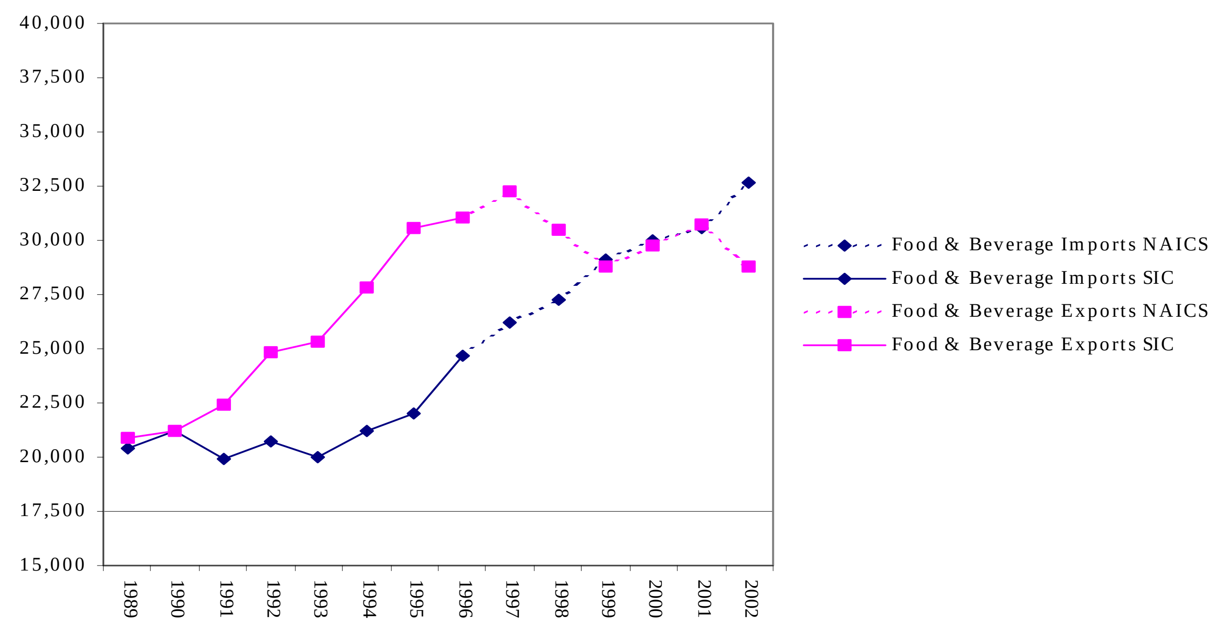
[c] Calculated by EPA as exports divided by shipments.

[d] Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.

Source: U.S. DOC, 2006; U.S. DOC, 1988-1991, 1993-1996, 1998-2001; and 2003-2004; U.S. DOC, 1987, 1992, 1997, and 2002.

As shown in Figure C2F-6, following page, Food and Beverage Manufacturing imports remained relatively constant from 1989 through 1995, before beginning a steady climb through 2002. Over these seven years, Food and Beverage Manufacturing imports grew by approximately 48 percent, from $22.0 billion ($2005) in 1995 to $32.7 billion in 2002. Food and Beverage Manufacturing exports increased from 1989 through 1997, with a high of approximately $32.2 billion in that year. Since then, Food and Beverage Manufacturing exports have remained relatively stable, averaging $30 billion from 1998 to 2002. For most of this period, the Food and Beverage Manufacturing segments recorded a positive trade balance, even though the value of imports was growing. However, in 1999, imports exceeded exports by just over $300 million. By 2002, this trade deficit widened to over $3.5 billion.

Figure C2F-6: Value of Imports and Exports for Food Manufacturing and Beverage Manufacturing Segments (millions, $2005)



[a] Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*

Source: U.S. DOC, 2006.

C2F-4 FINANCIAL CONDITION AND PERFORMANCE

Financial performance in the Food Manufacturing and Beverage Manufacturing segments is not as closely linked to macroeconomic cycles as it is in other, more cyclical manufacturing industries. As products from these segments are generally “consumer staples,” they are not as affected by swings in the U.S. economy as other manufactured products, such as those from the five Primary Manufacturing Industries. As a result, businesses in these segments have been able to maintain a moderate level of positive financial performance over the profile time period, including the U.S. recession of the early 2000s, which more substantially affected other manufacturing industries such as pulp and paper and steel. Although the Food Manufacturing segment experienced some business weakness from the economic slowdown of the early 2000s, the effects were milder compared to other manufacturing industries. By 2002, business conditions improved and the Food Manufacturing segment returned to positive growth (Higgins, 2002). In 2003, the food and beverage companies were expected to fare much better than U.S. manufacturers generally in overall revenue growth, being ranked third out of major U.S. manufacturing industries in revenue growth expectations (Higgins, 2003).

This profile uses two measures of financial condition and performance: ***Net Profit Margin*** and ***Return on Total Capital***.

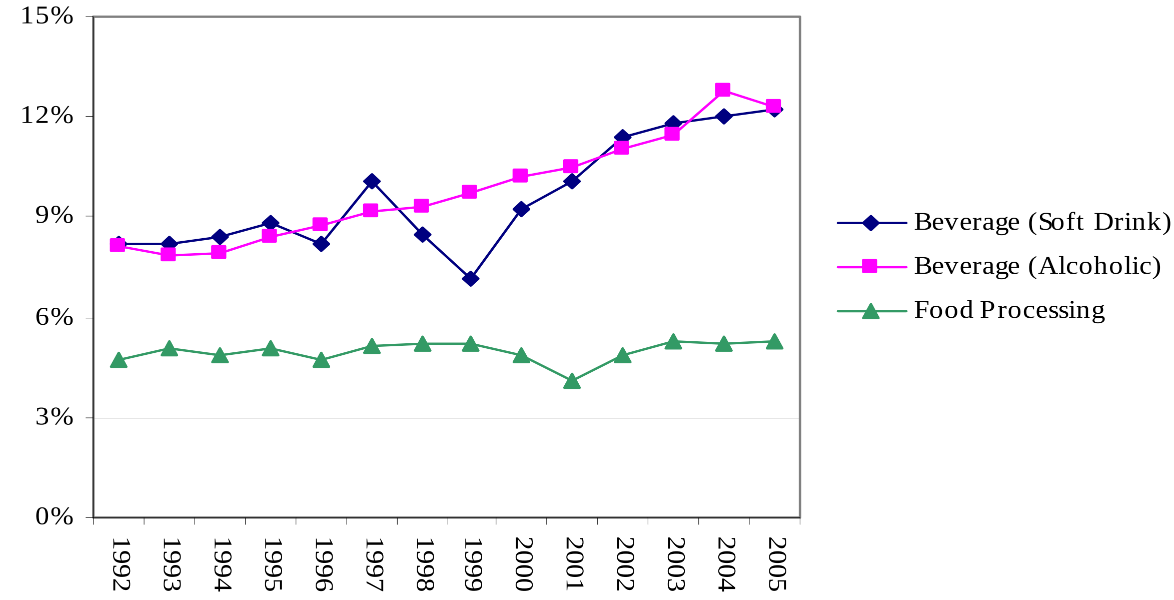
Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate a sufficient profit margin if the industry is to remain economically viable and attract capital. Year-to-year fluctuations in profit margin stem from several factors, including: variations in aggregate economic conditions (including international and U.S. conditions), variations in industry-specific market conditions (e.g., short-term capacity expansion resulting in overcapacity), or changes in the pricing and availability of inputs to the industry's production processes (e.g., the cost of energy to the manufacturing process). The extent to which these fluctuations affect an industry's profitability, in turn, depends heavily on the fixed vs. variable cost structure of the industry's operations. In a capital intensive industry such as the food and beverage industry, the relatively high fixed capital costs as well as other fixed overhead outlays, can cause even small fluctuations in output or prices to have a large positive or negative affect on profit margin.

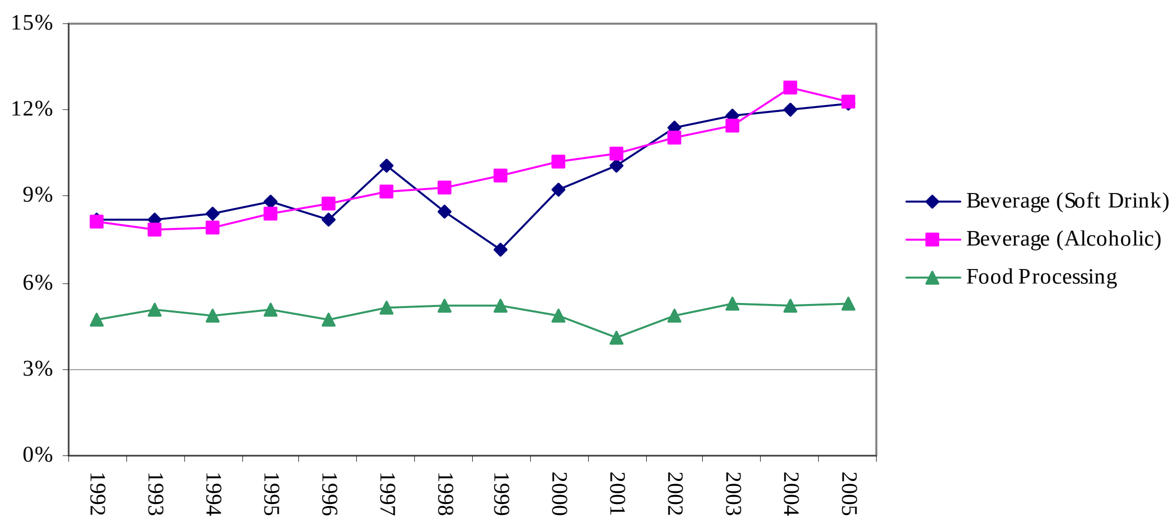
Return on total capital is calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element). As such, the return on total capital provides insight into the profitability of a business' assets independent of financial structure and is thus a "purer" indicator of asset profitability than return on equity. In the same way as described for net profit margin, the firms in an industry, and the industry collectively, must generate over time a sufficient return on capital if the industry is to remain economically viable and attract capital. The factors causing short-term variation in net profit margin will also be the primary sources of short-term variation in return on total capital.

EPA calculated net profit margin and return on total capital using data from the Value Line Investment Survey for U.S. firms identified by Value Line as operating primarily in the Food and Kindred Products industry and specifically in the following business segments: Food Processing (112 firms), Beverage-soft drink (15 firms), and Beverage-alcoholic (20 firms). The data series were calculated on a revenue-weighted basis using the Value Line-reported items: Net Profit Margin, Return on Total Capital, and Revenue. These data series thus represent the performance of a broad, but not exhaustive, set of publicly traded firms in these business segments over the analysis period. The data series excludes privately held firms and publicly held firms not reported in the Value Line database. The Value Line-based Food Processing data series may be taken to align approximately with the NAICS 311 sector, Food Manufacturing; the Beverage-soft drink and Beverage-alcoholic data series align approximately with the NAICS 3121 sector, Beverage Manufacturing.

Figure C2F-7, following page, shows trends in net profit margins for food processing, alcoholic beverage, and soft drink beverage firms between 1992 and 2005. All three business segments reported positive margins over the entire period. Being a lower risk segment of the overall Food and Kindred Products industry, the food-processing segment has the lowest net profit margin of the three groups, roughly 5 percent, but its margin remained the most stable over the time period. Margins in both beverage segments rose from approximately 8 percent in 1992 to just over 12 percent by 2005. However, the soft drink segment exhibited greater year-to-year volatility while the alcoholic beverage segment's margin experienced relatively steady growth over the period.

Figure C2F-7: Net Profit Margin for Food and Beverage Manufacturers

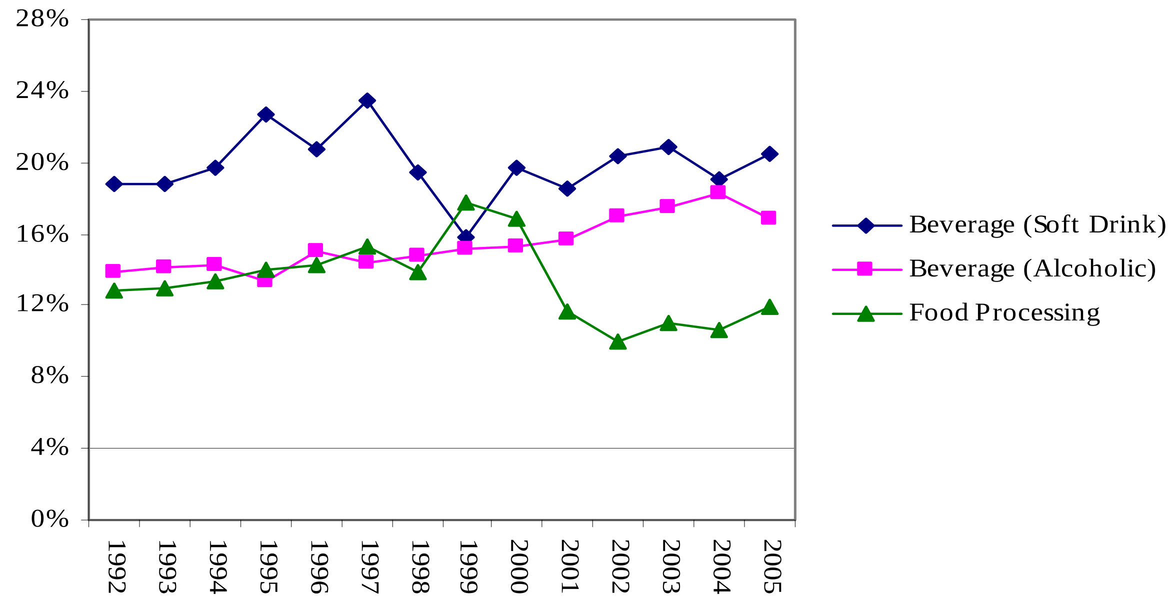


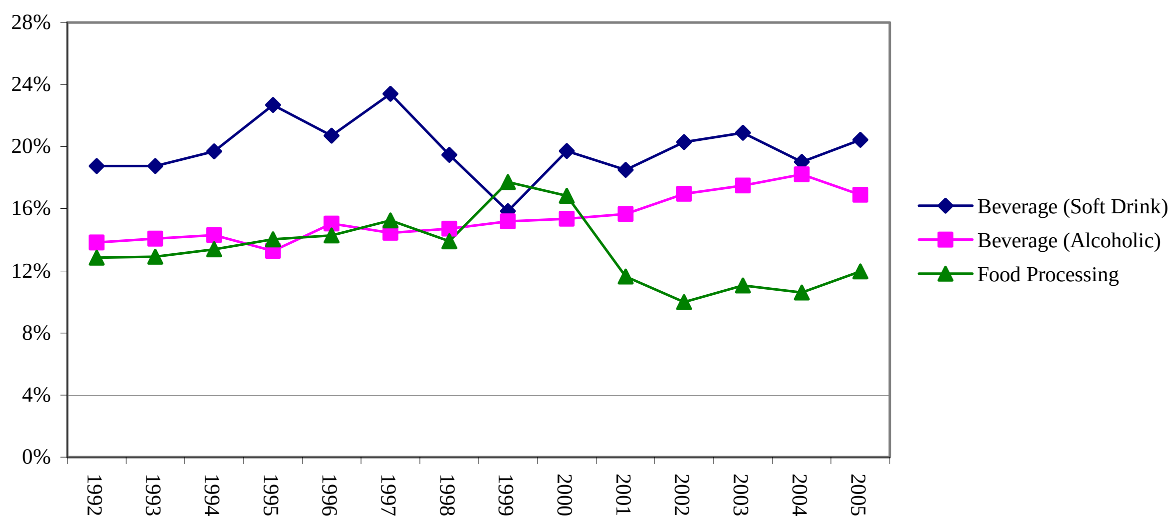


Source: Value Line, 2003; Value Line, 2006.

Figure C2F-8, following page, presents trends in return on total capital for the three segments. Again, all three business segments reported positive returns over the entire period. Of the three segments, the soft drink beverage segment recorded the highest average return on capital over the analysis period, followed by the alcoholic beverage segment and the food processing segments. Similar to the trend in net profit margin, the alcoholic beverage segment has shown the least volatility of the three segments in return on total capital, increasing from 14 percent in 1992 to about 17 percent by 2005, without experiencing any substantial shifts in performance over the time period. Since the onset of the U.S. recession in early 2000, the food-processing segment has shown the lowest return on total capital, decreasing from a high of almost 18 percent in 1999 to a low of 10 percent in 2002. The segment has rebounded since 2002, with returns to capital increasing to about 12 percent by 2005. Although the soft drink beverage segment achieved higher overall returns than the other segments, this segment has also exhibited substantial year-to-year volatility.

Figure C2F-8: Return on Total Capital for Food and Beverage Manufacturers





Source: Value Line, 2003; Value Line, 2006.

Overall, the business outlook for the Food and Kindred Products industry, both in aggregate and for the individual segments, is generally positive. Over the past several years, the Food Processing Segment has enjoyed generally stronger financial performance than the U.S manufacturing industry as a whole. Reflecting this strong performance, securities market returns for the food-processing segment have substantially exceeded the performance of the broader securities market. Between 2000 and mid-year 2005, the Standard & Poor's Packaged Foods/Meats segment index gained nearly 80 percent, while the Standard & Poor's 500 Index recorded a loss of approximately 5 percent (Standard & Poor's, 2005a). Near-term, this segment is experiencing some margin pressure from rising costs of energy and other input commodities, and from pension funding burdens. However, the longer-term outlook remains positive as the segment has modernized its capital stock and achieved substantial operating efficiencies through mergers and acquisitions and other restructurings to reduce operating costs. Finally, rising global income and trade liberalization are also expected to contribute to growing demand and additional market opportunities for U.S. producers (Standard & Poor's, 2005a).

The business outlook for the Soft Drink Segment is generally favorable. As shown in Figure C2F-7 and Figure C2F-8, this segment has performed better financially than the Food Processing Segment in recent years. The near-term business outlook remains generally positive for U.S. producers in this segment, in particular due to improved productivity and general strengthening of domestic and international markets for this segment's products (Standard & Poor's, 2005b).

The outlook for the Alcoholic Beverage Segment is also generally favorable. This segment is composed of two sub-industry segments, the *Brewers* sub-segment and *Distillers/Vintners* sub-segment. Although the Brewers sub-segment has achieved generally good financial performance over the past five years (increase of approximately 35 percent in the Standard & Poor's sub-segment index vs. Standard & Poor's 500 Index loss of approximately 5 percent), near-term this sub-segment is expected to record more modest gains, largely due to moderating growth in demand for this segment's products. At the same time, this sub-segment has achieved substantial productivity improvements and is positioned to achieve moderate growth and financial performance longer-term (Standard & Poor's, 2005c). The outlook for the Distillers/Vintners sub-segment is generally more favorable. After recording very strong financial performance since 2000 (increase of approximately 140 percent in the Standard & Poor's sub-segment index vs. Standard & Poor's 500 Index loss of approximately 5 percent), this sub-segment remains positioned to benefit from favorable demographic trends and a generally stable trend of modestly rising product demand. Consolidation and increased productivity also contribute to a favorable financial outlook for this sub-segment (Standard & Poor's, 2005d).

C2F-5 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Point source facilities that use or propose to use a cooling water intake structure that withdraws cooling water directly from a surface water body of the United States are potentially subject to Section 316(b) of the Clean Water Act. In 1982, the Food and Kindred products industry withdrew 272 billion gallons of cooling water, accounting for approximately 5 percent of total manufacturing cooling water intake in the United States. The industry ranked 6th in industrial cooling water use, behind the electric power generation industry, chemical, primary metals, petroleum and coal products, and paper and allied products industries (U.S. DOC, 1982).

This section provides information for the facilities in the Food and Kindred Products industry that EPA estimates to be subject to regulation under the regulatory analysis options. Existing facilities that meet all of the following conditions would have been subject to regulation under the three regulatory analysis options:

- Have a National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one;
- Use or propose to use one or more cooling water intake structures to withdraw water from waters of the United States;
- Use at least twenty-five (25) percent of the water withdrawn exclusively for contact or non-contact cooling purposes; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

The regulatory options also cover substantial additions or modifications to operations undertaken at such facilities. Although EPA initially identified the set of facilities that were estimated to be *potentially* subject to the Phase III regulation based on a minimum applicability threshold of 2 MGD, this section focuses on the facilities nationwide in the profiled Food and Kindred Products industry segments that are estimated to be subject to regulation based on the design intake flow and waterbody applicability criteria set forth in the regulatory analysis options (see Table C2F-1, above for additional information on the broader set of facilities potentially subject to regulation).

C2F -5.1 Waterbody and Cooling System Type

Table C2F-11, Table C2F-12, and Table C2F-16, following page, report the distribution of the Food and Kindred Products industry facilities by type of water body and cooling system for each analysis option. All of the Section 316(b) Food and Kindred Products facilities withdraw cooling water from either a freshwater river or stream.

Table C2F-11: Number of Food and Kindred Products Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling System

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Freshwater River/ Stream	0	0%	3	33%	3	33%	3	33%	9

Source: Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2F-12: Number of Food and Kindred Products Facilities Estimated Subject to the 200 MGD All Option by Waterbody Type and Cooling System

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Freshwater River/ Stream	0	0%	0	100%	3	100%	0	0%	3

Source: Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Table C2F-13: Number of Food and Kindred Products Facilities Estimated Subject to the 100 MGD CWB Option by Waterbody Type and Cooling System

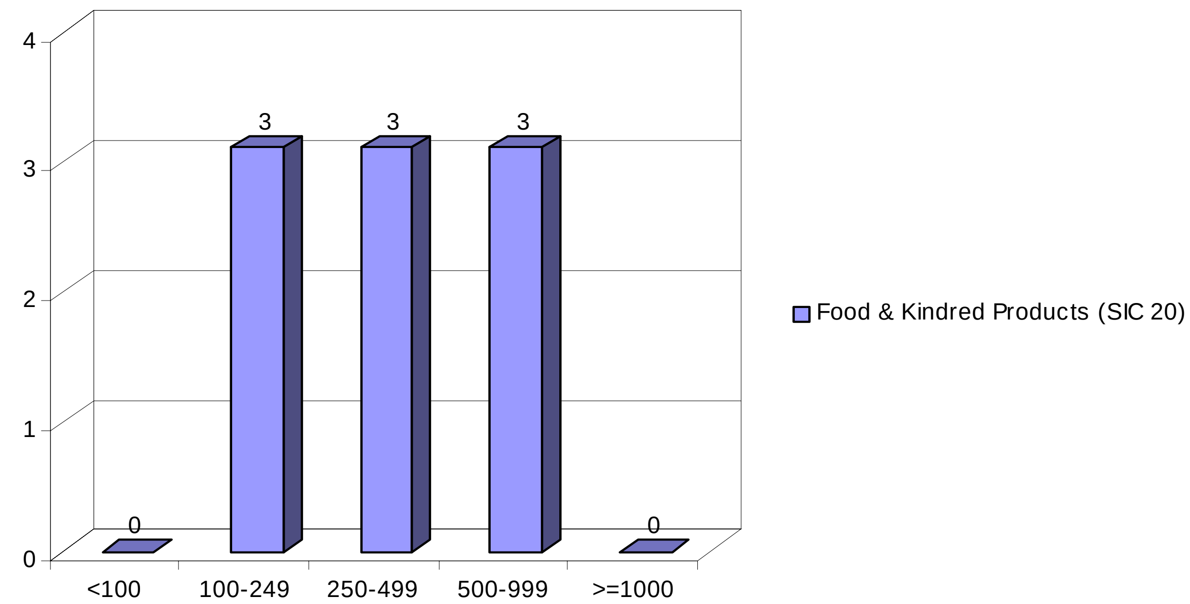
Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Freshwater River/ Stream	0	0%	0	100%	3	50%	3	50%	6

Source: Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2F -5.2 Facility Size

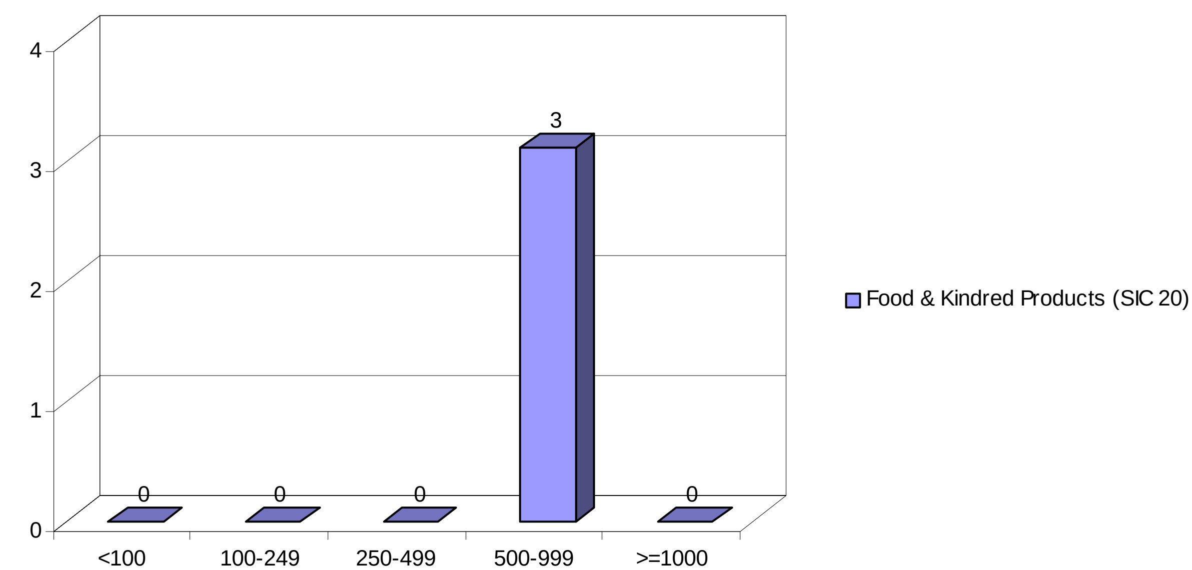
Figure C2F-11, Figure C2F-10, and Figure C2F-11 below, show the employment size category for the Food and Kindred Products industry facilities estimated subject to regulation under the regulatory analysis options. The majority of the facilities have equal or greater than 100, but fewer than 500 employees. Three of the facilities (33 percent) have between 500 and 999 employees, with no facilities employing greater than 1,000 employees.

Figure C2F-9: Number of Facilities Estimated Subject to the 50 MGD All Option by Employment Size for the Profiled Food Manufacturing and Beverage Segments



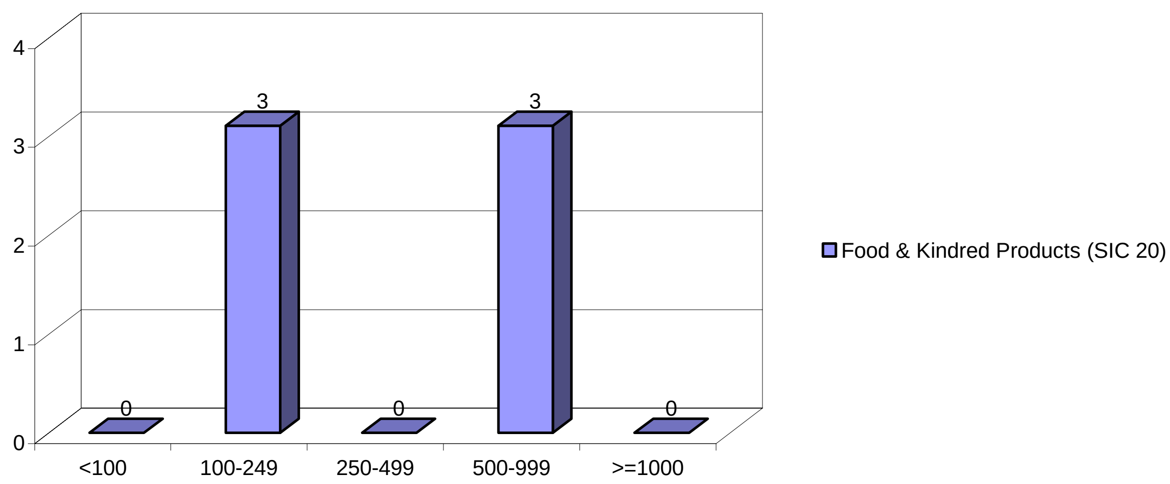
Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2F-10: Number of Facilities Estimated Subject to the 200 MGD All Option by Employment Size for the Profiled Food Manufacturing and Beverage Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

Figure C2F-11: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size for the Profiled Food Manufacturing and Beverage Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2006.

C2F -5.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of facilities in the Food and Kindred Products facility dataset that are owned by small firms. Depending on their SIC code, firms are defined as small based on either their revenues or number of employees. As shown in Table C2F-14, Table C2F-15, and Table C2F-16, large firms own all of the Food and Kindred Products facilities estimated to be subject to regulation, regardless of the analysis option considered.

Table C2F-14: Number of Facilities Estimated Subject to the 50 MGD All Option by Firm Size for the Food and Kindred Products Industry

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
20	Food and Kindred Products	9	100%	0	0%	9

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2F-15: Number of Facilities Estimated Subject to the 200 MGD All Option by Firm Size for the Food and Kindred Products Industry

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
20	Food and Kindred Products	3	100%	0	0%	3

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

Table C2F-16: Number of Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size for the Food and Kindred Products Industry

SIC Code	SIC Description	Large		Small		Total
		Number	% of SIC	Number	% of SIC	
20	Food and Kindred Products	3	100%	0	0%	3

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA 2006; U.S. EPA analysis, 2006.

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Chapter C2G: Facilities in Other Industries (Various SICs)

CHAPTER CONTENTS

INTRODUCTION

The preceding profile sections focus on the six Primary Manufacturing Industries – Paper and Allied Products, Chemicals and Allied Products, Petroleum Refining, Steel, Aluminum, and Food and Kindred Products – identified, after electric power generators, as using the largest amount of cooling water in their operations and most likely, after electric power generators, to be within the scope of the 316(b) Phase III regulation. However, facilities in other industries use cooling water and would therefore also be subject to the final regulation if they meet the regulation's specifications. This section of the profile provides information on a sample of facilities in these Other Industries.

Although EPA targeted its *Detailed Industry Questionnaire* at the electric power industry and manufacturing industries that use large amounts of cooling water, the Agency received 10 questionnaire responses from facilities with business operations in industries other than these major cooling water-intensive industries. EPA originally believed these facilities to be non-utility electric power generators; however, inspection of their responses indicated that the facilities were better understood as cooling water-dependent facilities whose principal operations lie in businesses other than the electric power industry or the Primary Manufacturing Industries. Unlike the sample facility observations for the six Primary Manufacturing Industries, the sample of observations from Other Industries is not based on a scientifically framed sample and the information from this sample of observations may not be reliably extrapolated beyond these facilities. As a result, EPA's profile of information for the Other Industries facilities is restricted to these 10 sample facilities and is not presented as national estimates.

Of the 10 Other Industries facilities, 7 withdraw at least 50 million gallons of water a day and are thus would be subject to regulation under the regulatory analysis options considered for existing facilities. These facilities fall in a wide range of businesses, as defined by 2-digit SIC industry group. Table C2G-1, following page, presents the number of responses received from facilities in the Other Industries by industry group. The information summarized in the following sections focuses on these Other Industries facilities that EPA estimates will be subject to regulation under the regulatory analysis options.

Table C2G-1: Facilities in Other Industries by 2-digit SIC code Estimated Subject to Regulation Under the Regulatory Analysis Options

No. of Facilities	SIC Code	SIC Description	Important Operations
2	10	Metal mining	Mining, developing mines, or exploring for metallic minerals (ores); ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately.
3	34	Fabricated metal products, except machinery and transportation equipment	Ferrous and nonferrous metal products, such as metal cans, tinware, handtools, cutlery, general hardware, nonelectric heating apparatus, fabricated structural metal products, metal forgings, metal stampings, ordnance (except vehicles and guided missiles), and a variety of metal and wire products, not elsewhere classified.
1	37	Transportation equipment	Equipment for transportation of passengers and cargo by land, air, and water.
1	49	Electric, gas, and sanitary services	Generation, transmission, and/or distribution of electricity or gas or steam. Water and irrigation systems, and sanitary systems engaged in the collection and disposal of garbage, sewage and other wastes by means of destroying or processing materials.

Source: U.S. EPA, 2000; Executive Office of the President, 1987.

C2G-1 FACILITIES OPERATING COOLING WATER INTAKE STRUCTURES

Section 316(b) of the Clean Water Act applies to point source facilities that use or propose to use a cooling water intake structure and that withdraws cooling water directly from a surface waterbody of the United States. This section provides information for facilities in Other Industries subject to regulation under the regulatory analysis options. The regulatory analysis options apply to existing facilities that meet all of the following conditions:

- Use a cooling water intake structure or structures, or obtain cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure; or their cooling water intake structure(s) withdraw(s) cooling water from waters of the U.S., and at least twenty-five (25) percent of the water withdrawn is used for contact or non-contact cooling purposes;
- Have an National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and
- Meet the applicability criteria for the specific regulatory analysis option in terms of design intake flow and source waterbody type (i.e., 50 MGD for All Waterbodies, 100 MGD for Certain Waterbodies, or 200 MGD for All Waterbodies).

The regulatory options also cover substantial additions or modifications to operations undertaken at such facilities.

C2G-1.1 Waterbody and Cooling System Types

Table C2G-2, Table C2G-3, and Table C2G-7, following page, summarize information on the Other Industries facilities by type of water body and cooling system for each option. All of these facilities have a once-through system. Plants with once-through cooling water systems withdraw between 70 and 98 percent more water than those with recirculating systems.

Table C2G-2: Other Industries Facilities Estimated Subject to the 50 MGD All Option by Water Body and Cooling System Type

Water Body Type	Cooling System								
	Recirculating		Combination		Once-Through		Other		Total[a]
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Other Industries									
Estuary/ Tidal River	0	0%	0	0%	1	15%	0	0%	1
Freshwater Stream/River	0	0%	0	0%	3	40%	0	0%	3
Great Lake	0	0%	0	0%	2	30%	0	0%	2
Ocean	0	0%	0	0%	1	15%	0	0%	1
Total[a]	***0***	***0%***	***0***	***0%***	***7***	***100%***	***0***	***0%***	***7***

[a] Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

Table C2G-3: Other Industries Facilities Estimated Subject to the 200 MGD All Option by Water Body and Cooling System Type

Water Body Type	Cooling System								
	Recirculating		Combination		Once-Through		Other		Total[a]
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Other Industries									
Estuary/ Tidal River	0	0%	0	0%	1	50%	0	0%	1
Great Lake	0	0%	0	0%	1	50%	0	0%	1
Total[a]	***0***	***0%***	***0***	***0%***	***2***	***100%***	***0***	***0%***	***2***

[a] Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

Table C2G-4: Other Industries Facilities Estimated Subject to the 100 MGD CWB Option by Water Body and Cooling System Type

Water Body Type	Cooling System								
	Recirculating		Combination		Once-Through		Other		Total[a]
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Other Industries									
Estuary/ Tidal River	0	0%	0	0%	1	25%	0	0%	1
Freshwater Stream/River	0	0%	0	0%	1	25%	0	0%	1
Great Lake	0	0%	0	0%	2	50%	0	0%	2
Total[a]	***0***	***0%***	***0***	***0%***	***4***	***100%***	***0***	***0%***	***4***

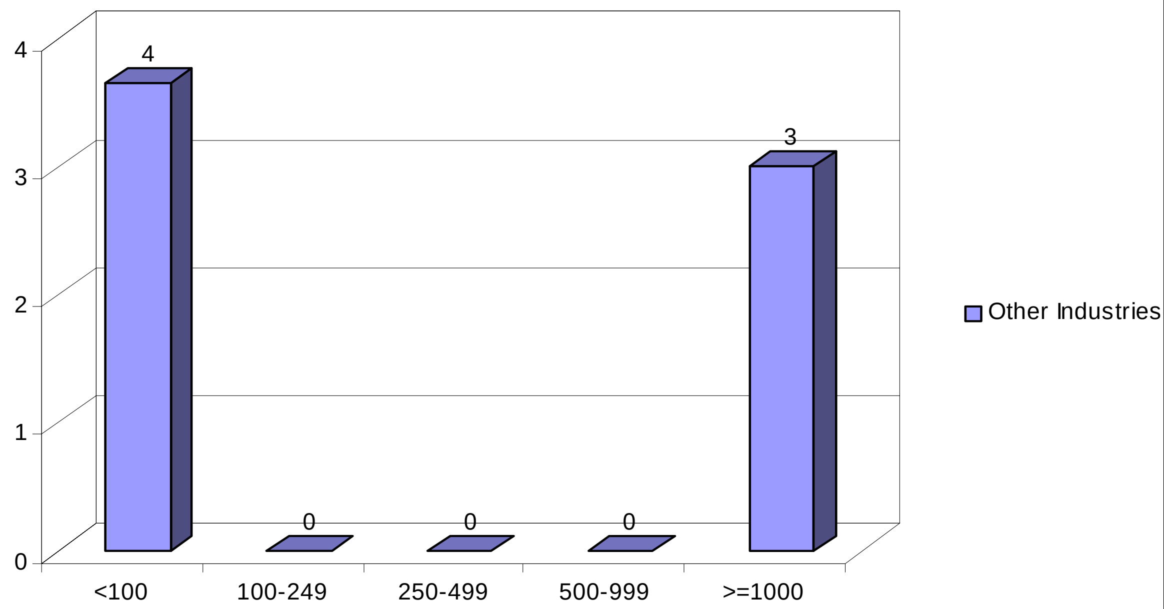
[a] Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

C2G-1.2 Facility Size

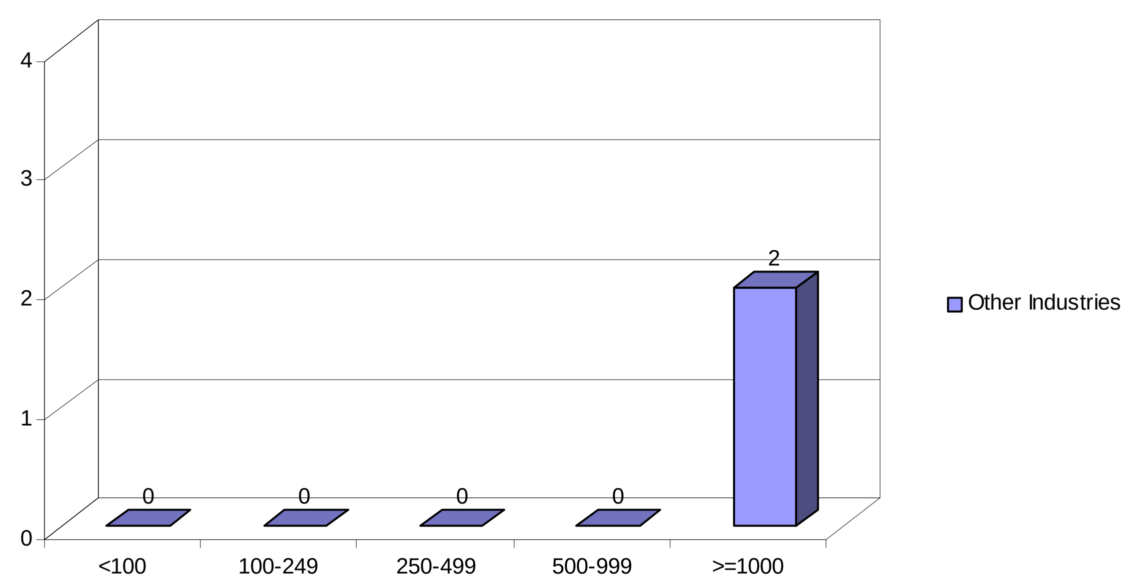
Figure C2G-3, Figure C2G-2, and Figure C2G-3 show the employment size category for the Other Industries facilities that EPA estimates will be subject to the regulation under each analysis option.

Figure C2G-1: Other Industries Facilities Estimated Subject to the 50 MGD All Option by Employment Size



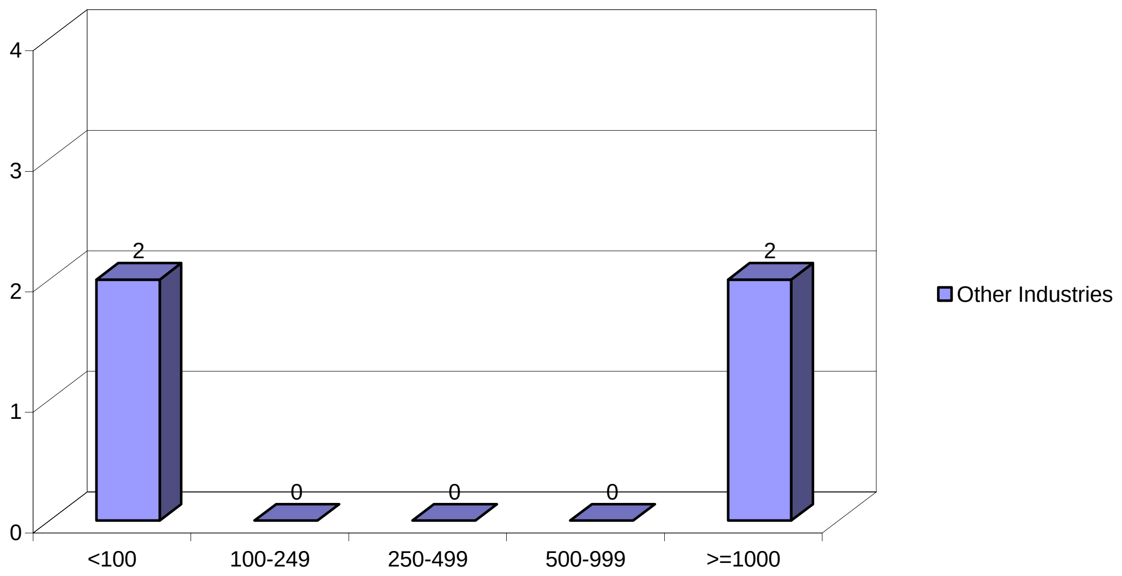
Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

Figure C2G-2: Other Industries Facilities Estimated Subject to the 200 MGD All Option by Employment Size



Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

Figure C2G-3: Other Industries Facilities Estimated Subject to the 100 MGD CWB Option by Employment Size



Source: U.S. EPA, 2000; U.S. EPA Analysis, 2006.

C2G-1.3 Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of the Other Industries facilities that are owned by small firms. Depending on their SIC code, firms are defined as small based on either revenues or number of employees. As reported in Table C2G-5, Table C2G-6, and Table C2G-7, large firms own all of the Other Industries facilities that EPA estimates will be subject to regulation.

Table C2G-5: Other Industries Facilities Estimated Subject to the 50 MGD All Option by Firm Size

	Large	Small	Total
Other Industries	7	0	7

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA, 2006; U.S. EPA Analysis, 2006.

Table C2G-6: Other Industries Facilities Estimated Subject to the 200 MGD All Option by Firm Size

	Large	Small	Total
Other Industries	2	0	2

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA, 2006; U.S. EPA Analysis, 2006.

Table C2G-7: Other Industries Facilities Estimated Subject to the 100 MGD CWB Option by Firm Size

	Large	Small	Total
Other Industries	4	0	4

Source: U.S. EPA, 2000; D&B, 2001; U.S. SBA, 2006; U.S. EPA Analysis, 2006.

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GLOSSARY

Capital expenditures: As reported in the Economic Censuses, reflects permanent additions and major alterations, as well as replacements and additions to capacity, for which depreciation, depletion, or Office of Minerals Exploration accounts are ordinarily maintained. Reported capital expenditures include work done on contract, as well as by the mine forces. Totals for expenditures include the costs of assets leased from other concerns through capital leases. Excluded are expenditures for land and cost of maintenance and repairs charged as current operating expenses. Also excluded are capital expenditures for mineral land and rights, which are shown as a separate item.

Capacity utilization: Indicates the extent to which plant capacity is being used and shows potential excess or insufficient capacity. This profile reports capacity utilization as published by the U.S. Bureau of Census in the Survey of Plant Capacity published in the Current Industrial Reports. The utilization rate is equal to an output index divided by a capacity index. Output is measured by seasonally adjusted indexes of industrial production, and is based on actual output in 1992. The capacity indexes attempt to capture the concept of sustainable practical capacity, which is defined as the greatest level of output that a plant can maintain within the framework of a realistic work schedule, taking account of normal downtime, and assuming sufficient availability of inputs to operate the machinery and equipment in place.

Concentration ratio: The combined percentage of total industry output accounted for by the largest producers in the industry. For example, the four-firm concentration ratio (CR4) refers to the market share of the four largest firms. The higher the concentration ratio, the more concentrated the industry. A market is generally considered highly concentrated if the CR4 is greater than 50 percent.

Coverage ratio: The ratio of primary products shipped by the establishments classified in the industry to the total shipments of such products that are shipped by all manufacturing establishments, wherever classified. An industry with a high coverage ratio accounts for most of the value of shipments of its primary products, whereas an industry with a low coverage ratio produces a smaller portion of the total value of shipments of its primary products produced by all sources.

Employment: Total number of full-time equivalent employees, including production workers and non-production workers.

Export dependence: The share of shipments by domestic producers that is exported; calculated by dividing the value of exports by the value of domestic shipments.

Herfindahl-Hirschman index (HHI): An alternative measure of concentration. Equal to the sum of the squares of the market shares for the largest 50 firms in the industry. The higher the index, the more concentrated the industry. The Department of Justice uses the HHI for antitrust enforcement purposes. The benchmark used by DOJ is 1,000, where any industry with an HHI less than 1,000 is considered to be unconcentrated. The advantage of the HHI over the concentration ratio is that the former gives information about the dispersion of market share among all the firms in the industry, not just the largest firms (Arnold, 1989).

Import penetration: The share of all consumption in the U.S. that is provided by imports; calculated by dividing imports by reported or apparent domestic consumption (the latter calculated as domestic value of shipments minus exports plus imports).

Labor productivity: Amount of output produced per unit of labor input on average. Calculated in this profile as real value added divided by production hours. This measure indicates how an industry uses labor as an input in the production process. Changes over time in labor productivity may reflect changes in the relative use of labor versus other inputs to produce output, due to technological changes or cost-cutting efforts. Changing patterns of labor utilization relative to output are particularly important in understanding how regulatory requirements may translate into job losses, both in aggregate and at the community level.

Net Profit Margin: is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income.

Nominal values: Dollar values expressed in current dollars.

Operating margin: Measure of the relationship between input costs and the value of production, as an indicator of financial performance and condition. Everything else being equal, industries and firms with lower operating margins will generally have less flexibility to absorb the costs associated with a regulation than those with higher operating margins. Operating margins were calculated in this profile by subtracting the cost of materials and total payroll from the value of shipments. Operating margin is only an approximate measure of profitability, since it does not consider capital costs and other costs. It is used to examine trends in revenues compared with production costs within an industry; it should not be used for cross-industry comparisons of financial performance.

Primary product shipments: An establishment is classified in a particular industry (4-digit SIC codes) if its shipments of the primary products of that industry exceed in value its shipments of the products of any other single industry. An establishment=s primary product shipments are those products considered primary to its industry.

Producer production indexes (PPI): A family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services (Bureau of Labor Statistics, PPI Overview).

Real values: Nominal values normalized using a price index to express values in a single year=s dollars. Removes the effects of price inflation when evaluating trends in dollar measures.

Return on Total Capital: calculated as annual net profit, plus one-half of annual long-term interest, divided by the total of shareholders' equity and long-term debt (total capital). This concept measures the total productivity of the capital deployed by a firm or industry, regardless of the financial source of the capital (i.e., equity, debt, or liability element).

Secondary product shipments: An establishment=s products that are considered secondary to the industry in which the establishment is classified and primary to other industries. For example, a petroleum refinery classified in SIC code 2911 would produce petroleum products as primary products, but might produce organic chemicals as secondary products.

Value added: A measure of manufacturing activity, derived by subtracting the cost of purchased inputs (materials, supplies, containers, fuel, purchased electricity, contract work, and contract labor) from the value of shipments (products manufactured plus receipts for services rendered), and adjusted by the addition of value added by merchandising operations (i.e., the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) plus the net change in finished goods and work-in-process between the beginning-and end-of-year inventories. Value added avoids the duplication in value of shipments as a measure of economic activity that results from the use of products of some establishments as materials by others. Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas.

Value of shipments: Net selling values of all products shipped as well as miscellaneous receipts. Includes all items made by or for an establishments from materials owned by it, whether sold, transferred to other plants of the same company, or shipped on consignment. Value of shipments is a measure of the dollar value of production, and is often used as a proxy for revenues. This profile uses value of shipments to indicate the size of a market and how the size differs from year to year, and to calculate operating margins.

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