United States
Environmental Protection
Agency

Economic and Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule

EPA 821-R-11-003

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1 Introduction

1.1 Background

This document (the *Economic and Benefits Analysis* or EA) provides analytical support for development of EPA's Proposed Existing Facilities Rule, which implements Clean Water Act (CWA) 316(b) requirements governing cooling water intake structures at certain existing power producing facilities (Electric Generators) and manufacturing facilities (Manufacturers). These requirements would apply to existing Electric Generators and Manufacturers (existing facilities) with cooling water intake structures that are designed to withdraw two million gallons per day (MGD) or more of water from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the United States for cooling purposes. The national requirements, which will be implemented through National Pollutant Discharge Elimination System (NPDES) permits upon promulgation, are based on the best technology available to minimize the adverse environmental impact associated with the use of cooling water intake structures.

This is EPA's second attempt to develop CWA 316(b) requirements for existing Electric Generators and Manufacturers. Two preceding efforts, the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule (suspended 2004 Phase II Final Rule or Phase II Final Rule) applicable to existing generators with a design intake flow (DIF) of greater than 50 MGD, and the 2006 Final Section 316(b) Phase III Existing Facilities Rule (2006 Phase III Final Rule or Phase III Final Rule) applicable to existing electric generators with a DIF of less than 50 MGD and existing manufacturing facilities, were challenged in court and subsequently remanded for further rulemaking.

Specifically, in 2004, EPA published the Phase II Final Rule applicable to existing power plants (69 FR 41576 (July 9, 2004)). However, in response to court rulings, including a remand order from the Second Circuit Court of Appeals in 2007, and a subsequent ruling by the Supreme Court in 2009, EPA suspended the Phase II regulations. In a later rulemaking in 2006, EPA published the Phase III Final Rule, which establishes categorical regulations for certain new offshore oil and gas extraction facilities, and establishes that 316(b) requirements for electric generators with a DIF of less than 50 MGD and existing manufacturing facilities should be established through conditions established by NPDES permit directors on a case-by-case basis using best professional judgment. In 2010, the Fifth Circuit Court of Appeals accepted EPA's request to remand the existing facility portion of the Phase III Final Rule to the Agency for further rulemaking.

In response to these court rulings, EPA suspended the previous existing facilities 316(b) rules and initiated development of new CWA 316(b) requirements for existing electric generators and manufacturers. This proposed regulation, *the existing facilities rule*, represents EPA's initial action to re-promulgate regulatory provisions that will replace the suspended 316(b) requirements.

1.2 Overview of the Economic and Benefits Analysis of the Proposed Existing Facilities Rule

1.2.1 Facilities Expected To Be Subject to the Proposed Existing Facilities Rule

The Proposed Existing Facilities Rule applies to existing Electric Generators and Manufacturers that have intakes designed to withdraw two million gallons of water per day or more from waters of the United States and use at least 25 percent of this water for cooling purposes. EPA estimates that 559 Electric Generators and 593 Manufacturers will be within the scope of this regulation.

Electric Generators

The 559 in-scope Electric Generators have total electric generating capacity of 490,827 MW, which represents approximately 45 percent of the national total of electric generating capacity (*Table 1-1)*. EPA further estimates that these 559 in-scope generating facilities are owned by 143 parent entities. The largest quantity of in-scope facilities and generating capacity occurs in the *Investor-Owned Utility* category, with a total of 283 facilities and 291,051 MW of capacity estimated to be within the regulation's scope. This capacity represents over 71 percent of the total generating capacity owned by Investor-Owned Utilities, and more than 25 percent of the generating facilities owned by this ownership category. For more detail on the electric generating industry and the expected in-scope facilities in that industry, see *Chapter 2: Industry Profiles*.

Table 1-1: Existing Electric Generators, Capacity, and Parent-Entities, by Ownership Type, 2007[a]

Ownership Type	Parent-Entities			Facilities			Capacity (MW)		
	Industry Total[b]	In-Scope		Industry Total	In-Scope		Industry Total	In-Scope	
		Number	% of Total		Number[c]	% of Total		Number[c]	% of Total
Investor-Owned	212	43	20.3%	1,117	283	25.5%	407,460	291,051	71.4%
Nonutility	1,737	37	2.1%	2,784	171	6.6%	471,262	133,972	28.4%
Federal	9	1	11.1%	197	14	7.1%	72,234	24,612	34.1%
State	25	4	16.0%	104	9	8.7%	22,405	8,592	38.3%
Municipality	1,843	35	1.9%	869	44	5.4%	51,057	12,880	25.2%
Cooperative	883	20	2.3%	205	31	15.1%	40,311	14,028	34.8%
Political Subdivision	126	3	2.4%	93	7	7.5%	20,721	5,692	27.5%
Total	**4,835**	**143**	**3.0%**	**5,369**	**559**	**10.8%**	**1,085,449**	**490,827**	**45.2%**

a. Individual values may not sum to totals due to independent rounding.

b. Information on the total number of parent-entities is based on data from Form EIA-861 and Form EIA-860. Information on facilities and capacity is based on data from Form EIA-860. These data sources report information for non-corresponding sets of power producers. Therefore, the total number of parent-entities is not directly comparable to the information on total facilities or total capacity.

c. EPA estimated the number of in-scope Electric Generators and their capacity using the original 316(b) survey weights. These weights account for survey non-respondents (see *Appendix 3.A* for details).

Source: U.S. EPA, 2010; U.S. DOE, 2007a (EIA-860); U.S. DOE, 2007b (EIA-861).

Manufacturers

EPA identified six manufacturing industries, in addition to electric power generators, that use substantial amounts of cooling water in their operations and that are likely to contain the largest numbers of facilities and cooling water intake capacity within the scope of the Proposed Existing Facilities Rule: Paper and Allied Products, Chemicals and Allied Products, Petroleum Refining, Steel, Aluminum, and Food and Kindred Products. Out of an estimated 593 in-scope Manufacturers, 576 are in these six *primary manufacturing industries*. The other 17 Manufacturers fall in a wide range of businesses. These 17 facilities in *other manufacturing industries* also use cooling water and would therefore also be subject to the Proposed Existing Facilities Rule; however, based on EPA's previous reviews of industries' reliance on cooling water, the cooling water intake flow of these remaining industries is small relative to that of the power industry and the six selected industries. Therefore, the cost and economic impact analyses conducted for Manufacturers and presented in this document focus primarily on the six *primary manufacturing industries* listed above.

Overall, EPA estimates that approximately 2 percent of facilities, and 23 percent of the total value of shipments for the 6 primary manufacturing industries will be subject to today's proposed rule. The majority of Manufacturers expected to be subject to the Proposed Existing Facilities Rule, or 225 facilities, are in the Pulp and Paper industry, while facilities in the Chemicals and Allied Products make up the second largest category (179 facilities) (*Table 1-2*). In-scope Manufacturers in the Pulp and Paper and Petroleum industries represent the largest shares of their respective industry facility totals at 38 percent and 11 percent, respectively. In terms of in-scope economic value, in-scope Manufacturers in the Petroleum industry account for the largest quantity of value of shipments ($216 billion), followed by in-scope facilities in the Chemical industry ($75 billion), Pulp and Paper industry ($70 billion), and Steel industry ($63 billion). These values also represent substantial shares of the total value of economic activity in the various Manufacturing sectors: in-scope Manufacturers in the Pulp and Paper industry account for the largest share of total industry value of shipments (85 percent), followed by in-scope Manufacturers in the Aluminum industry (61 percent), and Steel (49 percent). In-scope Manufacturers in the Food and Beverage industry make up the smallest group in terms of absolute number of facilities and value of shipments as well as their shares of total industry values. For more detail on the expected in-scope facilities in the manufacturing industries, see *Chapter 2: Industry Profiles*.

Table 1-2: Existing Manufacturers, Value of Shipments, and Parent-Entities, by Industry

Industry Sector	Number of Facilities			Value of Shipments (mill; 2009 $)[a,b]			Number of Parent Entities		
	Sector Total	In-Scope[d,e]			In-Scope[d,e]		Sector Total	In-Scope[c,d]	
		Num	% of Tot	Sector Total	Value	% of Tot		Num	% of Tot
Aluminum	333	26	8%	$36,557	$22,253	61%	266	5-14	1.9%-5.3%
Chemicals	4,433	179	4%	$476,287	$74,822	16%	3,011	26-116	0.9%-3.9%
Food	28,938	38	0%	$697,164	$15,068	2%	24,168	8-25	0.0%-0.1%
Paper	597	225	38%	$82,796	$70,142	85%	311	42-126	13.5%-40.5%
Petroleum	352	39	11%	$590,441	$216,320	37%	228	17-24	7.5%-10.5%
Steel	1,525	68	4%	$128,082	$62,507	49%	1,406	16-43	1.1%-3.1%
Total	**36,178**	**576**	**2%**	**$2,011,327**	**$461,112**	**23%**	**29,390**	**114-348**	**0.4%-1.2%**

a. For this analysis, facility revenue was used as a measure of value of output the absence of value of shipments for sample facilities.
b. To compare in-scope revenue values with the industry value of shipments, EPA brought in-scope revenue values forward to 2007 using industry-specific Producer Price Index (PPI) published by the Bureau of Labor Statistics (BLS) and stated in 2009 dollars using GDP deflator published by the Bureau of Economic Analysis (BEA).
c. Ranges of parent-entity counts and total shares represent different parent weighting schemes (see Appendix 3.A of the EBA for more details).
d. In-scope facility counts include baseline closures and exclude 17 facilities with NAICS codes that do not fall into any of these six primary manufacturing industries (see Chapter 3 of the EBA).
e. Number of in-scope facilities is estimated using technology weights. In-scope revenue values are weighted estimates; these estimates were generated using economic analysis weights. See Appendix 3.A of the EBA for information on weights development.
Source: U.S. EPA, 2000; U.S. Economic Census 2000; SUSB 2006.

1.2.2 Analyses Performed in Support of the Proposed Existing Facilities Rule

In developing costs and in performing analyses of the Proposed Existing Facilities Rule options, generally, EPA followed closely the analysis approaches and impact evaluation concepts used in the analysis for the previous CWA 316(b) regulatory analyses, and to the extent possible relied on the same data sources.[1] The discussion in the following chapters provides an overall summary of the analytic approaches with emphasis on the differences in the current analysis from the previous CWA 316(b) regulatory analyses and on the updating of information.

EPA performed the following analyses in support of the Proposed Existing Facilities Rule:

- Industry economic profiles (*Chapter 2*)
- Compliance cost assessment (*Chapter 3*)
- Facility-level severe and moderate impact analysis and firm-level cost-to-revenue analysis for Manufacturers (*Chapter 4*)
- Facility-level cost-to-revenue analysis and electricity rate impact analysis for Electric Generators (*Chapter 5*)
- Electricity market model analysis (*Chapter 6*)
- Regulatory Flexibility Act (RFA) analysis (*Chapter 7*)
- Unfunded Mandates Reform Act (UMRA) analysis (*Chapter 8*)
- Analyses to address executive orders and other administrative requirements (*Chapter 9*)
- Assessment of economy-wide output and employment effects (*Chapter 10*)
- Assessment of total social costs (*Chapter 11*)
- Assessment of total social costs and benefits (*Chapter 12*)

1 For more details on these analyses see *Chapter B1: Summary of Compliance Costs* in the suspended 2004 Phase II Final EA Report and *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* in the 2006 Phase III Final EA Report.

In addition to these chapters and their respective analyses, the EA document also includes Chapter 13, which addresses a regulatory option that was developed and analyzed late in the document preparation process. Chapter 13 includes all analytic findings for this additional regulatory option as described in the preceding EA chapters.

1.2.3 Regulatory Options Considered for the Proposed Existing Facilities Rule

EPA analyzed three regulatory options for its analysis of the Proposed Existing Facilities Rule, which vary in the technology requirements and compliance schedules applicable to in-scope facilities:

- *Option 1: Impingement Mortality at All Existing Facilities and Entrainment Mortality Controls for All New Units at Existing Facilities; Determined Entrainment Controls for Facilities Greater than 2 MGD DIF On a Site-Specific Basis (IM Everywhere*[2]*)*: Under this option, all in-scope existing facilities are required to achieve either the design or the performance standard for impingement mortality. EPA has identified modified traveling screens with a fish return system as the technology basis for these limits. The proposed limitations on impingement mortality are a maximum of 31% mortality on a monthly basis and 12% on an annual basis. Facilities would be required to meet the IM technology specifications within 5 years of rule promulgation. In addition, entrainment controls would be established by the permitting authority on a case-by-case basis for all facilities with at least 2 MGD DIF, and new units at an existing facility would be required to reduce flow commensurate with closed cycle cooling. For details of the technologies, see the Technical Development Document for the Proposed Section 316(b) Existing Facilities Rule (EPA-821-R-11-0003), hereafter referred to as the Technical Development Document (TDD); see the Federal Register notice and rule language for further discussion of the requirements of this option.
- *Option 2: Impingement Mortality Everywhere and Entrainment Mortality for Existing Facilities with DIF >125 MGD and All New Units at Existing Facilities (IM Everywhere, EM for Facilities with DIF>125 MGD)*: Under this option, in-scope existing facilities with a DIF exceeding 125 MGD are required to achieve impingement and entrainment mortality reductions by reducing intake flows commensurate with closed cycle cooling (i.e., these facilities are assigned the technology requirements from Option 3, below). All other in-scope existing facilities are required to achieve numeric impingement mortality limits only (i.e., these facilities are assigned the technology requirements from Option 1, above). Facilities installing IM-only technology would be required to meet this requirement within 5 years of rule promulgation. Facilities with DIF exceeding 125 MGD and installing EM technology would be required to meet this requirement within 10 years for non-nuclear electric generating facilities, and within 15 years for nuclear electric generating facilities and manufacturing facilities. In addition, entrainment controls would be established by the permitting authority on a case-by-case basis for all facilities with at least 2 MGD DIF but less than 125 MGD DIF, and new units at an existing facility would be required to reduce flow commensurate with closed cycle cooling. For details of the technologies, see the *Technical Development Document*; see the Federal Register notice for further discussion of this option.
- *Option 3: Impingement and Entrainment Mortality Everywhere (I&E Mortality Everywhere)*: Under this option, in addition to requirements for all in-scope existing facilities to achieve numeric impingement mortality limits, all facilities must achieve entrainment mortality reductions by reducing intake flows commensurate with closed cycle cooling. EPA has identified wet cooling towers as the technology basis for these limits. This option would establish optimized wet cooling towers as a design standard. Optimized wet cooling would be demonstrated through flow monitoring and conductivity measurements. Optimized cooling towers achieve flow reductions of 97.5 percent and 94.9 percent for freshwater and saltwater

[2] The shorthand notation for this and the other option refers to the minimum direct requirements of the regulatory options. For example, for Option 1, in addition to this minimum requirement (e.g., IM technology for all in-scope facilities), additional requirements for EM technology may be determined on a case-by-case basis and all new units at existing facilities would be required to meet EM technology standards.

sources, respectively. Alternatively, this option would allow facilities to demonstrate flow reductions commensurate with closed cycle cooling based on optimized wet cooling towers. Facilities would be required to meet this EM technology requirement within 10 years of rule promulgation for non-nuclear electric generating facilities, and within 15 years for nuclear electric generating facilities and manufacturing facilities. In addition, new units at an existing facility would be required to reduce flow commensurate with closed cycle cooling. For details of the technologies, see the *Technical Development Document*; see the Federal Register notice for further discussion of this option.

- *Option 4: Uniform Impingement Mortality Controls at Existing Facilities with DIF of 50 MGD or more; Best Professional Judgment-based Permits for Existing Facilities with DIF Less Than 50 MGD but more than 2 MGD DIF; Uniform Entrainment Controls for All New Units at Existing Facilities (IM for Facilities with DIF>50 MGD).* Option 4 is the same as *Option 1: IM Everywhere*, in all respects except that Option 4 requires only in-scope existing facilities with a DIF greater that 50 MGD to achieve the uniform national impingement mortality design/performance standard. Existing facilities between 2 and 50 MGD would remain subject to 316(b) permitting based on best professional judgment. EPA developed and analyzed this option *after* completing the analysis and documentation of the other three regulatory options. As a result, the analysis results for Option 4 are presented in a separate chapter of the EA document.

1.2.4 Organization of the Economic and Benefits Analysis Report

This Economic and Benefits Analysis Report (the EBA Report) follows a similar organizational structure to the EBA report for the previous 316(b) regulations, with the exception that the detailed benefits analysis is presented in a separate document, the *Environmental and Economic Benefits Assessment*. The EBA includes the following chapters:

- *Chapter 2: Industry Profiles* provides background information on the electric power generation industry and the six primary manufacturing industries, and specifically the characteristics of the in-scope facilities in relation to other facilities in the respective industries.
- *Chapter 3: Development of Costs for Regulatory Options* details the methods used to develop and assign the costs of compliance and administration for the Proposed Existing Facilities Rule to individual complying facilities, and to NPDES permitting authorities and the Federal government.
- *Chapter 4: Cost Impact Analyses – Manufacturers* assesses the impacts of compliance on the Manufacturers segment of in-scope facilities in terms of *severe impacts* (i.e., facility closures) and *moderate impacts* (i.e., adverse changes in a facility’s financial position that are of lower severity than closure), and on their owning entities based on a cost-to-revenue basis.
- *Chapter 5: Cost Impact Analyses – Electric Generators* assesses the impacts of compliance on the Electric Generators segment of in-scope facilities and their owning entities based on a cost-to-revenue analysis. This chapter also assesses the potential impact on consumer electricity rates in terms of increased electricity prices for households and for other consumers of electricity.
- *Chapter 6: Assessing the Impact of the Existing Facilities Regulatory Options in the Context of National Electricity Markets* analyzes the impacts of the rule using the output of the Integrated Planning Model (IPM), which predicts impacts of the proposed rule in the context of changes to the entire electricity market, including both in-scope and out of scope facilities.
- *Chapter 7: Assessing the Potential Impact of the Proposed Existing Facilities Rule on Small Entities – Regulatory Flexibility Act (RFA) Analysis* addresses the requirements of RFA and assesses the impact of the rule on small entities on the basis of a cost-to-revenue comparison.

- *Chapter 8: Unfunded Mandates Reform Act (UMRA) Analysis* addresses the requirements of UMRA by assessing the impact on government entities, both in terms of compliance costs to government-owned Electric Generators and in terms of administrative costs to governments implementing the rule. This analysis also compares the impacts to small governments with those of large governments and small private entities.
- *Chapter 9: Other Administrative Requirements* addresses the requirements of Executive Orders that EPA is required to satisfy for this proposal, notably Executive Order 13211, which requires EPA to determine if this action will have a significant effect on energy supply, distribution, or use.
- *Chapter 10: Assessment of Total Economic Impact* looks at the economy-wide output and employment of effects – direct, indirect, and induced – of the proposed regulation, accounting for inter-industry linkages at the national level.
- *Chapter 11: Assessment of Total Social Costs* looks at the impact of the regulation in terms of its total social cost, including costs to complying facilities, implementation costs to governments, and the costs to society from potential reductions in electric generating capacity on a year-by-year basis.
- *Chapter 12: Comparison of Social Costs and Benefits* compares the estimated total costs of the regulation with estimated benefits, on the bases of both a year-explicit schedule of costs and benefits, and annualized costs and benefits, and also compares the incremental benefits across regulatory options.
- *Chapter 13: Cost and Economic Impact of Additional Regulatory Option* presents the cost, economic impact and benefits analysis results for Option 4 (*IM for Facilities with DIF>50 MGD*), which was developed and analyzed after completion of analysis and EA documentation for Regulatory Options 1, 2, and 3. For this reason, the EA findings for Option 4 are presented in a separate chapter.

This document includes seven appendixes:

- *Appendix 3A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses* describes the development and use of sample weights for the cost and economic impact analysis of the proposed regulatory options.
- *Appendix 3B: Analysis of Short Term Reduction in Capacity Availability Due to Installation Downtime* assesses the potential impact of reduced generating capacity availability due to downtime of generating units during technology installation.
- *Appendix 3C: Mapping Manufacturers' Standard Industrial Classification Codes to North American Industry Classification System Codes* discusses the mapping of the facility-level 4-digit SIC codes for which the 316(b) Survey-based facility information for Manufacturers was originally reported, onto 6-digit NAICS codes for use in the current cost and economic impact analysis.
- *Appendix 4A: Cost Pass-Through Analysis* assesses the cost pass-through (CPT) potential for the six Primary Manufacturing Industries sectors in which a substantial number of facilities are expected to be subject to the Proposed 316(b) Existing Facilities Rule.
- *Appendix 4B: Adjusting Baseline Facility Cash Flow* describes EPA's development of adjustment factors to bring certain survey-based financial data for the six Primary Manufacturing Industries to the present.
- *Appendix 4C: Estimating Capital Outlays for Section 316(b) Manufacturing Sectors Discounted Cash Flow Analyses* describes the analysis used to estimate ongoing capital outlays for use in the facility-level cash flow analyses for Manufacturers.
- *Appendix 4D: Analysis of Other Regulations* presents analysis of other environmental regulations that were recently or will soon be promulgated, potentially imposing additional costs on 316(b) Manufacturing Industries beyond those reflected in in-scope facilities' baseline financial statements.

2 Introduction to Industry Profiles

In this chapter, EPA presents economic profiles of the industries identified in the previous 316(b) rulemakings as most reliant on cooling water in their operations and thus containing substantial numbers of facilities that are expected to be within the scope of the Proposed Existing Facilities Regulation. These profiles review information on the historical economic/financial performance, structure, and economic outlook for these industries and are meant to provide insight on how the requirements of the Proposed Regulation will affect these industries. In particular, the profiles assess the number of facilities that are expected to be within the scope of the Proposed Regulation and the economic activity and employment in the in-scope segments, and review factors influencing the ability of these industries to meet the Proposed Regulation's compliance requirements without undue adverse economic impact.

These profiles cover the two broad categories of facilities that are within the Proposed Rule's scope:

1. Electric Generators
2. Manufacturers

In the previous rulemaking efforts, EPA identified the electric power sector – Electric Generators – as the industry most reliant on cooling water in its operations. Within the Manufacturers category, EPA previously identified six industries as having the largest total reliance on cooling water and the largest numbers of facilities that would likely be subject to 316(b) regulations, including the Proposed Existing Facilities rule. These six industries, referred to as the Primary Manufacturing Industries, are covered by this profile:

- Paper and Allied Products (NAICS 322)
- Chemicals and Allied Products (NAICS 325)
- Petroleum Refining (NAICS 324)
- Steel (NAICS 3311 and 3312)
- Aluminum (NAICS 3313)
- Food and Kindred Products (NAICS 311 and 3121).

Facilities in other industries also use cooling water and could therefore be subject to section 316(b) regulations; however, based on EPA's previous reviews of industries' reliance on cooling water, the cooling water intake flow of these remaining industries is small relative to that of the power industry and the six selected industries. Therefore, the industry profiles presented in the following subchapters for the 316(b) Existing Facilities Rule focus on the Electric Generators as well as the Manufacturers industries listed above.

This profile also reports information on certain facilities from which EPA received questionnaire responses in its earlier 316(b) surveys that were found not to be part of Electric Generators or 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 manufacturing industries listed above. This profile includes information for these facilities, referred to as "Other Industries."

The remainder of this chapter is divided into eight subchapters:

- 2A: Paper and Allied Products (NAICS 322),
- 2B: Chemicals and Allied Products (NAICS 325),
- 2C: Petroleum and Coal Products (NAICS 324),
- 2D: Steel (NAICS 3311 and 3312),
- 2E: Aluminum (NAICS 3313),
- 2F: Food and Kindred Products (NAICS 311 and 3121),
- 2G: Other Industries,

- 2H: Electric Power

Each Manufacturers industry subchapter, 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 316(b) Existing Facilities Rule. Data presented in these six sub-chapters span nearly two decades to ensure a review of industry trends since the time of the *Detailed Industry Questionnaire* (1996-1998). 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.

The Electric Power industry subchapter compiles and analyzes economic and operational data for the electric power generating industry. It provides information on the structure and overall performance of the industry and explains important trends that may influence the nature and magnitude of economic impacts that could result from regulation of existing facilities.

This profile uses the North American Industry Classification System (NAICS) as the primary framework for analyzing and reporting information about the industries analyzed for the 316(b) Existing Facilities regulation. However, older data were often reported in the Standard Industrial Classification (SIC) system, which the U.S. Economic Census used for economic reporting until 1997 when data reporting switched to the NAICS system. Where necessary, EPA converted information reported in the SIC framework to the NAICS 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 (see *Appendix 3C for a more in-depth discussion)*. EPA presents nearly twenty years of industry data to prevent any data anomalies at the time of the change in classifications from affecting the longer-term understanding of trends in the profiled industries.

2A Profile of the Paper and Allied Products Industry

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified five 4-digit SIC codes in the Paper and Allied Products manufacturing industry (SIC 26) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws at least 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 316(b) Existing Facilities regulation" or "in-scope facilities"). For the purpose of this analysis, EPA identified a six-digit NAICS code for each of these potential facilities using the information from DQ and public sources (see *Appendix 3.C: Conversion the Data from Standard Industrial Classification (SIC) to North American Industry Classification System (NAICS)*). As the result of this mapping, EPA identified six 6-digit NAICS codes in the Paper and Allied Products manufacturing industry (NAICS 322).

For each of these six analyzed 6-digit NAICS codes, *Table 2A-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), and the number of facilities estimated to be potentially subject to the proposed 316(b) Existing Facilities Rule based on the minimum withdrawal threshold of 2 MGD (see *Chapter 1: Introduction* for more details on the Rule applicability criteria).

Table 2A-1: Existing Facilities in the Paper and Allied Products Industry (NAICS 322)

NAICS	NAICS Description	Important Products Manufactured	Number of In-Scope Facilities[a]
322110	Pulp Mills	Pulp from bagasse, linters, rags, straw, wastepaper, and wood manufactured by chemical, mechanical, or semichemical processes without making paper for paperboard.	34
32212	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.	134
322130	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.	48
		Total	***216***
		Other Paper and Allied Products Segments	
322222	Coated and Laminated Paper Manufacturing	Cutting and coating paper, cutting a laminating paper and other flexible materials (except plastics film), laminating aluminum and other metal foils for non-packaging uses from purchased foil.	3
322224	Uncoated Paper and Multiwall Bag Manufacturing	Uncoated, multiwall, paper bags manufactured from purchased paper.	3
322299	All Other Converted Paper Products Manufacturing	Containers, bags, coated and treated paper, stationary products, and sanitary paper products from paper and paperboard products; converted pulp products (i.e. egg cartons, food trays, and other food containers) from molded pulp.	3
		Total Other	***9***
		Total Paper and Allied Products (NAICS 322)	
		Total NAICS Code 322	***225***

[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, 2010.

As shown in *Table 2A-1*, EPA estimates that out of an estimated total of 563 facilities[3] with a NPDES permit and operating cooling water intake structures in the Paper and Allied Products Industry (NAICS 322), that 225 (40 percent) are expected to be subject to the 316(b) Proposed Existing Facilities Regulation. EPA also estimated the percentage of total industry 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 2007 Economic Census is $82.8 billion ($2009). 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 the potential existing 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 the 316(b) Existing Facilities regulation is $70.1 billion. Therefore, EPA estimates that the percentage of total production in the paper industry that occurs at facilities estimated to be subject to regulation is 85 percent.

The responses to the DQ indicate that three segments account for most of the existing Manufacturers in the Paper and Allied Products industry: (1) Pulp Mills (NAICS 322110), (2) Paper Mills (NAICS 32212), and (3) Paperboard Mills (NAICS 322130). The remainder of this profile therefore focuses on these three industry segments.

3 This estimate of the number of facilities potentially subject to regulation is based on the universe of facilities that received the 1999 screener questionnaire.

Table 2A-2 provides the cross-walk between NAICS codes and SIC codes for the profiled paper NAICS codes. The table shows that both Pulp Mills and Paperboard Mills have a 1 to 1 relationship to their SIC codes. A large portion of SIC code 2621 (84 percent based on value of shipments) corresponds to Newsprint Mills. NAICS 322121, classified as Paper (except newsprint) Mills, corresponds to three SIC codes (2621, 2676, and 3842).

Table 2A-2: Relationship between NAICS and SIC Codes for the Paper and Allied Products Industry (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	Number of Establishments	Value of Shipments (Millions; $2009)	Employment
322110	Pulp mills	2611	Pulp mills	39	$5,196	7,268
322121	Paper (except newsprint) mills	2621	Paper Mills	241	$47,841	75,921
		2676	Sanitary Paper Products			
		3842	Surgical Appliances and Supplies			
322122	Newsprint mills	2621	Paper Mills	21	$3,556	4,917
322130	Paperboard mills	2631	Paperboard mills	187	$26,204	36,641

Sources: U.S. DOC. 2007 Economic Census.

2A.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 the Proposed 316(b) Existing Facilities Rule 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.

2A.1.1 Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the Paper and Allied Products 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 Mills industry segment 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 industry 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 judges that in-scope facilities in the Paper and Allied Products industry subject to the 316(b) Existing Facilities Regulation are not likely to be able to recover compliance costs through prices increases to customers. 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 within their operating finances (see following sections and *Appendix 4.A: Cost Pass-Through Analysis* for more information).

2A.1.2 Financial Health and General Business Outlook

Over the past two decades, the Paper and Allied Products industry, like other U.S. manufacturing industries, has experienced a range of economic/financial conditions, including substantial challenges. Going into 2000, the industry's financial performance started to improve from the erratic conditions of 1990s, but the subsequent recession and global economic downturn, coupled with continuing overproduction, led to declining financial results that persisted through 2003. Financial performance in 2004 through 2007 showed significant improvement and steady growth. However, during the current economic recession, the Paper and Allied Products industry's revenues and overall market value once again decreased significantly, but less so than the overall S&P 500 trend (McNutt, 2009).

Throughout this decade, the Paper and Allied Products industry continued 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 expected recovery in U.S. economic conditions, the Paper and Allied Products industry appears poised to achieve stronger financial performance from this point out. In 2009, the Paper and Allied products sub-industry equity price index increased 134.4 percent, compared to a 24.3 percent increase for the S&P 1500 (S&P, 2010b). Domestic demand for paper and paperboard products is expected to increase as the economy rebounds as the result of large government stimulus packages, inventory rebuilding by end users, and competitiveness of paper in certain markets. Overall world paper and paperboard usage is expected to return to solid growth in 2010 to 2011, reaching 396 million tons in 2011, which is 3 million tons above the pre-recession value. Much of this world demand growth will be fueled by strong economic development and a rising middle class in developing countries, lead by China (Young, 2009). This should position businesses that potentially within the scope of the Existing Facilities Rule to withstand additional regulatory compliance costs without having a significant financial impact.

2A.1.3 Domestic Production

The Paper and Allied Products industry is one of the top ten U.S. manufacturing industries; the larger forest products industry, which includes the paper and allied products subsector, accounts for approximately 5 percent of the nation's GDP (AF&PA, 2009). Growth in the paper industry is generally tied closely 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, beginning in 2000, exports took on an increasingly important role, and growth in a number of foreign paper and paperboard markets became 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 over the years U.S. producers have continued to seek growth opportunities in overseas markets. Although exports still represent a small share of domestic shipments for the paper and paperboard mills segment, 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 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). Over the last two decades, U.S. producers have faced growing competition from new facilities constructed overseas, however (McGraw-Hill, 2000). The 2009 AF&PA Annual Survey of Paper, Paperboard, and Pulp Capacity reports that the average annual rate of contraction from 2001 to 2007 hovered around 1 percent, largely as a result of foreign competition and more recently, the domestic economic recession. However, in 2008, industry capacity declined by only 0.8 percent, and according to the survey, industry capacity is expected to expand by 0.3 percent in 2010 and 2011 (AF&PA, 2009).

The Paper and Allied Products 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 electricity (McGraw-Hill, 2000). The use of renewable resources (biomass, black liquor, hydroelectric, etc.) for energy production has increased steadily over the past several decades, rising from 40 percent of total industry energy consumption in 1972 to 56 percent in 2000. Renewable resource-based energy was estimated to account for about 60 percent of consumption in 2004 (Paper Age, 2004a).

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, 2003). While this consolidation led to a balance in supply and demand and subsequent relative financial soundness, the Paper and Paperboard industry segment suffered from the 2008-2009 recession with nearly all grades and segments recording declines in global consumption. One exception, tissue paper, grew 1.0 – 1.5 percent in 2009, with a full rebound to strong growth rates expected to occur in 2010; 9 percent growth is expected in China consumption alone. (Uutela, 2010).

The connection between business activity and office paper demand is eroding as electronic substitution, such as online bill paying, email, internet publications, and electronic readers, become viable substitutes for several uses of paper (S&P, 2010b). For instance, in 1999, newsprint demand was at its peak but with the advent and growing popularity of the internet, domestic newsprint demand has fallen 57 percent in ten years (Timonen, 2010). However, paper as a means for transmitting and storing information is far from being obsolete. Global paper consumption increased dramatically in the decade prior to the economic recession, and will continue to rise especially in developing countries (Environmental Paper Network, 2007). However, the newsprint industry is most at risk from competition from substitutes.

2A.1.4 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. 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 also placed a greater emphasis on foreign markets both through export sales and investments in overseas facilities (McGraw-Hill, 2000). The Paper industry segment 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, 2001c). 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 United States in 2001 dropped 1.5 percent, while earnings at the top 31 U.S. corporations fell by nearly 75 percent, partly due to a decrease in prices of up to 15 percent (Paun et al. 2004).

Capacity for the U.S. Paper and Paperboard segment declined annually from 2001 to 2003, in contrast to annual increases in capacity for the previous two decades. Capacity declined 1.9 percent in 2001, 1.3 percent in 2002, and 0.4 percent in 2003, and remained largely 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 United States 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 percent to 53 million tons, while paper and paperboard production decreased 5.5 percent to 81 million tons (Paun et al. 2004). During the rest of the decade, however, the overall production for the U.S. Paper and Allied Products industry remained relatively flat until the recession of 2008-2009, when production of all grades began to decline.[4] Only tissue production remained strong during the recessionary period (McNutt, 2009). During 2009 alone, total printing-writing paper

[4] Grades are product categories such as containerboard, packaging, printing & writing papers, newsprint, and tissue.

shipments experienced a 17 percent decline, shipments for Kraft paper fell by 16 percent, and containerboard by 9.5 percent. (AF&PA, 2009). Although these industry segments showed decline in total output, the last quarter of 2009 saw relative production increases from the previous months, and signaled the potential beginning of recovery from the economic downturn.

As the economy continues to improve, demand should pick up, with better financial performance expected in the next few years, 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 in the short run (Schwartz, 2009). These improving conditions should better position firms to manage any increase in production costs resulting from regulatory compliance.

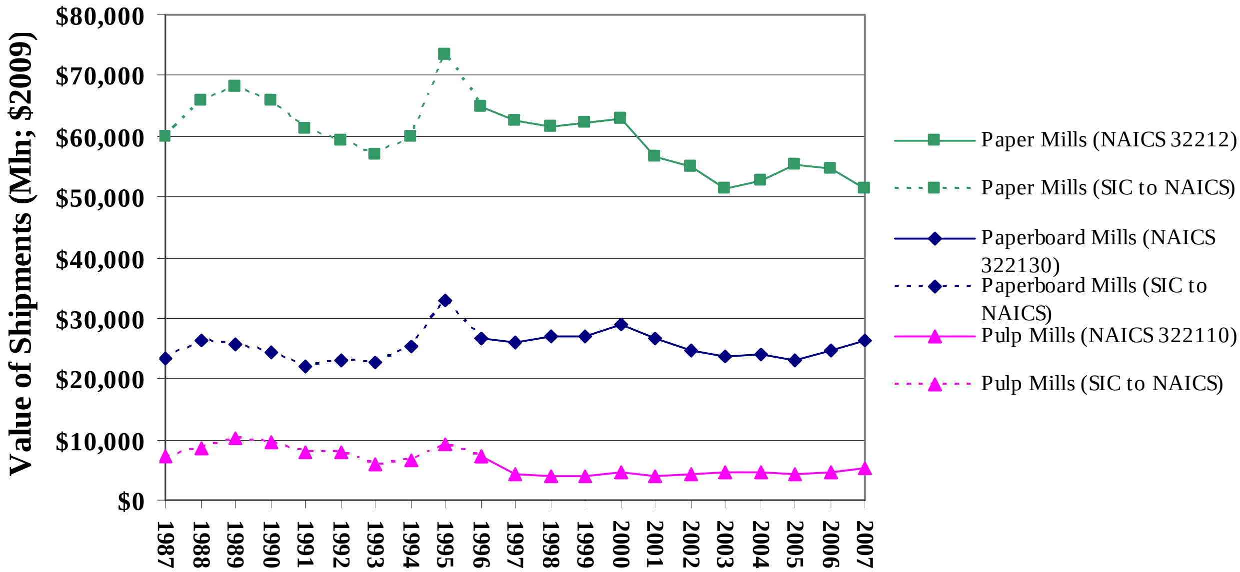
Figure 2A-1 shows the trend in ***value of shipments*** and ***value added*** for the three profiled segments.[5] Value of shipments and value added, two common measures of manufacturing output, provide insight into an industry's overall economic health and outlook. ***Value of shipments*** is the sum 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 from other industries used to make the products sold.

Between 1987 and 2007, the Paper and Allied Products industry performed erratically, with swings in value of 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 and value added during the 20-year analysis period, while both the Paper Mills and the Pulp Mills segments recorded real declines over the same period, with pulp mills faring the worst. Moreover, the recent downturn in the housing market has been particularly disruptive for this industry. Stagnant new home sales have left saw mills unable to sell lumber products, forcing many to shut down operations. As a result, these closings have caused the price of inputs such as wood chips and kraft pulp to increase. The combination of rising input prices and a sharp decline in demand has led manufacturers to sell their products at a loss thereby reducing the total value of shipments for this industry in recent years (Great American Group, 2009).

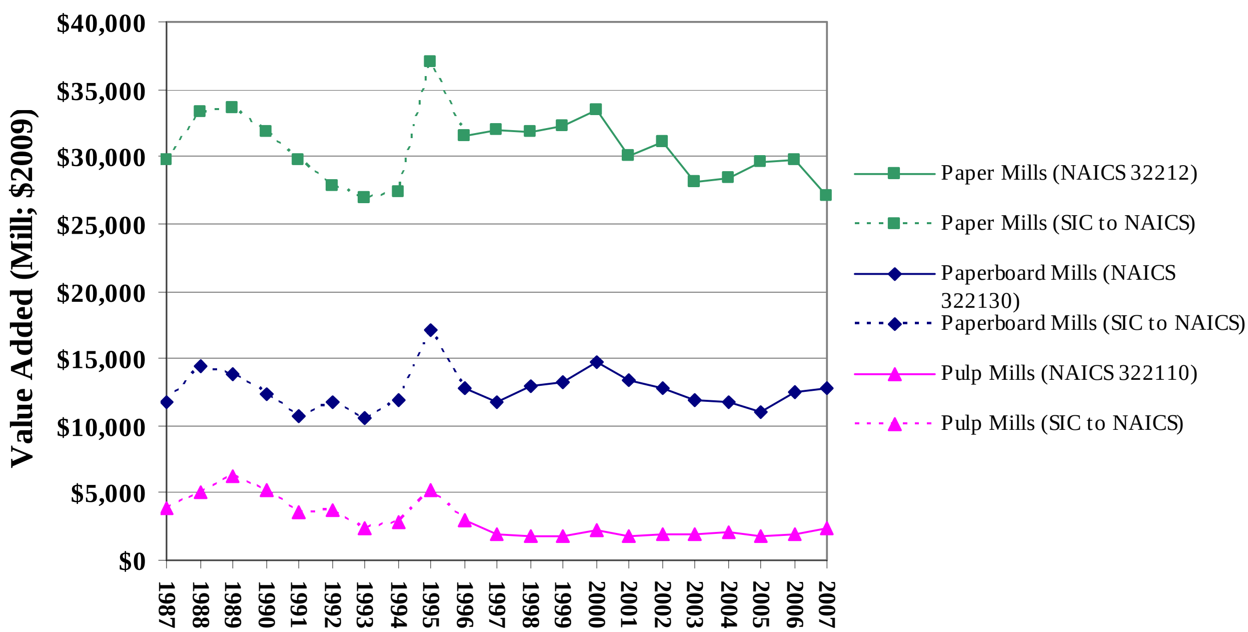
5 Terms highlighted in bold and italic font are further explained in the glossary.

Figure 2A-1: Value of Shipments and Value Added for Profiled Paper and Allied Products Segments (Millions, $2009)[a]

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2A-3 provides the Federal Reserve System's index of industrial production for the profiled pulp and paper segments, which shows trends in production between 1990 and 2009. 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. Overall, production for all three analyzed Paper and Allied Products industry segments declined between 1990 and 2009, with the Paper Mills segment experiencing the largest decline. However, during the last decade, the Pulp Mills segment experienced a slight increase in production of 3.1 percent, despite the waning global economy. During the same period, the Paper Mills and the Paperboard Mills segments were not as successful in maintaining production, and both had average annual growth rates of negative 3.0 percent. Following recovery from the most recent recession, the pulp and paper industry production index could be expected to improve.

Table 2A-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
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	106.2	1.0%	95.5	0.3%	97.9	-1.5%
2006	91.5	-10.9%	101.7	7.1%	92.7	-4.4%
2007	92.5	1.1%	99.6	-2.1%	93.7	1.1%
2008	90.3	-2.4%	96.2	-3.4%	89.1	-4.9%
2009[d]	82.6	-8.6%	83.2	-13.6%	80.1	-10.1%
Total Percent Change 1990-2009	**-1.7%**		**-23.4%**		**-14.6%**	
Total Percent Change 2000-2009	**3.1%**		**-24.0%**		**-23.8%**	
Average Annual Growth Rate 1990-2009	**-0.1%**		**-1.4%**		**-0.8%**	

a. NAICS 32211.
b. NAICS 32212.
c. NAICS 32213.
d. Average through 9/2009

Source: Economagic; Federal Reserve, Board of Governors, 2009b.

2A.1.5 Prices

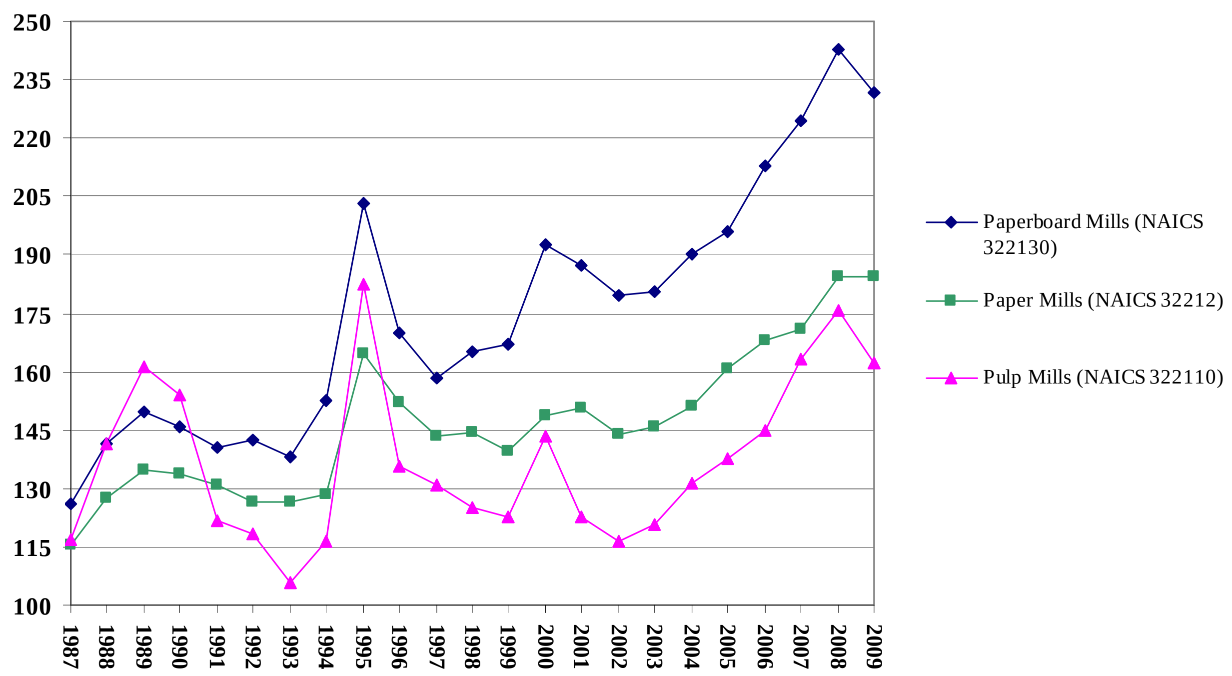
The ***producer price index (PPI)*** measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

Price levels in the U.S. Paper and Allied Products industry closely reflect domestic and foreign demand, and industry capacity and operating rates, which determine supply (S&P, 2001c). 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 economic slowdown of 2001, however, producers appeared more willing to cut output to prevent sharp reductions in prices (Ince, 1999; S&P, 2001c).

As shown in *Figure 2A-2***,** the Paper and Allied Products 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 that decade. Entering the 2000s decade, prices in the Paper and Allied Products 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, 2003). 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, 2001c). Prices started to level off near the end of 2002, and proceeded to rise during 2003 through 2007.

In 2008, Paper and Allied Products industry prices reached near historical peak levels. Overall, following the recession, prices remained comparable to the strong 2008 averages. Prices for many grades of paper trended higher for most of 2008 due in part to capacity closures. Market pulp prices have fallen sharply and quickly in the last year (McNutt, 2009). Paperboard prices have also decreased while prices for paper have flattened out.

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



Source: BLS, 2009c.

Paper and Allied Products industry manufacturers have exhibited more resilient prices compared to other industries during the current economic downturn (Cody, 2009). Overall, prices for pulp, paper, and paperboard products are expected to increase slightly in 2010 due to gradually improving economic activity and employment levels (S&P, 2010b).

2A.1.6 Number of facilities and firms

Table 2A-4 and *Table 2A-5* present the number of facilities and firms for the three profiled Paper and Allied Products industry segments between 1990 and 2006. The Statistics of U.S. Businesses reports that the number of facilities in the Pulp Mills segment decreased by 4.3 percent between 1990 and 2006, while the number of Pulp Mill firms remained constant in the same period. One of the reasons for this decline in number of facilities was 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. In fact, U.S. de-inked recycled market pulp capacity more than doubled between 1994 and 1998 (McGraw-Hill, 2000). The secondary fiber share of total papermaking fiber production increased steadily during the decade, 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.

Between 1990 and 2006, the number of facilities and parent firms in the Paper Mills industry segment decreased by 22.1 percent and 17.4 percent, respectively. The numbers of facilities and firms in the Paperboard Mills industry segment also declined by 9.3 and 14.7 percent, respectively. Overcapacity in the 1990s limited the construction of new facilities. In 1998 and 1999, alone, 0.6 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 was removed (Pponline, 1999). In 2001 and 2002, 8.2 million tons of capacity closed, mostly in containerboard, market pulp, and print and writing papers (Paper Age, 2004c).

The number of Pulp Mill facilities and firms has not demonstrated the same level of decline as Paper and Paperboard manufacturers. In particular, in 2004 the number of facilities grew by 13.2 percent and the number of firms by 14.8 percent, suggesting that the Pulp Mills segment could be entering a period of long-term growth. There has been extensive restructuring and consolidation in the Paper segment during the second half of 2000s decade, especially for containerboard producers – resulting in a higher concentration of top producers. Boxboard and newsprint manufacturers have also experienced a significant number of closures. Newsprint is perceived to be the weakest subsector of the Paper and Allied Products industry, and may face additional consolidation in the future (McNutt, 2009). Whereas it seems that other Paper and Allied Products industry product categories have merely suffered from volatility in the U.S. and global economy, newsprint and graphic papers have demonstrated long-term decline in demand and susceptibility to closures due to increasing competition from electronic products. Overall, 41 Paper and Paperboard machine lines and 18 mills closed permanently in 2008 (AF&PA, 2009).

Table 2A-4: Number of Facilities Owned by Firms in the Profiled Paper and Allied Products Segments

Year[a]	Pulp Mills[b]		Paper Mills[c]		Paperboard Mills[d]	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	46	n/a	327	n/a	226	n/a
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	44	7.3%	235	-9.4%	232	8.4%
1999	45	2.3%	242	3.2%	233	0.4%
2000	48	6.7%	240	-1.0%	238	2.1%
2001	51	6.3%	238	-0.8%	247	3.8%
2002	44	-13.7%	271	14.0%	231	-6.5%
2003	38	-13.6%	287	5.9%	221	-4.3%
2004	43	13.2%	385	2.4%	221	0.0%
2005	43	0.0%	368	-4.4%	210	-5.0%
2006	44	2.3%	348	-5.4%	205	-2.4%
Total Percent Change 1990-2006	**-4.3%**		**-22.1%**		**-9.3%**	
Total Percent Change 2000-2007	**-8.3%**		**11.9%**		**-13.9%**	
Average Annual Growth Rate	**-0.3%**		**-1.5%**		**-0.6%**	

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census *Bridge Between SIC and NAICS*.
b. NAICS 322110.
c. NAICS 32212.
d. NAICS 322130.
Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

Table 2A-5: Number of Firms in the Profiled Paper and Allied Products Segments

Year[a]	Pulp Mills[b]		Paper Mills[c]		Paperboard Mills[d]	
	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	32	18.5%	124	-5.3%	95	11.8%
1999	33	3.1%	133	7.2%	95	0.0%
2000	36	9.1%	134	0.7%	105	10.5%
2001	40	11.1%	140	4.6%	116	10.5%
2002	27	-32.5%	174	23.9%	107	-7.8%
2003	27	0.0%	162	-6.7%	90	-15.9
2004	31	14.8%	226	7.6%	92	2.2%
2005	30	-3.2%	211	-6.6%	88	-4.3%
2006	31	3.3%	197	-6.6%	87	-1.1%
Total Percent Change 1990-2006	**0.0%**		**-17.4%**		**-14.7%**	
Total Percent Change 2000-2006	**-13.9%**		**15.2%**		**-17.1%**	
Average Annual Growth Rate	**0.0%**		**-1.2%**		**-1.0%**	

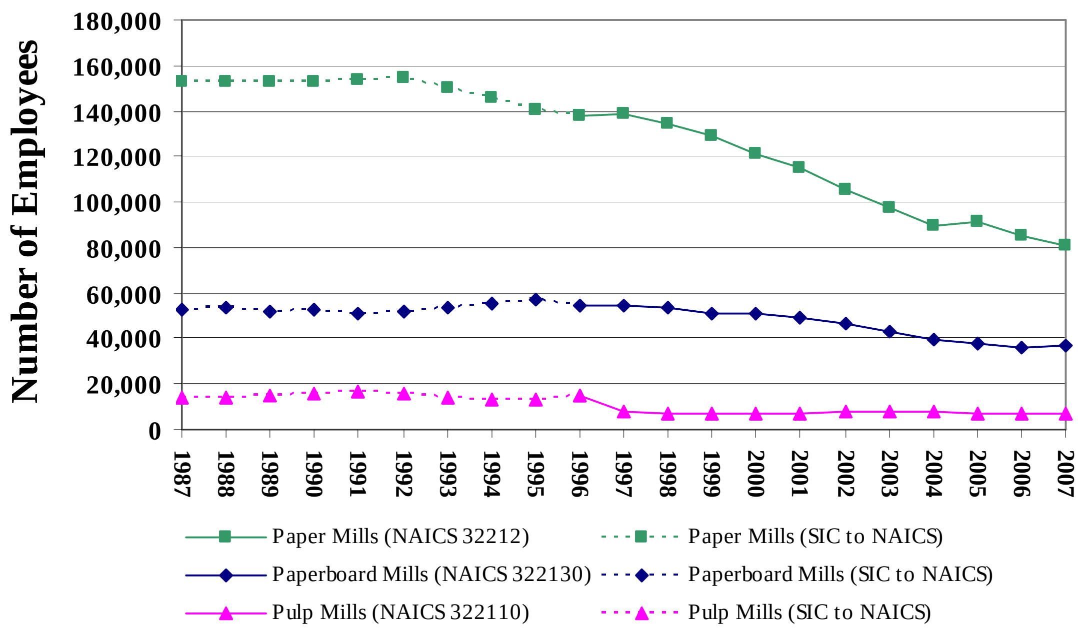
a. Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC*.
b. NAICS 322110.
c. NAICS 32212.
d. NAICS 322130.
Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

2A.1.7 Employment and productivity

The U.S. Paper and Allied Products 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 principally aimed at productivity improvements.

Employment in the three profiled Paper and Allied Products industry segments remained relatively constant from 1987 through the mid 1990s. Since then, employment at Pulp Mills has dropped considerably, decreasing by 46 percent by 2007; Paper Mills also saw a substantial reduction in the workforce of close to 43 percent in the same period. Employment in Paperboard Mills fell the least over this period, but still declined by over 35 percent. Part of this employment loss is attributable to firms closing older and higher cost facilities with lower employee productivity (McNutt, Cenatempo & Kinstrey, 2004). Pulp, paper, and paperboard mills have faced serious losses in employment in the latter part of the 2000s decade, losing roughly 81,000 jobs between January of 2000 and December of 2009. The majority of layoff events occurred in 2001 and 2009 during recessionary periods, but layoffs diminished considerably in the third and fourth quarters of 2009 (BLS, 2010). *Figure 2A-3* presents employment for the three profiled Paper and Allied Products industry segments between 1987 and 2007.

Figure 2A-3: Employment for Profiled Paper and Allied Products Segments[a]



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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2A-6 on the following page presents the change in value added per labor hour, a measure of ***labor productivity***, for each of the profiled Paper and Allied Products industry segments between 1987 and 2007. 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 2007. These changes were primarily driven by fluctuations in value added and production levels. Overall, productivity in Pulp Mills increased by 12.6 percent during this period, while increasing by 65.4 and 51.4 percent in the Paper Mills and Paperboard Mills, respectively. The effect of the current recession on productivity has been mixed, historically speaking (McNutt, 2009). The outlook for worker and capital productivity coming out of the recession is therefore uncertain, but no dramatic movements upwards or downwards have been observed thus far.

Table 2A-6: Productivity Trends for Profiled Paper and Allied Products Segments ($2009)

Year[a]	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	$3,867	24	162	n/a	$29,712	248	120	n/a	$11,719	89	132	n/a
1988	$5,107	24	214	32.1%	$33,309	251	133	11.0%	$14,385	91	158	19.6%
1989	$6,219	25	245	14.6%	$33,642	249	135	1.5%	$13,893	89	156	-1.7%
1990	$5,194	28	188	-23.4%	$31,785	248	128	-5.0%	$12,350	91	136	-12.4%
1991	$3,592	28	130	-30.6%	$29,784	250	119	-7.0%	$10,656	87	123	-9.7%
1992	$3,664	26	139	7.1%	$27,797	254	109	-8.3%	$11,754	88	133	7.9%
1993	$2,401	23	104	-25.4%	$26,871	252	107	-2.4%	$10,561	90	117	-11.8%
1994	$2,877	22	132	27.0%	$27,363	244	112	5.0%	$11,930	94	127	8.5%
1995	$5,273	23	233	76.8%	$36,961	238	155	38.7%	$17,038	98	175	37.1%
1996	$2,908	24	122	-47.9%	$31,543	235	134	-13.6%	$12,755	95	134	-23.0%
1997	$1,957	13	152	24.5%	$32,042	236	136	0.9%	$11,737	93	126	-6.2%
1998	$1,802	12	145	-4.4%	$31,852	225	141	4.4%	$12,978	90	144	14.1%
1999	$1,825	12	156	7.7%	$32,280	218	148	4.7%	$13,194	86	153	6.6%
2000	$2,262	12	190	22.0%	$33,455	202	165	11.5%	$14,753	86	171	11.5%
2001	$1,711	12	143	-24.9%	$30,075	190	159	-4.0%	$13,356	83	160	-6.3%
2002	$2,000	13	159	11.2%	$31,086	173	179	13.1%	$12,853	75	170	6.3%
2003	$1,936	13	146	-8.2%	$28,068	164	172	-4.3%	$11,915	74	160	-6.1%
2004	$2,104	13	162	11.0%	$28,470	155	184	7.1%	$11,761	67	175	9.1%
2005	$1,842	12	150	-7.3%	$29,585	161	184	0.2%	$10,965	63	173	-1.1%
2006	$1,877	12	153	1.9%	$29,745	146	204	10.7%	$12,528	62	203	17.7%
2007	$2,349	13	182	19.0%	$26,999	137	198	-3.1%	$12,803	64	201	-1.4%
Total % Change 1987-2007	**-39.3%**	**-46.0%**	**12.6%**		**-9.1%**	**-45.0%**	**65.1%**		**9.2%**	**-27.9%**	**51.4%**	
Total Percent Change 2000-2007	**3.8%**	**8.5%**	**-4.3%**		**-19.3%**	**-32.5%**	**19.6%**		**-13.2%**	**-26.0%**	**17.3%**	
Average Annual Growth Rate	**-2.5%**	**-3.0%**	**0.6%**		**-0.5%**	**-2.9%**	**2.5%**		**0.4%**	**-1.6%**	**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 SIC classification data to the NAICS code classifications using the 1997 Economic Census *Bridge Between SIC and NAICS.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2A.1.8 Capital expenditures

The Paper and Allied Products industry is highly cyclical and capital intensive. 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. The total level of capital expenditures for the Pulp, Paper, and Paperboard industry segments was $3.8 billion in 2007. The Paper Mills and Paperboard Mills segments accounted for approximately 95 percent of that spending (see *Table 2A-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 recent years has been 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.

Overall, from 1987 to 2007, the annual value of capital expenditures decreased by 27 percent for Pulp Mills, 54 percent for Paper Mills, and 11 percent for Paperboard Mills. However, North American producers have improved production asset quality in the latter half of the 2000s through incremental investment and closure of uncompetitive lines. The median age of paper machine lines decreased by 23 percent between 1999 and 2007. During the same time period, the average maximum speed of paper machine lines increased by 33 percent, the average width by 35 percent, and the average capacity by 20 percent (McNutt, 2009). It has been suggested that some industries, such as containerboard producers, have been successful enough at matching supply to demand that investment in new capital will be an attractive option for 2010 (Waghorne, 2010).

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

Table 2A-7: Capital Expenditures for Profiled Paper and Allied Products Segments (millions, $2009)

Year[a]	Pulp Mills		Paper Mills		Paperboard Mills	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	$392	n/a	$5,077	n/a	$1,309	n/a
1988	$507	29.3%	$5,823	14.7%	$2,487	89.9%
1989	$1,100	117.2%	$8,794	51.0%	$2,611	5.0%
1990	$1,602	45.6%	$6,929	-21.2%	$4,525	73.3%
1991	$1,455	-9.2%	$5,710	-17.6%	$3,160	-30.2%
1992	$1,108	-23.9%	$4,509	-21.0%	$2,927	-7.4%
1993	$598	-46.0%	$4,497	-0.3%	$2,306	-21.2%
1994	$433	-27.5%	$4,765	5.9%	$2,400	4.1%
1995	$622	43.5%	$4,211	-11.6%	$2,816	17.3%
1996	$922	48.2%	$4,632	10.0%	$3,118	10.7%
1997	$447	-51.5%	$4,893	5.6%	$2,096	-32.8%
1998	$534	19.3%	$5,111	4.5%	$1,789	-14.6%
1999	$236	-55.8%	$3,862	-24.4%	$1,610	-10.0%
2000	$293	24.2%	$4,090	5.9%	$1,469	-8.8%
2001	$234	-20.3%	$3,815	-6.7%	$1,247	-15.1%
2002	$223	-4.6%	$3,327	-12.8%	$975	-21.8%
2003	$212	-4.8%	$3,200	-3.8%	$892	-8.5%
2004	$213	0.2%	$2,305	-28.0%	$1,052	17.9%
2005	$132	-38.0%	$2,491	8.1%	$1,106	5.2%
2006	$386	192.9%	$2,377	-4.6%	$1,056	-4.6%
2007	$285	-26.1%	$2,337	-1.7%	$1,162	10.0%
Total Percent Change 1987- 2007	**-27.2%**		**-54.0%**		**-11.3%**	
Total Percent Change 2000- 2007	**-2.7%**		**-42.9%**		**-20.9%**	
Average Annual Growth Rate 1987 - 2007	**-1.6%**		**-3.8%**		**-0.6%**	

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census *Bridge Between SIC and NAICS.*

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2A.1.9 Capacity utilization

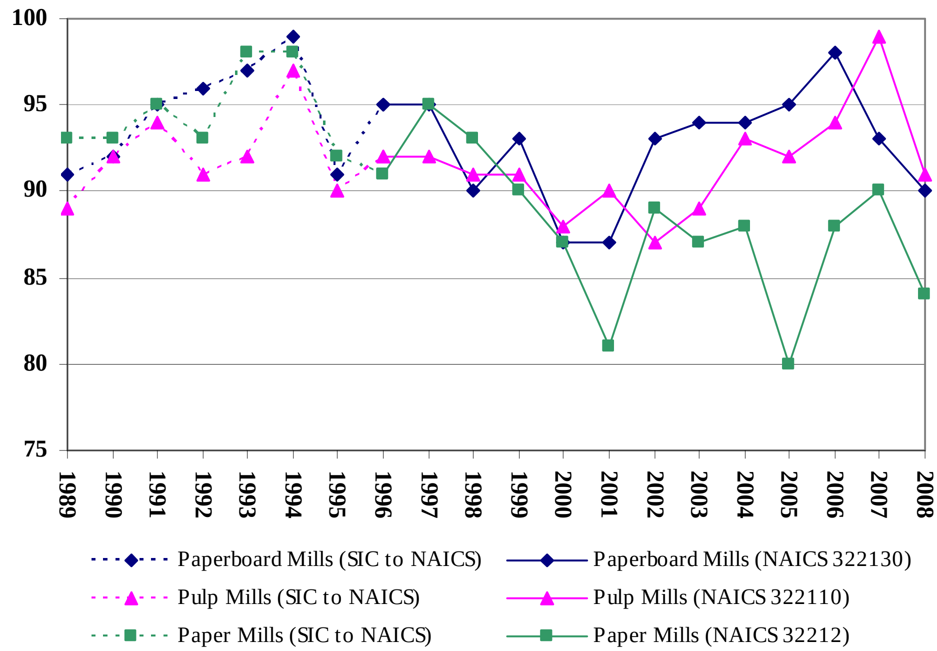
Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization provides insight into the extent of excess or insufficient capacity in an industry, and into the likelihood of investment in new capacity.

As shown in *Figure 2A-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 began 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, 2001c). 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 Mills and Pulp Mills industry segments had returned to its 1990 level, while capacity utilization in the Pulp Mills industry segment increased between 2001 and 2002 and remained relatively constant over 2003 to 2004.

In the second half of the 2000s decade, capacity utilization rose substantially for paperboard and pulp mills previous to the economy collapse in 2008. During this same period, capacity utilization for paper mills fluctuated, but remained fairly low. Producers of many grades curtailed production and capacity in those categories suffering from overcapacity in an effort to improve the balance between supply and demand (S&P, 2010b). U.S. paper and paperboard capacity edged down 0.8 percent in 2008 to 96.3 million tons, and declined 7.3 percent cumulatively since its 2000 peak level (AF&PA, 2009). Boxboard and containerboard producers currently have experienced increasing excess capacity, but still below 2001 to 2003 levels. The market pulp and printing and writing papers sectors have also experienced relatively high levels of excess capacity/low capacity utilization, but this is expected to be remedied by recovery from the economic recession. For the struggling newsprint industry, capacity rationalization has been able to keep supply and demand in balance, but further cutbacks are expected (McNutt, 2009).

Overall, total paper and paperboard capacity is slated to expand by 0.3 percent in both 2010 and 2011, with uncoated mechanical paper, tissue paper, linerboard, corrugating medium, and market pulp being forecast as the most successful product grades (AF&PA, 2009).

Figure 2A-4: Capacity Utilization Rate (Fourth Quarter) for Pulp and Paper Industry[a,b]



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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.
b. Before 2007, U.S. Census sampled every industry in a specific NAICS6. Beginning in 2007, U.S. Census only sampled certain industries within any NAICS6, and therefore, the data collected before 2007 cannot be directly compared to the data collected in 2007 and beyond.
Source: U.S. DOC, Survey of Plant Capacity 1989-2006. 2007-2009 data was obtained from the Census Bureau, however the data do not meet the criteria outlined in the Census Bureau's Statistical Quality Standard: Releasing Information Products. Data is included here for completeness as it is the only data available for Capacity Utilization for these years.

2A.2 Structure and Competitiveness

The Paper and Allied Products industry 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, 2001c).

The Paper and Allied Products industry consolidated through mergers and acquisitions and has closed older mills during the last two decades as a way to improve profits in a mature industry. About six percent of North American containerboard capacity was shut down (most were on a permanent basis) in late 1998 and early 1999. Companies were reluctant to invest in any major new capacity, which might result in excess capacity (S&P, 2001c). In 1999, new capacity additions in the Paper and Allied Products industry were at their lowest level of the past ten years (Pponline.com, 2000); this caution in adding to capacity has continued through the 2000 to 2010 decade. 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). U.S. mills have responded to this increased foreign competition by cutting capacity and retiring obsolete equipment and, with help from private equity investors, have succeeded in constraining supply and improving average product quality, hoping to improve long-term returns. Moreover, the devaluation of the dollar over the last three years has made domestic paper products more affordable than foreign goods (Great American Group, 2009).

Major mergers in the most recent decade 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, 2001c, 2004b).

2A.2.1 Firm size

For this industry, 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 criteria, therefore preventing precise use of the SBA size threshold in conjunction with SUSB data. The SUSB data presented in *Table 2A-8* show the following size distribution in 2006:

- 20 of 31 (65 percent) firms in the *Pulp Mills* segment had less than 500 employees. Therefore, at least 65 percent of firms were classified as small. These small firms owned 22 facilities, or 50 percent of all facilities in the segment.
- 143 of 193 (74 percent) firms in the *Paper Mills* segment had less than 500 employees. These small firms owned 149, or 43 percent of all Paper Mills.
- 55 of 87 (63 percent) firms in the *Paperboard Mills* segment had less than 500 employees. Therefore, at least 63 percent of paperboard mills were classified as small. These firms owned 57, or 28 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 2A-8* below shows the distribution of firms and facilities for each profiled segment by employment size of the parent firm.

Table 2A-8: Number of Firms and Facilities by Size Category for Profiled Paper and Allied Products Segments in 2006

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	10	10	58	58	18	18
20-99	6	6	42	42	19	20
100-499	4	6	43	49	18	19
500+	11	22	50	199	32	148
Total	**31**	**44**	**193**	**348**	**87**	**205**

Source: U.S. DOC, Statistics of U.S. Businesses, 2006.

2A.2.2 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 ($60^2 + 30^2 + 10^2$). 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 2A-9 shows that Pulp Mills have an HHI of 1,175, Paper Mills have an HHI of 721, and Paperboard Mills have an HHI of 749 at 2002, the latest year for which concentration data. At these HHI levels, the Paper Mills and Paperboard Mills segments are *unconcentrated* while the Pulp Mills segment is at the lower end of the *moderately concentrated* range. all three industry segments appear relatively unconcentrated. With the majority of the firms in this industry having relatively 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 profiled segments remained relatively stable between 1987 and 2002, with a slight upwards jump for Paper and Paperboard manufacturers between 1997 and 2002. The Pulp Mills segment has the highest concentration of the three profiled segments, with a CR4 of 61 percent and a HHI of 1,175 in 2002. Recent mergers and acquisitions have led to an increase in concentration in the Paper Mills and Paperboard Mills 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). 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.

As described previously, this period of consolidation in the Paper and Allied Products industry continued throughout the second half of the decade. Containerboard producers have in particular gone through a period of extensive restructuring resulting in a higher concentration of top producers (McNutt, 2009). When more current industry concentration data become available in late 2010/early 2011, the industry is likely to show higher concentration levels than indicated by the 2002 data.

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.

Table 2A-9: Selected Ratios for Profiled Paper and Allied Products Segments, 1987, 1992, 1997, and 2002

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
	2002	21	61%	88%	100%	100%	1,175
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
	2002	187	50%	66%	81%	97%	721
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
	2002	80	49%	68%	88%	99%	749

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

2A.2.3 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 Existing Facilities regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities Rule 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 2007 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 2A-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 82 and 83 percent, respectively, in 2007. Import penetration and export dependence ratios for the Paper and Paperboard Mills segments in 2007 were 15 and 10 percent, respectively. 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 2007. 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, 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 Mills and Paperboard Mills segments is 721 and 749 respectively, suggesting firms in these segments have small market shares, which would curtail their ability to pass through any increase in production costs.

In the later part of the decade, U.S. total Pulp, Paper, and Paperboard export growth outpaced imports, and this trend continued in 2008. However, with a stronger U.S. dollar in 2009, export growth could begin to slow down (McNutt, 2009). The biggest growth in paper consumption is predicted to take place in Asia (excluding Japan). This growth, driven largely by India and China's rapidly increasing populations and developing markets, is expected to rise dramatically in the next decade (Environmental Paper Network, 2007). In particular, China's overall paper demand is projected to grow from approximately 60 million tons in 2005 to 143 million in 2021 (RISI 2007). The five largest importers of U.S. paper and paperboard articles from 2004 through 2009 were Canada, Mexico, Japan, China, and the United Kingdom (U.S. DOC 2009).

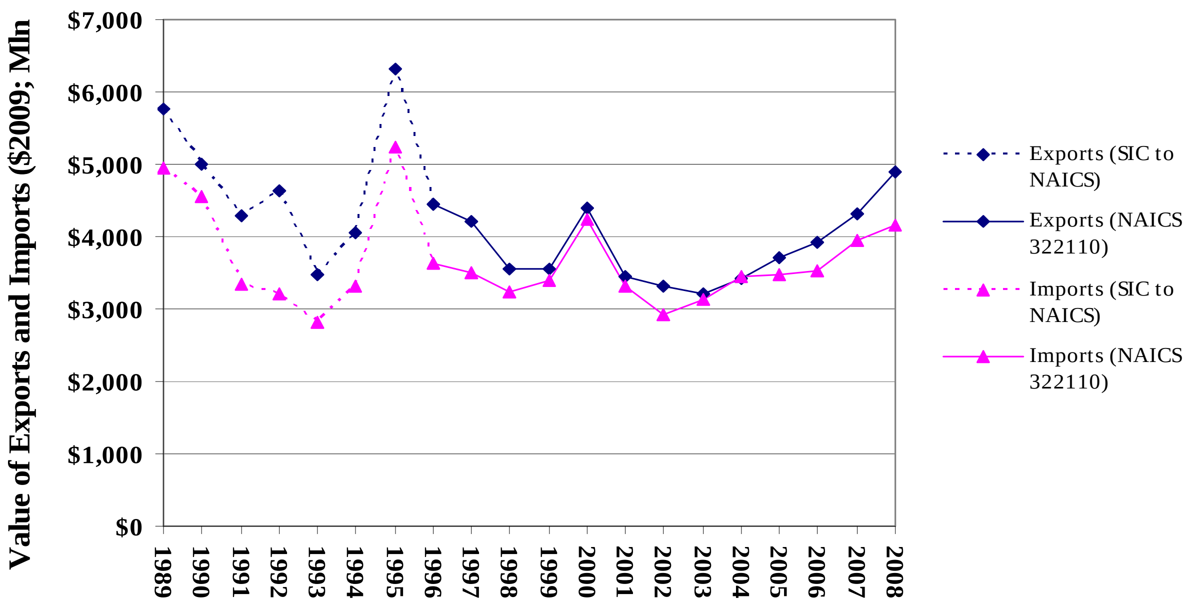
Table 2A-10: Trade Statistics for Profiled Paper and Allied Products Segments (Millions, $2009)						
Year[a]	Value of Imports	Value of Exports	Value of Shipments	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
Pulp Mills						
1989	$4,952	$5,752	$10,131	9,331	53%	57%
1990	$4,544	$4,999	$9,486	9,031	50%	53%
1991	$3,346	$4,287	$7,825	6,884	49%	55%
1992	$3,198	$4,641	$7,839	6,396	50%	59%
1993	$2,805	$3,483	$6,009	5,331	53%	58%
1994	$3,327	$4,060	$6,634	5,901	56%	61%
1995	$5,246	$6,325	$9,322	8,243	64%	68%
1996	$3,621	$4,436	$7,277	6,462	56%	61%
1997	$3,512	$4,223	$4,237	3,526	100%	100%
1998	$3,241	$3,561	$4,018	3,699	88%	89%
1999	$3,387	$3,559	$3,939	3,767	90%	90%
2000	$4,247	$4,403	$4,583	4,427	96%	96%
2001	$3,313	$3,449	$3,922	3,786	88%	88%
2002	$2,922	$3,322	$4,208	3,808	77%	79%
2003	$3,134	$3,213	$4,538	4,460	70%	71%
2004	$3,436	$3,427	$4,646	4,655	74%	74%
2005	$3,470	$3,710	$4,439	4,198	83%	84%
2006	$3,524	$3,917	$4,526	4,133	85%	87%
2007	$3,959	$4,309	$5,196	4,846	82%	83%
Total Percent Change 1989 - 2007	**-12.9%**	**-13.8%**	**-45.2%**	**-46.3%**		
Total Percent Change 2000 - 2007	**-6.8%**	**-2.2%**	**13.4%**	**9.5%**		
Average Annual Growth Rate 1989 - 2007	**-0.8%**	**-0.9%**	**-3.5%**	**-3.6%**		
Paper and Paperboard Mills						
1989	$12,407	$5,005	$93,842	101,244	12%	5%
1990	$12,017	$5,579	$89,990	96,429	12%	6%
1991	$10,816	$6,407	$83,414	87,823	12%	8%
1992	$10,315	$6,569	$82,381	86,126	12%	8%
1993	$10,865	$6,377	$79,637	84,125	13%	8%
1994	$10,952	$7,190	$85,422	89,184	12%	8%
1995	$14,678	$9,269	$106,555	111,964	13%	9%
1996	$12,959	$9,050	$91,529	95,438	14%	10%
1997	$12,281	$8,309	$88,635	92,608	13%	9%
1998	$13,235	$7,806	$88,379	93,808	14%	9%
1999	$13,392	$7,441	$89,130	95,081	14%	8%
2000	$14,524	$8,084	$91,795	98,235	15%	9%
2001	$13,606	$7,034	$83,249	89,821	15%	8%
2002	$12,624	$5,769	$79,782	86,638	15%	7%
2003	$12,618	$5,738	$75,154	82,035	15%	8%
2004	$14,164	$6,015	$76,601	84,750	17%	8%
2005	$14,323	$6,574	$78,359	86,107	17%	8%
2006	$14,290	$6,835	$79,378	86,833	16%	9%
2007	$12,675	$7,512	$77,601	82,763	15%	10%
Total Percent Change 1989 - 2007	**5.5%**	**34.7%**	**-13.8%**	**-14.2%**		
Total Percent Change 2000 - 2007	**-12.7%**	**-7.1%**	**-15.5%**	**-15.8%**		
Average Annual Growth Rate 1989 - 2007	**0.3%**	**1.8%**	**-0.9%**	**-0.9%**		

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.
b. Calculated by EPA as shipments + imports - exports.
c. Calculated by EPA as imports divided by implied domestic consumption.
d. Calculated by EPA as exports divided by shipments.
Source: U.S. International Trade Commission, 1989-2007.

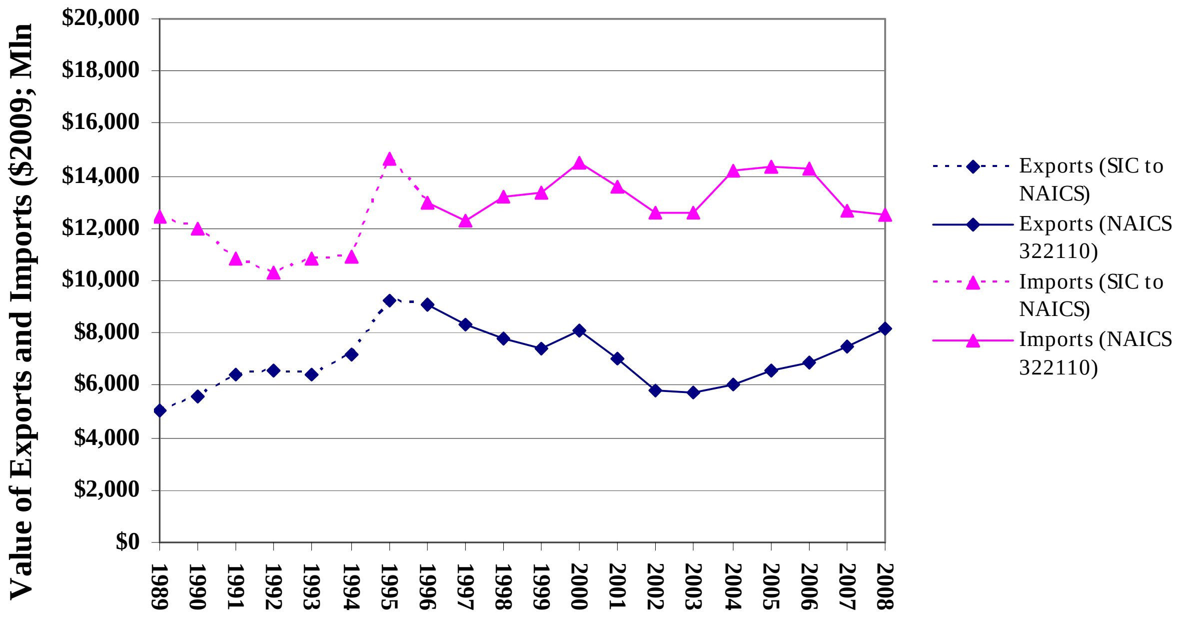
As shown in *Figure 2A-5,* the value of imports and exports peaked in the mid-1990s, before dropping and rebounding in 2000. As expected, values of both dropped again in 2001 and 2002, as the global economy fell into recession. Imports and exports grew steadily from 2003 to 2007 within the Pulp Mills industry segment, while the Paper and Paperboard industry segments turned increasingly towards exporting product and showed a slight decrease in imports.

Figure 2A-5: Value of Imports and Exports for Profiled Paper and Allied Products Segments (millions, $2009)[a]

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.

Source: *U.S. International Trade Commission, 1989-2007.*

2A.3 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). The ability of Paper and Allied Products industry manufacturers to withstand recession and react to changing global economic conditions will be critical in the coming years.

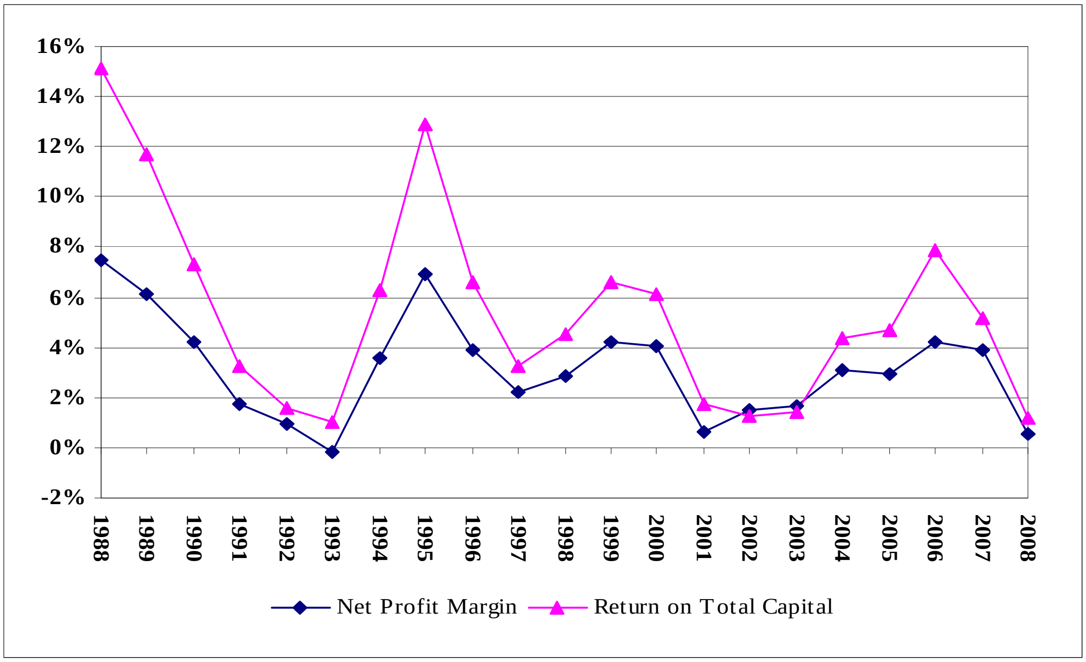
Net Profit Margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate 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 Paper 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 pre-tax income divided by the sum of current portion of long-term debt due in 1 year or less, long-term debt due in more that 1 year, all other noncurrent liabilities and total stockholders' equity (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 2A-6 below shows trends in net profit margins and return on total capital for the Paper and Allied Products industry between 1989 and 2008. The figure shows considerable volatility in the trend. Profitability and return on capital declined steadily 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 peaked as demand rebounded, but weakened again in 1997 and 2001, 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 during these years. However, both net profit margins and return on capital improved gradually from 2004 to early 2007. Since 2007, though, the industry's financial performance has declined significantly owing to the current recession. Despite many significant obstacles, experts expect that demand for Paper and Allied Products will reach 21.8 million tons in 2011, and that high value-added products will lead growth in this segment as companies search for profit-earning ways to differentiate their product (Great American Group, 2009).

During the entire decade, total shareholder returns for the Paper and Allied Products industry, indexed to year 2001, performed at a higher level than the S&P 500 index. However, at the start of the recession in 2008, total shareholder returns began falling quickly back to S&P 500 levels. Ten of the largest public US-based forest and paper companies posted earnings of US $1.2 billion in the third quarter of 2008. All but two companies posted positive or improved earnings, reflecting an estimated US $1.1 billion of tax credits for the use of black liquor as a biofuel to generate energy (Pricewaterhouse Coopers, 2009). And the overall outlook for financial performance in the near future looks promising given that during 2009, the paper products sub-industry index rose 134.4 percent compared to a 24.3 percent increase for the S&P 1500 index (S&P 2010). Industry analysts believe pricing levels will increase modestly in the future due to gradually improving economic activity and employment, but it is uncertain how long-term demand for some paper categories will evolve over time.

Figure 2A-6: Net Profit Margin and Return on Capital for Paper and Allied Products



Source: Quarterly Financial Report, 1988-2008; U.S. Census Bureau.

2A.4 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. 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 regulatory analysis options in terms of design intake flow (i.e., 2 MGD).

The regulatory analysis options also cover substantial additions or modifications to operations undertaken at such facilities. EPA identified the set of facilities that were estimated to be potentially subject to the 316(b) Existing Facilities regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities in the profiled paper and allied products segments.[5]

2A.4.1 Waterbody and Cooling System Type

Table 2A-11 reports the distribution of facilities in the profiled paper and allied products segments that are potentially subject to the existing facilities regulation by type of waterbody and cooling water intake system. 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 2A-11: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Waterbody Type and Cooling Water Intake 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	
Estuary/Tidal River	0	0%	0	0%	6	5%	0	0%	6
Ocean	0	0%	0	0%	0	0%	0	0%	0
Lake/Reservoir	0	0%	6	15%	6	5%	11	33%	23
Freshwater River/ Stream	29	100%	35	85%	105	85%	19	58%	188
Great Lake	0	0%	0	0%	6	5%	3	9%	9
Total[a]	**29**	**13%**	**41**	**18%**	**122**	**54%**	**33**	**14%**	**225**

Based on technical weights (See Appendix 3.A).

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

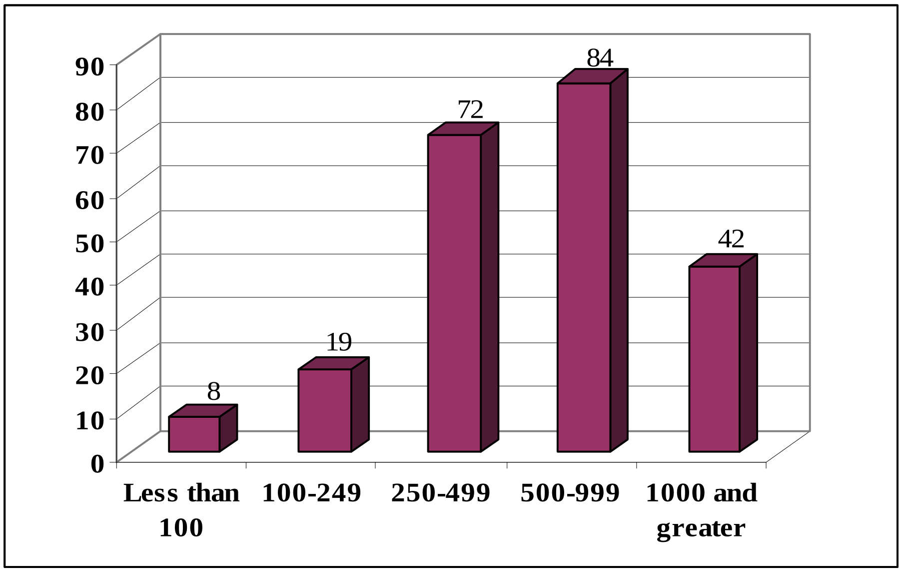
Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2A.4.2 Facility Size

All of the pulp and paper facilities analyzed are relatively large, with no facilities employing fewer than 100 people. *Figure 2A-7*, shows the number of facilities in the profiled pulp and paper segments potentially subject to the regulation by employment size category for each primary analysis option.

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).

Figure 2A-7: Number of Facilities Estimated within Scope of the 316(b) Existing Facilities Regulation by Employment Size for Profiled Paper and Allied Products Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2A.4.3 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. EPA estimates that 28 small entity-owned facilities and 187 large entity-owned facilities in the Paper and Allied Products Segment are potentially subject to the 316(b) Existing Facilities regulation.

2B Profile of the Chemicals and Allied Products Industry

2B.1 Introduction

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified 13 four-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, withdraws at least 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 316(b) Existing Facilities regulation" or "in-scope facilities"). For this analysis, EPA identified a six-digit NAICS code for each of these potential facilities using the information from DQ and public sources (see *Appendix 3.C: Conversion the Data from Standard Industrial Classification (SIC) to North American Industry Classification System (NAICS)*). As the result of this mapping, EPA identified 15 6-digit NAICS codes in the Chemicals and Allied Products manufacturing industry (NAICS 325).

For each of the 15 NAICS codes, *Table 2B-1*, following page, provides a description of the industry segment, a list of primary products manufactured, the total number of the DQ respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), and the number of facilities estimated to be potentially subject to Proposed 316(b) Existing Facilities Regulation based on the minimum withdrawal threshold of 2 MGD (see *Chapter 1: Introduction* for more details on the Rule applicability criteria).

Table 2B-1: Phase III Facilities in the Chemicals and Allied Products Industry (NAICS 325)			
NAICS	**NAICS Description**	**Important Products Manufactured**	**Number of In-Scope Facilities[a]**
		Basic Chemicals (NAICS 3251XX)	
325110	Petrochemical mfg	Acyclic hydrocarbons such as ethylene, propylene, and butylene and cyclic aromatic hydrocarbons such as benzene and toluene made from refined petroleum or liquid hydrocarbons.	13
325120	Industrial gas mfg	Industrial organic and inorganic gases in compressed, liquid, and solid forms.	4
325131	Inorganic dye & pigment mfg	Inorganic dyes and pigments such as antimony, copper, lead, and titanium based pigments.	9
325181	Alkalies & chlorine mfg	Alkalies such as chlorine, sodium, and hydroxide using an electrolysis process.	20
325188	All other basic inorganic chemical mfg	Basic inorganic chemicals except industrial gases, inorganic dyes and pigments, alkalies and chlorine, and carbon black.	32
325199	All other basic organic chemical mfg	Basic organic chemical products, (except aromatic petrochemicals, industrial gases, synthetic organic dyes and pigments, gum and wood chemicals, cyclic crudes and intermediates, and ethyl alcohol).	38
		Total Basic Chemicals	**116**
		Resins and Synthetics (NAICS 3252XX)	
325211	Plastics material & resin mfg	Resins, plastics materials, and nonvulcanizable thermoplastic elastomers and mixing and blending resins on a custom basis; noncustomized synthetic resins.	24
325221	Cellulosic organic fiber mfg	Cellulosic (i.e. rayon and acetate) fibers and filaments in the form of monofilament, filament yarn, staple, or tow.	1
325222	Noncellulosic organic fiber mfg	Noncellulosic (i.e. nylon, polyolefin, and polyester) fibers and filaments in the form of monofilament, filament yarn, staple, or tow.	9
		Total Resins and Synthetics	35
		Pesticides and Fertilizers (SIC 3253XX)	
325311	Nitrogenous fertilizer mfg	Nitrogenous fertilizer materials and mixing ingredients into fertilizer; fertilizer from animal or sewage waste.	9
325312	Phosphatic fertilizer mfg	Phosphatic fertilizer material and phosphatic material mixed into fertilizer.	1
		Total Pesticides and Fertilizers	**10**
		Pharmaceuticals (3254XX)	
325411	Medicinal & botanical mfg	Uncompounded medicinal chemicals and their derivatives (i.e. generally for use by pharmaceutical preparation manufacturers); grading, grinding, and milling uncompounded botanicals.	2
325412	Pharmaceutical preparation mfg	In-vivo diagnostic substances and pharmaceutical preparations (except biological) intended for internal and external consumption in dose forms, such as ampoules, tablets, capsules, vials, ointments, powders, solutions, and suspensions.	6
		Total Pharmaceuticals	**8**
		Other Chemical Segments[c]	
325611	Soap & other detergent mfg	Soaps and other detergents, such as laundry detergents, dishwashing detergents, toothpaste gels, tooth powders, and natural glycerin.	4
325998	All other miscellaneous chemical product & preparation mfg	Chemical products excluding basic chemicals, resins, and synthetic rubber; cellulosic and noncellulosic fiber and filaments; pesticides, fertilizers, and other agricultural chemicals; pharmaceuticals and medicines; paints, coating and adhesives; soap, cleaning compounds, and toilet preparations; printing inks; explosives; custom compounding of purchased resins; and photographic films, paper, plates, and chemicals.	9
		Total Other	**13**
		Total Chemicals and Allied Products (NAICS 325)	
		Total NAICS Code 325	**179**

a. Number of weighted detailed questionnaire survey respondents.

b. Individual numbers may not add up due to independent rounding.

c. Not included in analysis.

Source: U.S. DOC Economic Census, 2007. Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2010.

As shown in *Table 2B-1*, EPA estimates that, out of an estimated total of 6,945[6] facilities with a NPDES permit and operating cooling water intake structures in the Chemicals and Allied Products Industry (NAICS 325), 179 (or 3 percent) would be subject to the 316(b) Proposed Existing Facilities Rule. The total value of shipments for the Chemicals and Allied Products Industry from the 2007 Economic Census is $494.0 billion ($2009). 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 in-scope 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 to be $74.8 billion ($2009). Therefore, EPA estimates that 15 percent of total production in the chemical industry occurs at facilities estimated to be subject to regulation under the 316(b) Proposed Existing Facilities Rule.

The DQ responses indicate that four chemical segments account for a significant majority of the Chemicals and Allied Products industry facilities subject to the 316(b) Proposed Existing Facilities Regulation: (1) Basic Chemicals (including NAICS codes 325110, 325120, 325131, 328181, 325188, 325199); (2) Resins and Synthetics (including NAICS codes 325211, 325221, and 325222); (3) Pesticides and Fertilizers (including NAICS codes 325311 and 325312); and (4) Pharmaceuticals (including NAICS codes 325411, and 325412). This profile therefore provides detailed information for these four industry segments.

Table 2B-2 on the following page provides the cross-walk between NAICS codes and SIC codes for the profiled chemical NAICS codes. The table shows that some NAICS code industry segments have 1 to 1 relationships to SIC codes, while the other NAICS codes in the four profiled chemical segments correspond to two SIC codes.

6 This estimate of the number of facilities potentially subject to regulation is based on the universe of facilities that received the 1999 screener questionnaire.

Table 2B-2: Relationship between NAICS and SIC Codes for the Chemicals and Allied Products Industry (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	# of Establishments	Sales, Shipments, or Receipts (Millions; $2009)	# of Employees
Basic Chemicals						
325110	Petrochemical manuf-g	2865	Cyclic crudes & intermediates	56	$80,262	9,257
		2869	Industrial organic chemicals, n.e.c.			
325120	Industrial gas manuf-g	2869	Industrial organic chemicals, n.e.c.	576	$9,863	11,446
		2813	Industrial gases			
325131	Inorganic dye and pigment manuf-g	2816	Inorganic pigments	96	$5,880	7,606
		2819	Industrial inorganic chemicals, n.e.c.			
328181	Alkalies & chlorine manuf-g	2812	Alkalies & chlorine	49	$6,584	6,364
325188	All other inorganic chemical manuf-g	2819	Industrial inorganic chemicals, n.e.c.	631	$23,593	35,801
		2869	Industrial organic chemicals, n.e.c.			
325199	All other organic chemical manuf-g	2869	Industrial organic chemicals, n.e.c.	818	$84,743	70,602
		2899	Chemical preparations, n.e.c.			
Resins and Synthetics						
325211	Plastics material & resin manuf-g	2821	Plastics materials & resins	1,059	$88,085	71,216
325221	Cellulosic organic fiber manuf-g	2823	Cellulosic manmade fibers	15	$957	1,353
325222	Noncellulosic organic fiber manuf-g	2824	Organic fibers, noncellulosic	109	$7,196	14,684
Pharmaceuticals						
325311	Nitrogenous fertilizer manuf-g	2873	Nitrogenous fertilizers	156	$5,709	3,920
325312	Phosphatic fertilizer manuf-g	2874	Phosphatic fertilizers	80	$6,694	6,264
Pesticides and Fertilizers						
325411	Medicinal & botanical manuf-g	2833	Medicinals & botanicals	399	$11,476	23,848
325412	Pharmaceutical preparation manuf-g	2834	Pharmaceutical preparations	963	$145,245	159,420
		2835	Diagnostic substances			

Source: U.S. DOC Economic Census, 2007.

2B.2 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 the Proposed 316(b) Existing Facilities Rule 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.

2B.2.1 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 industry concentration level and its implications for market power, the U.S. Chemicals and Allied Products 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 judges 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, *Appendix 3*: *Cost Pass-Through Analysis*, and *Chapter C3: Economic Impact Analysis for Manufacturers*, for further information).

2B.2.2 Financial Health and General Business Outlook

Over the last two decades, the Chemicals and Allied Products 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 and Allied Products industry was affected by reduced U.S. demand as the economy entered a recessionary period. Although domestic market conditions improved by mid-decade, weakness in Asian markets, along with other domestic economic factors, dealt a serious blow to the chemicals industry in 1998. A significant drop in demand for Chemicals and Allied Products during the economic recession of the early 2000s resulted in record low capacity utilization and a significant drop in capital expenditures. All profiled Chemicals and Allied Products Industry segments except Pharmaceuticals saw significant declines in exports, imports, value of shipments as well as value added. As the U.S. economy began to recover, the domestic Chemicals and Allied Products industry saw continuous improvements in demand levels and consequent improvement of financial performance during 2003 to 2005. By 2007, value of shipments significantly grew, prices were at record highs, and labor productivity increased, with the Pharmaceuticals industry segment performing especially well. Beginning in 2008, the Chemicals and Allied Products industry faced a substantial drop in demand due to the economic recession. This economic downturn forced firms in the Chemicals and Allied Products industry to realign their research and development capabilities, marking a shift in companies' long-term strategies and prompting them to identify growth opportunities in areas such as energy, food and water (Jagger, 2009). With firms using this downturn as an opportunity for growth and innovation, the Chemicals and Allied Products industry should be able to withstand additional regulatory compliance costs without a material financial impact.

2B.3 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 over $630 billion of total manufacturing value added (Bassi and Yudken, 2009).

The Chemical and Allied Products industry as a whole is highly energy-intensive. This is especially the case for basic chemicals as well as certain specialty chemical segments (e.g., industrial gases). The industry relies upon energy inputs not only for fuel and power for its operations, but also as raw materials in the manufacturing of many of its products. For example, oil and natural gas are raw materials (termed "feedstocks") for the manufacture of organic chemicals. However, various technology developments throughout the years have allowed the industry to become less energy intensive; the U.S. chemical industry has reduced its fuel and power energy consumed per unit of output by 53 percent since 1974 (ACC, 2009).

2B.3.1 Output

Figure 2B-1 shows constant dollar ***value of shipments*** and ***value added*** for the four profiled Chemicals and Allied Products industry segments between 1988 and 2007.[7] 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

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

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 2B-1 shows that between 1988 and 1993, the Basic Chemicals segment experienced a slight decrease in both value of shipments and value added, followed by volatility through 1998. The mid 1990s were marked by increased competition in the global market for petrochemicals, which comprise a large portion of basic chemical products. The increased competition stems from the considerable capacity expansions for these products seen in developing nations during that time (McGraw-Hill, 2000). Both value of shipments and value added declined in 2001 as the Basic Chemicals segment faced decreased demand due to the economic slowdown, but have risen significantly and continuously since then. In 2007, value of shipments was nearly double the 2001 value and value added reached peak levels.

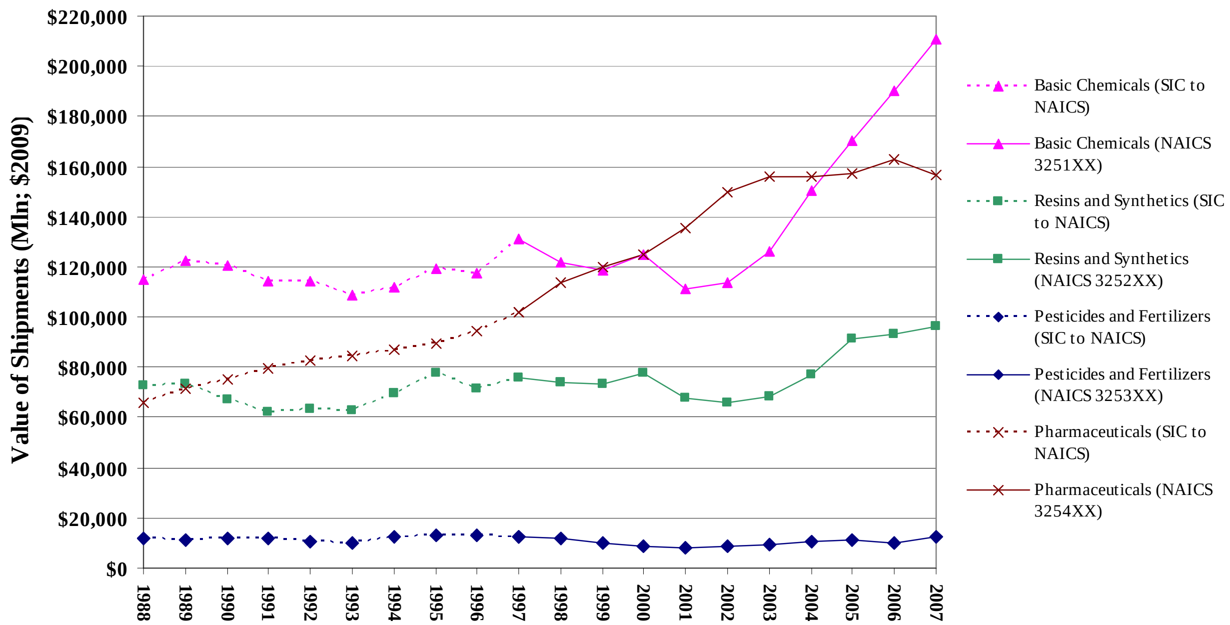
The profiled Resins and Synthetics, and Pesticides and Fertilizers segments remained more stable during 1988 through 2007 than the Basic Chemicals segment. In the early 1990s, domestic producers benefited from the relatively weak dollar, which made U.S. products more competitive in the global market. 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 through 2007, the value of shipments and value added of both the Resins and Synthetics and Pesticides and Fertilizers segments remained relatively stable.

Out of four profiled industry segments, the Pharmaceuticals segment saw the least volatility. Value of shipments and value added in the Pharmaceuticals segment has been nearly steadily increasing since 1988, reaching peak levels in 2006.

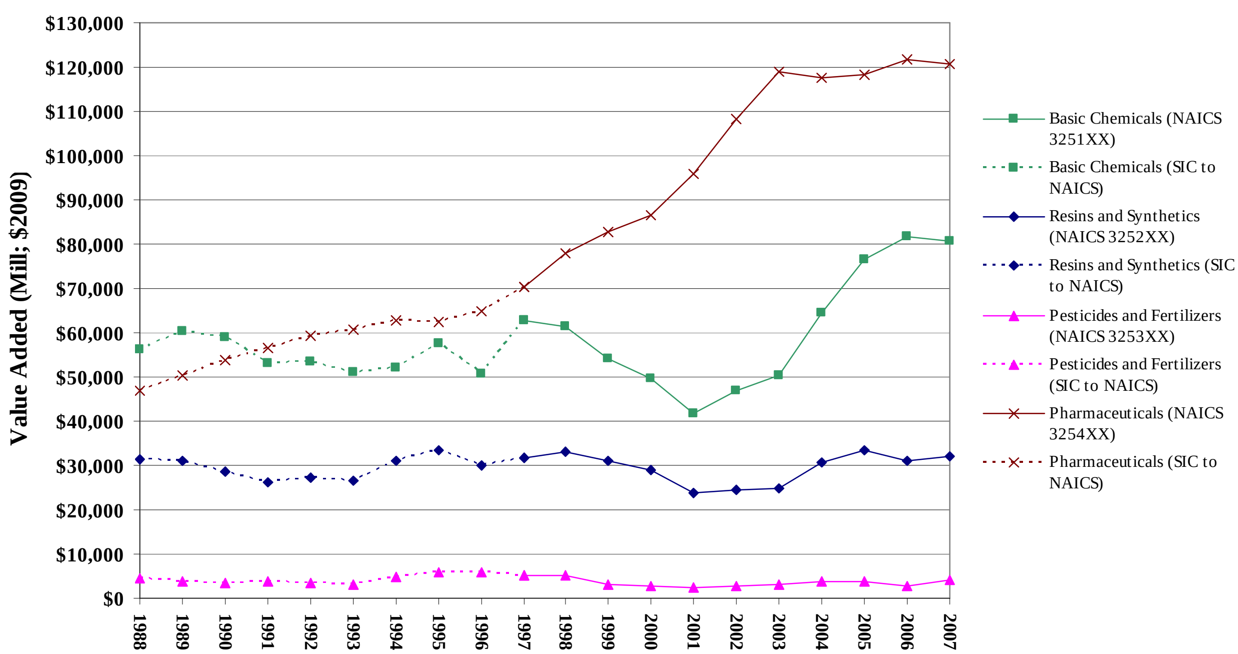
Overall, the Chemicals and Allied Products industry continues to be a strong contributor to the U.S. economy, growing more than 150 percent over the past two decades. The composition of the industry, however, has changed over time, with increasing emphasis being placed on high-technology fields such as pharmaceuticals, biotechnology, and advanced materials. The recent recession caused declines in industry-wide output save for the profiled Pharmaceuticals segment. However, this downturn is motivating companies to seek new ways to grow and realign research and development capabilities to seek new growth opportunities in renewable energy and food production, for example. Industry analysts predict that annual production in the Chemicals and Allied Products industry will rise around 3 percent in 2010, and prices are expected to increase, especially for soda ash makers and caustic soda producers (S&P, 2010a). This should better position in-scope facilities in the Chemicals and Allied Products industry to absorb compliance costs of the Proposed Existing Facilities Regulation.

Figure 2B-1: Value of Shipments and Value Added for Profiled Chemicals and Allied Products Industry Segments (millions, \$2009)[a]

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, 2003-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2B-3 provides the Federal Reserve System's index of industrial production for the 4 profiled industry segments, showing trends in production since 1990. This index reflects total output in physical terms, whereas value of shipments and value added reflect the value of output in economic terms. *Table 2B-3* shows varying trends in the four segments since 1990, but sharp declines in production in all segments except Pharmaceuticals during 2000 through 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).

Between 1990 and 2009, the Basic Chemicals and Pesticides and Fertilizers segments experienced an overall production decline of 1.5 and 16.3 percent, respectively. While production in the Basic Chemicals segment changed little between 2000 and 2009, production in the Pesticides and Fertilizers segment dropped 10 percent. Between 1990 and 2009, production in the Resins and Synthetics and Pharmaceuticals segments increased 6.5 and 101.4 percent, respectively. During the last decade, however, while Resins and Synthetics segment saw a relatively modest 13 percent decline, the Pharmaceuticals segment production increased drastically – more than 34 percent. Production in the Pharmaceuticals segment was the least affected by swings in overall economic conditions and is expected to outgrow the other chemical segments in 2010 (C&EN, 2010).

Table 2B-3: Industrial Production Index for Chemicals and Allied Products Industry Segments (Annual Averages)

	Basic Chemicals[a]		Resins and Synthetics[b]		Pesticides and Fertilizers[c]		Pharmaceuticals[d]	
Year	Index 2002=100	Percent Change	Index 2002=100	Percent Change	Index 2002=100	Percent Change	Index 2002=100	Percent Change
1990	104.8	n/a	88.3	n/a	113.2	n/a	57.4	n/a
1991	100.2	-4.5%	86.3	-2.3%	109.4	-3.4%	61.4	6.9%
1992	101.3	1.2%	91.4	5.8%	114.0	4.2%	60.6	-1.3%
1993	97.4	-3.8%	92.2	1.0%	114.9	0.8%	60.8	0.3%
1994	98.3	0.9%	99.6	8.0%	114.8	-0.2%	63.1	3.9%
1995	98.2	-0.1%	100.2	0.6%	114.3	-0.4%	65.7	4.0%
1996	98.1	-0.1%	98.1	-2.1%	116.6	2.0%	69.6	6.0%
1997	105.5	7.6%	104.3	6.3%	121.0	3.8%	73.3	5.4%
1998	102.0	-3.4%	108.7	4.3%	123.5	2.1%	79.7	8.7%
1999	107.0	4.9%	109.8	0.9%	111.3	-9.9%	82.9	4.0%
2000	103.3	-3.5%	107.7	-1.9%	105.1	-5.6%	86.2	4.0%
2001	92.9	-10.0%	97.2	-9.7%	96.7	-8.0%	92.7	7.6%
2002	100.0	7.6%	100.0	2.8%	100.0	3.4%	100.0	7.8%
2003	103.0	3.0%	98.1	-1.9%	104.8	4.8%	103.4	3.4%
2004	112.7	9.4%	102.8	4.8%	109.9	4.9%	104.0	0.6%
2005	114.4	1.5%	109.1	6.1%	114.4	4.1%	108.1	4.0%
2006	115.7	1.1%	107.8	-1.2%	121.8	6.5%	115.0	6.4%
2007	119.7	3.5%	108.6	0.7%	114.0	-6.4%	117.4	2.1%
2008	110.1	-8.0%	96.8	-10.9%	103.7	-9.0%	115.2	-1.9%
2009[e]	103.3	-6.2%	94.0	-2.8%	94.8	-8.6%	115.6	0.4%
Total Percent Change 1990-2009	**-1.5%**		**6.5%**		**-16.3%**		**101.4%**	
Total Percent Change 2000-2009	**0.0%**		**-12.7%**		**-9.9%**		**34.2%**	
Average Annual Growth Rate	**-0.1%**		**0.3%**		**-0.9%**		**3.8%**	

a. NAICS 3251.

b. NAICS 3252.

c. NAICS 3253

d. NAICS 3254

e. Average through 11/2009

Source: Economagic, Federal Reserve, Board of Governors, 2009a.

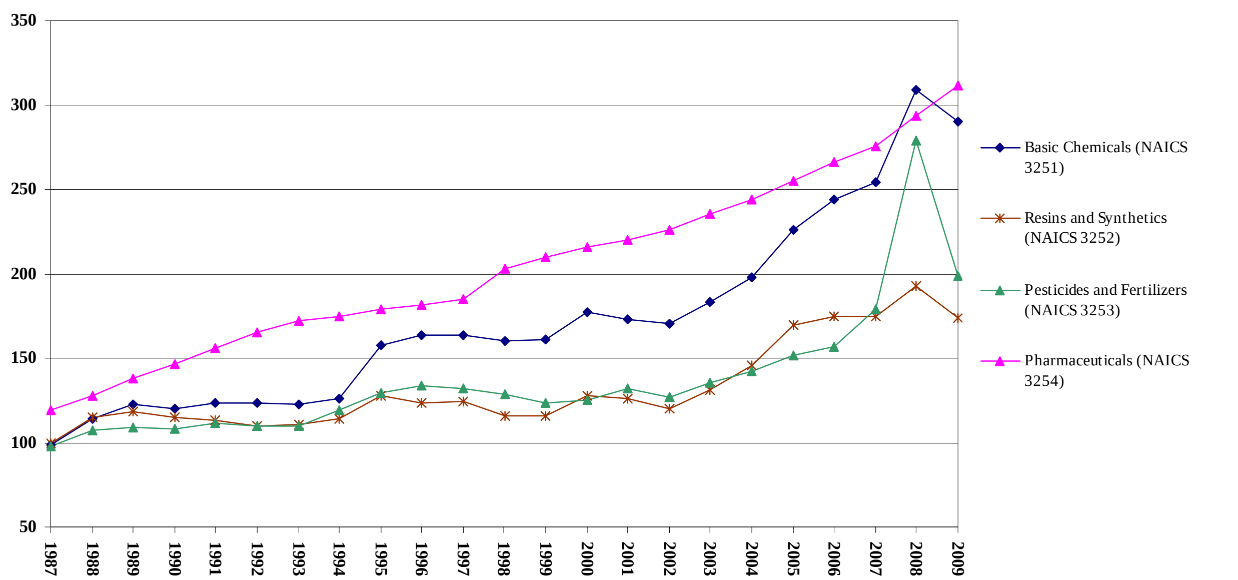
2B.3.2 Prices

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.

Chemicals product prices fluctuate in large part as a result of varying energy prices. For instance, basic petrochemicals, which comprise the majority of organic chemical products and are a part of the Basic Chemicals segment, 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 intermediate and final end products. The cyclical nature of market supply and demand conditions also significantly influence prices for commodity chemical products. Finally, all analyzed chemicals industry segments are characterized by large existing capital investments and production capacity, which can lead to fluctuations in prices in response to imbalances in supply and demand.

Figure 2B-2 shows PPI for the profiled Chemicals and Allied Products Industry segments for 1987 through 2009. All profiled segments except Pharmaceuticals saw some volatility during that time in response to changing economic conditions, energy prices, and changes in operating processes. For instance, the price jump for the Resins and Synthetics and Basic Chemicals segments in 2000 is the result of an increase in the price of natural gas – feedstock for 70 percent of U.S. ethylene production (Chemical Marketing Reporter, 2001). Price increases for Resins and Synthetics also reflected a shift by U.S. producers away from production of commodity resins to specialty and higher value-added products (McGraw-Hill, 2000). Overall, during 1987 through 2008, selling prices increased for all four profiled chemicals industry segments, especially during the last decade. As the result of the recent recession, prices for all profiled segments except Pharmaceuticals declined significantly in 2009 but are expected to recover in 2010 (S&P, 2010a).

Figure 2B-2: Producer Price Indexes for Profiled Chemicals and Allied Products Industry Segments



Source: BLS, 2009a.

2B.3.3 Number of Facilities and Firms

According to Statistics of U.S. Businesses, the number of facilities in the Basic Chemicals segment remained relatively stable between 1990 and 1997, followed by five consecutive years of decreases in the number of facilities. In 2003, however, the number of facilities increased again and remained flat for the next few years. Overall, the Basic Chemicals segment experienced a 7.3 percent decline in the number of facilities over the 1990 to 2006 time period. The Resins and Synthetics and Pharmaceuticals segments saw overall increases of 50.7 and 41.2 percent, respectively in the number of facilities from 1990 to 2006. Above average increases in the number of facilities in the Resins and Synthetics segment reported between 1993 and 1996 reflected growth in the demand for plastics in a number of end-uses (McGraw-Hill, 2000). *Table 2B-4* shows the downward trend in the number of facilities since 1996 producing pesticides and fertilizer products. The recent increasing cost of feedstock (largely crude oil) and other factors increasing production costs has led to consolidation and mergers of national and multinational chemical companies (MBendi, 2010).

Table 2B-4: Number of Facilities for Profiled Chemicals and Allied Products Industry Segments

	Basic Chemicals[b]		Resins and Synthetics[c]		Pesticides and Fertilizers[d]		Pharmaceuticals[e]	
Year[a]	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	2,181	n/a	601	n/a	227	n/a	933	n/a
1991	2,275	4.3%	621	3.3%	228	0.4%	962	3.1%
1992	2,261	-0.6%	555	-10.6%	251	10.1%	1,013	5.4%
1993	2,283	1.0%	600	8.1%	250	-0.4%	1,044	3.0%
1994	2,261	-0.9%	595	-0.8%	233	-6.8%	981	-6.0%
1995	2,234	-1.2%	659	10.8%	239	2.6%	1,005	2.4%
1996	2,152	-3.7%	741	12.4%	252	5.4%	1,142	13.7%
1997	2,247	4.4%	705	-4.9%	215	-14.7%	1,190	4.2%
1998	2,157	-4.0%	677	-4.0%	221	2.8%	1,241	4.3%
1999	2,135	-1.0%	700	3.4%	222	0.5%	1,249	0.6%
2000	2,113	-1.0%	714	2.0%	222	0.0%	1,251	0.2%
2001	2,065	-2.3%	744	4.2%	223	0.5%	1,257	0.5%
2002	1,976	-4.3%	806	8.3%	207	-7.2%	1,244	-1.0%
2003	2,042	3.3%	907	12.5%	189	-8.7%	1,268	1.9%
2004	2,065	1.1%	905	-0.2%	193	2.1%	1,280	0.9%
2005	2,021	-2.1%	924	2.1%	193	0.0%	1,281	0.1%
2006	2,022	0.0%	906	-1.9%	188	-2.6%	1,317	2.8%
Total Percent Change 1990-2006	**-7.3%**		**50.7%**		**-17.2%**		**41.2%**	
Total Percent Change 2000-2006	**-4.3%**		**26.9%**		**-15.3%**		**5.3%**	
Average Annual Growth Rate	**-0.5%**		**2.6%**		**-1.2%**		**2.2%**	

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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.
b. NAICS 3251.
c. NAICS 3252.
d. NAICS 3253
e. NAICS 3254
Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

Table 2B-5 shows the number of firms in the four profiled chemical segments between 1990 and 2006. The trend in the number of firms between 1990 and 2006 is similar to the number of facilities. The number of firms in the Basic Chemicals segment peaked in 1994, and then declined continuously during 1995 to 2002, before increasing slightly in 2003 and then leveling off. The Resins and Synthetics segment followed a more positive trend and increased 83.3 percent to 647 firms in 2006. The number of firms in the Pesticides and Fertilizers segment fluctuated over the period, falling steeply in 2002 and 2003 following the economic recessionary period. The number of firms in the Pharmaceuticals segment increased substantially between 1995 and 1999, from 859 to 1,076 firms, before stabilizing through 2006.

Table 2B-5: Number of Firms for Profiled Chemicals and Allied Products Industry Segments

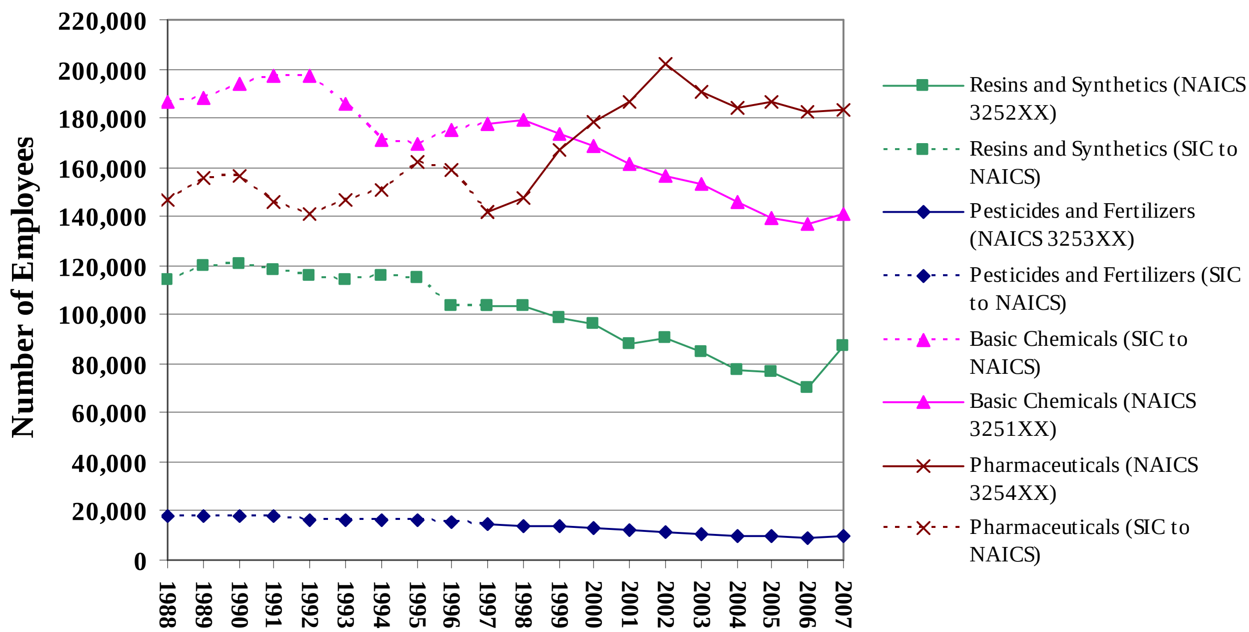
	Basic Chemicals[b]		Resins and Synthetics[c]		Pesticides and Fertilizers[d]		Pharmaceuticals[e]	
Year[a]	Number of Firms	Percent Change	Number of Firms	Percent Change	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	1,189	n/a	353	n/a	163	n/a	799	n/a
1991	1,227	3.2%	380	7.6%	161	-1.2%	835	4.4%
1992	1,267	3.3%	319	-16.1%	180	11.8%	872	4.5%
1993	1,294	2.1%	350	9.7%	177	-1.7%	908	4.1%
1994	2,245	73.5%	595	70.0%	233	31.6%	981	8.1%
1995	1,251	-44.3%	409	-31.3%	166	-28.8%	859	-12.5%
1996	1,161	-7.2%	477	16.6%	181	9.0%	991	15.3%
1997	1,222	5.2%	434	-9.0%	174	-3.9%	1,033	4.3%
1998	1,136	-7.0%	395	-9.0%	173	-0.6%	1,073	3.8%
1999	1,096	-3.5%	411	4.1%	175	1.2%	1,076	0.3%
2000	1,090	-0.5%	429	4.4%	174	-0.6%	1,073	-0.3%
2001	1,085	-0.5%	456	6.3%	178	2.3%	1,074	0.1%
2002	1,020	-6.0%	518	13.6%	165	-7.3%	1,053	-2.0%
2003	1,091	7.0%	635	22.6%	146	-11.5%	1,065	1.1%
2004	1,086	-0.5%	622	-2.0%	150	2.7%	1,074	0.8%
2005	1,085	-0.1%	653	5.0%	154	2.7%	1,074	0.0%
2006	1,105	1.8%	647	-0.9%	152	-1.3%	1,107	3.1%
Total Percent Change 1990-2006	**-7.1%**		**83.3%**		**-6.7%**		**38.5%**	
Total Percent Change 2000-2006	**1.4%**		**50.8%**		**-12.6%**		**3.2%**	
Average Annual Growth Rate	**-0.5%**		**3.9%**		**-0.4%**		**2.1%**	

a. Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the NAICS. For this analysis, EPA converted the SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.
b. NAICS 3251.
c. NAICS 3252.
d. NAICS 3253
e. NAICS 3254
Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

2B.3.4 Employment and Productivity

Figure 2B-3 provides information on ***employment*** from the Annual Survey of Manufactures and Economic Census. With the exception of minor short-lived fluctuations, employment in the Basic Chemicals and Resins and Synthetics segments remained relatively stable between 1988 and 1998 before seeing yearly declines through 2006. This decrease reflects the industry's restructuring and downsizing efforts, which are intended to reduce costs in response to competitive challenges. However, in the last observed year of the analysis period, between 2006 and 2007, employment began increasing for both segments. Employment in the Pharmaceuticals segment fluctuated between 1988 and 1997 and then experienced a period of strong growth through 2002, from 141,883 to 202,087 employees. Employment in this segment remained fairly constant over the next five years, dropping slightly below peak 2002 levels. The Pesticides and Fertilizers segment experienced the least amount of fluctuation over the two decades but had fairly significant employment losses compared to the small size of the industry. From 1988 to 2007, only the Pharmaceuticals sector showed an overall increase in industry employment of 25 percent. The Pesticides and Fertilizers segment had the largest overall decrease in employment at 42 percent, while the Basic Chemicals and Resins and Synthetics segments' employment both declined 24 percent.

Figure 2B-3: Employment for Profiled Chemicals and Allied Products Industry Segments[a]



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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2003, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2B-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 2007. The trends in each segment show considerable volatility through the 1990s into the 2000s. The gains in productivity in this early period for the Basic 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, 2001a). Over the 1988 to 2007 period, all four segments saw significant increases in productivity. A great majority of this growth occurred from 2000 to 2007, where productivity increased 79 percent in the Basic Chemicals segment, 26 percent in the Resins and Synthetics segment, 84 percent in the Pesticides and Fertilizers segment, and 37 percent in the Pharmaceuticals segment. The complexity of the industry is increasing, requiring highly developed skills and workers with better training and education. In addition, scientifically trained personnel – such as chemists, chemical engineers, agronomists, toxicologists, and biologists – are in high demand. Increases in spending and productivity for the chemical industry are not expected to reverse the loss in chemicals industry employment. Workforce losses in 2008 and 2009 are expected to continue into 2010 following additional productivity gains (C&EN, 2010).

Table 2B-6: Productivity Trends for Profiled Chemicals and Allied Products Industry Segments ($2009)

Year[a]	Basic Chemicals			Resins and Synthetics			Pesticides and Fertilizers			Pharmaceuticals		
	Prod. Hours (mill.)	Value Added/Hour $/hr.	Value Added/Hour % Change	Prod. Hours (mill.)	Value Added/Hour $/hr.	Value Added/Hour % Change	Prod. Hours (mill.)	Value Added/Hour $/hr	Value Added/Hour % Change	Prod. Hours (mill.)	Value Added/Hour $/hr	Value Added/Hour % Change
1988	229	244	n/a	166	189	n/a	25	180	n/a	133	353	n/a
1989	228	265	8.6%	172	181	-4.6%	26	142	-21.1%	137	369	4.3%
1990	234	252	-5.0%	170	168	-7.1%	27	131	-7.8%	136	395	7.0%
1991	239	222	-11.8%	167	157	-6.6%	27	146	11.6%	134	424	7.4%
1992	240	222	0.0%	166	164	4.3%	26	139	-5.2%	146	406	-4.2%
1993	229	223	0.3%	164	162	-0.8%	25	131	-5.6%	147	414	1.9%
1994	212	246	10.4%	168	183	12.9%	26	194	47.9%	153	411	-0.7%
1995	214	270	9.9%	167	200	9.0%	26	221	14.1%	177	352	-14.4%
1996	220	230	-14.9%	156	193	-3.6%	25	234	5.6%	175	370	5.0%
1997	213	294	27.8%	156	204	6.2%	22	227	-2.8%	154	456	23.4%
1998	211	290	-1.4%	153	216	5.7%	22	237	4.3%	154	504	10.4%
1999	201	269	-7.2%	146	212	-2.0%	21	152	-35.7%	166	501	-0.6%
2000	204	244	-9.4%	146	199	-6.1%	19	141	-7.1%	178	487	-2.8%
2001	194	216	-11.6%	130	182	-8.6%	18	140	-0.9%	187	511	5.1%
2002	189	248	14.9%	130	189	3.7%	17	162	15.6%	189	574	12.3%
2003	188	268	8.2%	127	195	3.5%	17	175	7.9%	189	630	9.6%
2004	181	356	32.8%	119	258	31.8%	16	227	29.7%	183	643	2.1%
2005	175	437	22.7%	118	284	10.1%	15	248	9.3%	186	637	-1.0%
2006	170	481	10.1%	107	290	2.4%	14	199	-19.7%	186	653	2.6%
2007	185	437	-9.2%	127	252	-13.3%	15	260	30.6%	180	669	2.3%
1988-2007	**-19.4%**	**78.8%**		**-23.4%**	**32.8%**		**-39.1%**	**44.2%**		**36.0%**	**89.2%**	
2000-2007	**-9.4%**	**79.0%**		**-12.8%**	**26.4%**		**-19.7%**	**83.7%**		**1.5%**	**37.4%**	
Average Annual Growth Rate	**-1.1%**	**3.1%**		**-1.4%**	**1.5%**		**-2.6%**	**1.9%**		**1.6%**	**3.4%**	

a. Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the 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, 2002-2003, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2B.3.5 Capital Expenditures

The Chemicals and Allied Products industry is relatively capital-intensive. According to the *2007 Economic Census*, facilities in NAICS 325 had aggregate capital spending of approximately $16.7 billion in 2007. 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. *Table 2B-7* on the following page shows that all four profiled chemical industry segments experienced substantial increases in capital expenditures through the 1990s. 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, 2001a). Expenditures declined somewhat during the early 2000s due to a weakening economy, with the exception of the pharmaceuticals sector, which has remained relatively strong and continued to grow throughout the last two decades. As a whole, the industry increased spending in more recent years and is looking towards new capital expenditure strategies for growth in the near future, hoping to capitalize on long-term societal "megatrends," including increased use of renewable energy and the need for improved food and water supplies (Jagger, 2009).

Table 2B-7: Capital Expenditures for Profiled Chemicals and Allied Products Industry Segments (in millions, $2009)

	Basic Chemicals		Resins and Synthetics		Pesticides and Fertilizers		Pharmaceuticals	
Year[a]	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1988	$5,850	n/a	$3,853	n/a	$298	n/a	$3,093	n/a
1989	$7,538	28.9%	$4,361	13.2%	$402	35.1%	$3,422	10.6%
1990	$8,328	10.5%	$5,052	15.8%	$360	-10.5%	$3,075	-10.1%
1991	$8,405	0.9%	$4,650	-7.9%	$613	70.1%	$3,375	9.8%
1992	$8,146	-3.1%	$3,616	-22.2%	$741	20.9%	$4,414	30.8%
1993	$6,296	-22.7%	$4,287	18.5%	$471	-36.4%	$4,298	-2.6%
1994	$5,670	-9.9%	$4,449	3.8%	$459	-2.6%	$4,364	1.5%
1995	$7,549	33.1%	$4,198	-5.6%	$498	8.6%	$4,830	10.7%
1996	$9,241	22.4%	$3,677	-12.4%	$666	33.7%	$4,612	-4.5%
1997	$8,896	-3.7%	$4,628	25.9%	$1,038	55.9%	$4,696	1.8%
1998	$8,775	-1.4%	$5,193	12.2%	$950	-8.5%	$4,264	-9.2%
1999	$7,776	-11.4%	$5,414	4.3%	$738	-22.3%	$4,557	6.9%
2000	$6,775	-12.9%	$3,433	-36.6%	$436	-41.0%	$5,524	21.2%
2001	$6,012	-11.3%	$2,790	-18.7%	$410	-6.1%	$6,085	10.2%
2002	$5,046	-16.1%	$2,929	5.0%	$406	-1.0%	$6,060	-0.4%
2003	$4,324	-14.3%	$2,023	-30.9%	$319	-21.4%	$5,992	-1.1%
2004	$4,680	8.2%	$2,188	8.1%	$311	-2.4%	$6,685	11.6%
2005	$5,012	7.1%	$2,746	25.5%	$335	7.6%	$5,179	-22.5%
2006	$5,855	16.8%	$2,734	-0.4%	$409	21.9%	$4,423	-14.6%
2007	$7,465	27.5%	$3,268	19.5%	$471	15.3%	$5,538	25.2%
Total Percent Change 1988 - 2007	**27.6%**		**-15.2%**		**58.1%**		**79.0%**	
Total Percent Change 2000 - 2007	**10.2%**		**-4.8%**		**8.0%**		**0.2%**	
Average Annual Growth Rate	**1.3%**		**-0.9%**		**2.4%**		**3.1%**	

a. Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the 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, 2002-2003, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

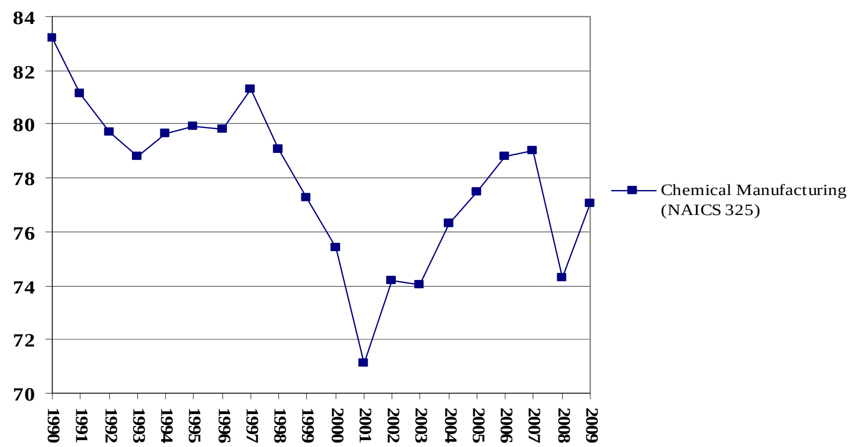
2B.3.6 Capacity Utilization

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 2B-4 presents capacity utilization from 1990 to 2009 for the entire Chemicals and Allied Products industry (NAICS 325). Capacity utilization for the industry fluctuated throughout the 1990s, dropping from 1990 through 1993, increasing gradually through 1997, and then dropping rapidly to a low of 71 percent in 2001. The next eight years showed recovery, with increases in capacity utilization each year except during the recessions of 2001 and

2008. Following a period of regular capacity utilization increases, the chemicals industry conserved cash by cutting capital spending by 20.1 percent at the beginning of the 2008 recession, according to the American Chemistry Council (C&EN, 2010). Overall, between 1990 and 2009, capacity utilization in the Chemicals and Allied Products industry fell 7.4 percent, but has grown 2.2 percent since 2000. As the U.S. economy recovers, companies in the Chemicals and Allied Products industry could still find themselves with significant excess capacity, despite recent cuts in capacity investments, and may not return to making major investments until 2011 However (C&EN, 2010).

Figure 2B-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Chemicals and Allied Products Industry Segments[a,b]



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*.
b. Before 2007, U.S. Census sampled every industry in a specific NAICS6. Beginning in 2007, U.S. Census only sampled certain industries within any NAICS6, and therefore, the data collected before 2007 cannot be directly compared to the data collected in 2007 and beyond.
Source: U.S. DOC, Survey of Plant Capacity 1989-2009, U.S. Census Bureau.

2B.4 Structure and Competitiveness

The Chemicals and Allied Products 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 Resins and Synthetics segment, for example, experienced sizable consolidations in the late 1990s into 2000 (S&P, 2001a). In the most recent decade, there has been a significant increase in trade activity for all profiled Chemicals and Allied Products industry segments, with particularly notable growth in imports of pesticides, fertilizers, and pharmaceutical products. Consolidation and restructuring efforts have also been very strong since 2000, as global chemical merger and acquisition activity climbed from $33 billion to $55 billion in 2005 to 2007 alone (Chang, 2008).

2B.4.1 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 Basic Chemicals segment (325110, 325120, 325131, 328181, 325188, and 325199) and Resins and Synthetics (NAICS codes 325211, 325221, and 325222) are defined as small if they have

1,000 or fewer employees (except for NAICS 325211, for which the threshold is 750 or fewer employees). Firms in the NAICS industry 325311 and 325312 of the Pesticides and Fertilizers segment are considered small if they have 1,000 or fewer and 500 or fewer employees, respectively. Firms in Pharmaceuticals (NAICS codes 325411 and 325412) 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 2B-8* show that in 2006, 872 of 1,105 firms in the Basic Chemicals segment had less than 500 employees. Therefore, at least 79 percent of firms in this segment were classified as small. These small firms owned 982 facilities, or 49 percent of all facilities in the segment. In the Resins and Synthetics Industry segment, 537 of 647 firms, or 83 percent, had less than 500 employees in 2006. These small firms owned 589 of 906 facilities (65 percent) in this segment. In the Pesticides and Fertilizers segment, 86 percent of firms (131 of 152) had fewer than 500 employees, owning 72 percent of all facilities in that segment. And for the Pharmaceuticals segment, 966 of the 1,107 firms (87 percent) had less than 500 employees, and these firms accounted for 76 percent of the total number of facilities.

Table 2B-8 below shows the distribution of firms and facilities in the four profiled segments by the employment size of the parent firm.

Table 2B-8: Number of Firms and Facilities by Firm Size Category for Profiled Chemical Segments, 2006

Year	Basic Chemicals		Resins and Synthetics		Pesticides and Fertilizers		Pharmaceuticals	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	495	495	269	270	101	101	612	613
20-99	234	254	184	192	19	19	222	237
100-499	143	233	84	127	11	16	132	151
500+	233	1040	110	317	21	52	141	316
Total	**1,105**	**2,022**	**647**	**906**	**152**	**188**	**1,107**	**1,317**

Source: U.S. DOC, Statistics of U.S. Businesses, 2006 (U.S. DOC, 2006).

2B.4.2 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 ($60^2 + 30^2 + 10^2$). 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 1,000 are considered unconcentrated, markets in which the HHI is between 1,000 and 1,800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 are considered to be concentrated.

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.

Of the profiled Chemicals and Allied Products segments, as shown in *Table 2B-9*, the following industry sub-sectors were highly concentrated in 2002: Petrochemical Manufacturing (NAICS 325110), Phosphatic Fertilizer Manufacturing (NAICS 325312), and Medicinal and Botanical manufacturing (NAICS 325411). HHI and CH4 values indicated that Industrial Gas Manufacturing (NAICS 325120), Inorganic Dye and Pigment Manufacturing (NAICS 325131), Alkalies and Chlorine manufacturing (NAICS 325181), and Noncellulosic Organic Fiber Manufacturing (NAICS 325222) were all moderately concentrated. In contrast, Plastics Material and Resin Manufacturing (NAICS 325211), Nitrogenous Fertilizer Manufacturing (NAICS 325311), Pharmaceutical Preparation Manufacturing (NAICS 325412), Other Basic Inorganic Chemical Manufacturing (NAICS 325188), and Other Basic Organic Chemical Manufacturing (NAICS 325199) would be considered competitive. The diversity of products in some of the profiled industry segments, however, makes generalizations about concentration less reliable than in industry segments with a more limited product slate. That is, within a single NAICS 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 NAICS 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 the discretionary pricing power of U.S. firms in the profiled industry segments.

Table 2B-9: Selected Ratios for SIC and NAICS Codes Within Profiled Chemicals and Allied Products Industry Segments in 1987, 1992, 1997, and 2002

SIC (S) or NAICS (N) Code	Year [a]	Concentration Ratios				
		4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
Basic Chemicals						
S 2869	1987	31%	48%	68%	86%	376
	1992	29%	43%	67%	86%	336
N 325110	1997	60%	83%	98%	100%	1,187
	2002	85%	94%	100%	100%	2,662
S 2813	1987	77%	88%	95%	98%	1,538
	1992	78%	91%	96%	99%	1,629
N 325120	1997	64%	85%	96%	99%	1,223
	2002	64%	82%	97%	99%	1,218
S 2816	1987	64%	76%	94%	99%	1,550
	1992	69%	79%	93%	99%	1,910
N 325131	1997	67%	79%	95%	100%	1,848
	2002	69%	82%	96%	100%	1,704
S 2812	1987	72%	93%	99%	100%	2,328
	1992	75%	90%	99%	100%	1,994
N 325181	1997	78%	92%	100%	100%	2,870
	2002	73%	90%	100%	100%	1,786
S 2819	1987	38%	49%	68%	84%	468
	1992	39%	50%	68%	85%	677
N 325188	1997	31%	42%	63%	82%	394
	2002	21%	33%	56%	80%	217
S 2869	1987	31%	48%	68%	86%	376
	1992	29%	43%	67%	86%	336
N 325199	1997	25%	38%	57%	80%	256
	2002	22%	36%	57%	80%	238
Resins and Synthetics						
S 2821	1987	20%	33%	61%	89%	248
	1992	24%	39%	63%	90%	284
N 325211	1997	26%	39%	64%	89%	304
	2002	32%	46%	68%	88%	443
S 2823	1987	NA	100%	NA	NA	NA
	1992	98%	NA	NA	NA	NA
N 325221	1997	100%	NA	NA	NA	NA
	2002	93%	NA	NA	NA	NA
S 2824	1987	76%	92%	98%	100%	2,403
	1992	74%	90%	98%	100%	2,158
N 325222	1997	69%	87%	98%	100%	1,708
	2002	57%	82%	96%	100%	1,262
Pesticides and Fertilizers						
S 2873	1987	33%	55%	82%	97%	486
	1992	48%	67%	91%	99%	792
N 325311	1997	54%	76%	94%	99%	903
	2002	54%	79%	95%	98%	977
S 2874	1987	48%	74%	98%	99%	880
	1992	62%	83%	98%	99%	1,528
N 325312	1997	71%	88%	99%	100%	1,675
	2002	78%	93%	100%	100%	1,853
Pharmaceuticals						
S 2833	1987	72%	80%	89%	95%	2,588
	1992	76%	84%	91%	97%	2,999
N 325411	1997	62%	73%	85%	93%	2,059
	2002	64%	73%	83%	92%	2,704
S 2834	1987	22%	36%	65%	88%	273
	1992	26%	42%	72%	90%	341
N 325412	1997	36%	50%	71%	89%	462
	2002	36%	53%	76%	89%	530

Table 2B-9: Selected Ratios for SIC and NAICS Codes Within Profiled Chemicals and Allied Products Industry Segments in 1987, 1992, 1997, and 2002

SIC (S) or NAICS (N) Code	Year [a]	Concentration Ratios				
		4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index

a. Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the NAICS system. 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, Economic Census, 1987, 1992, 1997, and 2002.

2B.4.3 Foreign Trade

The Chemicals and Allied Products industry is one of the largest exporters in the United States, with $106 billion in annual exports accounting for more than 10 percent of total U.S. merchandise exports. In fact, U.S. manufacturers produce 19 percent of the world's chemicals, more than any other country (ACC, 2009).

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 Proposed Existing Facilities Regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities 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 2007 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 2B-10 presents trade statistics for each of the profiled Chemicals and Allied Products industry segments. Both export dependence and import penetration experienced increases in each of these segments between 1990 and 2007.

Globalization of markets has become a key factor in the Basic Chemicals segment, with both import penetration and export dependence growing substantially over the 18-year analysis period - imports tripled and exports doubled. The greater growth in imports underscores the increasing competition from foreign producers in domestic and world markets.

Increased globalization has also affected the Resins and Synthetics segment. Imports and exports of resins and synthetics have increased significantly over the 18-year analysis period, reflecting the continued growth in the global market. As with the Basic Chemical segment, this segment has shown substantial overall increases in values of imports and exports with total growth of 243 percent and 137 percent, respectively during the last two decades. Import penetration grew more quickly than export dependence in this segment due to declining export opportunities and increased foreign competition in the domestic markets. Nevertheless, the United States remained a net exporter of resins and synthetics, despite these trends. The market for pesticides and fertilizers has also become increasingly competitive. Significant capacity expansions for pesticides and fertilizers 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. However, this balance recently changed as imports exceeded exports from 2000 through 2007. From 1990 through 2007, imports in the profiled Pesticides and Fertilizers segment grew by 377 percent, while exports declined 10 percent. The Pharmaceuticals segment had by far the largest surge in trade activity over the observed period, with imports growing over twelve-fold, and exports increasing by 480 percent.

In 2007, import penetration ratios in the Basic Chemicals and Resins and Synthetics segments were 22 and 17 percent respectively, compared to 27 percent reported for the U.S. manufacturing industry as a whole. Therefore, neither of these two profiled segments faces strong competition from foreign firms in U.S. markets. At the same time, the import penetration ratio was 49 percent for the Pesticides and Fertilizers segment and 35 percent for the Pharmaceuticals segment, suggesting that businesses in these segments do face strong competition from foreign firms in the U.S. markets. Further, between 1990 and 2007 import penetration ratio for all profiled segments except Basic Chemicals rose significantly (165 percent, 403 percent, and 149 percent, respectively), which could indicate that foreign firms have begun aggressive pursuit of these U.S. markets.

In 2007, the export dependence ratio was 22 percent for the Basic Chemicals segment, 30 percent for the Resins and Synthetics segment, 29 percent for the Pesticides and Fertilizers segment, and 18 percent for the Pharmaceuticals segment compared to 17 percent reported for the U.S. manufacturing industry as a whole. Therefore, all 4 segments likely face significant competitive pressure in retaining their positions in the foreign markets. Further, for all profiled chemical industry segments except Pesticides and Fertilizers, export dependence has been steadily increasing during the last two decades. Given these levels of exposure to competition from foreign firms in domestic and export markets, the profiled chemicals industry segments likely have limited discretionary power to recover compliance costs expected to be uncured as the result of the Proposed Existing Facilities Regulation through price increases.

Recent trends in international chemicals markets imply that U.S. producers in the profiled Chemicals and Allied Products industry will continue to face strong competition from foreign producers. However, trade is also expected to play an important role in industry growth as increased importance is given to bilateral and multilateral trade agreements. Free Trade Area of the Americas (FTAA) and other free trade agreements with Chile and Vietnam offer U.S. chemical companies the opportunity to expand exports to these regions/countries. Trade barriers such as higher tariff rates are falling in many countries as a result of commitment to the Chemical Tariff Harmonization Agreement. These developments are favorable for increasing exports from the United States. At the same time, industry exposure to fluctuations in regional and global economic conditions is on the rise due to the increasing share of imports in domestic consumption (AllBusiness, 2009).

Table 2B-10: Trade Statistics for Profiled Chemicals and Allied Products Industry Segments

Year[a]	Value of Imports (millions, $2009)	Value of Exports (millions, $2009)	Value of Shipments (millions, $2009)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
Basic Chemicals						
1990	$14,964	$19,875	$120,460	115,550	13%	16%
1991	$15,095	$20,321	$114,177	108,951	14%	18%
1992	$15,545	$20,110	$114,156	109,591	14%	18%
1993	$15,237	$19,552	$109,039	104,723	15%	18%
1994	$17,579	$21,934	$111,889	107,533	16%	20%
1995	$20,725	$26,527	$119,249	113,448	18%	22%
1996	$21,944	$24,896	$117,274	114,322	19%	21%
1997	$24,083	$28,590	$130,827	126,320	19%	22%
1998	$23,879	$25,976	$121,760	119,664	20%	21%
1999	$25,442	$26,247	$118,993	118,189	22%	22%
2000	$30,477	$29,356	$125,139	126,260	24%	23%
2001	$29,500	$28,099	$111,212	112,613	26%	25%
2002	$28,670	$27,100	$113,779	115,349	25%	24%
2003	$31,571	$30,464	$126,242	127,349	25%	24%
2004	$36,345	$35,100	$150,479	151,724	24%	23%
2005	$42,781	$36,728	$170,142	176,195	24%	22%
2006	$44,131	$41,552	$190,013	192,592	23%	22%
2007	$47,054	$45,375	$210,924	212,604	22%	22%
Total Percent Change 1990-2007	**214.4%**	**128.3%**	**75.1%**	**84.0%**		
Total Percent Change 2000-2007	**54.4%**	**54.6%**	**68.6%**	**68.4%**		
Average Annual Growth Rate	**7%**	**5%**	**3%**	**4%**		
Resins and Synthetics						
1990	$4,035	$11,995	$67,214	59,253	7%	18%
1991	$3,938	$13,328	$61,883	52,494	8%	22%
1992	$4,463	$12,163	$63,346	55,647	8%	19%
1993	$5,361	$12,051	$62,921	56,230	10%	19%
1994	$6,590	$13,772	$69,639	62,456	11%	20%
1995	$7,658	$16,715	$77,396	68,338	11%	22%
1996	$7,655	$16,778	$71,706	62,582	12%	23%
1997	$8,024	$16,883	$75,639	66,780	12%	22%
1998	$8,137	$15,707	$74,253	66,683	12%	21%
1999	$8,434	$15,452	$73,269	66,251	13%	21%
2000	$9,593	$17,764	$77,519	69,347	14%	23%
2001	$9,029	$16,334	$67,596	60,291	15%	24%
2002	$9,062	$16,545	$66,182	58,700	15%	25%
2003	$10,019	$17,427	$68,451	61,043	16%	25%
2004	$11,286	$20,486	$76,886	67,685	17%	27%
2005	$14,060	$22,819	$91,428	82,669	17%	25%
2006	$14,568	$25,330	$92,910	82,148	18%	27%
2007	$13,848	$28,459	$96,238	81,627	17%	30%
Total Percent Change 1990-2007	**243.2%**	**137.2%**	**43.2%**	**37.8%**		
Total Percent Change 2000-2007	**44.4%**	**60.2%**	**24.1%**	**17.7%**		
Average Annual Growth Rate	**8%**	**5%**	**2%**	**2%**		

Table 2B-10: Trade Statistics for Profiled Chemicals and Allied Products Industry Segments

Year[a]	Value of Imports (millions, $2009)	Value of Exports (millions, $2009)	Value of Shipments (millions, $2009)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
Pesticides and Fertilizers						
1990	$1,782	$3,957	$11,782	9,606	19%	34%
1991	$1,611	$4,440	$12,072	9,243	17%	37%
1992	$1,624	$3,477	$10,768	8,915	18%	32%
1993	$1,893	$2,597	$9,984	9,280	20%	26%
1994	$2,083	$3,771	$12,153	10,465	20%	31%
1995	$2,181	$4,369	$13,170	10,982	20%	33%
1996	$2,139	$4,109	$13,291	11,321	19%	31%
1997	$3,018	$4,072	$12,250	11,196	27%	33%
1998	$3,022	$4,297	$11,997	10,722	28%	36%
1999	$2,869	$3,855	$9,638	8,652	33%	40%
2000	$3,350	$2,957	$8,845	9,238	36%	33%
2001	$3,869	$2,654	$8,249	9,463	41%	32%
2002	$3,135	$2,601	$8,556	9,090	34%	30%
2003	$4,595	$2,840	$9,607	11,361	40%	30%
2004	$5,419	$3,083	$10,822	13,158	41%	28%
2005	$7,282	$3,321	$11,041	15,003	49%	30%
2006	$6,586	$3,248	$9,795	13,133	50%	33%
2007	$8,505	$3,579	$12,403	17,328	49%	29%
Total Percent Change 1990-2007	**377.3%**	**-9.6%**	**5.3%**	**80.4%**		
Total Percent Change 2000-2007	**153.9%**	**21.0%**	**40.2%**	**87.6%**		
Average Annual Growth Rate	**10%**	**-1%**	**0%**	**4%**		
Pharmaceuticals						
1990	$5,299	$4,994	$75,140	75,446	7%	7%
1991	$6,427	$5,423	$79,735	80,739	8%	7%
1992	$7,504	$6,370	$82,830	83,964	9%	8%
1993	$7,445	$6,486	$84,342	85,301	9%	8%
1994	$8,267	$6,587	$86,992	88,671	9%	8%
1995	$10,287	$6,623	$89,716	93,380	11%	7%
1996	$13,179	$7,235	$94,731	100,676	13%	8%
1997	$17,217	$10,957	$102,069	108,329	16%	11%
1998	$21,960	$12,784	$113,596	122,772	18%	11%
1999	$28,491	$14,617	$120,165	134,040	21%	12%
2000	$34,328	$16,675	$124,879	142,532	24%	13%
2001	$39,093	$19,125	$135,223	155,191	25%	14%
2002	$46,255	$19,031	$149,641	176,865	26%	13%
2003	$54,847	$22,089	$156,290	189,047	29%	14%
2004	$57,190	$25,756	$155,815	187,249	31%	17%
2005	$58,483	$26,088	$157,312	189,708	31%	17%
2006	$65,632	$27,623	$162,697	200,707	33%	17%
2007	$69,846	$28,943	$156,721	197,624	35%	18%
Total Percent Change 1990-2007	**1218.0%**	**479.5%**	**108.6%**	**161.9%**		
Total Percent Change 2000-2007	**203.5%**	**173.6%**	**125.5%**	**138.7%**		
Average Annual Growth Rate	**16%**	**11%**	**4%**	**6%**		

a. Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the NAICS system. For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the *1997 Economic Census Bridge Between NAICS and SIC.*

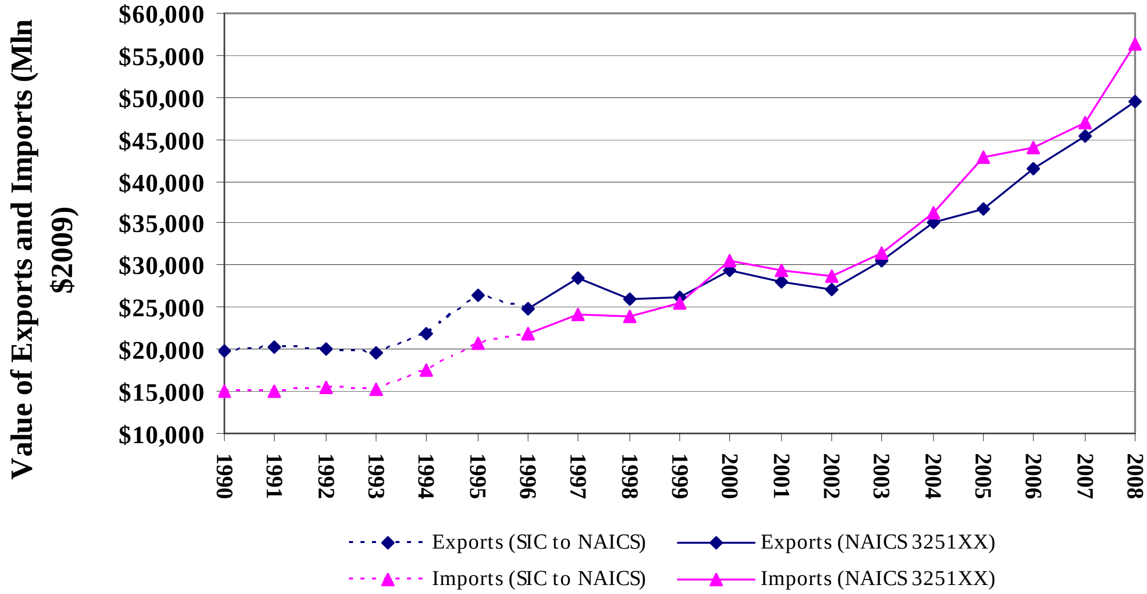
Table 2B-10: Trade Statistics for Profiled Chemicals and Allied Products Industry Segments

Year[a]	Value of Imports (millions, $2009)	Value of Exports (millions, $2009)	Value of Shipments (millions, $2009)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]

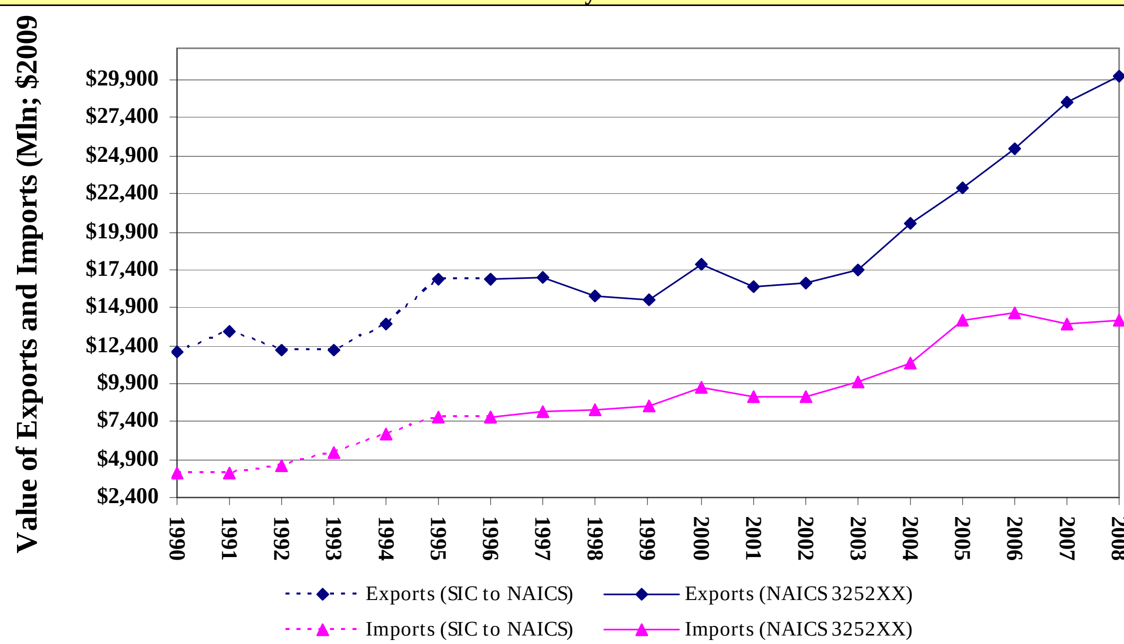
b. Calculated by EPA as shipments + imports - exports.
c. Calculated by EPA as imports divided by implied domestic consumption.
d. Calculated by EPA as exports divided by shipments.
Source: U.S. International Trade Commission, 1989-2007.

Figure 2B-5: Value of Imports and Exports for Profiled Chemicals and Allied Products Industry Segments[a]

Basic Chemicals

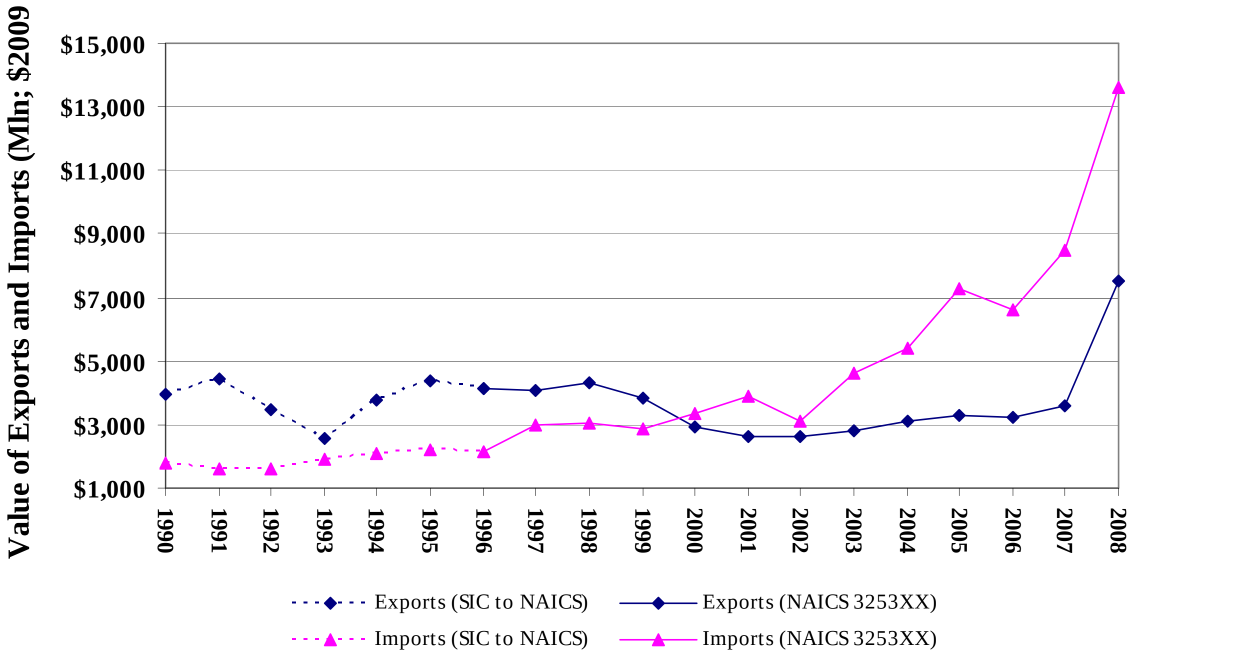


Resins and Synthetics

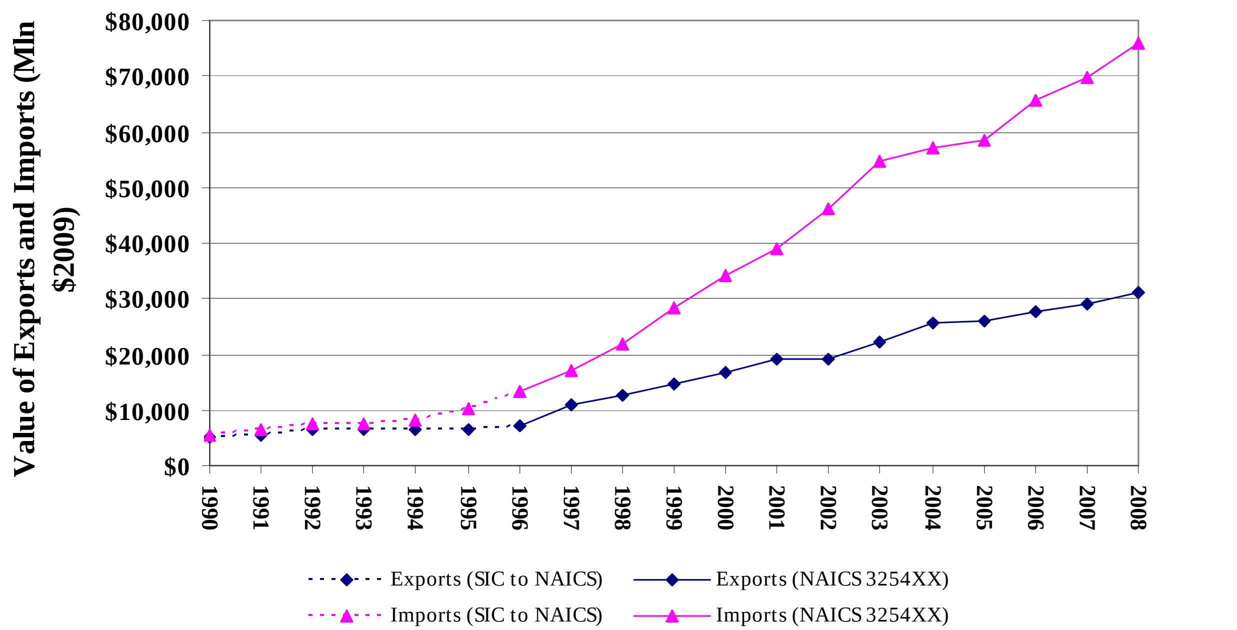


Pesticides and Fertilizers

Figure 2B-5: Value of Imports and Exports for Profiled Chemicals and Allied Products Industry Segments[a]



Pharmaceuticals



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. International Trade Commission, 1989-2007.

2B.5 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 21-year period, 1988-2008: ***net profit margin*** and ***return on total capital***. EPA calculated these measures using data from the Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (QFR) published by the U.S. Census Bureau. Financial performance in the most recent financial reporting period (2008) 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 pre-tax income divided by the sum of current portion of long-term debt due in 1 year or less, long-term debt due in more that 1 year, all other noncurrent liabilities and total stockholders' equity (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 2B-6 presents net profit margin and return on total capital for public-reporting firms in two chemical industry segments – (1) Basic Chemicals, Resins, and Synthetics Manufacturing, which covers profiled segments Basic Chemicals and Resins and Synthetics and (2) Pharmaceuticals and Medicines Manufacturing – for the 21-year period, 1988 through 2008. *Figure 2B-6* also presents net profit margin and return on total capital for public-reporting firms in Other Chemicals segment – for the 17-year period, 1992 through 2008.[8] The first segment corresponds approximately to the profiled Basic Chemicals and Resins and Synthetics industry segments; the second segment corresponds approximately to the profiled Pharmaceuticals industry segment; and the third segment corresponds to the profiled Pesticides and Fertilizers industry segment. The financial performance information reported in *Figure 2B-6* confirms the trends and performance discussed above in this section.

[8] For the Other Chemicals QFR segment, which includes the profiled Pesticides and Fertilizers segment, QFR data are available only since 1992. In addition to NAICS 3253: Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing, which corresponds to the profiled Pesticides and Fertilizers segment, the QFR Other Chemicals segment includes NAICS 3255: Paint, Coating, and Adhesive Manufacturing; NAICS 3256: Soap, Cleaning Compound, and Toilet Preparation Manufacturing, and NAICS 3259: Other Chemical Product and Preparation Manufacturing.

As shown in *Figure 2B-6*, the Basic Chemicals and Resins and Synthetics segments have seen moderate volatility of financial performance over the analysis period. Return on total capital moved off a post-recession low near -3 percent in 1992 to achieve levels of 7 to 10 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 1990s decade, though, increased competition from foreign producers and demand weakness in Asian markets eroded this performance. As a result, return on capital fell gradually 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 percent to less than one percent. Starting in 2002, however, return on total capital showed steady improvement, increasing to nearly 10 percent by 2005 and then leveling out prior to the economic recession of 2008. 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 a peak value of 6.6 percent, before dipping in 2008 along with the general trend of the economy.

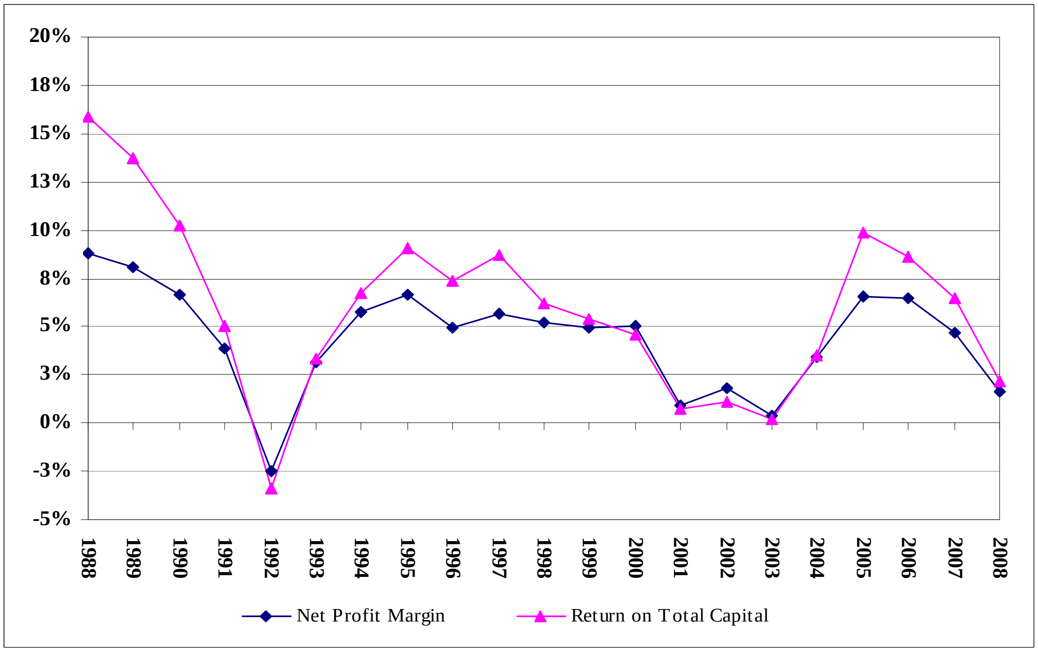
The same factors largely influenced performance in the Pharmaceuticals and Medicines Manufacturing segment over the 21-year period. Performance in this segment was stronger than that in the other industry segments and followed a less volatile pattern. Net profit margins rose from a low near 12 percent in 1993 to a peak of 15.9 percent in 1998. Since then, performance trended down to reach a low of approximately 14 percent in 2000. This segment achieved steady, though moderate improvement during 2002 to 2004, and then rose rapidly to reach a period high level of 21.7 percent in 2008. Return on total capital again shows a similar, though more volatile, trend compared to net profit margin.

The Other Chemicals industry segment, which includes the profiled Pesticides and Fertilizers segment, was susceptible to the same economic influences mentioned in the previous two paragraphs. The financial performance of this segment was more volatile than the Pharmaceutical segment but more stable than the Basic Chemicals segment. Both the net profit margin and return on total capital for this segment followed a similar patter: performance was extremely transient for the first decade, peaking in 1996 and then falling sharply until 2001. In the 2000s decade, the financial health of this industry was much more stable and has been rising since 2001, with the exception of 2005. However, current levels of performance still have not reached the same peak level they rose to in 1996.

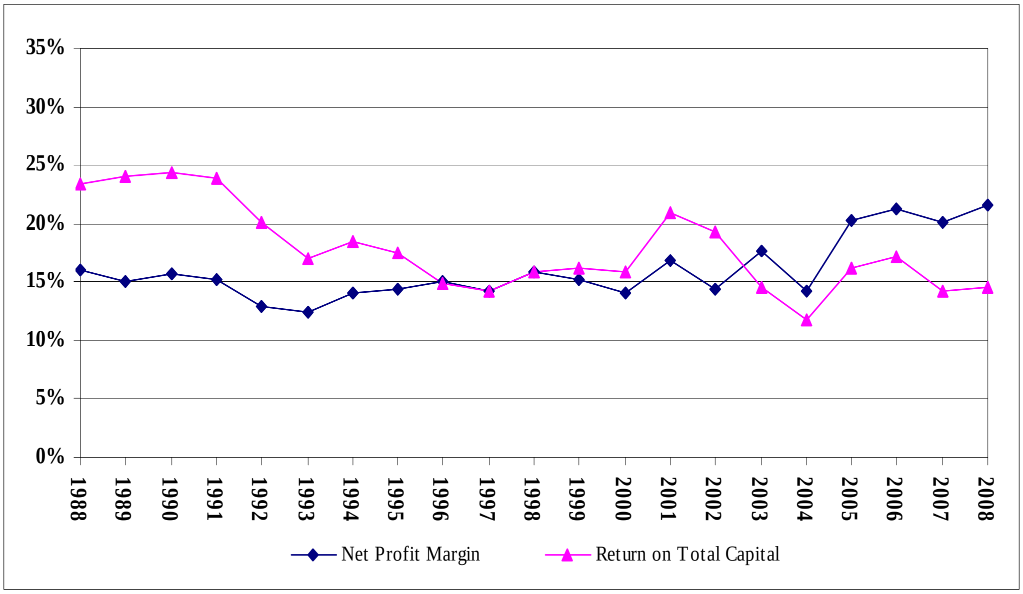
Overall, the majority of profiled segments of the chemical industry remain at weaker levels of financial performance than achieved during the mid 1990s but appear to have recovered from the downturn of 2001-2002. As mentioned throughout this chapter, industry analysts predict that the chemicals sector will recover from the 2008 recession on all levels and is expected to provide improved ability to withstand additional regulatory compliance costs without imposing significant financial impacts.

Figure 2B-6: Net Profit Margin and Return in Total Capital for the Chemicals and Allied Products Industry Segments

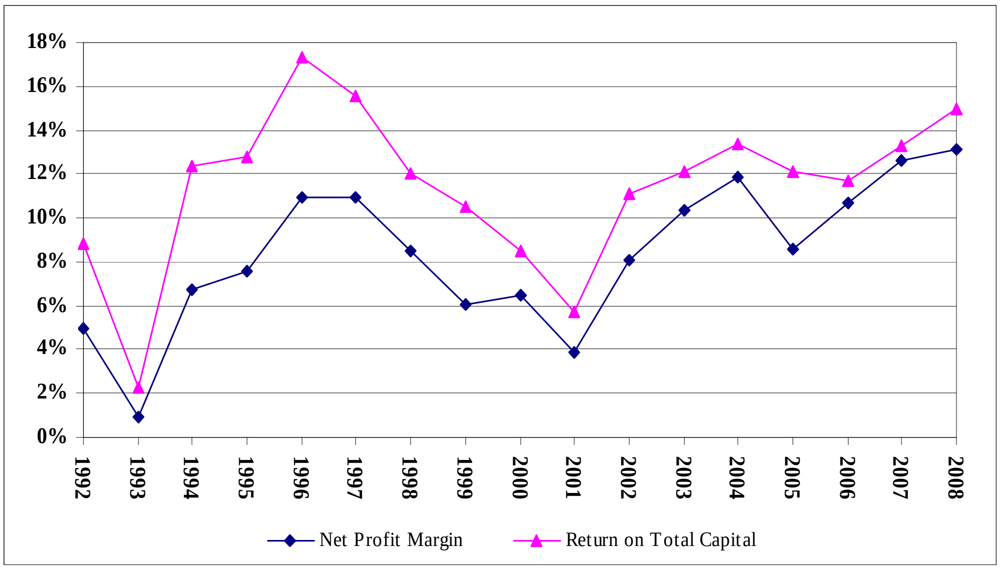
Basic Chemicals, Resins, and Synthetics Manufacturing



Pharmaceuticals and Medicines Manufacturing



Other Chemicals Manufacturing (Incl. Pesticides and Fertilizers)



Source: Quarterly Financial Report, 1988-2008; U.S. Census Bureau.

2B.6 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 Chemicals 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 (i.e., 2 MGD).

The regulatory analysis options also cover substantial additions or modifications to operations undertaken at such facilities. EPA initially identified the set of facilities that were estimated to be *potentially* subject to the 316(b) Existing Facilities Regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities for the petroleum segment.[5]

2B.6.1 Waterbody and Cooling System Type

Table 2B-11, shows the distribution of facilities by type of water body and cooling system for each option.

Table 2B-11: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Waterbody Type and Cooling Water Intake 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	
Estuary/ Tidal River	0	0%	13	36%	3	4%	0	0%	16
Ocean	0	0%	0	0%	9	10%	0	0%	9
Lake/Reservoir	4	12%	6	17%	4	5%	0	0%	15
Freshwater River/ Stream[a]	30	88%	17	48%	61	68%	10	70%	123
Great Lake	0	0%	0	0%	13	14%	4	30%	17
Total[b]	**35**	**19%**	**36**	**20%**	**90**	**50%**	**14**	**8%**	**179**

Based on technical weights (See Appendix 3.A).

a. Four freshwater facilities' cooling water intake system types are unknown. These facilities are included in the total for Freshwater River/Stream.

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

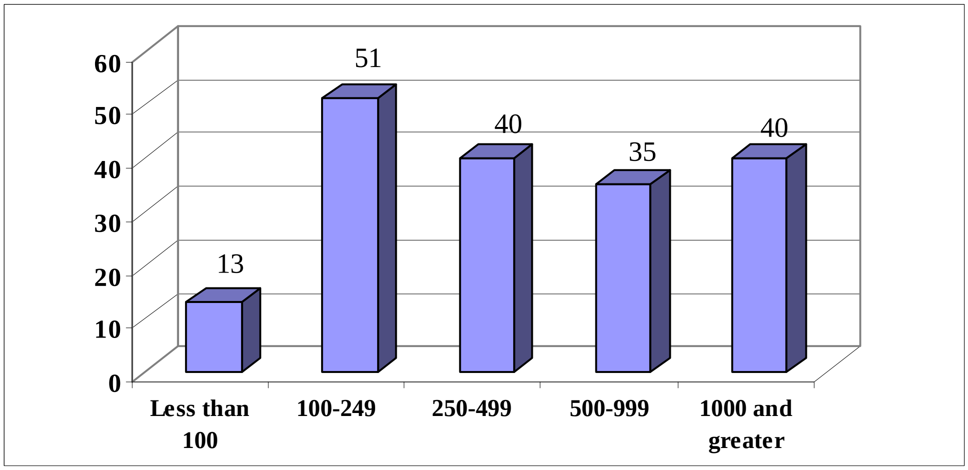
Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2B.6.2 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 2B-7*, shows the number of facilities in the profiled chemical segments by employment size category for each analysis option.

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).

Figure 2B-7: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Employment Size for Profiled Chemicals and Allied Products Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis2010.

2B.6.3 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 Basic Chemicals segment (NAICS codes 325110, 325120, 325131, 325181, 325188, and 325199), firms in the Resins and Synthetics sector (NAICS codes 325221, and 325222), and firms in the Pesticides and Fertilizer segment (NAICS code 32311) are defined as small if they have 1,000 or fewer employees except firms in NAICS 32521 as well as firms in the Pharmaceutical segment (NAICS codes 325411 and 325412), which are defined as small if they have 750 or fewer employees; remaining firms in the Pesticides and Fertilizer segment (NAICS 325312) are defined as small if they have 500 or fewer employees.

EPA estimates that 21 small entity-owned facilities and 145 large entity-owned facilities in the Chemical segment will be subject to the 316(b) Existing Facilities regulation. Insufficient survey data are available to classify the entity size of an additional 13 in-scope facilities in this segment.

2C Profile of the Petroleum Refining Industry

2C.1 Introduction

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified the Petroleum Refining Industry (SIC 2911 or NAICS 324110) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws at least 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 316(b) Existing Facilities regulation" or "in-scope facilities").

Table 2C-1, below, provides a description of the industry segment, a list of primary products manufactured, the total number of the DQ respondents (weighted to represent a national total of facilities that hold a NPDES permit and operate cooling water intake structures), and the number of facilities estimated to be potentially subject to 316 (b) Existing Facilities Rule based on the minimum withdrawal threshold of 2 MGD (see *Chapter 1: Introduction* for more details on the Rule applicability criteria).

Table 2C-1: Existing Facilities in the Petroleum Refining Industry (NAICS 324110)

NAICS	NAICS Description	Important Products Manufactured	Number of In-Scope Facilities[a]
324110	Petroleum Refineries	Gasoline, including finished base stocks and blending agents; jet fuel; kerosene; light fuel oils; heavy fuel oils, including grades no. 5, 6, heavy diesel-type, heavy gas-enrichment oils; lubricating oils and greases; unfinished oils and lubricating oil base stock; asphalt; liquefied refinery gases, including other aliphatics (feed stock and other uses); and other finished petroleum products, including waxes.	39

a. Number of weighted detailed questionnaire survey respondents.

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2010.

As shown in *Table 2C-1*, EPA estimates that, out of an estimated total of 163[9] facilities with a NPDES permit and operating cooling water intake structures in the Petroleum Refining industry (NAICS 324110), 39 (or 24 percent) would be subject to regulation under the 316(b) Proposed Existing Facilities Regulation. 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 Petroleum Refining Industry from the 2007 Economic Census is $590.4 billion ($2009). 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 existing 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 316(b) Existing Facilities Regulation to be $216.3 billion ($2009). Therefore, EPA estimates that the percentage of total production in the petroleum refining industry that occurs at facilities estimated to be subject to the regulation is 37 percent.

Table 2C-2 provides the crosswalk between NAICS codes and SIC codes for the profiled petroleum NAICS codes. For the Petroleum Refineries segment, the translation of SIC-reported data to the NAICS framework is straightforward as these frameworks have a simple one-to-one match for Petroleum Refining: NAICS code 324110 and SIC code 2911.

[9] This estimate of the number of facilities holding a NPDES permit and operating a cooling water intake structure is based on the responses from facilities that received the 1999 screener questionnaire.

Table 2C-2: Relationship between NAICS and SIC Codes for the Petroleum Refineries Industry (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	Num. Establishments	Value of Shipments (Millions; $2009)	Employment (FTEs)
324110	Petroleum Refineries	2911	Petroleum Refining	189	$590,441	65,022

Sources: U.S. DOC. 2007 Economic Census.

2C.2 Summary Insights from this Profile

A key purpose of this profile is to provide insight into the ability of Petroleum Refining firms to absorb compliance costs under the Proposed 316(b) Existing Facilities Rule 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.

2C.2.1 Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the Petroleum Refining industry 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 judges that in-scope refineries subject to the 316(b) Existing Facilities Regulation are not likely to be able to recover compliance costs through price increases to customers. Even though the Petroleum Refining industry is not characterized by high competitive pressure from foreign markets, the low market concentration leads EPA to judge 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 within their operating finances (see following sections and *Appendix 34.A: Cost Pass-Through Analysis*, for further information).

2C.2.2 Financial Health and General Business Outlook

Over the past two decades, 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 industry 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. As the U.S. economy began recovery from its economic weakness caused by the 2001 recession, the domestic petroleum refining industry also recovered, with continuous improvements in demand levels and financial performance during 2003 to 2007. Between July and December of 2008, however, at the outset of the recent economic recession, the price of crude oil dropped more than $100 a barrel. Economists predict that this slide in oil demand will rebound as the economy recovers in the coming years (Protec Fuel Management, 2009). In fact, the 2009 Annual Energy Outlook, published by the U.S. Energy Information Administration (EIA) of the U.S. Department of Energy (DOE), projects that petroleum production will increase from 13.08 quadrillion Btu in 2008 to 15.51 in 2020, 15.68 in 2030, and 15.87 in 2035, showing gradual expansion in domestic petroleum production (U.S. DOE, 2009a). In addition, according to the 2010 Annual Energy Outlook, total liquid fuels consumption, including petroleum products, will grow by roughly 1 percent annually until 2035, owing a majority of this increase to the transportation sector's growing demand (U.S. DOE, 2010). Although the Petroleum Refining industry has weathered difficult periods over the last two decades, the expected strengthening of the industry's financial condition and general business outlook as the world and U.S.

economy recover from the current economic weakness, point to the ability of the in-scope facilities in the Petroleum Refining industry to withstand additional regulatory compliance costs without imposing significant financial impacts.

2C.3 Domestic Production

The Petroleum Refining industry accounts for about 11 percent of the value of shipments of the entire U.S. manufacturing sector and employs 0.5 percent of the manufacturing sector's workers (U.S. Census Bureau, 2009a). According to the Annual Survey of Manufactures, in 2007, Petroleum Refineries achieved shipments of approximately $590.4 billion dollars ($2009) and employed 60,022 people. Petroleum products constitute approximately 37 percent of the total energy used in the United States, including virtually all of the energy consumed in transportation (U.S. DOE, 2009b).

According to EIA, 150 Petroleum Refineries operated in the United States in 2008 (U.S. DOE, 2009b).[1] Some data reported in this profile are taken from EIA publications. Readers should note that the Census data reported for NAICS 324110 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.

2C.3.1 Output

Table 2C-3 shows trends in production of petroleum refinery products from 1990 through 2008. 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 because of 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 production continued to increase until the global recession hit in 2008, when overall U.S. production fell slightly by 0.1 percent. U.S. demand for oil and gas refined products fell by more than three million b/d from the peak in February 2008 to the trough in June 2009 during the global economic slowdown; as a result, refining margins have narrowed and refiners have responded by reducing throughput rates, idling and closing less efficient facilities, and cutting capital expenditures (S&P, 2010c). As the U.S. and global economy improves, Petroleum

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1 In addition, one operating and one idle refinery were located in Puerto Rico and one operating refinery in the Virgin Islands.

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).

Refining firms are also likely to see improvements in their markets and earnings. This should place companies in a better position to incur any costs associated with regulatory compliance.

Table 2C-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%
2005	8.32	3.95	1.55	0.63	0.75	17.8	0.2%
2006	8.36	4.04	1.48	0.64	0.76	17.98	1.0%
2007	8.36	4.13	1.45	0.67	0.75	17.99	0.1%
2008	8.4	4.29	1.47	0.62	0.67	17.98	-0.1%
Total Percent Change 1990-2008	**20.7%**	**46.4%**	**-1.3%**	**-34.7%**	**-14.1%**	**17.7%**	
Total Percent Change 2000-2008	**5.7%**	**19.8%**	**-8.7%**	**-11.4%**	**-15.2%**	**4.3%**	
Average Annual Growth Rate	**1.1%**	**2.1%**	**-0.1%**	**-2.3%**	**-0.8%**	**0.9%**	

a. Kerosene, lubricants, petrochemical feedstocks, waxes, and miscellaneous products.

Source: U.S. DOE, Annual Energy Review, 2009b

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 (from other industries) used to make the products that are sold.

Figure 2C-1 shows value of shipments and value added for petroleum products from 1987 to 2007. 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 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).

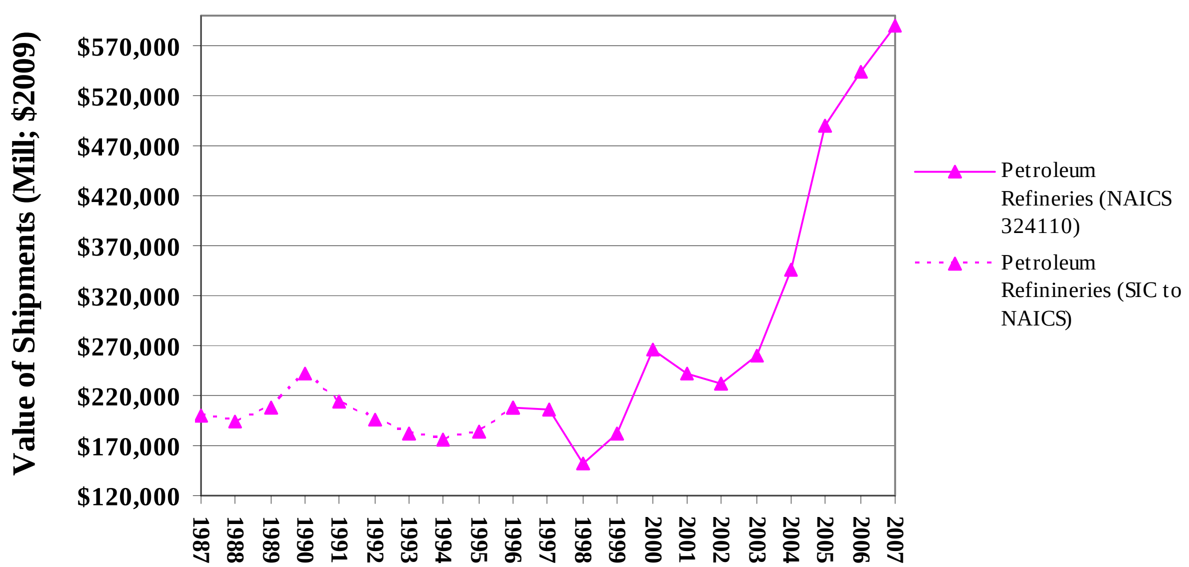
As crude oil producers and refiners cut back on production, the industry was restored with significant improvements in 1999 and 2000, before the global economic slowdown and weakening demand decreased the

4 Terms highlighted in bold and italic font are further explained in the glossary.

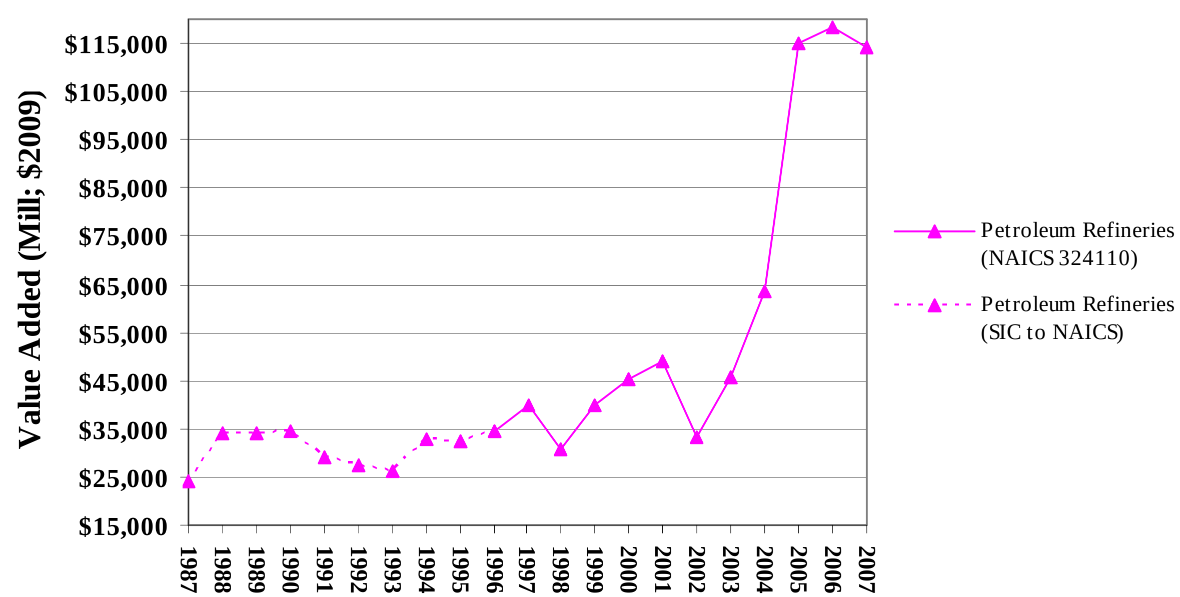
value of shipments in 2001. From 2003 through 2007, however, value of shipments increased significantly, peaking at nearly $600 billion in 2007. The average annual percentage change during this four-year period was 23.4 percent. Value added generally followed the path of value of shipments over the last two decades.

Figure 2C-1: Value of Shipments and Value Added for Petroleum Refineries (millions, $2009)[a]

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, 2003-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

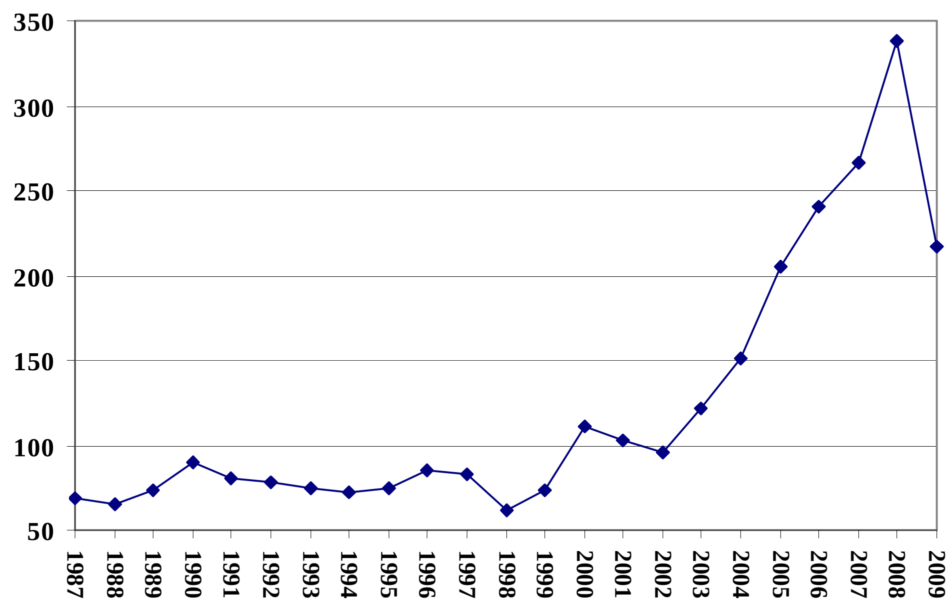
2C.3.2 Prices

The producer price index (PPI) measures price changes from the perspective of the seller, and indicates the overall trend of product pricing, and thus provides insight into supply-demand conditions, within a given industry.

Figure 2C-2 shows substantial fluctuations in petroleum product prices between 1987 and 2008. 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 fell 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 2C-2*. The higher prices reflect low refinery product inventories and higher crude oil input prices (Value Line, 2010). 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 2008, however, prices rose dramatically. By 2008, the price of petroleum products was over double the price seen in 2000, the previous peak year during the 1987 to 2002 time period.

During the second half of 2008, petroleum industry prices began to decline as the result of economic recession and continued to do so though the middle of 2009. Oil prices fell during 2008 due to a broad-based financial de-leveraging occurring across all markets and investment asset classes. The drop in oil prices nearly exactly corresponded to price movements in the collapsing stock market (Protec Fuel Management, 2008). Although world oil prices declined sharply in 2008, they have generally risen throughout 2009. Prices are forecast to rebound as the world economy recovers and global demand grows more rapidly than liquid supplies from producers outside of the Organization of the Petroleum Exporting Countries (OPEC). In 2035, the average real price of crude oil is expected to be $133 per barrel ($2008) (U.S. DOE, 2009a).

Figure 2C-2: Producer Price Index for Petroleum Refineries



Source: BLS, 2009d.

2C.3.3 Number of Facilities and Firms

The number of operable refineries fell substantially during the 1980s, with fluctuations in the number of refinery firms and facilities through the 1990s and 2000s. The earlier 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.

Table 2C-4 presents the numbers of refinery facilities and firms from 1990 to 2006 based on Statistics of U.S. Businesses for NAICS 324110. As shown in the table, despite some significant losses in 1997 and 2003, both the number of refinery facilities and the number of firms reporting Petroleum Refining as their primary business have grown since 1990. The number of petroleum refinery firms grew 40.7 percent from 2000 to 2006, while the number of facilities correspondingly grew by 18.1 percent. Since refinery operable distillation capacity is projected to increase by 8,000 barrels per calendar day from 2009 to 2010, either new facilities or increased efficiency can be expected in the next year for petroleum refineries (U.S. DOE, 2010). Most additional new capacity in the United States is expected to be concentrated on the Gulf Coast, with some in the Midwest (Turner, 2006).

Table 2C-4: Number of Firms and Facilities for Petroleum Refineries

Year[a]	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	155	21.1%	304	22.6%
1999	145	-6.5%	292	-3.9%
2000	162	11.7%	298	2.1%
2001	165	1.9%	302	1.3%
2002	202	22.4%	349	15.6%
2003	142	-29.7%	274	-21.5%
2004	155	9.2%	364	32.8%
2005	177	14.2%	301	-17.3%
2006	228	28.8%	352	16.9%
Total Percent Change 1990-2006	**6.0%**		**3.5%**	
Total Percent Change 2000-2006	**40.7%**		**18.1%**	
Average Annual Growth Rate	**0.4%**		**0.2%**	

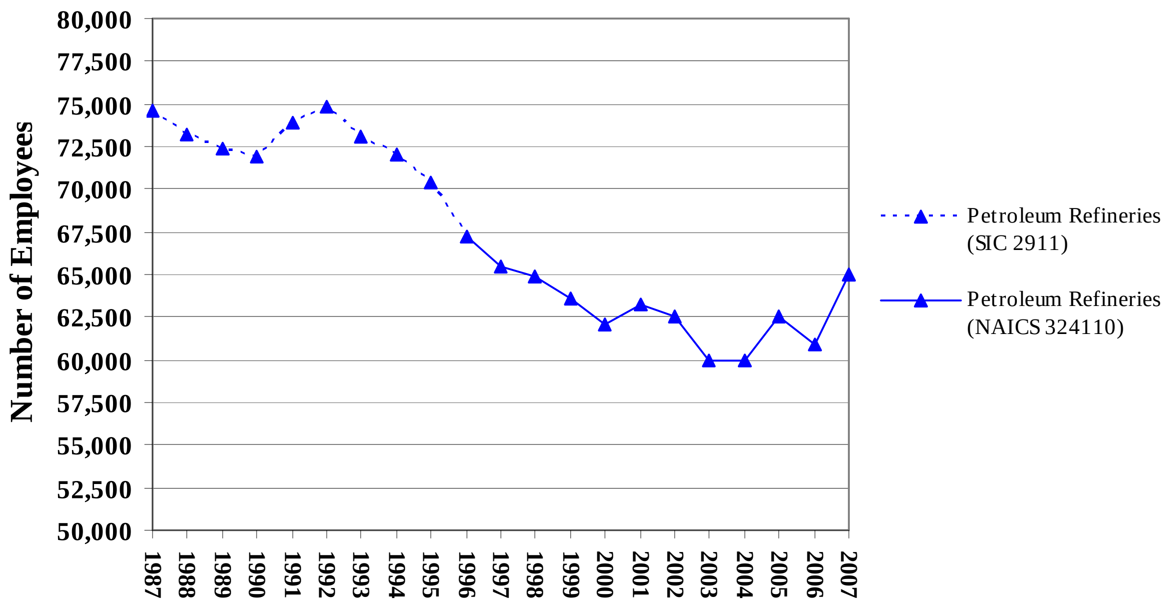
a Before 1998, these data were compiled in the Standard Industrial Classification (SIC) system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using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

Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

2C.3.4 Employment and Productivity

Employment in the Petroleum Refining segment declined by 13 percent between 1987 and 2007, from 74,600 to 65,022 employees, shown in *Figure 2C-3*. After increasing in the early 1990s, employment at Petroleum Refineries declined almost continuously through 2003, reflecting overall industry consolidation, before showing slight recovery during the remainder of the decade. The declining level of employment is not so much an indicator of financial success for the industry, but rather an indicator of the increasing mechanization of petroleum refineries. The industry has become highly automated, with the average annual revenue per worker currently at over $3 million (First Research, 2009).

Figure 2C-3: Employment for Petroleum Refineries[a]



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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2C-5 shows substantial year-to-year changes in labor productivity, measured by value added per production hour. These fluctuations largely reflect volatility in value added, which in turn indicates variation 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 2007, but with a slight increase (1.4 percent) in the number of production hours in the last seven years since 2000. Value added was not negatively affected, as it more than quadrupled over the same two-decade period.

Table 2C-5: Productivity Trends for Petroleum Refineries ($2009)[a]

Year	Value Added (millions)	Production Hours (millions)	Value Added/Hour ($/hr)	Value Added/Hour % Change in Value Added/ Hour
1987	$24,100	103	$233	n/a
1988	$33,900	103	$329	41.2%
1989	$34,075	105	$326	-1.1%
1990	$34,697	106	$328	0.7%
1991	$29,066	107	$273	-16.8%
1992	$27,396	109	$251	-8.2%
1993	$26,256	107	$247	-1.6%
1994	$32,717	110	$297	20.6%
1995	$32,281	107	$303	1.7%
1996	$34,357	103	$335	10.7%
1997	$40,087	100	$402	19.9%
1998	$30,839	98	$315	-21.5%
1999	$39,871	94	$424	34.3%
2000	$45,363	92	$491	16.0%
2001	$48,829	94	$522	6.3%
2002	$33,312	84	$395	-24.3%
2003	$45,538	83	$550	39.2%
2004	$63,560	83	$769	39.8%
2005	$114,942	89	$1,294	68.2%
2006	$118,201	88	$1,348	4.2%
2007	$114,108	94	$1,219	-9.5%
Total Percent Change 1987-2007	**373.5%**	**-9.4%**	**422.7%**	
Total Percent Change 2000-2007	**151.5%**	**1.4%**	**148.2%**	
Average Annual Growth Rate 1987-2007	**8.1%**	**-0.5%**	**8.6%**	

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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2C.3.5 Capital Expenditures

Petroleum industry capital expenditures increased substantially between 1987 and 1993, generally decreased through the rest of the decade, then increased significantly in 2001, as shown in *Table 2C-6*. During 2001 through 2004, capital expenditures fluctuated somewhat, peaking at over 8.5 billion in 2002 before declining in both 2003 and 2004. The second half of the last decade showed a great increase in capital expenditures, reaching well over $17 billion in 2007 – a 413 percent change from 1987 expenditures and 205 percent change since 2000. 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. Significant expenditures for gasoline quality improvements occurred in the early 1990s and in 2002, and capital expenditure activity is expected to continue to rise as oil and gas discoveries are being mad worldwide. In 2009 alone, over

350 discoveries were announced, and in order to capitalize on these discoveries, companies are expecting to increase their capital budgets for 2010 and beyond (NPC, 2004; Global Data, 2010).

Table 2C-6: Capital Expenditures for Petroleum Refineries ($2009)[a]

Year	Capital Expenditures (millions)	% Change
1987	$3,449	n/a
1988	$3,813	10.5%
1989	$4,716	23.7%
1990	$5,806	23.1%
1991	$8,224	41.6%
1992	$8,806	7.1%
1993	$8,400	-4.6%
1994	$7,592	-9.6%
1995	$7,898	4.0%
1996	$6,866	-13.1%
1997	$5,510	-19.7%
1998	$5,352	-2.9%
1999	$4,988	-6.8%
2000	$5,801	16.3%
2001	$8,255	42.3%
2002	$8,781	6.4%
2003	$7,965	-9.3%
2004	$7,488	-6.0%
2005	$11,552	54.3%
2006	$11,839	2.5%
2007	$17,677	49.3%
Percent Change 1987- 2007	**412.5%**	
Percent Change 2000- 2007	**204.7%**	
Average Annual Growth Rate 1987- 2007	**8.5%**	

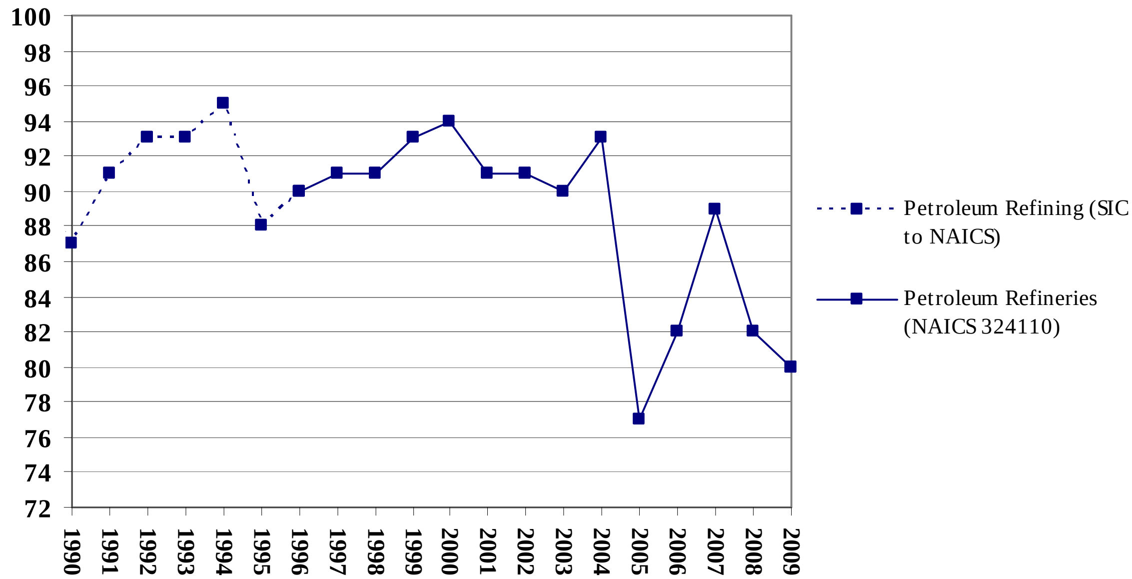
a Before 1997, these data were compiled in the Standard Industrial Classification (SIC) system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the 1997 Economic Census *Bridge Between NAICS and SIC.*
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2C.3.6 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 2C-4 below shows the fluctuation in capacity utilization rates over the period 1990-2009, based on the U.S. Census Bureau data. Overall, capacity utilization fluctuated over a relatively low range over the last two decades. Between 1990 and 1994, capacity utilization steadily increased, followed by a sharp drop in 1995. It remained relatively stable until 2004 when excess supply, recession, and other factors led to decreases in rates during the early part of this decade hitting particularly hard in 2005. The industry recovered very quickly, however, as capacity utilization increased during the following two years before dropping slightly in 2008 and 2009 as an aftershock of the economic downturn that began in 2007. Overall, refinery utilization remained relative high during the last two decades. Capacity utilization for production of specific products may vary, however, as the industry adjusts to changes in the desired product mix and characteristics.

Figure 2C-4: Capacity Utilization Rates (Fourth Quarter) for Petroleum Refineries[a,b]



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*.

b Prior to 2007, U.S. Census sampled every industry in a specific NAICS6. Beginning in 2007, U.S. Census only sampled certain industries within any NAICS6, and therefore, the data collected before 2007 cannot be directly compared to the data collected in 2007 and beyond.

Source: U.S. DOC, Survey of Plant Capacity 1989-2009, U.S. Census Bureau.

2C.4 Structure and Competitiveness

The U.S. Petroleum Refining industry 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 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 took 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 slowed during the earlier part of the decade, possibly because companies were trying to address financial issues after the 2001 recession and/or wanted to make sure that economy was indeed recovering (U.S. DOE, 2004).

The oil industry has been becoming less vertically integrated in recent years. The share of U.S. refining capacity owned by independent refiners with no production operations was eight percent in 1990 while by 2007, this share exceeded 21 percent. Important mergers and acquisitions in the later part of the decade included: ChevronTexaco and Unocal in 2005; Valero and Premcor in 2005; ConocoPhillips and Burlington Resources in 2006; Anadarko, Kerr-McGee, and Western Gas Resources in 2006; and Occidental and Vintage Petroleum in 2006 (API, 2008).

2C.4.1 Firm Size

For NAICS 324110, 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 2C-7* below shows the distribution of firms and establishments in NAICS 324110 by the employment size of the parent firm. The SUSB data show that 155 of the 352 NAICS 324110 establishments reported for 2006 (44 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 197 (56 percent) are owned by small firms (those with fewer than 500 employees).

Table 2C-7: Number of Firms and Establishments for Petroleum Refineries by Firm Employment Size Category, 2006[a]

Employment Size Category	Number of Firms	Number of Establishments
0-19	148	148
20-99	21	26
100-499	19	23
500+	40	155
Total	**228**	**352**

a Based on NAICS 324110

Source: U.S.DOC, Statistics of U.S. Businesses, 2006.

2C.4.2 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 market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market

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.

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 1,000 are considered unconcentrated, markets in which the HHI is between 1,000 and 1,800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 are considered to be concentrated.

As shown in *Table 2C-8*, the CR4 and the HHI for NAICS 324110 are both below the benchmarks of 50 percent and 1,000, respectively. For the Petroleum Refining segment, the HHI is 640, suggesting that as of 2002, the sector was still fairly unconcentrated, although the trend during the previous decade had been toward becoming a more concentrated industry. 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 2C-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
	2002	88	41%	64%	89%	99%	640

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

2C.4.3 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 Proposed Existing Facilities Regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities 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 2007 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 2C-9 presents trade statistics for the profiled Petroleum Refining segment from 1990 to 2007. The table shows that while export dependence has been relatively stable, import penetration decreased during the national 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. Since then, the industry has resumed a gradual increase in import penetration through 2007, prior to the global economic slump which would occur in the next two years. This cycle closely follows the periods of growth, stability, and decline of the U.S. economy during the volatile two decades. Mexico received the largest amount of U.S. exported petroleum and coal products in 2008, followed by Netherlands and Canada (U.S. Census Bureau, 2009b). Imports of refined petroleum products increased 40.9 percent from 1989 to 2008, with 46.3 percent of total imports coming from OPEC countries (U.S. DOE, 2009b).

The import penetration ratio for facilities in the Petroleum Refining segment in 2007 was only 16 percent, well below the U.S. manufacturing segment average of 27 percent. The export dependence ratio for petroleum refiners in 2007 was only five 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 Proposed Existing Facilities 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 2C-9: Foreign Trade Statistics for Petroleum Refining ($2009)

Year	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
1990	$23,313	$9,104	$242,359	$256,568	9%	4%
1991	$17,332	$9,333	$213,478	$221,477	8%	4%
1992	$15,664	$8,260	$195,405	$202,809	8%	4%
1993	$14,792	$7,916	$182,372	$189,248	8%	4%
1994	$13,896	$6,814	$176,857	$183,939	8%	4%
1995	$12,825	$7,180	$183,327	$188,972	7%	4%
1996	$26,042	$8,323	$208,828	$226,547	11%	4%
1997	$28,244	$8,934	$205,984	$225,293	13%	4%
1998	$23,678	$6,659	$151,676	$168,695	14%	4%
1999	$29,505	$7,291	$182,543	$204,757	14%	4%
2000	$52,059	$10,808	$266,930	$308,181	17%	4%
2001	$45,200	$9,777	$242,075	$277,498	16%	4%
2002	$39,967	$9,216	$232,083	$262,834	15%	4%
2003	$48,338	$10,688	$260,951	$298,602	16%	4%
2004	$65,553	$13,994	$346,349	$397,908	16%	4%
2005	$93,858	$19,216	$489,475	$564,117	17%	4%
2006	$102,907	$27,247	$544,446	$620,107	17%	5%
2007	$109,568	$31,505	$590,441	$668,505	16%	5%
Total Percent Change 1990 - 2007	**370.0%**	**246.1%**	**143.6%**	**160.6%**		
Total Percent Change 1990 - 2007	**110.5%**	**191.5%**	**121.2%**	**116.9%**		
Average Annual Growth Rate	**10%**	**8%**	**5%**	**6%**		

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.

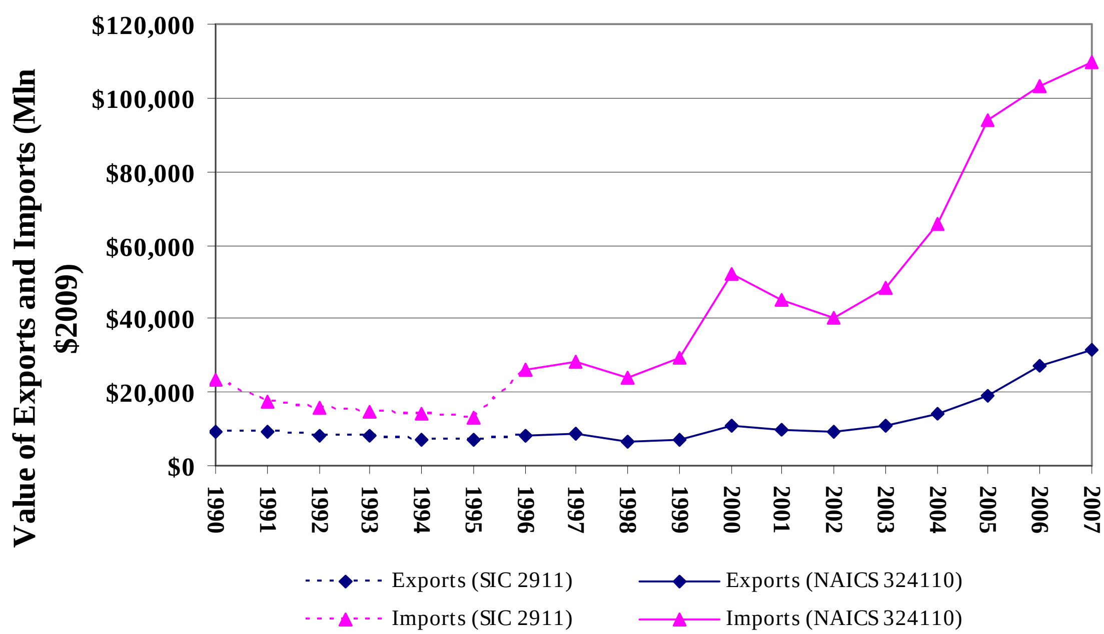
Note: Before 1997, these data were compiled in the Standard Industrial Classification (SIC) system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using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

Source: U.S. International Trade Commission, 1989-2007.

The United States consumes more petroleum than it produces, requiring net imports of both crude oil and refined products to meet domestic demand. In 2008, the United States imported 9.76 million barrels per day (MBD) of crude oil and 3.12 MBD of refined products. These refined product imports represented roughly 16 percent of the 19.42 MBD of refined products supplied to U.S. consumers. The U.S. exported 1.80 MBD of refined products in 2008 (U.S. DOE, 2009b).

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 2C-5*). For the remainder of the decade, both imports and exports have shown rapid growth, with value of imports surpassing 100 billion dollars, and the value of exports reaching over 30 billion dollars.

Figure 2C-5: Value of Imports and Exports for Petroleum Refining (millions, $2009)[a]



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. International Trade Commission, 1989-2007.

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. Distillate fuel oil is the leading petroleum export product, accounting for 29 percent of petroleum exports in 2008, followed by petroleum coke (almost 22 percent of exports) and residual fuel oil (almost 20 percent) (U.S. DOE, 2009b). 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. DOE, 1997). U.S. refiners and marketers have gained experience in marketing to diverse world markets, and U.S. products are now sold widely abroad. As reported by the International Trade Administration and shown in *Figure 2C-5*, the real value of petroleum exports fluctuated between $5 and $10 billion during the years 1990 and 2002, and then increased over five-fold during the next five year span.

2C.5 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 16-year period, 1992-2008: net profit margin and return on total capital. EPA calculated these measures using data from the Quarterly Financial Report (QFR). Financial performance in the most recent financial reporting period (2008) 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 pre-tax income divided by the sum of: current portion of long-term debt due in 1 year or less, long-term debt due in more that 1 year, all other noncurrent liabilities and total stockholders' equity (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 other 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 important sources of short-term variation in *return on total capital*.

Figure 2C-6 below shows trends in net profit margins and return on total capital for the Petroleum Refining segment between 1988 and 2008. 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 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 industry. 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 hardship, the domestic Petroleum Refining segment returned to relatively strong financial performance.

During the last decade, Petroleum Refining industry's performance continued to improve from 2004 through 2006, reaching the highest return on total capital and net profit margin observed over the time period. The industry showed a decrease in both net profit margin and return on total capital in 2007 and 2008, trending along with the beginning of the U.S. and global economy decline. The oil and gas refining and marketing sub-industry is currently facing a challenging environment due to imbalance between supply and demand. This imbalance stems from a fall in U.S. demand for refined products by more than 3 million b/d from February 2008 to June 2009, at the same time that a minimum of 2 million b/d per year of new refining capacity worldwide is expected between 2009 and 2014 (S&P, 2010c; U.S. DOE, 2009a). However, world oil demand is expected to return to growth of 1.5 percent per year as the world economy recovers in 2010 and 2011, and these conditions should allow the net profit margins for petroleum refineries to return to strong levels within the next five years (Auers, 2009).

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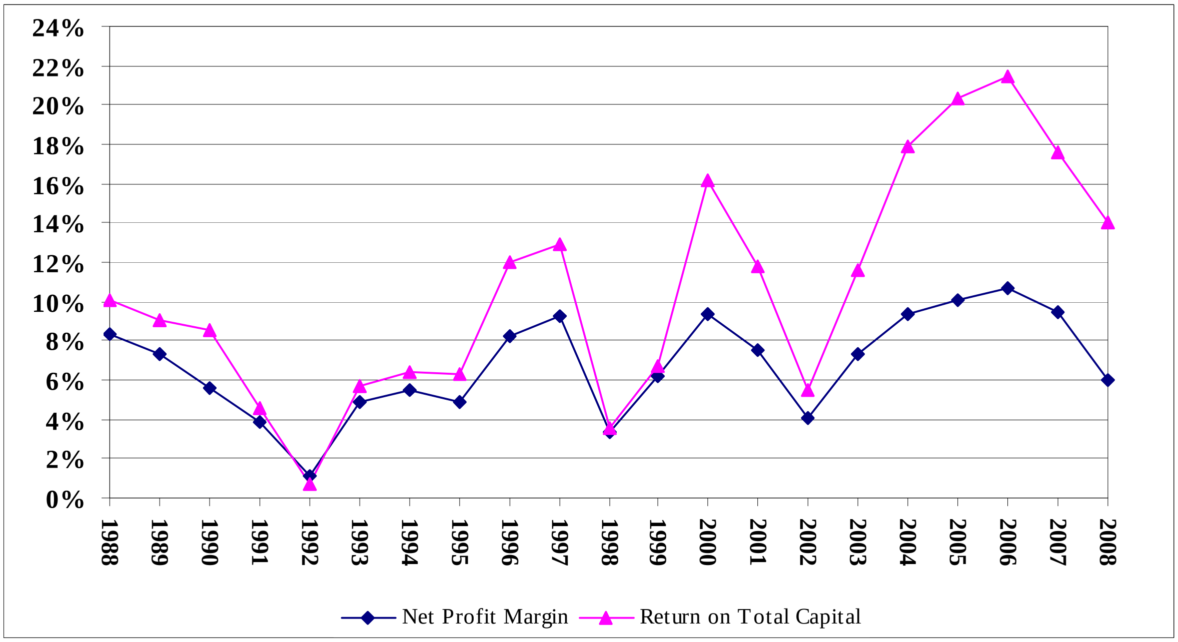
7 Crude oils processed by U.S. refineries have become heavier and more contaminated with materials such as sulfur. This trend reflects reduced U.S. dependence on the more expensive high gravity ("light") and low sulfur ("sweet") crude oils produced in the Middle East, and greater reliance on crude oil from Latin America (especially Mexico and Venezuela), which is relatively heavy and contains higher sulfur ("sour") (U.S. DOE, 1999a).

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.

Figure 2C-6: Net Profit Margin and Return on Total Capital for Petroleum Refining



Source: *Quarterly Financial Report, 1988-2008; U.S. Census Bureau.*

2C.6 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 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 coverage criteria for the proposed regulation in terms of design intake flow – i.e., 2 MGD.

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.

11 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).

EPA initially identified the set of facilities that were estimated to be *potentially* subject to the 316(b) Existing Facilities Regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities for the petroleum segment.[11]

2C.6.1 Waterbody and Cooling Water Intake System Type

Table 2C-10, shows the distribution of facilities by type of water body and cooling water intake system for each option.

Table 2C-10: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Waterbody Type and Cooling Water Intake System for the Petroleum Refining Segment

Water Body Type	Cooling Water Intake System						Total
	Recirculating		Combination		Once-Through		
	Number	% of Total	Number	% of Total	Number	% of Total	
Estuary/ Tidal River	0	0%	3	27%	2	40%	5
Ocean	0	0%	0	0%	1	20%	1
Lake/Reservoir	1	5%	0	0%	0	0%	1
Freshwater River/ Stream	21	95%	6	54%	2	40%	29
Great Lake	0	0%	2	18%	0	0%	2
Total[a]	**22**	**56%**	**12**	**31%**	**5**	**14%**	**39**

Based on technical weights (See Appendix 3.A).

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

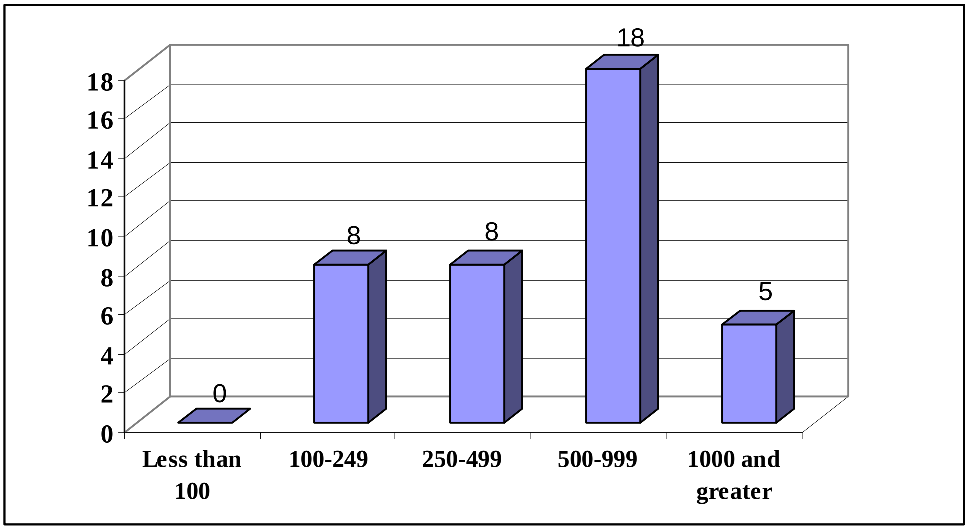
Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

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).

2C.6.2 Facility Size

All petroleum refinery facilities that are estimated to be subject to regulation under the regulatory analysis options are relatively large. Figure 2C-7, shows the number of potentially regulated facilities by employment size category.

Figure 2C-7: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Employment Size for the Petroleum Refinery Segment



Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2C.6.3 Firm Size

EPA used the Small Business Administration (SBA) small entity thresholds to determine the number of facilities in the petroleum-refining segment that are owned by small firms. Firms in this industry are considered small if they employ fewer than 1,500 people. EPA estimates that four small entity-owned facilities and 30 large entity-owned facilities in the Petroleum Refining segment will be subject to the proposed regulation. In addition, ownership status for four facilities is unable to be classified due to insufficient survey data.

2D Profile of the Steel Industry

2D.1 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, withdraws at least 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 316(b) Proposed Existing Facilities regulation", "existing facilities", or "in-scope facilities"). For the purpose of this analysis, EPA identified a six-digit NAICS code for each of these potential facilities using the information from DQ and public sources (see *Appendix 3.C: Conversion the Data from Standard Industrial Classification (SIC) to North American Industry Classification System (NAICS)*). As the result of this mapping, EPA identified five 6-digit NAICS codes in the Steel and Allied Products manufacturing industry (NAICS 3311/2).

For each of the five NAICS codes, *Table 2D-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), and the number of facilities estimated to be potentially subject to the 316(b) Existing Facilities Regulation based on the minimum withdrawal threshold of 2 MGD.

Table 2D-1: Existing Facilities in the Steel Industry (NAICS 3311/2)

NAICS	NAICS Description	Important Products Manufactured	Number of In-Scope Facilities[a]
Steel Mills (NAICS 3311)			
331111	Iron and Steel 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	42
331112	Electrometallurgical ferroalloy products manufacturing	Iron-rich alloys and more pure forms of elements added during the steel manufacturing process. Ferroalloys add critical elements for low and high metal alloys.	2
Steel Products (NAICS 3312)			
331210	Iron and steel pipe and tubes manufacturing from purchased steel	Production of welded or seamless steel pipe and tubes and heavy riveted steel pipe from purchased materials	9
331221	Rolled steel shape manufacturing	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	12
331222	Steel wire drawing	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	3
		Total Steel Products [b]	**24**
Total Steel (NAICS 3311/2)			
		Total NAICS Code 3311/2 [b]	**68**

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, 2010.

As shown in *Table 2D-1*, EPA estimates that, out of an estimated total of 476 facilities[10] with a NPDES permit and operating cooling water intake structures in the Steel Industry (NAICS 3311/2), 68 (14 percent) are expected to be subject to the Proposed 316(b) Existing Facilities regulation. 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 steel industry from the 2007 Economic Census is $128.1 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 existing 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 the 316(b) Existing Facilities Regulation is $38.9 billion. Therefore, EPA estimates that 30 percent of total production in the steel industry occurs at facilities estimated to be subject to regulation.

The responses to the Detailed Questionnaire indicate that two main steel segments account for all of the potential in-scope facilities: (1) Steel Mills (NAICS codes 331111 and 331112) and (2) Steel Products (NAICS codes 331210, 331221, and 331222).

Table 2D-2 provides the crosswalk between the new NAICS codes and the SIC codes for the profiled steel NAICS codes. The table shows that electrometallurgical ferroalloy product manufacturing (NAICS 331112), rolled steel shape manufacturing (NAICS 331221), steel wire drawing (NAICS 331222), and Iron and steel pipes and tubes manufacturing from purchased steel (NAICS 331210) have a one-to-one relationship to SIC codes. The remaining NAICS code – iron and steel mills (NAICS 331111) – corresponds to two SIC codes.

Table 2D-2: Relationships between NAICS and SIC Codes for the Steel Industries (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	Number of Establishments	Value of Shipments (Millions; $2009)	Employment
331111	Iron and steel mills	3312	Blast furnaces and steel mills	743	$105,608	114,315
		3399	Blast furnaces and steel mills			
331112	Electrometallurgical ferroalloy product manufacturing	3313	Electrometallurgical products	20	$1,364	2,144
331221	Rolled steel shape manufacturing	3316	Cold finishing of steel shapes	486	$6,784	10,391
331222	Steel wire drawing	3315	Steel wire and related products	274	$5,400	15,156
331210	Iron and steel pipes and tubes manufacturing from purchased steel	3317	Steel pipe and tubes	153	$8,927	17,408

Sources: U.S. DOC. 2007 Economic Census.

2D.2 Summary Insights from this Profile

The key purpose of this profile is to provide insight into the ability of steel industry firms to absorb compliance costs under the Proposed 316(b) Existing Facilities Rule 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

[10] This estimate of the number of facilities holding a NPDES permit and operating a cooling water intake structure is based on the responses from facilities that received the 1999 screener questionnaire.

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.

2D.2.1 Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the profiled Steel industry is relatively unconcentrated, which suggests 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 judges that in-scope facilities subject to the 316(b) Existing Facilities Regulation are not likely to be able to recover compliance costs through price increases to customers and would have to absorb all compliance costs within their operating finances (see following sections and *Appendix 4.A: Cost Pass-Through Analysis*, for further information).

2D.2.2 Financial Health and General Business Outlook

Over the past two decades, the U.S. 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 because of the Asian financial crisis, with the associated decline in Asian demand for steel and currency devaluations, thereby causing a number of bankruptcies of U.S. Steel firms and steelworker layoffs. In addition to being affected by the increased inflow of low-priced imported steel, the U.S. Steel industry was also negatively affected by economic recession in 2000 and 2001. Tariffs provided temporary relief through 2002, but were removed by the end of 2003. By 2003, the U.S. steel industry's financial performance improved significantly, particularly for the Steel Mills industry segment, and value of shipments and value added increased substantially. During this time, demand grew considerably, the industry became more concentrated with high levels of productivity, and trade activity increased. The 2008 recession slowed growth of the U.S. Steel industry, with a substantial decrease in production in 2008. Overall however, the current condition of the steel industry suggests that it is in a position for continued strong performance following general recovery of the U.S. economy, despite the fact that it has weathered difficult periods during the last two decades. The industry's more moderate recent fluctuation in financial condition (compared to the other industries subject to the Proposed Existing Facilities Rule) suggests an average ability to withstand additional regulatory compliance costs. This is particularly true for the profiled Steel Mills segment, which has shown somewhat more resilience than the profiled Steel Products segment in light of the recent adverse economic conditions.

2D.3 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. 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, 2001b). While the traditional integrated facilities using basic oxygen furnaces (BOF) still account for a substantial share of U.S. steel mill product production, the share of electric arc furnace (EAF) facilities using scrap steel as an input has grown steadily.[11] By 2007, about 47 companies operating about 98 steelmaking plants, used the EAF steelmaking process; these non-integrated, minimill facilities produced 57 million metric tons of steel, an increase of about 1.7 percent compared with that of 2006, and accounted for 41.8 percent of total U.S. steelmaking (USGS, 2007f). The range of products produced by EAFs has also expanded over time. Initially, EAFs produced primarily lower-quality structural materials. Starting in the 1990s, EAFs began producing higher quality sheet products as well. A majority of 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 use steel (in the form of blooms, billets, and slabs) in combination with 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 NAICS 331111 while establishments that primarily engaged in manufacturing of electrometallurgical ferroalloys are included in NAICS 331112. NAICS codes 331222, 331221, and 331212 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, 2000).

The steel industry represents about 3 percent of total U.S. energy demand, and the total cost of energy accounts for approximately 15-20 percent of the total manufacturing cost (NEED, 2010). 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-fired plants' coal and electricity for up to 60 percent of their total energy requirements (NEED, 2010). Because of its high energy intensity, the steel industry has invested over $60 billion in new technologies since 1975 in an effort to improve energy efficiency and productivity. As a result of this effort as well as increased use of recycled steel and older plant closures, the industry has been able to reduce its energy consumption by 45 percent per ton of steel since 1973 (NEED, 2010).

2D.3.1 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 sport utility vehicles contributed to increased U.S. steel consumption in the 1990s. However, recent efforts to increase the fuel efficiency of vehicles have eroded steel's position in the automotive market as a whole, 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 2D-3 shows trends in production from the two major groups of steel producers: BOF and EAF facilities.

[11] 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.

Table 2D-3: U.S. Steel Production by Type of Producer

Year	Steel Production		Percent from BOF[c]	Percent from EAF[d]
	Million MT	% Change		
1990[a]	89.7	n/a	59.1%	37.3%
1991[b]	79.7	-11.1%	60.0%	38.4%
1992	84.3	5.8%	62.0%	38.0%
1993	88.8	5.3%	60.6%	39.4%
1994	91.2	2.7%	60.7%	39.3%
1995	95.2	4.4%	59.6%	40.4%
1996	95.5	0.3%	57.4%	42.6%
1997	98.5	3.1%	56.2%	43.8%
1998	98.6	0.1%	54.9%	45.1%
1999	97.4	-1.2%	53.7%	46.3%
2000	102.0	4.7%	53.0%	47.0%
2001	90.1	-11.7%	52.6%	47.4%
2002	91.6	1.7%	49.6%	50.4%
2003	93.7	2.3%	49.0%	51.0%
2004	99.7	6.4%	47.8%	52.2%
2005	94.9	-4.8%	45.0%	55.0%
2006	98.2	3.5%	42.9%	57.1%
2007	98.1	-0.1%	41.8%	58.2%
2008	91.9	-6.3%	42.6%	57.4%
Percent Change 1990-2008	**2.45%**			
Percent Change 2000-2008	**-9.90%**			
Average Annual Growth Rate	**0.15%**			

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. Basic oxygen furnaces
d. Electric arc furnaces
Source: Mineral Commodity Summaries, Aluminum 1995, 1999, 2002, 2006, 2010

This table shows the cyclical nature of the U.S. steel industry, with variations in growth from year to year reflecting general domestic 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. Following this difficult transition, the United States 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.[12] 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 three years of tariffs ranging up to 30 percent on certain steel imports. Relief from imports was nullified to some extent when the U.S. Department of Commerce exempted 727

12 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).

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, 2002f). Removal of all tariffs occurred on December 4, 2003 (S&P, 2004c). The steel industry recovered, but slowly, from the import penetration in the late 1990s 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.

Between 2000 and 2005, world steel demand increased by 6 percent, and China surpassed Japan, Russia, and the United States to become the number one steel producer (British Geological Survey, 2005). During this period the two different methods for producing steel – integrated (ore-based) and electric arc furnace (scrap-based) – began converging in response to the changing cost balance of raw materials, scrap and energy (AISI, 2001a). The combination of rising GDP, a smaller decline in nonresidential construction, a recovery in auto sales, and rebuilding of distributor inventory is expected to lead to an increase in the volume of steel shipped in 2010 (S&P, 2010e).

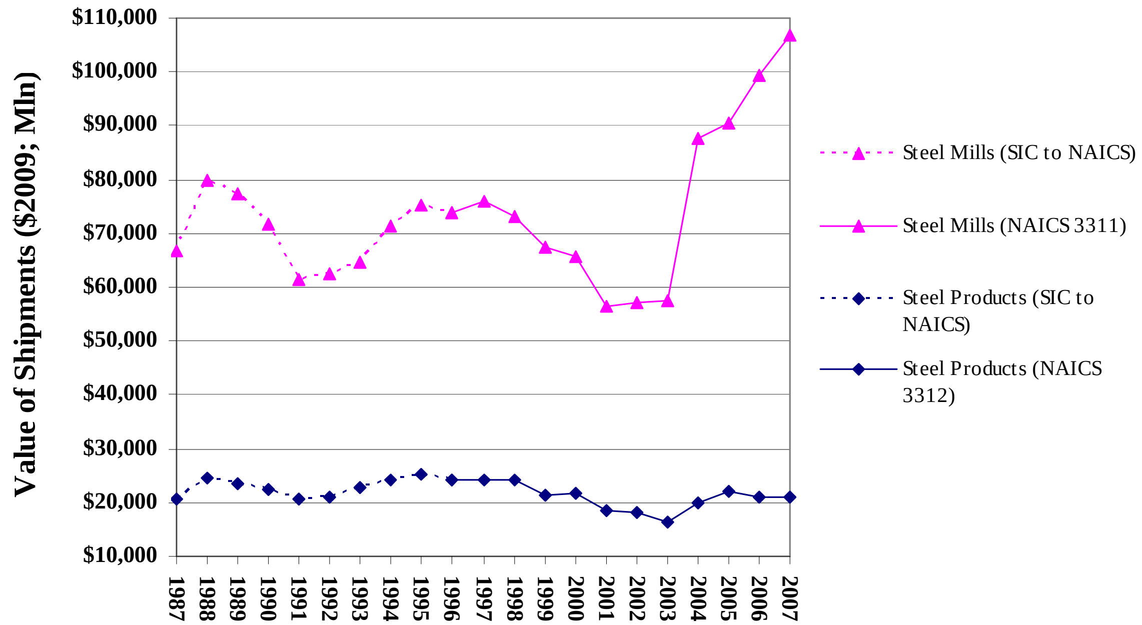
Value of shipments and ***value added*** are two common measures of manufacturing output.[13] Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall 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 2D-1 presents trends in constant-dollar value of shipments and value added for the profiled Steel Mills and Steel Products segments. 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 began to decline in 1997 and continued to do so through 2001. However, from 2001 through 2007, the Steel Mills segment experienced continuous growth, peaking at over $105 billion at the end of that period. Steel Mills value added also continued to decline until 2001 and increased drastically in 2004. However, between 2004 and 2007, value added for the Steel Mills segment experienced only a moderate growth. Value of shipments and value added for Steel Products were less volatile, increasing gradually during 1990 through 1995 and 1996, respectively, when both value of shipments and value added began to decline, bottoming in 2003. Since then through 2007, both value of shipments and value added for the profiled Steel Products segment experienced overall moderate growth.

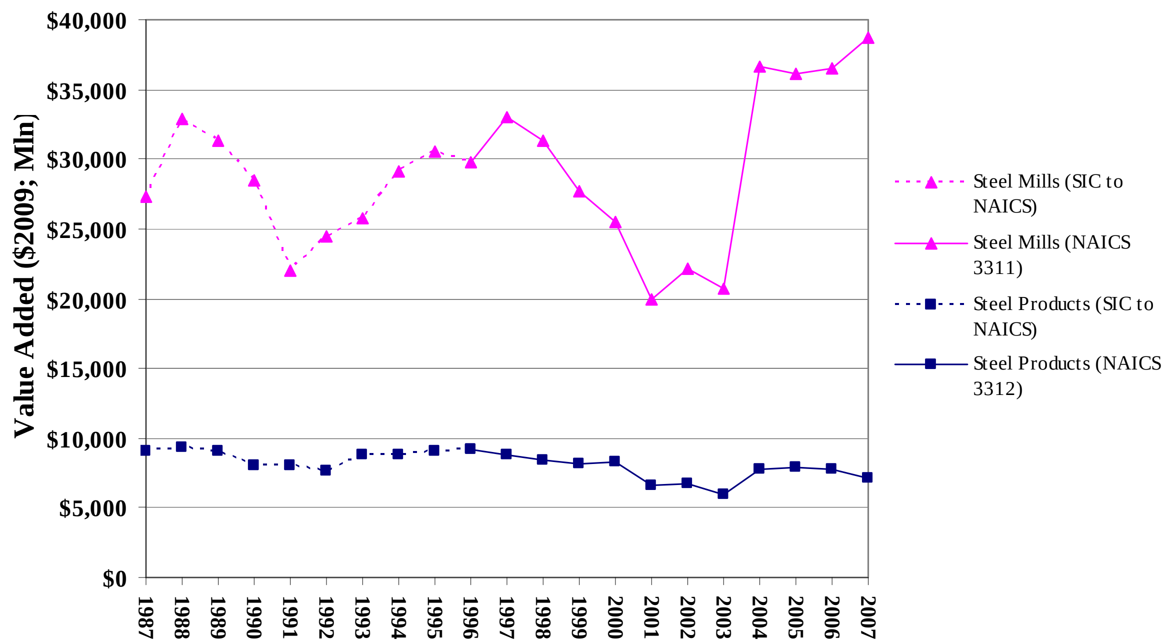
[13] Terms highlighted in bold and italic font are further explained in the glossary.

Figure 2D-1:Value of Shipments and Value Added for Profiled Steel Industry Segments (millions, $2009)[a]

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.*

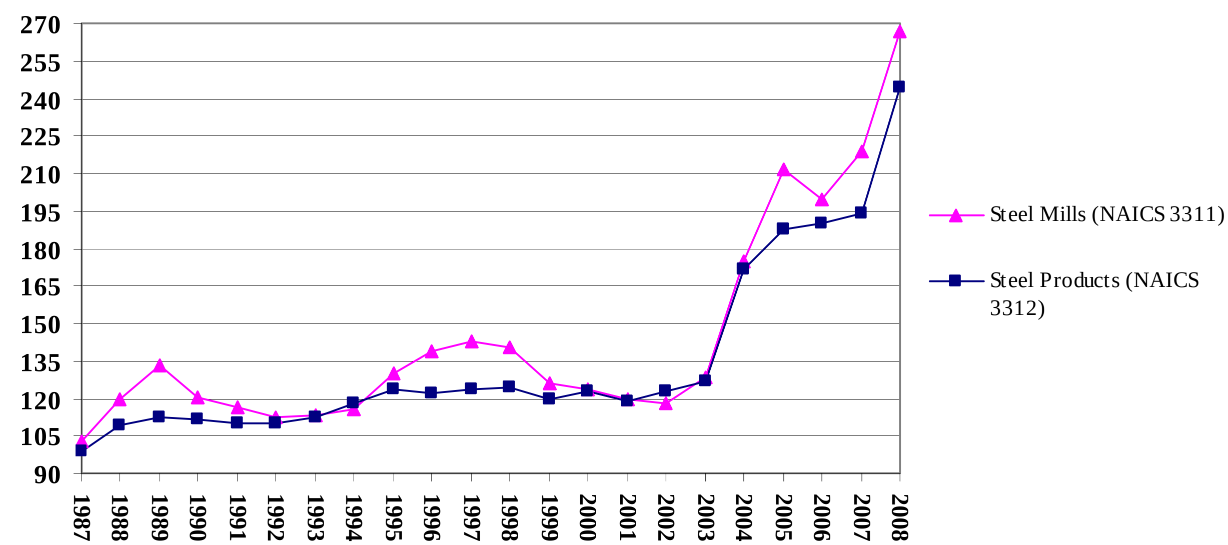
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2D.3.2 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 2D-2*, below, prices increased from 1987 to 1989 and then dropped slightly in the early 1990s, due to depressed domestic economy and the resulting decline in demand for steel. During the 1990s, prices in both profiled segments remained on average unchanged, with prices in the Steel Mills segments rising temporarily in the middle of the decade. As the U.S. and world economies began to recover in 2002, so did steel prices, which began to rise and continued to do so through 2008, with a significant jump in the middle of this decade. Overall, during the last two decades, prices in the profiled Steel Mills segment showed a slightly higher degree of volatility compared to those in the profiled Steel Products segment.

Figure 2D-2: Producer Price Index for Profiled Steel Industry Segments



Source: BLS, 2009.

2D.3.3 Number of Facilities and Firms

The number of operating Steel Mills fluctuated significantly between 1990 and 2006, as the U.S. industry underwent a substantial restructuring. *Table 2D-4* shows substantial decreases in the number of facilities in the profiled Steel Mills segment in 1992 and 1993 due to a significant decrease in global demand and resulting overcapacity. This decrease was followed by a significant recovery in 1995 and 1996, and another significant drop in 1997. 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 during 1997-1998 ultimately led to bankruptcy for a number of U.S. producers, including LTV and Bethlehem Steel (S&P, 2001b). Additionally, seven major bankruptcies occurred over 2002 and early 2003, including Bayou Steel Corp, Kentucky Electric Steel Inc, Slater Steel Inc, and Weirton Steel Corp (USGS, 2004b). Between 2000 and 2006, the number of facilities in the Steel Mills and Steel Products segments dropped by approximately 18 percent and 25 percent, respectively. Nonetheless, the Steel Mills segment saw an overall 43 percent increase in the number of facilities during 1990 to 2006 with average annual growth rate of 2.3 percent. While the Steel Products segment also grew during the same analysis period, this growth was much more moderate – approximately 6 percent with an average annual growth rate of less than 1 percent.

Table 2D-4: Number of Facilities in the Profiled Steel Industry Segments[a]

Year	Steel Mills		Steel Products	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	579	n/a	659	n/a
1991	609	5.3%	782	18.7%
1992	499	-18.1%	807	3.1%
1993	436	-12.7%	808	0.1%
1994	431	-1.1%	779	-3.5%
1995	477	10.7%	766	-1.6%
1996	555	16.4%	748	-2.4%
1997	377	-32.1%	705	-5.8%
1998	410	8.7%	769	9.1%
1999	702	71.2%	824	7.2%
2000	1,003	42.9%	933	13.2%
2001	1,374	37.0%	939	0.6%
2002	1,259	-8.4%	870	-7.3%
2003	876	-30.4%	828	-4.8%
2004	799	-8.8%	734	-11.4%
2005	839	5.0%	716	-2.5%
2006	827	-1.4%	698	-2.5%
Total Percent Change 1990-2006	**42.9%**		**5.9%**	
Total Percent Change 2000-2006	**-17.5%**		**-25.2%**	
Average Annual Growth Rate	**2.3%**		**0.4%**	

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, 1990-1997; SUSB, 1998-2006.

Table 2D-5 shows the number of firms in the two profiled steel segments between 1990 and 2006. The trend in the number of firms over the period between 1990 and 2006 is similar to the trend in the number of facilities in the profiled Steel Mills industry segment. The number of firms in this segment decreased to a period-low of 288 in 1997, before increasing significantly during 1998 through 2001, to 1,269 firms. This rise in the number of Steel Mill firms was followed by declines during 2002 through 2004, and then a slight recovery in 2005. Between 2000 and 2006, the number of firms in the Steel Mills segment fell by nearly 21 percent. Overall, however, between 1990 and 2006, the number of Steel Mill firms increased by nearly 47 percent with an average annual growth rate of approximately 2 percent. The number of firms in the Steel Products segment also decreased between 1992 and 1997, before rising steadily through 2001, and then declining slightly between 2002 and 2006. However, unlike the Steel Mills segment, the number of firms in the Steel Products segment experienced a decline not only in the last decade – nearly 22 percent – but an overall decline of nearly 2 percent between 1990 and 2006.

Table 2D-5: Number of Firms in the Profiled Steel Industry Segments[a]

Year	Steel Mills		Steel Products	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	482	n/a	578	n/a
1991	505	4.7%	615	6.4%
1992	401	-20.6%	642	4.3%
1993	345	-14.0%	622	-3.1%
1994	342	-0.9%	599	-3.7%
1995	388	13.6%	588	-1.8%
1996	462	19.1%	567	-3.5%
1997	288	-37.7%	528	-6.9%
1998	320	11.0%	577	9.3%
1999	603	88.4%	628	8.8%
2000	900	49.3%	725	15.4%
2001	1,269	41.0%	729	0.6%
2002	1,149	-9.5%	681	-6.6%
2003	758	-34.0%	684	0.4%
2004	684	-9.8%	598	-12.6%
2005	718	5.0%	580	-3.0%
2006	708	-1.4%	568	-2.1%
Total Percent Change 1990-2006	**46.9%**		**-1.8%**	
Total Percent Change 2000-2006	**-21.3%**		**-21.7%**	
Average Annual Growth Rate	**2.4%**		**-0.1%**	

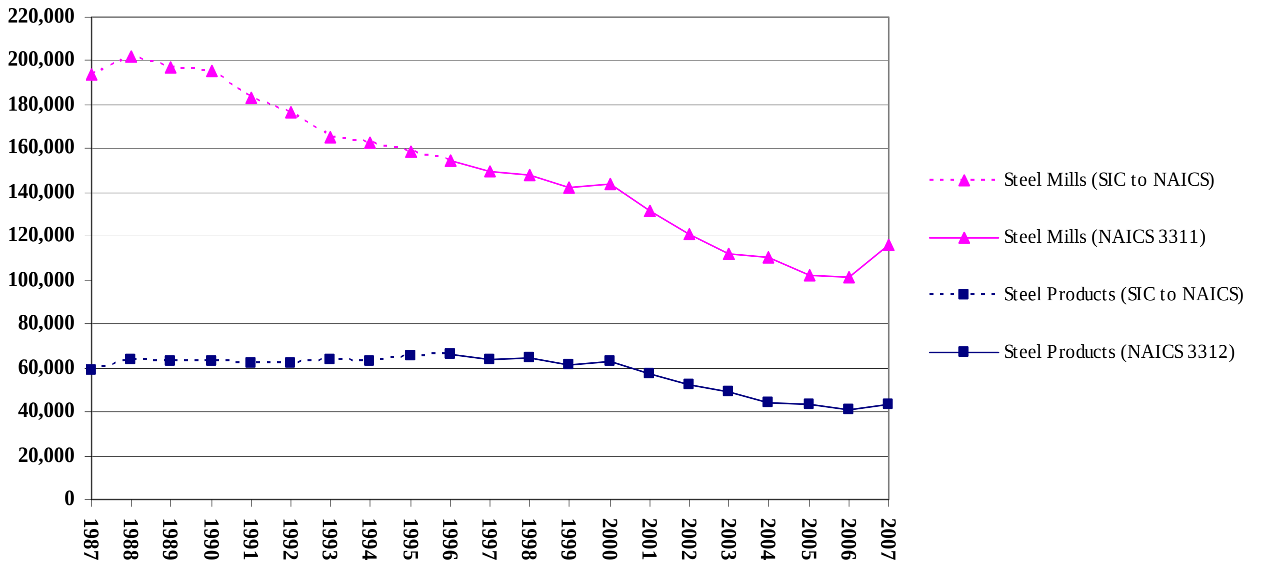
a Before 1998, data were compiled in the SIC system; since 1998, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the *1997 Economic Census Bridge Between NAICS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

Source: U.S. SBA, 1990-1997; SUSB, 1998-2006.

2D.3.4 Employment and Productivity

Figure 2D-3, following page, provides information on ***employment*** from the Annual Survey of Manufactures and the Economic Census for the profiled Steel Mills and Steel Products segments. As shown in the figure, between 1987 and 2007, employment levels in the Steel Mills segment decreased by a total of nearly 40 percent at an average annual rate of approximately 3 percent. Employment is a significant cost component for steelmakers. Labor cost reductions enabled Steel Mills to improve profitability and competitiveness in the face of limited opportunities for price increase in the highly competitive market of Steel Products. A steady decline in employment in the 1990s reflects a 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 1997-1998 import crisis, with almost 26,000 U.S. steelworkers reportedly losing their jobs (AISI, 2001b). During the 2000s decade, employment in the Steel Mills segment declined until 2006 when the industry had a sudden rise in number of employees. Employment in the Steel Products segment also declined, largely steadily, at an average annual rate of 2 percent resulting in a total decline of approximately 27 percent over the period 1987-2007 (approximately 31 percent between 2000 and 2007).

Figure 2D-3: Employment for Profiled Steel Industry Segments[a]



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 2D-6 presents the change in value added per labor hour, a measure of ***labor productivity***, for the Steel Mills and Steel Products segments between 1987 and 2007. Labor productivity at Steel Mills increased significantly over this period. Between 1987 and 2007, value added per labor hour increased nearly 120 percent, with most growth – 86 percent – taking place since 2000. 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 experienced an overall growth between 1987 and 2007, although less so compared to that in the Steel Mills segment; labor productivity grew by nearly 20 percent between 1987 and 2007, with most of this growth – approximately 30 percent – taking place between 2000 and 2007.

Table 2D-6: Productivity Trends for the Profiled Steel Industry Segments ($2009)[a]								
Year	Steel Mills				Steel Products			
	Value Added (millions)	Production Hours (millions)	Value Added/Hour		Value Added (millions)	Production Hours (millions)	Value Added/Hour	
			$/hr	Percent Change			$/hr	Percent Change
1987	$27,340	313	$87	n/a	$9,045	105	$86	n/a
1988	$32,896	333	$99	12.9%	$9,280	91	$103	18.7%
1989	$31,361	357	$88	-11.0%	$9,048	109	$83	-19.0%
1990	$28,508	323	$88	0.4%	$7,993	89	$89	7.6%
1991	$21,982	287	$77	-13.1%	$8,047	104	$78	-13.0%
1992	$24,430	285	$86	11.8%	$7,695	84	$92	17.9%
1993	$25,754	276	$93	8.9%	$8,858	106	$84	-8.8%
1994	$29,158	275	$106	13.7%	$8,804	88	$100	20.0%
1995	$30,491	271	$113	6.1%	$9,062	110	$82	-18.0%
1996	$29,823	268	$111	-1.2%	$9,189	130	$71	-14.2%
1997	$33,016	259	$128	14.9%	$8,779	106	$83	18.0%
1998	$31,343	252	$124	-2.8%	$8,438	108	$78	-5.9%
1999	$27,655	243	$114	-8.2%	$8,119	103	$79	1.2%
2000	$25,545	248	$103	-9.5%	$8,271	104	$79	0.3%
2001	$19,940	289	$69	-33.1%	$6,590	92	$71	-10.2%
2002	$22,123	200	$111	60.5%	$6,782	86	$79	10.6%
2003	$20,681	185	$112	1.2%	$5,904	80	$73	-6.9%
2004	$36,674	191	$192	71.5%	$7,804	73	$107	45.9%
2005	$36,150	183	$197	2.7%	$7,886	73	$108	1.1%
2006	$36,535	178	$205	3.9%	$7,708	71	$108	-0.1%
2007	$38,647	202	$192	-6.5%	$7,087	69	$103	-4.5%
Total Percent Change 1987-2007	**41.4%**	**-35.5%**	**119.3%**		**-21.6%**	**-34.6%**	**19.7%**	
Total Percent Change 2000-2007	**51.3%**	**-18.6%**	**85.8%**		**-14.3%**	**-34.2%**	**30.2%**	
Average Annual Growth Rate	**1.7%**	**-2.2%**	**4.0%**		**-1.2%**	**-2.1%**	**0.9%**	

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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2D.3.5 Capital Expenditures

New capital expenditures are needed to modernize, expand, and replace existing capacity to meet growing demand. Capital expenditures in the profiled Steel Mills and the Steel Products segments between 1987 and 2007 are presented in *Table 2D-7*, following page. As shown in the table, capital expenditures in both the Steel Mills and the Steel Products segments fluctuated significantly during this analysis period. Steel mill capital outlays increased in the late 1980s and early 1990s, rising by a total of 87 percent between 1987 and 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). The import crisis of the late 1990s and later weakening of the U.S. economy put pressure on the domestic steel industry, and expenditures for new capacity began to decline in 1997 in both segments (McGraw-Hill, 2000). However, capital expenditures in the Steel Mills segment recovered during the 2000s, increasing by approximately 31 percent, while the Steel Products segments showed continuing drops in capital expenditures resulting in a total decline of approximately 23 percent. Overall, between 1987 and 2007, capital expenditures increased by nearly 62 percent in the Steel Mills segment and dropped by approximately 51 percent in the Steel Products segment.

Table 2D-7: Capital Expenditures for the Profiled Steel Industry Segments (millions, $2009)[a]

Year	Steel Mills		Steel Products	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	$2,115	n/a	$911	n/a
1988	$3,180	50.4%	$689	-24.3%
1989	$4,006	26.0%	$773	12.1%
1990	$3,930	-1.9%	$773	0.0%
1991	$4,413	12.3%	$554	-28.3%
1992	$3,222	-27.0%	$570	2.8%
1993	$2,531	-21.4%	$625	9.6%
1994	$3,622	43.1%	$718	15.0%
1995	$3,725	2.8%	$699	-2.7%
1996	$3,760	1.0%	$750	7.2%
1997	$3,471	-7.7%	$693	-7.6%
1998	$3,379	-2.7%	$664	-4.1%
1999	$2,866	-15.2%	$557	-16.2%
2000	$2,605	-9.1%	$580	4.2%
2001	$1,878	-27.9%	$444	-23.6%
2002	$1,627	-13.3%	$482	8.6%
2003	$1,118	-31.3%	$490	1.8%
2004	$1,690	51.2%	$509	3.7%
2005	$1,979	17.1%	$396	-22.2%
2006	$1,948	-1.6%	$418	5.7%
2007	$3,414	75.3%	$450	7.7%
Total Percent Change 1987-2007	**61.5%**		**-50.6%**	
Total Percent Change 2000-2007	**31.0%**		**-22.4%**	
Average Annual Growth Rate	**2.4%**		**-3.5%**	

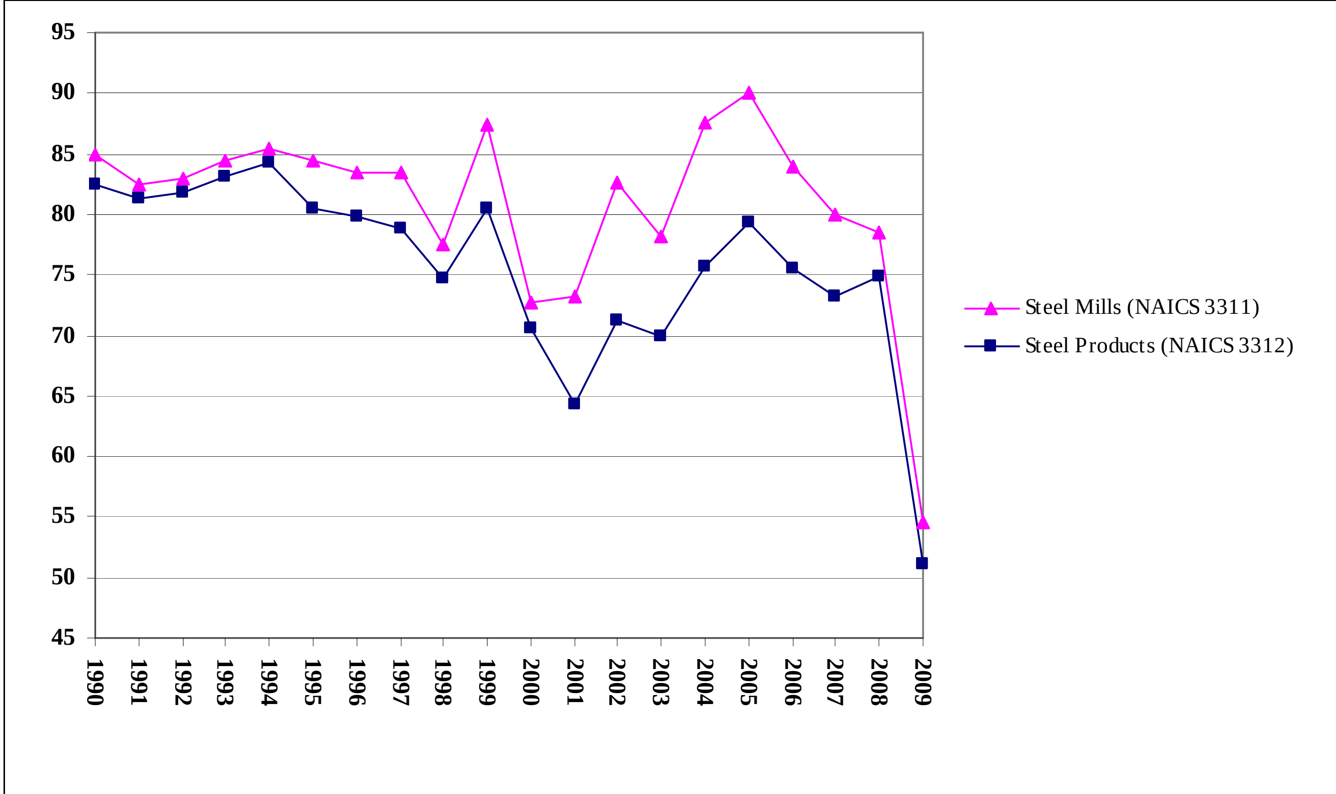
a. Before 1997, the Department of Commerce compiled data in the SIC system; since 1997, these data have been compiled in the North American Industry Classification System (NAICS). For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the *1997 Economic Census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

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2D.3.6 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. *Figure 2D-4* presents capacity utilization index for 1990 through 2009 for the profiled Steel Mill and Steel Products segments. Capacity utilization followed a similar trend for both industry segments. Capacity utilization in the Steel Mills and the Steel Products segments declined by more than 35 and 38 percent, respectively, during the last two decades and by nearly 25 and 28 percent, respectively, during the last decade alone. The most dramatic drops in capacity utilization took place around the 2001 and the 2008 economic recessions; in fact, the 2009 drop in capacity utilization marked the most drastic drop in capacity utilization in the last two decades. For the Steel Mills segment, capacity utilization dropped by 17 percent and 31 percent, respectively, while for the Steel products segment it fell by 12 percent and 32 percent, respectively. With global steelmaking capacity outstripping the growth of steel consumption in recent years, and as steel demand is now contracting due to global economic downturn, it appears that the global steel industry could be facing overcapacity and poor financial performance in the next few years (OECD, 2009).

Figure 2D-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Steel Industry Segments[a,b]



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.*

b Prior to 2007, U.S. Census sampled every industry in a specific NAICS6. Beginning in 2007, U.S. Census only sampled certain industries within any NAICS6, and therefore, the data collected before 2007 cannot be directly compared to the data collected in 2007 and beyond.

Source: U.S. DOC, Survey of Plant Capacity 1989-2009, U.S. Census Bureau.

2D.4 Structure and Competitiveness

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, 2001b). 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 during periods of weak demand, driving integrated companies out of many of the commodity steel markets (S&P, 2001b). The advent of minimills, with their lower initial capital investments, has made it easier for new producers to enter the market.

2D.4.1 Firm Size

For both the Steel Mills and Steel Products segments, the Small Business Administration defines a small firm as having 1,000 or fewer employees (750 or fewer employees for NAICS 331112). 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 2D-8* below shows the distribution of firms, facilities, and receipts by the employment size of the parent firm.

The SUSB data presented in *Table 2D-8* show that in 2006, 640 of 708 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 654 facilities, or 80 percent of all facilities in the segment. Of the 568 firms with facilities that manufacture Steel Products, 482, or 85 percent, employ fewer than 500 employees, and are therefore considered small businesses. Small firms own 73 percent of facilities in the industry.

Table 2D-8: Number of Firms and Facilities by Employment Size Category in the Profiled Steel Industry Segments, 2006

Employment Size Category	Steel Mills		Steel Products	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	473	475	272	272
20-99	109	110	120	123
100-499	58	69	90	114
500+	68	173	86	189
Total	**708**	**827**	**568**	**698**

Source: U.S.DOC, Statistics of U.S. Businesses, 2006.

2D.4.2 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.[14] 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 2D-9 shows that Steel Mills, comprised of NAICS 331111 and 331112, have HHIs of 657 and 2,196, respectively and that Steel Products, comprised of NAICS 331222, 331221, and 331210, have HHIs of 326, 491, and 279, respectively. Consequently, the Steel Products segment is considered competitive, based on standard

[14] 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.

measures of concentration. Because the Steel Mills segment is mostly comprised of the firms in NAICS 331111 industry sector, this segment is also mostly competitive. Other than for electrometallurgical products manufacturing, the CR4 and the HHI for all but one relevant NAICS code – NAICS 331112 – are below the benchmarks of 50 percent and 1,000, respectively. The relatively low concentration values suggest low overall ability of the industry to pass through compliance costs as price increases to customers.

Table 2D-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[a]	1987	271	44%	63%	81%	94%	607
	1992	135	37%	58%	81%	96%	551
N 331111	1997	191	33%	53%	75%	94%	445
	2002	285	44%	59%	78%	93%	657
S 3313	1987	25	55%	78%	99%	100%	1,208
	1992	31	56%	77%	98%	100%	1,103
N 331112	1997	19	61%	82%	100%	100%	1,123
	2002	19	75%	92%	100%	100%	2,196
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
	2002	270	30%	42%	61%	85%	326
S 3316	1987	156	45%	62%	82%	95%	654
	1992	158	43%	60%	81%	96%	604
N 331221	1997	153	44%	60%	81%	96%	631
	2002	121	34%	51%	73%	93%	491
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
	2002	133	26%	39%	61%	86%	279

a. SIC code represents largest percentage of facilities and value of shipments within this NAICS based on the 1997 Bridge Between SIC and NAICS

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

2D.4.3 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 316(b) Proposed Existing Facilities Rule. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities 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 2007 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 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, 2001b). Global steel trade fell during the economic recession of 2008, trade imbalances narrowed, and governments responded with an increase in trade policy measures to support the steel industry such as tariff increases, non-tariff barriers in emerging Asia, export-facilitating measures, and trade remedy measures (OECD, 2009).

Table 2D-10 presents trade statistics for the profiled steel industry segments from 1990 to 2007. As shown in the table, although the trend in export dependence has been relatively stable, import penetration increased almost continuously. 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. steel exports rose in 1995 to the highest level since 1941, and dropped slightly until 2003 before nearly tripling in the following four years. Import penetration rose to 19 percent in 1994, 1996, and 2000 and reached another peak of 27 percent in 2006, 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 2007, followed by Mexico. Brazil, China, the EU, Germany, Japan, the Republic of Korea, Mexico, Russia, and Ukraine were major sources of steel mill product imports (USGS, 2008f).

The steel industry's import penetration ratio in 2007 was 25 percent (compared to the 27 percent penetration for the entire U.S. manufacturing industry), implying that domestic steel producers face moderate competition from foreign firms in setting prices on the domestic market. The steel industry's export dependence ratio in 2007 was 10 percent (compared to the 15 percent export dependence for the entire U.S. manufacturing industry), suggesting that this industry's overall cost pass-through potential is not significantly affected by its foreign market sales.

The combination of moderate import penetration and relatively low export dependence suggest that international trade considerations are not a strong factor in determining the cost pass-through potential of firms facing compliance requirements under the Proposed 316(b) Existing Facilities Rule. However, potential changes in tariffs and other international trade policies that were implemented during the recent recession, as well as the global recession, itself, may have altered the overall balance of international competitiveness factors affecting the U.S. steel industry. These potential effects are not able to be accounted for in this analysis because 2007 is the latest year of trade data.

Table 2D-10: Import Penetration and Export Dependence: Profiled Steel Mills and Steel Products Segments ($2009)[a]

Year	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
1990	$15,990	$4,651	$94,002	105,341	15%	5%
1991	$14,435	$5,819	$82,298	90,914	16%	7%
1992	$14,288	$4,736	$83,440	92,992	15%	6%
1993	$15,163	$4,337	$87,223	98,049	15%	5%
1994	$21,116	$4,536	$95,679	112,258	19%	5%
1995	$20,563	$6,762	$100,498	114,299	18%	7%
1996	$21,343	$5,925	$98,147	113,565	19%	6%
1997	$17,331	$5,373	$99,832	111,790	16%	5%
1998	$20,826	$5,069	$97,395	113,152	18%	5%
1999	$16,552	$4,676	$88,667	100,543	16%	5%
2000	$19,327	$5,360	$87,262	101,229	19%	6%
2001	$14,882	$5,111	$74,826	84,597	18%	7%
2002	$15,699	$4,837	$75,286	86,148	18%	6%
2003	$14,156	$5,823	$73,627	81,960	17%	8%
2004	$29,547	$7,395	$107,341	129,493	23%	7%
2005	$31,196	$9,862	$112,393	133,727	23%	9%
2006	$39,802	$10,942	$120,045	148,905	27%	9%
2007	$37,814	$13,084	$128,082	152,812	25%	10%
Total Percent Change 1990 - 2007	**136.5%**	**181.3%**	**36.3%**	**45.1%**		
Total Percent Change 1990 - 2007	**95.7%**	**144.1%**	**46.8%**	**51.0%**		
Average Annual Growth Rate	**5.2%**	**6.3%**	**1.8%**	**2.2%**		

a. 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.*

b Calculated by EPA as shipments + imports - exports.

c. Calculated by EPA as imports divided by implied domestic consumption.

d. Calculated by EPA as exports divided by shipments.

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.

2D.5 Financial Condition and Performance

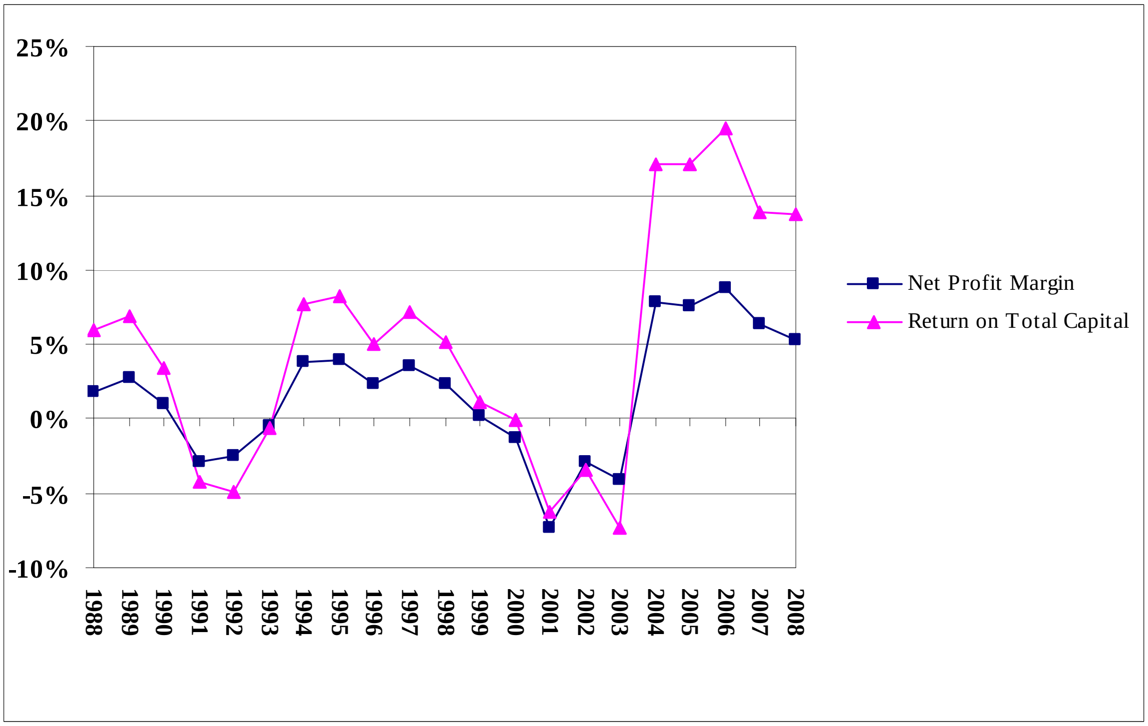
The financial performance and condition of the U.S. steel industry are important determinants of its ability to withstand the costs of regulatory compliance without material, adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 21-year period, 1992-2008: net profit margin and return on total capital. EPA calculated these using data from the Quarterly Financial Report (QFR) (*see Appendix 4.B: Adjusting Baseline Facility Cash Flow*). Financial performance in the most recent financial reporting period (2008) 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 pre-tax income divided by the sum of current portion of long-term debt due in 1 year or less, long-term debt due in more that one year, all other noncurrent liabilities and total stockholders' equity (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 2D-5, following page, presents trends in net profit margins and return on total capital for the steel industry between 1988 and 2008. The graph shows considerable volatility in the trend over this analysis period. After registering improvement in financial performance in the first half of the 1990s, steel industry financial performance declined markedly between 1995 and 2002/2003, due first to increasing imports resulting from Asian financial crisis with the associated decline in Asian demand for steel and currency devaluations, and later, general economic weakness. Financial performance improved in 2002 slightly when the U.S. steel industry received temporary relief with tariffs ranging up to 30 percent on certain steel imports. However, in 2003 the integrated steel industry again saw poor operating results, as high raw material costs outweighed increased sales and higher volumes. In 2004, the steel industry's financial performance improved strongly, with returns on total capital and net profit margins peaking in 2006. In 2007, at the beginning of the recent economic recession, financial performance of the steel industry began to deteriorate. However, in 2009, financial conditions in the steel industry began to improve; as a result, the steel sub-industry equity price index rose 37.9 percent versus a 24.3 percent gain in the S&P 500 index. Longer term, experts expect the industry will benefit from greater pricing power stemming from further expected consolidation, a lower production cost structure, and continuing decline in the U.S. dollar (S&P, 2010e).

Figure 2D-5: Net Profit Margin and Return on Total Capital for the Iron and Steel Industry



Source: Quarterly Financial Report, 1988-2008; U.S. Census Bureau.

2D.6 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.[15] The industry ranked third 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 coverage criteria for the proposed regulation specific regulatory analysis option in terms of design intake flow (i.e., 2 MGD).

[15] 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.

EPA initially identified the set of facilities that were estimated to be *potentially* subject to the 316(b) Existing Facilities Regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities for the petroleum segment.[16]

2D.6.1 Waterbody and Cooling Water Intake 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 2D-11, shows the distribution of in-scope facilities in the profiled Steel industry by type of water body and cooling water intake system. As reported in the table, most in-scope facilities employ a combination of a once-through and recirculating system. In addition, most in-scope facilities in the Steel industry draw water from a freshwater stream or river.

Table 2D-11: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Waterbody Type and Cooling Water Intake System for the Profiled Steel Industry Segments

Water Body Type	Cooling Water Intake Systems								Total
	Recirculating		Combination		Once-Through		Other		
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Lake/Reservoir	0	0%	0	0%	1	6%	0	0%	1
Freshwater River/ Stream	13	100%	19	69%	18	89%	7	100%	57
Great Lake	0	0%	9	31%	1	6%	0	0%	10
Total[a]	**13**	**18%**	**27**	**40%**	**21**	**31%**	**7**	**11%**	**68**

Based on technical weights (See Appendix 3.A).

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

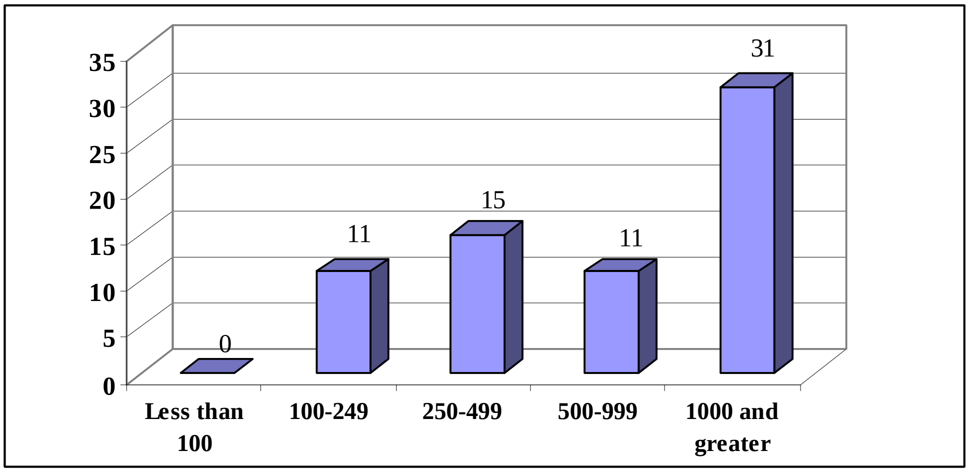
Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2D.6.2 Facility Size

Figure 2D-6, shows the number of in-scope facilities by employment size category. The in-scope facilities in the Steel Mills and Steel Products segments are on-average relatively large.

16 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).

Figure 2D-6: Number of Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Employment Size for Profiled Steel Industry Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2D.6.3 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 (except for facilities with NAICS code 331112 which are defined as small if they have 750 or fewer employees). EPA estimates that eight small entity-owned facilities and 57 large entity-owned facilities in the Steel industry segment will be subject to the proposed regulation. In addition, the ownership size of three facilities was unable to be classified due to insufficient survey data.

2E Profile of the Aluminum Industry

2E.1 Introduction

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified two 3-digit SIC codes in the Nonferrous Metals manufacturing industry (SIC codes 333/335) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws at least 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 proposed Existing Facilities regulation" or "in-scope facilities"). For the purpose of this analysis, EPA identified a six-digit NAICS code for each of these potential facilities using information from the DQ and public sources (see *Appendix 3.C: Conversion the Data from Standard Industrial Classification (SIC) to North American Industry Classification System (NAICS)*). As the result of this mapping, EPA identified four 6-digit NAICS codes in the Nonferrous Metals manufacturing industry (NAICS 331311-5).

For these four NAICS codes, *Table 2E-1*, below, provides a description of the industry segment, a list of primary products manufactured, and the number of facilities estimated to be potentially subject to the 316(b) Existing Facilities regulation based on the minimum withdrawal threshold of 2 MGD.

Table 2E-1: Existing Facilities in the Aluminum Industries (NAICS 33131)

NAICS Code	NAICS Description	Important Products Manufactured	Number of In-Scope Facilities[a]
Primary Stages of Production (Primary Aluminum)			
331311	Alumina refining	Refining alumina (i.e. aluminum oxide) generally from bauxite.	6
331312	Primary aluminum production	Aluminum from alumina and/or aluminum from alumina and rolling, drawing, extruding, or casting the aluminum they make into primary forms (i.e. bar, billet, ingot, plate, rod, sheet, strip).	7
Secondary Stages of Production (Secondary Aluminum)			
331314	Secondary smelting and alloying of aluminum	Recovered aluminum and aluminum alloys from scrap and/or dross (i.e. secondary smelting) and billet or ingot (except by rolling); manufactured alloys, powder, paste, or flake from purchased aluminum.	3
331315	Aluminum sheet, plate, and foil manufacturing	Flat-rolling or continuous casting sheet, plate, foil, and welded tube from purchased aluminum; recovered aluminum from scrap.	9
		Total NAICS 331311-5[b]	**25**

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, 2010.

As shown in *Table 2E-1*, EPA estimates that, out of an estimated total of 88[17] facilities with a NPDES permit and operating cooling water intake structures in the Aluminum industry (NAICS 331311-5), 25 (or 28 percent) facilities are estimated to be subject to the 316(b) Proposed Existing Facilities Rule. EPA also estimated the percentage of total production that occurs at facilities estimated to be subject to the regulatory analysis options. The total value of shipments for the profiled Aluminum Industry (NAICS 331311-5) from the 2007 Economic Census is $36.6 billion ($2009). 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 manufacturing facilities potentially subject to the regulatory analysis. 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 316(b) Proposed Existing Facilities Rule is

17 This estimate of the number of facilities holding a NPDES permit and operating a cooling water intake structure is based on the responses from facilities that received the 1999 screener questionnaire.

$22.3 billion ($2009). Therefore, EPA estimates that 61 percent of total domestic aluminum production occurs at facilities estimated to be subject to the proposed regulation.

Table 2E-2 provides the crosswalk between NAICS codes and SIC codes for the profiled Aluminum NAICS codes. The table shows that of the profiled 6-digit NAICS codes in the Aluminum industry, alumina refining (NAICS 331311), primary aluminum production (NAICS 331312), and aluminum sheet, plate, and foil manufacturing (NAICS 331315) have a one-to-one relationship to SIC codes. Secondary smelting and alloying of aluminum (NAICS 331314) represents two SIC codes: secondary nonferrous metals (3341) and primary metal products (3399).

Table 2E-2: Relationships between NAICS and SIC Codes for the Aluminum Industries (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	Number of Establishments	Value of Shipments (Millions; $2009)	Employment
331311	Alumina refining	2819	Industrial inorganic chemicals	16	$1,382	1,611
331312	Primary aluminum production	3334	Primary aluminum	54	$6,880	9,355
331314	Secondary smelting and alloying of aluminum	3341	Secondary nonferrous metals	138	$9,010	8,286
		3399	Primary metal products, n.e.c.			
331315	Aluminum sheet, plate, and foil manufacturing	3353	Aluminum sheet, plate, and foil	115	$19,285	17,626

Source: U.S. DOC, 2007Economic Census

2E.2 Summary Insights from this Profile

The key purpose of this profile is to provide insight into the ability of aluminum industry firms to absorb compliance costs under the Proposed 316(b) Existing Facilities Rule 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.

2E.2.1 Likely Ability to Pass Compliance Costs Through to Customers

As reported in the following sections of this profile, the Aluminum industry on average has a moderate-to-high degree of market concentration, with the profiled Primary Aluminum production segment being slightly more concentrated than the profiled Secondary Aluminum Production segment. This potentially supports the notion that firms in the Primary Aluminum production segment may be able to pass some portion of their compliance-related costs through to consumers while firms in the Secondary Aluminum production segment may not. However, the domestic Primary Aluminum production segment faces significant competition from imports into the U.S. market, which has increased over time and is likely to continue doing so going forward. Further, the Secondary Aluminum production segment has been persistently and notably reliant on sales into foreign markets, although to a lesser degree than the Primary Aluminum production segment. 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 Aluminum industry, in addition to the moderate-to-high degree of concentration in the profiled Aluminum industry, and strong competitive pressures from abroad, EPA judges that in-scope facilities in the profiled Aluminum industry subject to the 316(b) Existing Facilities Regulation are not likely to be able to recover compliance costs through price increases to customers and would have to absorb all compliance costs within their operating finances (see following sections and *Appendix 4.A: Cost Pass-Through Analysis*, for further information).

2E.2.2 Financial Health and General Business Outlook

Over the last two decades, 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 middle of that 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 during 2000 through 2002, reflecting recessionary weakness in both the U.S. and world economies, and again resulted in oversupply of aluminum and declining financial performance of facilities in the aluminum industry. As the U.S. economy began to show signs of recovery in 2003, so did the overall aluminum industry with higher demand levels and improving financial performance over the course of 2004 and 2006. Despite increasing costs of energy and other aluminum production inputs, which lead to lower aluminum production levels and higher aluminum prices during that time, demand for aluminum grew; increasing prices of steel and copper compared to aluminum lead to aluminum substitution in the manufacturing of certain goods like cable, beverage cans, and automobile parts (USGS, 2006c). Higher demand for aluminum also lead to smelter restarts and substantial increases in primary aluminum production throughout 2007 and the first half of 2008. The recent recession, however, resulted in lower demand for aluminum, leading to significantly lower aluminum prices and consequent production cuts by aluminum smelters. By June 2009, 54 percent of domestic production smelting capacity was idle (USGS, 2008a). Decreased consumption of aluminum in developed economies as a result of the economic events of 2008 could keep U.S. aluminum production below the 2008 level for the next several years. Moreover, relatively high electricity rates in the United States compared to those in other nations diminishes the likelihood that domestic smelters will reopen in the near term (USGS, 2008a).

2E.3 Domestic Production

The Primary stages of aluminum production involve 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).

Secondary stages of aluminum production involve recovering aluminum and aluminum alloys from scrap and/or dross, making billet and ingot, and manufacturing of alloys, powder, paste, of flake from purchased aluminum. In 2009, aluminum recovered from purchased scrap was about three million tons, of which about 60 percent came from new (manufacturing) scrap and 40 percent from old scrap (discarded aluminum products). Aluminum recovered from old scrap was equivalent to about 35 percent of apparent consumption (USGS, 2010c). Reclamation of used aluminum beverage cans continues to be a major source of supply for the U.S. aluminum industry, generating large savings in production energy costs (USGS, 2009c). 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.

In addition, the Secondary stages of aluminum production include manufacturing of semi-fabricated aluminum products. 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. 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. As noted above, the Primary stages of aluminum production is an electrometallurgical process, which is extremely energy intensive. Electricity accounts for approximately 30 percent of total production costs for primary aluminum smelting. The Aluminum industry is therefore a major industrial user of electricity, spending more than two billion dollars annually. Throughout the years aluminum facilities have been pursuing opportunities to reduce its use of electricity as a means of lowering costs. Consequently, in the last 50 years, the average amount of electricity needed to make a pound of aluminum has declined from 12 kilowatt hours to approximately 7 kWh (Aluminum Association, undated).

2E.3.1 Output

The transportation sector is the largest North American market for aluminum, accounting for 6.2 billion pounds, or 28.1 percent of total consumption. Other major markets include: containers and packaging (22.2 percent); building and construction (28.1 percent); electrical (7.0 percent); machinery and equipment (6.8 percent); and consumer durables (6.0 percent) (Aluminum Association, 2009).

Demand for aluminum reflects the overall state of domestic and world economies, as well as long-term trends in aluminum products 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 domestic and world economies, resulting in oversupply. In addition, 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. The U.S. aluminum 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, 1999a; USGS, 1998d; USGS, 1994a; Value Line, 2001). However, as the U.S. economy began to recover in 2003, the aluminum industry saw higher demand levels, but also higher input prices, which contributed to a slight production decline during 2003 through 2006. In 2009, following the recession of 2008, sales and net profits in the aluminum industry were low; however, recovery in the global economy along with a mild rebound in several key markets will likely result in higher demand for aluminum in 2010 compared to the estimated drop of 9 percent in 2009. In particular, industry analysts expect that U.S. construction spending will increase 1.7 percent and U.S. car sales will rise 7.7 percent during 2010, giving a boost to aluminum production (S&P, 2010).

Table 2E-3 shows trends in output of aluminum by Primary and Secondary stages of aluminum production. Secondary aluminum production grew from 24 percent to just over 34 percent of total domestic production over the period from 1991 to 2008. Primary production of aluminum recorded a net decrease over the 18-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, 2001c). Production has remained fairly constant in recent years.

Table 2E-3: U.S. Aluminum Production

	Aluminum Ingot					
	Primary Stages of Production		Secondary Stages of Production		Total Production	
Year	Thousand MT	% Change	Thousand MT	% Change	Thousand MT	% Change
1991	4,121	na	1,320	na	5,441	na
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	2,481	-1.4%	1,080	-6.9%	3,561	-3.1%
2006	2,284	-7.9%	1,260	16.7%	3,544	-0.5%
2007	2,554	11.8%	1,600	27.0%	4,154	17.2%
2008	2,658	4.1%	1,340	-16.3%	3,998	-3.8%
Total percent change 1991-2008	**-35.5%**		**1.5%**		**-26.5%**	
Total percent change 2000-2008	**-27.9%**		**-2.2%**		**-21.0%**	
Average annual growth rate	**-2.5%**		**0.1%**		**-1.8%**	

Source: USGS Mineral Commodity Summaries, Aluminum 1995-2010c

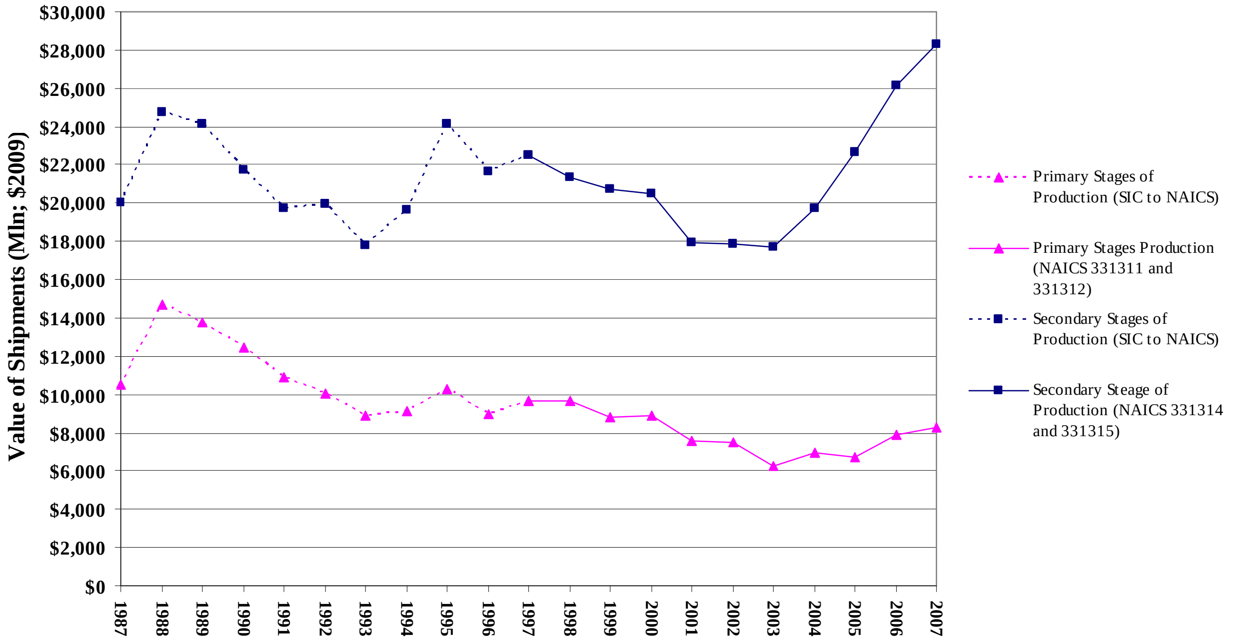
Value of shipments and ***value added*** are two common measures of manufacturing output.[18] Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments is the sum of receipts earned from the sale of outputs; it indicates the overall 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 2E-1 reports constant dollar value of shipments and value added for the Primary and Secondary stages of aluminum production between 1987 and 2007.

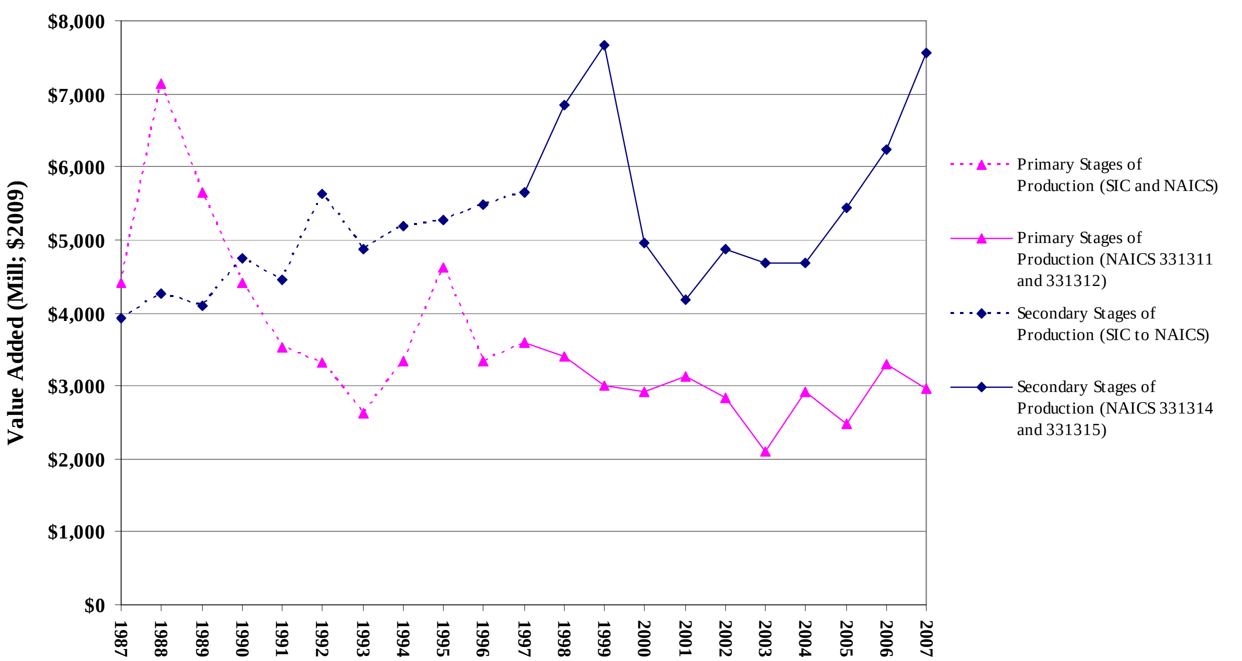
[18] Terms highlighted in bold and italic font are further explained in the glossary.

Figure 2E-1: Value of Shipments and Value Added for Profiled Aluminum Industry Segments (millions, $2009)[a]

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, 2003-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

The value of Primary Aluminum shipments shows generally the same pattern as the quantity data shown in *Table 2E-3*. Trends in production over 1987 to 2003 reflect trends in demand for aluminum; both production and value of shipments fell with increases in the percentage of domestic demand provided by imports. A similar trend can be observed for the Secondary Aluminum production during this period, which substitutes in some but not all markets for Primary Aluminum. In recent years however, value of shipments for both Primary and Secondary Aluminum has risen steadily (with a significantly steeper increase in the Secondary Aluminum segment) due to higher demand, increased domestic production, and declining reliance on imports for consumption. In 2008, the United States became a net exporter of aluminum, increasing net exports by 34 percent from the previous year as a result of a weak dollar, low labor costs, and low-cost shipping rates. Value added by aluminum production excludes the value of purchased materials and services (including electricity). *Figure 2E-1* shows more fluctuation in value added during the last decade than in value of shipments for both Primary and Secondary Aluminum production segments, which could be attributed to fluctuating input prices without the industry being able to implement significant price adjustments due to stiff competition from foreign markets. However, beginning in 2003, both value of shipments and value added for Primary and Secondary Aluminum production segments experienced growth, which could be attributed to an overall increase in market demand for aluminum, both domestically and world-wide. The recent fluctuations seen in the Primary Aluminum production industry segment can be attributed to rising cost of inputs, particularly energy and alumina (USGS, 2009c).

Value of shipments in the Secondary Aluminum production segment declined from late 1980s through 1993, and then recovered by mid-decade, before declining again in the late 1990s. As described above, the profiled Secondary Aluminum production segment is comprised of secondary smelting and alloying of aluminum and production of semi-finished aluminum products such as aluminum sheet, plate, and foil. Demand for secondary smelting and alloying of aluminum is primarily driven by demand from semi-finished aluminum products manufacturing firms. Demand for secondary and semi-finished aluminum products reflects demand from transportation, container, construction, and auto industries. Despite the rising cost of aluminum production during most of the last decade, which resulted in higher aluminum prices, world demand for aluminum continued to increase; prices for copper and steel experienced more significant increases compared to those of aluminum, leading to greater aluminum substitution in production of various goods such as cable, beverage cans, and automobile parts. Consequently, increasing demand for aluminum products during the last decade through the recession of 2008 resulted in increased value of shipments (USGS, 2006a). As discussed in the next section, however, prices for the Primary and Secondary Aluminum segment products dropped in 2009 as the result of the 2008 recession.

Overall, while the Primary Aluminum production segment shows lower values for the constant dollar value of shipments and value added at the end of the 21-year analysis period than at the beginning of the period, the Secondary Aluminum production segment shows higher values. The declining value of shipments and value added in the Primary Aluminum production segment reflect the increasing role of imports in meeting total U.S. demand and the increased competition this segment faces from foreign markets. Over time, the U.S. producers of Primary Aluminum products have been forced to absorb the cost of rising input costs due to increasing pressure from foreign markets.

2E.3.2 Prices

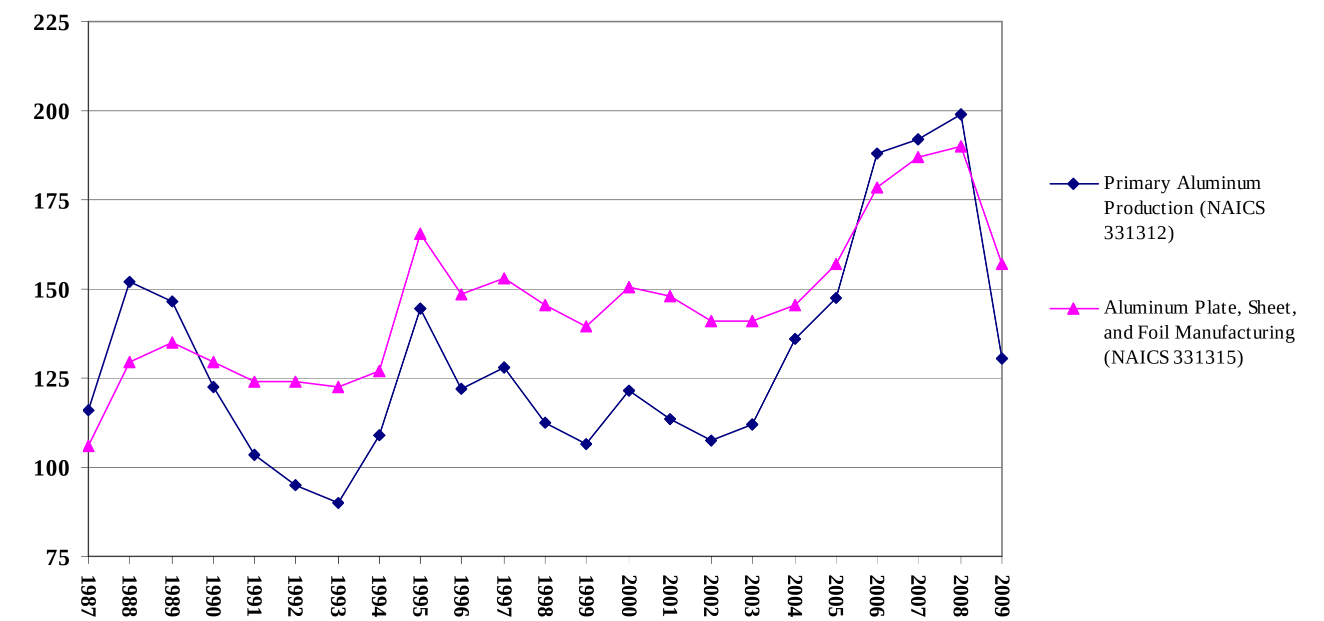
The producer price index (PPI) measures price changes, by segment, from the perspective of the seller, and indicates the overall trend of product pricing, and thus supply-demand conditions, within a segment.

The price trends shown for Primary Aluminum in *Figure 2E-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 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 2E-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. In response to declining aluminum prices, the United States and five other primary aluminum producing nations signed an agreement in January 1994 to curtail global output, 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, 2001e). 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 profiled segments increased significantly between 2003 and 2007. An increase in global demand, especially in emerging markets like China with cheap shipping and labor rates contributed to price increases during 2006 and 2007. But in 2009, prices dropped in response to the financial crisis and recession that began in 2008. Industry analysts expect the average price of aluminum to rise to $1.05 a pound in 2010, from the average price of $0.76 in 2009; this estimate relies on the expectation that global GDP will increase by 2.8 percent growth in 2010 (S&P, 2010). This prediction suggests that aluminum prices are expected to recover coming out of the current recession.

Figure 2E-2: Producer Price Indexes for Profiled Aluminum Industry Segments[a]



a. Data source does not provide Producer Price Indices for NAICS 331311 and NAICS 331314.
Source: BLS, 2009e.

2E.3.3 Number of Facilities and Firms

U.S. Geological Survey data indicate that between 1995 and 2010 the number of Primary Aluminum facilities and the number of domestic firms that own them declined, as shown in *Table 2E-4*. The number of domestic firms and plants they own declined sharply in 2002 and dropped again in 2004. The bulk of the idled capacity in the beginning of this decade 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, 2001c; USGS, 2002a). However, by 2007, the amount of idled capacity decreased because new power contracts were obtained by producers, which led to a slight increase in production. Domestic smelters operated at 69 percent of their capacity (USGS, 2008a). Because of the 2008 recession and the resulting decrease in demand for aluminum during the first half of 2009 smelter closures took place in Alcoa, TN; Massena, NY; and Ravenswood, WV, and by the beginning of the fourth quarter of 2009, domestic smelters were operating at only 49 percent of rated or engineered capacity (USGS, 2010c).

Table 2E-4: Primary Stages of 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
2006	6	15
2007	5	13
2008	6	14
2009	6	14
2010	6	13

Source: USGS, 1995-2010c

Table 2E-5 shows that the number of Primary Aluminum production facilities generally decreased every year between 1990 and 1999 and have generally risen every year after that until 2005. The number of facilities in the Secondary Aluminum production segment showed a more consistent trend, increasing nearly every year.

Table 2E-5: Number of Facilities for Profiled Aluminum Industry Segments

Year[a]	Primary Stages of Aluminum Production[b]		Secondary Stages of Aluminum Production[c]	
	Number of Establishments	Percent Change	Number of Establishments	Percent Change
1990	61	na	229	na
1991	64	5.3%	241	5.3%
1992	60	-7.5%	238	-1.0%
1993	52	-13.5%	224	-6.2%
1994	49	-5.8%	227	1.5%
1995	47	-2.5%	227	0.1%
1996	58	22.6%	207	-8.9%
1997	41	-29.2%	214	3.2%
1998	37	-9.9%	226	5.8%
1999	39	5.4%	247	9.3%
2000	44	12.8%	276	11.7%
2001	49	11.4%	289	4.7%
2002	57	16.3%	236	-18.3%
2003	63	10.5%	243	3.0%
2004	78	23.8%	250	2.9%
2005	73	-6.4%	251	0.4%
2006	69	-5.5%	264	5.2%
Total Percent Change 1990-2006	**12.7%**		**15.4%**	
Total Percent Change 2000-2006	**56.8%**		**-4.3%**	
Average Annual Growth Rate	**0.7%**		**0.9%**	

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.*
b. NAICS 331311-2
c. NAICS 331314-5
Source: U.S. SBA, 1990-1997; SUSB 1998-2006.

The trend in the number of Primary Aluminum production firms over the period 1990 through 2006 is similar to the trend in the number of facilities. However, the number of Secondary Aluminum production firms prior to 1997 fell by a larger percentage than the number of Secondary Aluminum production facilities. *Table 2E-6* presents SUSB information on the number of firms in each segment between 1990 and 2006.

Table 2E-6: Number of Firms for Profiled Aluminum Industry Segments

Year[a]	Primary Stages of Aluminum Production[b]		Secondary Stages of Aluminum Production[c]	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	42	na	192	na
1991	46	7.7%	206	7.2%
1992	41	-10.4%	204	-1.0%
1993	38	-7.6%	190	-6.9%
1994	38	-0.9%	185	-2.4%
1995	35	-7.5%	182	-2.0%
1996	44	-27.8%	161	-114%
1997	27	-38.6%	172	7.1%
1998	27	-0.9%	182	5.7%
1999	29	7.4%	199	9.3%
2000	32	10.3%	225	13.1%
2001	38	18.8%	239	6.2%
2002	50	31.6%	190	-20.5%
2003	51	2.0%	197	3.7%
2004	63	23.5%	201	2.0%
2005	62	-1.6%	194	-3.5%
2006	57	-8.1%	209	7.7%
Total Percent Change 1990-2006	**34.2%**		**8.8%**	
Total Percent Change 2000-2006	**78.1%**		**-7.1%**	
Average Annual Growth Rate	**1.9%**		**0.5%**	

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.*

b. NAICS 331311-2

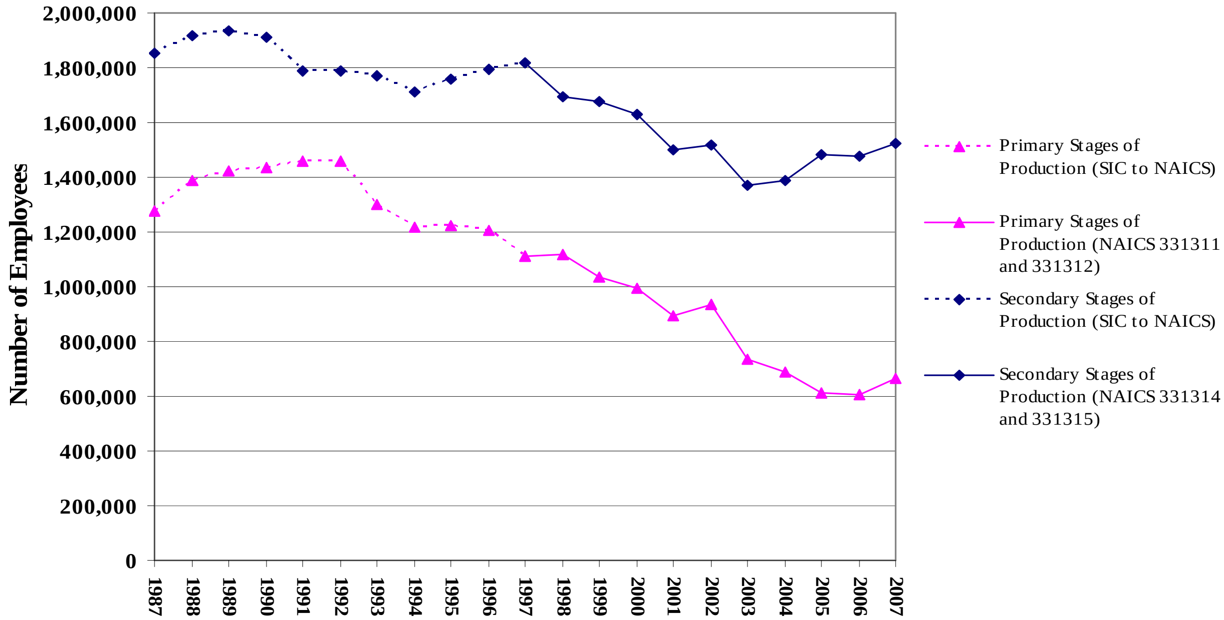
c. NAICS 331314-5

Source: U.S. SBA, 1990-1997; SUSB 1998-2006.

2E.3.4 Employment and Productivity

Figure 2E-3, below, provides information on employment for the profiled Primary and Secondary Aluminum production segments. Trends in Primary Aluminum employment reflect efforts by both production and producers' efforts to compete with less labor-intensive minimills through improvements in labor productivity (McGraw-Hill, 2000). Between 1992 and 2006 employment in the Primary Aluminum segment declined almost steadily, even when production increased. Employment in the Secondary Aluminum segment declined from 1987 through 1994, rose between 1995 and 1997, before declining until 2003 when it began to rise again.

Figure 2E-3: Employment for Profiled Aluminum Industry Segments[a]



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 SIC classification data to the NAICS code classifications using the 1997 Economic Census Bridge Between SIC and NAICS.

Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2E-7: presents year-over-year changes in value added per labor hour, a measure of labor productivity, for the Primary and Secondary Aluminum production segments between 1987 and 2007. The trend in labor productivity in both segments shows volatility over the entire period, reflecting variations in capacity utilization. Value added per hour in the Primary Aluminum segment showed a 14.0 percent net increase over the entire period 1987 through 2007, while value added per hour in the Secondary Aluminum segment saw a 124.4 percent increase over the same period.

Table 2E-7: Productivity Trends for Profiled Aluminum Segments ($2009)

Year[a]	Primary Stages of Aluminum Production: Value Added (millions)	Primary: Production Hours (millions)	Primary: Value Added/Hour ($/hour)	Primary: Value Added/Hour Percent Change	Secondary Stages of Aluminum Production: Value Added (millions)	Secondary: Production Hours (millions)	Secondary: Value Added/Hour ($/hour)	Secondary: Value Added/Hour Percent Change
1987	$4,409	32	137	n/a	$3,921	51	77	n/a
1988	$7,139	37	194	41.6%	$4,272	53	81	5.5%
1989	$5,657	35	162	-16.9%	$4,099	54	77	-5.6%
1990	$4,415	37	119	-26.5%	$4,747	52	91	18.5%
1991	$3,520	38	93	-21.9%	$4,458	51	88	-3.1%
1992	$3,324	38	87	-6.2%	$5,629	52	108	22.7%
1993	$2,621	35	76	-12.8%	$4,864	51	96	-10.7%
1994	$3,338	32	104	36.9%	$5,179	49	105	9.2%
1995	$4,614	34	136	31.3%	$5,280	52	102	-2.7%
1996	$3,333	34	99	-27.0%	$5,489	53	105	2.1%
1997	$3,586	31	115	15.8%	$5,639	52	108	3.6%
1998	$3,409	32	108	-6.4%	$6,846	51	136	25.1%
1999	$3,004	30	99	-8.5%	$7,661	49	157	16.1%
2000	$2,915	29	101	2.2%	$4,962	46	107	-32.0%
2001	$3,129	24	130	29.3%	$4,184	43	97	-9.3%
2002	$2,835	24	118	-9.3%	$4,868	41	120	23.3%
2003	$2,108	21	102	-14.0%	$4,687	41	114	-4.9%
2004	$2,920	19	151	48.5%	$4,681	41	114	0.2%
2005	$2,484	17	145	-3.9%	$5,447	43	126	10.5%
2006	$3,305	16	201	38.6%	$6,240	41	154	22.1%
2007	$2,957	19	156	-22.3%	$7,549	44	173	12.3%
Total Percent Change 1987- 2007	**-32.9%**	**-41.2%**	**14.0%**		**92.5%**	**-14.2%**	**124.4%**	
Total Percent Change 2000- 2007	**1.4%**	**-34.6%**	**55.1%**		**52.1%**	**-5.7%**	**61.3%**	
Average Annual Growth Rate	**-2.0%**	**-2.6%**	**0.7%**		**3.3%**	**-0.8%**	**4.1%**	

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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2E.3.5 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 may also require substantial capital expenditures.

Table 2E-8 presents capital expenditures in the Primary and Secondary Aluminum production segments during 1987 through 2007. As shown by the table, capital expenditures in the Primary Aluminum segment fluctuated in the early 1990s, but steadily increased beginning in 1995 and through the remainder of the decade, eventually increasing more than 200 percent. In the last ten years however, this segment has shown large fluctuations in capital expenditures from one year to the next, rising and falling as much as 50 percent in a single year. These changes resulted from the production surges and cutbacks, and capacity fluctuations, in response to supply and demand conditions prevalent in the market for aluminum.

Capital expenditures in the Secondary Aluminum production segment also fluctuated considerably between 1987 and 2007, peaking in 1990, ten years earlier than in the Primary Aluminum segment. Between 1991 and 1993 producers of Secondary Aluminum reduced capital expenditures by approximately 80 percent. Capital expenditures in this segment fluctuated during the remainder of the decade until 2002 where expenditures decreased more than 70 percent in two years. However, between 2005 and 2007, outlays increased by 106 percent in response to the increase in world demand. Lack of credit to aluminum companies as a result of the recession beginning in 2007/2008 is expected to cause delays in expansion projects in many parts of the world. Projects in places with lower power costs are still expected to move forward (USGS, 2008a).

Table 2E-8: Capital Expenditures for Profiled Aluminum Segments (millions, $2009)

Year[a]	Primary Stages of Aluminum Production		Secondary Stages of Aluminum Production	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	$437	n/a	$804	n/a
1988	$336	-23.2%	$925	15.0%
1989	$376	12.1%	$966	4.4%
1990	$355	-5.7%	$1,122	16.1%
1991	$376	5.8%	$893	-20.4%
1992	$377	0.4%	$718	-19.6%
1993	$297	-21.2%	$423	-41.2%
1994	$231	-22.4%	$455	7.8%
1995	$250	8.6%	$583	28.0%
1996	$318	27.0%	$596	2.3%
1997	$542	70.3%	$543	-9.0%
1998	$626	15.6%	$493	-9.2%
1999	$570	-9.1%	$544	10.3%
2000	$814	42.9%	$570	4.8%
2001	$453	-44.3%	$768	34.8%
2002	$220	-51.5%	$433	-43.7%
2003	$123	-44.1%	$298	-31.0%
2004	$170	38.0%	$298	-0.2%
2005	$125	-26.1%	$416	39.6%
2006	$161	28.6%	$472	13.5%
2007	$211	30.9%	$718	52.2%
Total Percent Change 1987 - 2007	**-51.8%**		**-10.7%**	
Total Percent Change 2000 - 2007	**-74.1%**		**26.1%**	
Average Annual Growth Rate	**-3.6%**		**-0.6%**	

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.

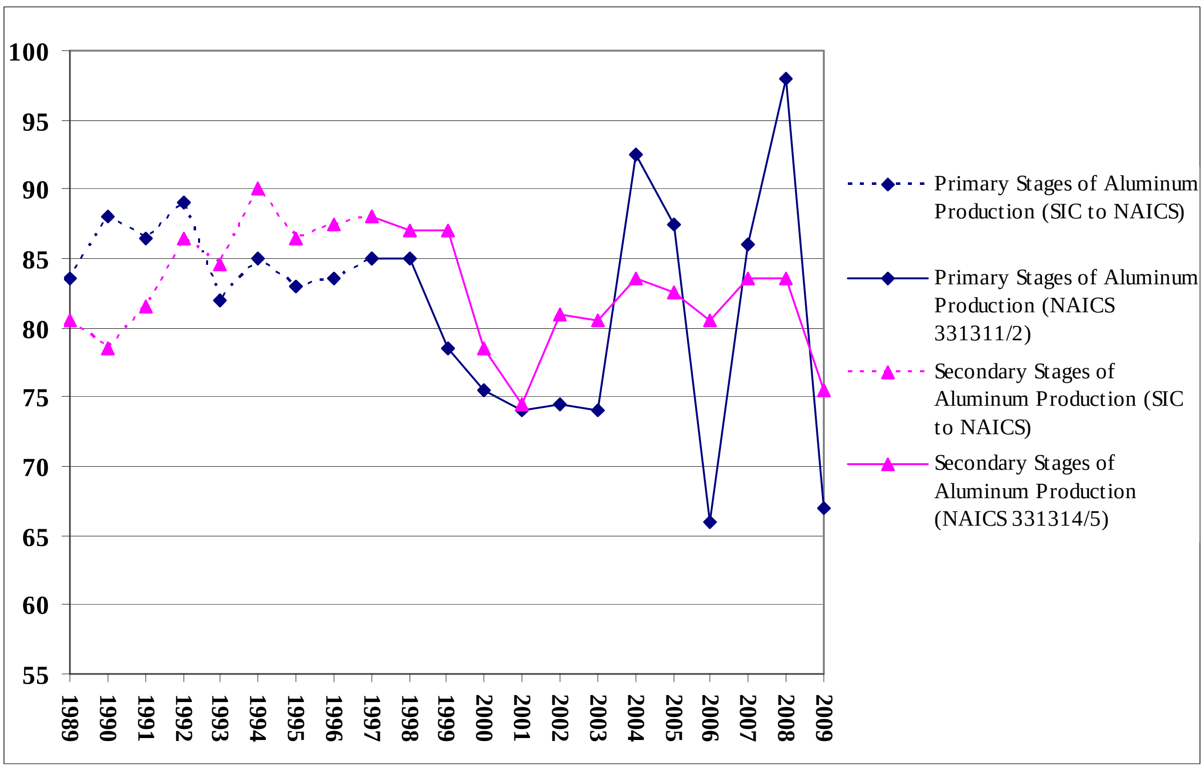
Source: U.S. DOC, 1988-1991, 1993-1996, 1998-2001, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2E.3.6 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 2E-4 shows capacity utilization from 1989 through 2009 for the two profiled Aluminum industry segments. As shown, capacity utilization fluctuated substantially throughout the 12-year analysis period for both segments. Between 1989 and 1998, capacity utilization in the Secondary Aluminum production segment increased on average, largely due to high demand for 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 the Secondary Aluminum production segment, is responsible for bringing idle capacity into production (McGraw-Hill, 1999). At the same time, capacity utilization in the profiled Primary Aluminum production segment remained approximately the same after some fluctuations during that decade. However, between 1998 and 2001, the general weakening of demand for aluminum products during the Asian economic crisis and later, general economic weakness in domestic and world economies, resulted in a marked fall-off in capacity utilization in both profiled segments. Again, reflecting the economic recovery that began in 2002, capacity utilization in both profiled segments began to rise and by 2007 had risen substantially. While capacity utilization in both profiled segments fluctuated during this decade, the Primary Aluminum production segment experienced larger fluctuations. Contrary to the Primary Aluminum production segment, utilization for the Secondary Aluminum production segment fluctuated much less throughout this decade, staying on average within a 5 percent margin. More recently, both profiled segments began to experience a decline in capacity utilization as a result of the economic recession that began in 2007/2008.

Figure 2E-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Aluminum Industry Segments[a,b,c]



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.*

b. Before 2007, U.S. Census sampled every industry in a specific NAICS6. Beginning in 2007, U.S. Census only sampled certain industries within any NAICS6, and therefore, the data collected before 2007 cannot be directly compared to the data collected in 2007 and beyond.

c. Capacity Utilization for the Primary Aluminum production segment (NAICS 331311/2) for 2007-2009 are for NAICS 331312; 2007-2009 data for NAICS 331311 were not available from the Census Bureau at the time of the analysis.

Source: U.S. DOC, Survey of Plant Capacity 1989-2009, U.S. Census Bureau.

2E.4 Structure and Competitiveness

On average, the U.S. Aluminum industry has moderate-to-high industry concentration, with the Primary Aluminum production segment being slightly more concentrated than the Secondary Aluminum production segment. A number of large mergers among aluminum producers have increased the degree of concentration in the industry in recent years. 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. As the result of these acquisitions, three companies accounted for 41 percent of primary global aluminum output. In 2007, Rusal and Sual and Rio Tinto acquired Alcan, thereby increasing concentration in the aluminum industry. Industry analysts speculate that with a greater degree of concentration, capacity will be more closely managed during varying market conditions, which will likely reduce volatility of industry prices and profits (USGS, 2008a).

2E.4.1 Firm Size

The Small Business Administration (SBA) defines a small firm for Primary Aluminum production (NAICS 331311 and 331312) as a firm with 1,000 or fewer employees and for Secondary Aluminum Production (NAICS 331314 and 331315) as a firm with 750 or fewer employees. The Statistics of U.S. Businesses (SUSB) provides employment data for firms with 500 or fewer employees and does not specify data for companies with 500-750 employees for the Primary Production industry and 500-1000 for the Secondary Production industry. Therefore, based on 2006 data for firms with up to 500 employees,

- 45 of the 57 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 48 facilities, or 70 percent of all facilities in the segment.
- 182 of the 209 firms in the Secondary Aluminum production segment had less than 500 employees. Therefore, at least 87 percent of this segment's firms are classified as small. These small firms owned 196 facilities, or 74 percent of all facilities in the segment.

Table 2E-9 below shows the distribution of firms and facilities in the Primary Aluminum production segment (NAICS 331311 and 331312) and the Secondary Aluminum production segment (NAICS 331314 and 331315) by the employment size of the parent firm.

Table 2E-9: Number of Firms and Facilities by Employment Size Category for the Profiled Aluminum Industry Segments, 2006

Employment Size Category	Primary Stages of Aluminum Production		Secondary Stages of Aluminum Production	
	Number of Firms	Number of Facilities	Number of Firms	Number of Facilities
0-19	30	30	101	101
20-99	8	8	49	52
100-499	7	10	32	43
500+	12	21	27	68
Total	57	69	209	264

Source: U.S.DOC, Statistics of U.S. Businesses, 2006 (U.S. DOC, 2006).

2E.4.2 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.[19] 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 1,000 are considered unconcentrated, markets in which the HHI is between 1,000 and 1,800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 are considered to be concentrated.

Table 2E-10 shows that the concentration ratios for the profiled Primary Aluminum production segment (NIACS 331311 and 331312) have increased for the top four and eight firms since 1997 (particularly for NAICS 331312). In 2002, the eight and four largest firms in this segment accounted for 97 and 85 percent of total U.S. primary capacity, respectively. Consolidation in the industry since the early 1990s has increased market 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 controlled 72 percent of 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, 2002a). While no HHI is available in 2002 for these NAICS codes, the recent merger history in this segment and the concentration ratios indicate a moderate to high degree of market concentration.

As reported in *Table 2E-10*, the profiled Secondary Aluminum production segment had an HHI of 694 for NAICS 331313 and 1,856 for NAICS 331314 in 2002. On average, this segment as a whole can be considered moderately concentrated. Thus, based on these ratios and indices, firms in the profiled Primary Aluminum production segment on average enjoy higher market power than those in the profiled Secondary Aluminum production segment. Consequently, while the firms in the Primary Aluminum production segment may be able to pass some of their compliance costs onto their consumers, the firms in the Secondary Aluminum production segment are less likely to be able to do so. 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.

[19] 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.

Table 2E-10: Selected Ratios for the Profiled Aluminum Segments, 1987, 1992, 1997, and 2002

SIC (S) or NAICS (N) Code	Year[b,c]	Total Number of Firms	Concentration Ratios				
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index
S 2819[a]	1987	427	38%	49%	68%	84%	468
	1992	446	39%	50%	68%	85%	677
N 331311	1997	5	NA	100%	NA	NA	NA
	2002	**8**	**97%**	**100%**	**NA**	**NA**	**NA**
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%	NA	1,231
	2002	**26**	**85%**	**98%**	**100%**	**100%**	**NA**
S 3341	1987	365	24%	36%	52%	74%	251
	1992	346	28%	41%	60%	79%	300
N 331314	1997	87	41%	54%	76%	94%	630
	2002	**124**	**45%**	**58%**	**79%**	**96%**	**694**
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
	2002	**79**	**71%**	**87%**	**97%**	**100%**	**1,856**

a. SIC code represents largest percentage of facilities and value of shipments within this NAICS based on the 1997 Bridge Between SIC and NAICS

b. Before 1997, data were compiled in the SIC system; since 1997, these data have been compiled in the NAICS system. For this analysis, EPA converted the NAICS classification data to the SIC code classifications using the *1997 Economic Census Bridge Between NAICS and SIC.*

c The *2002 Census of Manufactures* is the most recent concentration ratio data available.

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

2E.4.3 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 Proposed Existing Facilities Regulation. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities 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 2007 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 2E-11 reports export dependence and import penetration for both the Primary and Secondary Aluminum production segments, from 1990 through 2007. 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, 1994a). Nonetheless, imports have continued to represent a substantial and growing share of total U.S. consumption, and Canada and Russia have continued to be the top aluminum suppliers to the United States, accounting for 56 percent and 17 percent of all aluminum imports, respectively. During 2006 and 2007, imports for consumption increased to more than 60 percent to fill the supply deficit created by increased demand and decrease in domestic production. As domestic production began to increase in 2008, imports for consumption declined, and exports increased, and the United States became a net exporter of aluminum (USGS, 2009c).

Between 1990 and 2007, imports in the Primary Aluminum production segment on average grew by more than 7 percent each year while exports and value of shipments declined by nearly 2 percent each year, thereby indicating a continuous growth in dependence of the U.S. economy on aluminum imports and a steady decline of U.S. competitiveness on the world aluminum market. In 2007, the import penetration ratio for the Primary Aluminum production segment was 60 percent, which is more than double the U.S. manufacturing industry average of 27 percent. The export ratio for the Primary Aluminum production segment in 2007 was 21 percent compared to the national manufacturing average of 15 percent. This shows that the in-scope facilities in the profiled Primary Aluminum production segment are subject to significant international competitive pressures, largely manifesting though the increasing penetration of foreign product into domestic markets as well as declining competitiveness of domestically produced aluminum on world aluminum markets. Consequently, these facilities are not very likely to be able to pass a material share of compliance costs through to consumers.

Facilities in the profiled Secondary Aluminum production segment face lower competition from foreign producers in domestic and foreign markets than facilities in the profiled Primary Aluminum production segment. Unlike the Primary Aluminum production segment, between 1990 and 2007 exports, imports, and value of shipments in the Secondary Aluminum production segment experienced an annual average growth of approximately 2, 4, and 2 percent respectively. In 2007, the import penetration ratio for the Secondary Aluminum production segment was 13 percent, which is one-half of the U.S. manufacturing industry average of 27 percent. The export ratio for the Secondary Aluminum production segment in 2007 was 13 percent, or just below the average for the U.S. manufacturing industry. Consequently, in-scope facilities in the profiled Secondary Aluminum production segment would probably be in a better position to recover regulation-induced increases in production costs through price increases compared to in-scope facilities in the profiled Primary Aluminum production segment.

Overall, the competitive pressures 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 2E-11: Import Share and Export Dependence for the Profiled Aluminum Segments ($2009)

Year[a]	Value of Imports (millions)	Value of Exports (millions)	Value of Shipments (millions)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
Primary Stage of Aluminum Production						
1990	$2,969	$2,432	$12,433	12,970	23%	20%
1991	$2,598	$2,490	$10,882	10,990	24%	23%
1992	$2,640	$1,704	$10,078	11,014	24%	17%
1993	$3,516	$1,205	$8,915	11,225	31%	14%
1994	$5,395	$1,238	$9,106	13,263	41%	14%
1995	$5,702	$1,550	$10,262	14,414	40%	15%
1996	$4,741	$1,411	$9,004	12,333	38%	16%
1997	$5,943	$1,440	$9,663	14,167	42%	15%
1998	$6,095	$1,286	$9,660	14,469	42%	13%
1999	$6,132	$1,246	$8,842	13,728	45%	14%
2000	$6,481	$1,298	$8,858	14,041	46%	15%
2001	$5,815	$1,035	$7,543	12,322	47%	14%
2002	$5,775	$897	$7,471	12,349	47%	12%
2003	$5,798	$821	$6,226	11,203	52%	13%
2004	$7,405	$1,141	$6,968	13,232	56%	16%
2005	$8,617	$1,424	$6,705	13,899	62%	21%
2006	$10,501	$1,880	$7,921	16,543	63%	24%
2007	$9,666	$1,714	$8,262	16,215	60%	21%
Total Percent Change 1990 - 2007	**225.6%**	**-29.5%**	**-33.5%**	**25.0%**		
Total Percent Change 2000 - 2007	**49.1%**	**32.0%**	**-6.7%**	**15.5%**		
Average Annual Growth Rate	**7.2%**	**-2.0%**	**-2.4%**	**1.3%**		
Secondary Stages of Aluminum Production						
1990	$2,428	$1,824	$21,754	22,358	11%	8%
1991	$1,691	$1,924	$19,681	19,448	9%	10%
1992	$1,791	$1,969	$19,912	19,734	9%	10%
1993	$1,714	$1,860	$17,798	17,652	10%	10%
1994	$1,887	$2,335	$19,665	19,217	10%	12%
1995	$2,643	$3,196	$24,138	23,585	11%	13%
1996	$2,212	$2,855	$21,641	20,998	11%	13%
1997	$1,734	$3,212	$22,464	20,987	8%	14%
1998	$1,859	$3,028	$21,336	20,166	9%	14%
1999	$1,898	$2,864	$20,737	19,770	10%	14%
2000	$2,088	$2,904	$20,508	19,692	11%	14%
2001	$1,819	$2,516	$17,974	17,277	11%	14%
2002	$1,954	$2,202	$17,835	17,587	11%	12%
2003	$2,029	$2,211	$17,707	17,525	12%	12%
2004	$2,471	$2,687	$19,753	19,537	13%	14%
2005	$3,358	$3,066	$22,645	22,937	15%	14%
2006	$3,871	$3,603	$26,156	26,424	15%	14%
2007	$3,592	$3,646	$28,295	28,241	13%	13%
Total Percent Change 1990 - 2007	**47.9%**	**99.8%**	**30.1%**	**26.3%**		
Total Percent Change 2000 - 2007	**72.1%**	**25.6%**	**38.0%**	**43.4%**		
Average Annual Growth Rate	**2.3%**	**4.2%**	**1.6%**	**1.4%**		

a. 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.

b. Calculated by EPA as shipments + imports - exports.

c. Calculated by EPA as imports divided by implied domestic consumption.

d. Calculated by EPA as exports divided by shipments.

Source: U.S. International Trade Commission 1990-2007.

Table 2E-12 shows trends in exports and imports separately for the profiled Primary and Secondary Aluminum production segments 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 2008. Exports of primary aluminum have generally declined, with some fluctuation over the period. Exports of secondary aluminum rose steadily until 1999, before declining during 2000 to 2003. Exports did, however, rebound in 2004 and continued to rise or remain steady until 2008.

Table 2E-12: Trade Statistics for Aluminum and Semi-fabricated Aluminum Products (Quantities in thousand metric tons; Values in millions, $2009)

	Primary Aluminum Production				Secondary Aluminum Production			
	Import[a]		Export[b]		Import[a]		Export[b]	
Year	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1993	1,840	3,017	400	759	400	1,175	594	2,078
1994	2,480	4,783	339	737	507	1,487	719	2,538
1995	1,930	4,968	369	929	622	2,212	812	3,526
1996	1,910	4,016	417	901	498	1,695	760	3,147
1997	2,060	4,544	352	787	562	1,972	882	3,565
1998	2,400	4,698	265	576	649	2,202	893	3,496
1999	2,650	4,757	318	652	735	2,248	907	3,244
2000	2,490	4,990	273	580	791	2,586	845	2,947
2001	2,560	4,759	192	387	683	2,134	751	2,567
2002	2,790	4,814	206	402	796	2,290	706	2,240
2003	2,870	4,981	214	409	653	1,761	690	2,216
2004	3,250	6,670	298	641	724	2,212	795	2,700
2005	3,660	7,838	329	731	927	2,975	886	3,194
2006	3,440	9,610	346	963	914	3,434	923	3,806
2007	2,950	8,568	349	985	801	3,173	887	3,855
2008	2,790	7,903	308	901	693	2,803	929	4,068
Total Percent Change 1993-2008	**51.63%**	**161.93%**	**-23.00%**	**18.62%**	**73.25%**	**138.63%**	**56.40%**	**95.73%**
Average Annual Growth Rate	**57.95%**	**76.17%**	**-235.18%**	**39.11%**	**46.04%**	**63.73%**	**47.35%**	**65.93%**

a. Table 10: U.S. Imports for Consumption of Aluminum, by Class
b. Table 9: U.S. Exports of Aluminum, by Class
Source: USGS, Minerals Yearbook, 1993-2008a.

2E.5 Financial Condition and Performance

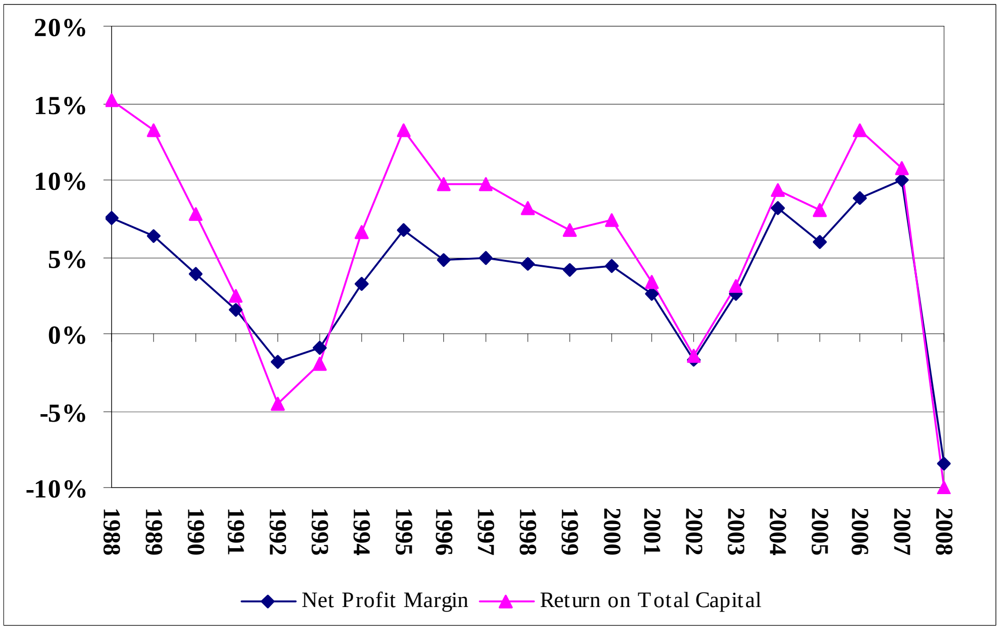
The financial performance and condition of the aluminum industry are important determinants of its ability to withstand the costs of regulatory compliance without material, adverse economic/financial impact. To provide insight into the industry's financial performance and condition, EPA reviewed two key measures of financial performance over the 21-year period, 1988-2008: ***net profit margin*** and ***return on total capital***. EPA calculated these measures using data from the Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (QFR) published by the U.S. Census Bureau. Financial performance in the most recent financial reporting period (2008) 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 pre-tax income divided by the sum of current portion of long-term debt due in one year or less, long-term debt due in more that 1 year, all other noncurrent liabilities and total stockholders' equity (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 2E-5, following page, shows net profit margin and return on total capital for the aluminum industry between 1998 and 2008. The graph shows considerable volatility in both metrics. Financial performance declined significantly between 1988 and 1992, 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. Between 2000 and 2002 financial performance declined again, reflecting economic downturn in both the United States and world economies. Financial health of the Aluminum industry began to improve after that and continued to do so until it significantly deteriorated in 2008 as a result of recession that affected every industry nationwide. During the fourth quarter of 2008 and early 2009, a number of smelters closed and the price of aluminum continued to decline. Going forward, higher electricity prices in the United States relative to other nations could prevent domestic smelters from reopening in the near term. World demand for aluminum remained low throughout 2009 owing to declines in automobile manufacturing and construction. Overall, decreased consumption of aluminum as a result of the recent economic recession could keep aluminum production at low levels for the next several years (USGS, 2008a).

Figure 2E-5: Net Profit Margin and Return on Total Capital for the Non-Ferrous Metals Industry



Source: Quarterly Financial Report. 1988-2008; U.S. Census Bureau.

2E.6 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.[20] 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 United States, 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 coverage criteria for the proposed regulation specific regulatory analysis option in terms of design intake flow (i.e., 2 MGD).

[20] 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.

EPA initially identified the set of facilities that were estimated to be *potentially* subject to the 316(b) Existing Facilities Regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities for the petroleum segment.[21]

2E.6.1 Waterbody and Cooling Water Intake System Type

Table 2E-13, shows the distribution of facilities by type of water body and cooling system.

Table 2E-13: Number of Facilities Estimated Subject to the 50 MGD All Option by Waterbody Type and Cooling Water Intake System for the Profiled Aluminum Segments

	Cooling Water Intake System				
	Recirculating		Once-Through		
Water Body Type	Number	% of Total	Number	% of Total	Total
Estuary/Tidal River	0	0%	4	21%	4
Freshwater Stream/River	3	73%	14	64%	17
Lake or Reservoir	1	27%	0	15%	1
Great Lake	0	0%	3	0%	3
Total	**4**	**17%**	**21**	**83%**	**26**

Based on technical weights (See Appendix 3.A).

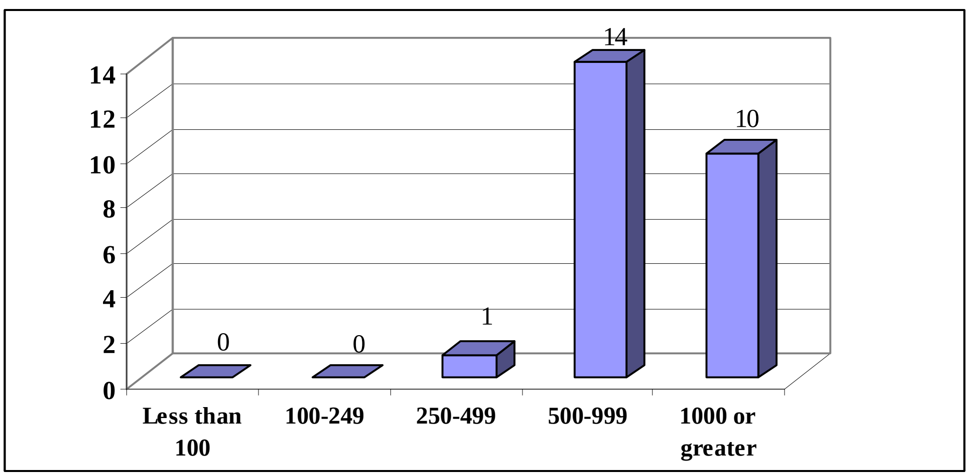
a. Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2E.6.2 Facility Size

The 316(b) facilities in the aluminum industry subject to the regulation under the regulatory analysis options are relatively large. *Figure 2E-6*, shows the number of regulated facilities by employment size category.

Figure 2E-6: Number of In-Scope Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Employment Size for the Profiled Aluminum Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

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[21] 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).

2E.6.3 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 Secondary Production segment are defined as small if they have 750 or fewer employees. EPA estimates there are seven small entity-owned facilities, and 18 large entity-owned facilities in the Aluminum industry subject to the regulation.

2F Profile of Food and Kindred Products Industry

2F.1 Introduction

EPA's *Detailed Industry Questionnaire*, hereafter referred to as the DQ, identified five 4-digit SIC codes in the Food and Kindred Products manufacturing industry (SIC 20) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws at least 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 316(b) Existing Facilities regulation" or "in-scope facilities"). For the purpose of this analysis, EPA identified a six-digit NAICS code for each of these potential facilities using the information from DQ and public sources (see *Appendix 3.C: Conversion the Data from Standard Industrial Classification (SIC) to North American Industry Classification System (NAICS)*). As the result of this mapping, EPA identified five 6-digit NAICS codes in the Food and Kindred Products manufacturing industry (NAICS 322).

For each of these five analyzed 6-digit NAICS codes, *Table 2F-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), and the number of facilities estimated to be potentially subject to the section 316(b) Proposed Existing Facilities Rule based on the minimum withdrawal threshold of 2 MGD (see *Chapter 1: Introduction* for more details on the Rule applicability criteria). Although the respondent DQs fall in only five of the 48 four-digit SIC codes that map onto 52 NAICS codes within the Food and Kindred Products industry, EPA knows of no basis to exclude any of the remaining four-digit SIC codes (or six-digit NAICS codes) from consideration in this profile. Accordingly, this profile focuses on the entirety of SIC 20 that map onto NAICS 311/3121, Food and Kindred Products.

Table 2F-1: Existing Facilities in the Food and Kindred Products Industry (NAICS 311/3121)

NAICS	NAICS Description	Important Products Manufactured	Number of In-scope Facilities
311211	Flour milling	Milling flour or meal from grains (except rice) or vegetables; milling flour and preparing flour mixes or doughs.	3
311221	Wet corn milling	Corn oil cake and meal; corn starch; corn syrup; dextrose, fructose; glucose; high fructose syrup; starches	13
311312	Cane sugar refining	Cane sugar; molasses; granulated sugar; raw sugar; cane syrup (all made from sugarcane); molasses, blackstrap; granulated sugar; refined sugar; syrup (all made from purchased raw cane or sugar syrup)	12
311313	Beet sugar mfg	Beet sugar; molasses; granulated sugar; liquid sugar; powdered sugar; syrup (all made from sugar beets)	6
312140	Distilleries	Distilled and blended liquors, except brandy; gin; rum; vodka; whiskey; cocktails; cordials; eggnog; grain alcohol for medicinal and beverage purposes	3
		Total NAICS 311/3121	**37**

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2010.

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 nine industry groups at the three-digit SIC level, and 48 industries at the four-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, 1997). Under NAICS, the previous SIC 20 sector is recorded in one 3-digit NAICS sector (NAICS 311) and one 4-digit NAICS sector (NAICS 3121), Beverage Manufacturing. 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 both the SIC and NAICS frameworks: in general, for years prior to 1997, data are in the SIC framework; for 1997 and after, data are in the NAICS framework. *Table 2F-1* summarizes the relationship between SIC and NAICS codes used for this profile and provides summary information on the relevant NAICS sectors from the 2007 Economic Census.

Table 2F-2: Relationship between NAICS and SIC Codes for the Petroleum Refining Industry (2007)

NAICS Code	NAICS Description	SIC Code	SIC Description	Establishments	Value of Shipments (Millions; $2009)	Employment
311 (Excl. 311811[a])	Food Manufacturing	20-- (excl. 2082, 2084-6, and 2097)	Food and Kindred Products	19,219	$606,694	1,466,762
3121	Beverage Manufacturing	2082	Malt Beverages	3,703	$90,470	134,407
		2084	Wines, Brandy, and Brandy Spirits			
		2085	Distilled and Blended Liquors			
		2086	Bottled and Canned Soft Drinks and Carbonated Waters			
		2097	Manufactured Ice			

a. NAICS 311811: Retail Bakeries is not a part of manufacturing sectors in the SIC framework. Because Annual Survey of Manufacturers used to analyze Food and Kindred Products manufacturing sector provides data only for manufacturing sectors, EPA excluded NAICS 311811 from the totals to the Food and Kindred Products sector.

Sources: U.S. DOC. 2007 Economic Census.

2F.2 Summary Insights from this Profile

The 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.

2F.2.1 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) Existing Facilities Regulation, EPA judges that a conservative assumption of no-cost-pass-through is appropriate for analysis of the impact on this industry. Consequently, for the cost and economic impact analysis, EPA assumed that in-scope facilities would absorb all compliance costs within their operating finances (see following sections and *Appendix 4.A: Cost Pass-Through Analysis*, for further information).

2F.2.2 Financial Health and General Business Outlook

Unlike the more cyclical sectors in the other profiled Primary Manufacturing Industries, the profiled Food and Kindred Products industry, being a consumer staples industry, was not as strongly affected by the economic downturns that occurred in the early 2000s and in 2008-2009. During the last two decades, this industry has maintained relatively healthy financial performance and steady growth despite economic fluctuations, increasing government regulations, and changing consumer preferences and behavior. To remain competitive, firms in the Food and Kindred Products industry have been able to promptly respond to changing economic, business, and regulatory environment by offering a greater variety of products while consistently and cost-effectively producing high quality products (Rockwell Automation, 2008). Extremely high prices for many food commodities brought a cash windfall in much of 2006-2008 for the industry. However, more recently, the global financial crisis has created new challenges as consumers move to cheaper food options and increasingly cook at home (Plunkett Research, 2010). The industry has exhibited substantially less fluctuation in capacity utilization and financial performance than more cyclical industries, such as the other five Primary Manufacturing Industries. Although foreign competition increased, the industry also experiences significantly less international competition than firms in the other 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 during the last two decades and has correspondingly recorded moderately increasing labor productivity. These factors suggest that the industry's capital equipment base has been maintained and regularly improved during the last two decades, and that the business faces no inordinate needs for capital expenditure due, for example, to offset a period in which capital outlays 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.

Given the proven ability of the profiled Food and Kindred Products industry to withstand economic fluctuations, regulatory changes, and constantly changing consumer behavior and business environment together with recent industry trends may suggest that going forward, the profiled Food and Kindred Products industry is very likely to continue its moderate steady growth accompanied by relatively healthy financial performance. Further, EPA judges that the profiled Food and Kindred Products industry is currently in better economic/financial condition overall than the other profiled Primary Manufacturing Industries and that this industry should be able to withstand the cost of Proposed Existing Facilities Rule compliance requirements without material adverse financial impact.

2F.3 Domestic Production

At the beginning of this decade, the profiled Food and Kindred Products industry was 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 in 2000 (McGraw-Hill, 2000). In 2009, U.S. total food sales exceeded $1.5 trillion (Plunkett Research, 2010), and the Food Manufacturing segment alone accounts for over 10 percent of all manufacturing shipments (U.S. DOC, 2008). The industry is considered mature, however, and firms are constantly seeking new avenues for increased sales in domestic and foreign markets. With total food industry shipments growing more slowly than GDP, U.S. producers have actively sought growth opportunities in overseas markets. Although exports still make up a small share of domestic shipments, changes in global food consumption could lead to increased demand and trade for processed food products going forward. 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 driven mainly by convenience and specialty food products (U.S. DOC, 2008).

2F.3.1 Output

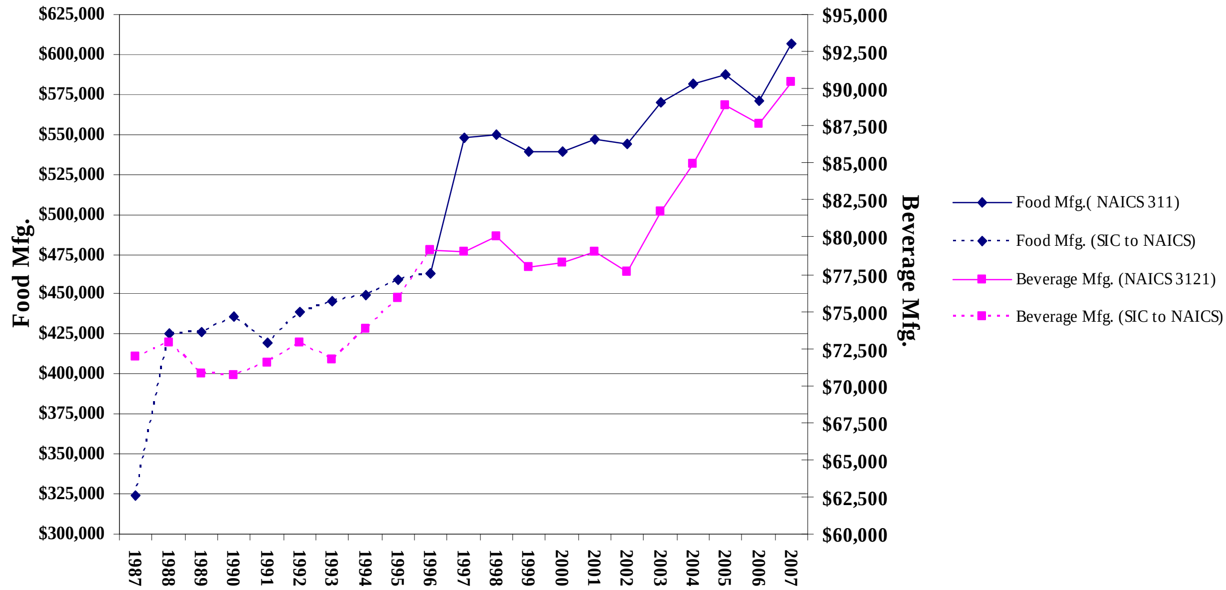
Figure 2F-1, following page, shows trends in constant dollar ***value of shipments*** and ***value added*** for the Food Manufacturing and Beverage Manufacturing segments.[22] Change in these values over time provides insight into the overall economic health and outlook for an industry. Value of shipments 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.

Over-time trends in value of shipments and value added show that both the Food Manufacturing and Beverage Manufacturing segments have achieved generally stable performance over the 1987-2007 analysis period: these industries have not been substantially affected by fluctuations in the performance trend of the U.S. economy. The lack of major swings in shipments and value added results largely from the consumer staple-character of the industry. At the end of the 1987-2007 analysis period, both profiled segments ended with a higher total value of shipments and value added: constant dollar value of shipments in the profiled Food Manufacturing and Beverage Manufacturing segments increased by 87 percent and 26 percent, respectively, while value added increased by 99 percent and 44 percent, respectively. The general trends indicate that firms in these industry segments have been able to increase shipments and value added, which is a sign that these firms have been successful in finding ways to expand their market and continue to grow.

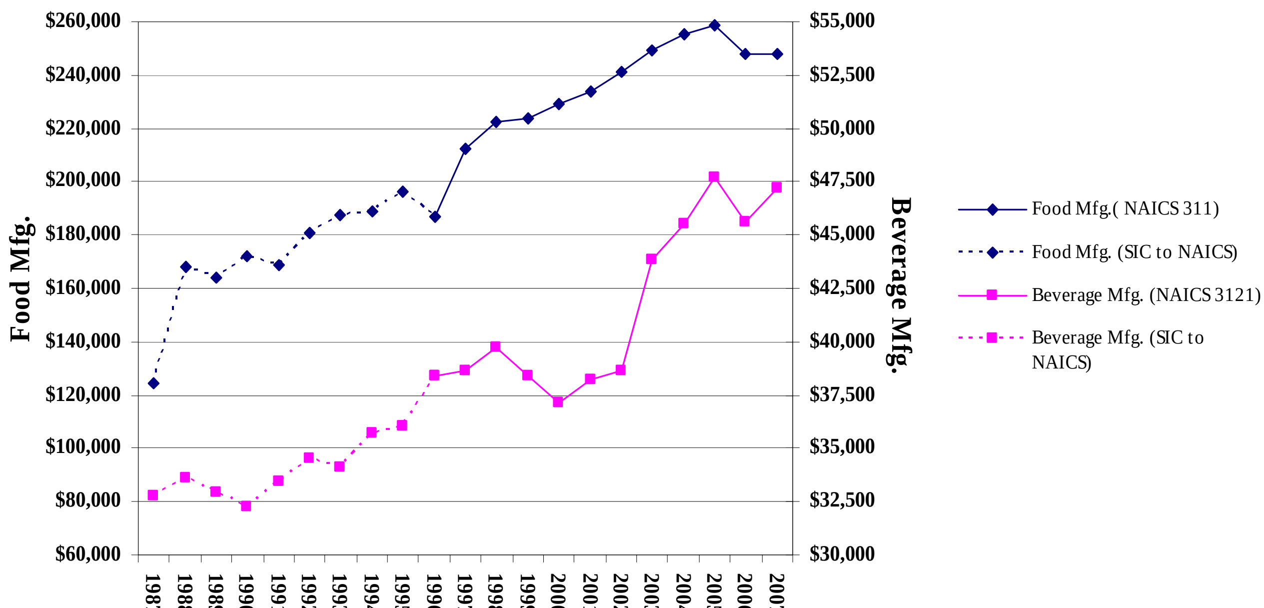
22 Terms highlighted in bold and italic font are further explained in the glossary.

Figure 2F-1: Value of Shipments and Value Added for Profiled Food Manufacturing and Beverage Manufacturing Segments (millions, $2009)[a]

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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2F-3 provides the Federal Reserve System's index of industrial production for the profiled Food Manufacturing and Beverage Manufacturing segments, showing trends in production between 1990 and 2009. 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 1996, 2003, and 2009, the Food Manufacturing segment has seen year-to-year production increases over the analysis period, with an overall increase in production of approximately 34 percent (13 percent during the last decade). Being less of a consumer staple industry segment, the Beverage Manufacturing segment saw slightly more fluctuations during the analysis period in response to the economic recessions of the early 1990s and early and late 2000s, but also experiencing an overall increase of 21 percent for the entire period (11 percent during the last decade). Food manufacturers continue to invest in greater automation in manufacturing processes with budgeted spending for plant equipment, upgrades, computers, and automation remaining at steady levels. With the recent national concerns over food safety and increasing food safety regulations, food manufacturers will likely also begin investing in additional technological processes to meet increasing food safety requirements (U.S. DOC, 2008).

Table 2F-3: U.S. Food and Beverage Manufacturing Industry Industrial Production Index

Year	Food Manufacturing[a]		Beverage Manufacturing[b]	
	Index 2002=100	**Percent Change**	**Index 2002=100**	**Percent Change**
1990	82.3	n/a	91.7	n/a
1991	83.8	1.8%	92.9	1.3%
1992	85.4	1.9%	93.4	0.5%
1993	87.6	2.6%	93.3	-0.2%
1994	88.2	0.6%	97.2	4.2%
1995	90.4	2.6%	97.9	0.7%
1996	88.6	-2.1%	102.1	4.3%
1997	91.0	2.8%	103.7	1.6%
1998	95.0	4.4%	105.3	1.5%
1999	96.0	1.0%	100.0	-5.0%
2000	97.7	1.7%	99.8	-0.2%
2001	97.7	0.0%	99.7	-0.1%
2002	100.0	2.4%	100.0	0.3%
2003	101.0	1.0%	105.4	5.4%
2004	101.1	0.1%	109.3	3.8%
2005	104.2	3.1%	115.3	5.5%
2006	105.4	1.1%	116.0	0.6%
2007	109.5	3.9%	119.4	2.9%
2008	111.1	1.5%	114.6	-4.0%
2009[c]	110.5	-0.6%	111.0	-3.1%
Total Percent Change 1990-2009	**34.3%**		**21.0%**	
Total Percent Change 2000-2009	**13.2%**		**11.3%**	
Average Annual Growth Rate	**1.6%**		**1.0%**	

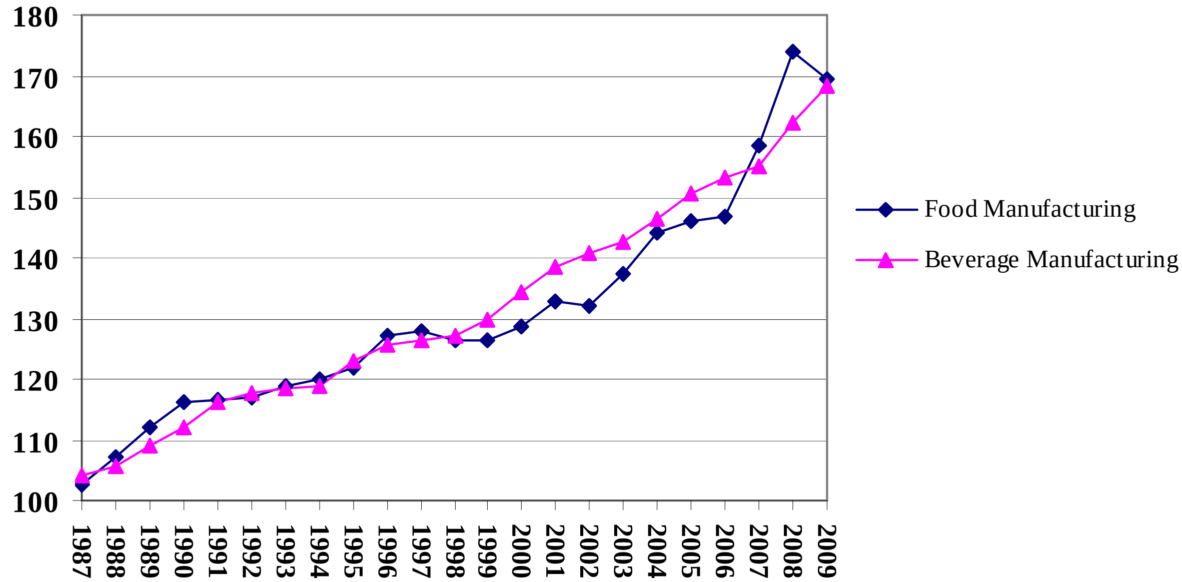
a. NAICS 311
b. NAICS 3121
c. Average through 9/2009
Source: Economagic; Federal Reserve, Board of Governors, 2009.

2F.3.2 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 2F-2*, price levels in the profiled Food Manufacturing and Beverage Manufacturing segments have risen steadily between 1987 and 2009, with an average annual growth rate of more than 2 percent. Total spending on food makes up about 13 percent of a household's total average annual expenditures. Of the average $6,111 in food spending, $3,417 is used for food to be consumed in the home and $2,694 is used for food consumed away from home. Prepared meals, ready-to-serve products, ethnically diverse food products, and organic food are showing increased demand as the U.S. population becomes older, more frugal, more diverse, and increasingly concerned about nutrition (U.S. DOC, 2008). The Beverage Manufacturing segment has also seen a steady increase in consumer spending over the last two decades despite being more susceptible to economic fluctuations. Further, industry experts expect the Beverage Manufacturing industry segment to continue the modest but stable upward trend as manufacturers address consumer concerns about appropriate beverage size and environmentally friendly packaging (CID, 2010).

Figure 2F-2: Producer Price Indexes for Food Manufacturing and Beverage Manufacturing Segments



Source: BLS, 2009b.

2F.3.3 Number of Facilities and Firms

Table 2F-4 and *Table 2F-5* present the number of facilities and firms for the Food Manufacturing and Beverage Manufacturing segments between 1990 and 2006. As reported in the *Statistics of U.S. Businesses*, between 1990 and 2006, the number of facilities in the Food Manufacturing segment increased by 14 percent. The number of firms in this segment grew by about 13 percent during this time period. During the same analysis period, the number of facilities and number of firms in the Beverage Manufacturing segment increased even more dramatically, by 62 percent and 68 percent, respectively. During the last decade, however, the Food Manufacturing saw a number of mergers and acquisitions (U.S. DOC, 2008). Consequently, while the number of facilities and firms in the Beverage Manufacturing grew by 29 percent and 32 percent, respectively, during the last decade, the Food Manufacturing segment saw a decrease in both of approximately 4 percent and 9 percent, respectively.

Table 2F-4: Number of Facilities Owned by Firms in the Food and Beverage Manufacturing Segments[a]

Year	Food Manufacturing		Beverage Manufacturing	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1990	16,740	n/a	2,200	n/a
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	20,088	8.2%	2,601	-2.2%
1999	19,954	-0.7%	2,671	2.7%
2000	19,902	-0.3%	2,748	2.9%
2001	20,340	2.2%	3,033	10.4%
2002	19,136	-5.9%	3,099	2.2%
2003	19,873	3.9%	3,082	-0.5%
2004	19,667	-1.0%	3,222	4.5%
2005	19,339	-1.7%	3,376	4.8%
2006	19,126	-1.1%	3,556	5.3%
Total Percent Change 1990-2006	**14.3%**		**61.6%**	
Total Percent Change 2000-2006	**-3.9%**		**29.4%**	
Average Annual Growth Rate	**0.8%**		**3.0%**	

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, 1990-1997; SUSB, 1998-2006.

Table 2F-5: Number of Firms in the Food and Beverage Manufacturing Segments[a]

Year	Food Manufacturing		Beverage Manufacturing	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	13,346	n/a	1,789	n/a
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	16,656	9.7%	2,137	-4.4%
1999	16,559	-0.6%	2,196	2.8%
2000	16,533	-0.2%	2,267	3.2%
2001	16,960	2.6%	2,558	12.8%
2002	15,796	-6.9%	2,616	2.3%
2003	16,561	4.8%	2,576	-1.5%
2004	15,511	-6.3%	2,692	4.5%
2005	15,274	-1.5%	2,839	5.5%
2006	15,093	-1.2%	2,998	5.6%
Total Percent Change 1990-2006	**13.1%**		**67.6%**	
Total Percent Change 2000-2006	**-8.7%**		**32.2%**	
Average Annual Growth Rate	**0.8%**		**3.3%**	

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, 1990-1997; SUSB, 1998-2006.

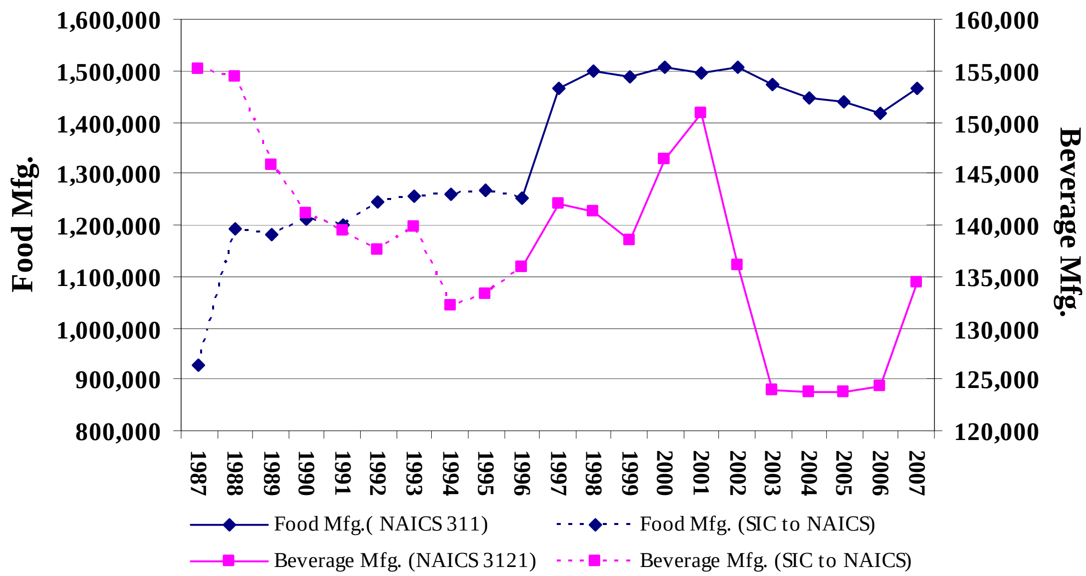
2F.3.4 Employment and Productivity

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. Indeed, spending for production, packaging and process control equipment is the most robust automation capital area (see *Section 2F.3.5*, below). The more advanced technology production equipment requires a more skilled labor force; therefore, the key to future productivity gains are said to lie in better skills training of line operators and supervisors. At the same time, more advanced technology equipment has resulted in more automated production process and has reduced the number of employees needed per dollar of production (Higgins, 2005).

Figure 2F-3 presents ***employment*** for the two profiled segments between 1987 and 2007. As shown in *Figure 2F-3*, between 1987 and 2007, employment exhibited different behavior in the two profiled segments. Other than sharp increases from in 1988 and 1997, employment in the Food Manufacturing segment was relatively stable, decreasing by no more than 2.5 percent and increasing by no more than 4 percent. Over the entire analysis period, employment in the Food Manufacturing segment increased by 58 percent. During the last decade, however, employment in this segment fell by nearly 3 percent. This drop in employment is likely the result of heavy investments in technology and increased automation and production improvements, which persisted in the Food Manufacturing segment in the last decade and have allowed companies to increase output while relying on fewer employees. This trend is likely to continue going forward which could potentially lead to further employment reductions in the Food Manufacturing segment (U.S. DOC, 2008).

The Beverage Manufacturing segment has experienced more volatility over the last two decades. Between 1987 and 1994, employment in the Beverage Manufacturing segment fell nearly every year, before reversing this trend and experiencing gains through 2001. These employment gains, however, were followed by consecutive significant declines of nearly 10 and 9 percent in 2002 and 2003, respectively. After relatively stable few years, 2007 saw a significant employment increase of over 8 percent – a promising sign for the industry's future employment outlook.

Figure 2F-3: Employment for Food Manufacturing and Beverage Manufacturing Segments[a]



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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

Table 2F-6 presents the change in value added per labor hour, a measure of ***labor productivity***, for the two profiled industry segments between 1987 and 2007. As shown in this table, labor productivity in the Food and Beverage Manufacturing segments has generally grown steadily and at an average annual rate of approximately 1 and 2 percent, respectively. However, labor productivity in the Beverage Manufacturing segment has shown a greater degree of fluctuation, with both annual increases and decreases in productivity exceeding 10 percent during the last two decades. Overall, the Beverage manufacturing segment saw a greater increase in productivity during the last two decades, nearly 45 percent, compared to a 15 percent productivity gain in the Food Manufacturing segment, with substantial gains occurring during the last decade. Technology improvement in the industry is playing an important role in increasing production in recent years, as automation allows output levels to increase without significant increases in employment (U.S. DOC, 2008).

Table 2F-6: Productivity Trends for Food and Beverage Manufacturing Segments ($2009)[a]

	Food Manufacturing				Beverage Manufacturing			
		Production	Value Added/Hour			Production	Value Added/Hour	
Year	Value Added ($ millions)	Hours (millions)	$/hr	Percent Change	Value Added ($ millions)	Hours (millions)	$/hr	Percent Change
1987	$124,685	1,325	94	n/a	$32,780	148	221	n/a
1988	$168,020	1,711	98	4.3%	$33,643	145	231	4.5%
1989	$164,302	1,708	96	-2.1%	$32,969	142	233	0.7%
1990	$171,954	1,788	96	0.0%	$32,238	140	230	-1.3%
1991	$168,847	1,776	95	-1.1%	$33,444	139	240	4.4%
1992	$181,077	1,877	96	1.5%	$34,516	140	246	2.6%
1993	$187,679	1,901	99	2.3%	$34,073	144	237	-3.9%
1994	$189,147	1,933	98	-0.9%	$35,741	138	258	9.1%
1995	$196,429	1,938	101	3.6%	$36,063	139	259	0.4%
1996	$186,869	1,911	98	-3.6%	$38,390	139	276	6.5%
1997	$212,485	2,234	95	-2.7%	$38,613	149	260	-6.1%
1998	$222,614	2,315	96	1.1%	$39,758	148	269	3.7%
1999	$223,642	2,310	97	0.7%	$38,386	140	274	1.9%
2000	$229,049	2,327	98	1.7%	$37,159	153	243	-11.4%
2001	$233,984	2,303	102	3.2%	$38,223	150	255	5.1%
2002	$241,304	2,279	106	4.2%	$38,621	139	278	8.8%
2003	$249,125	2,282	109	3.1%	$43,810	138	317	14.0%
2004	$255,095	2,246	114	4.0%	$45,515	132	344	8.6%
2005	$258,698	2,238	116	1.8%	$47,680	135	352	2.4%
2006	$248,129	2,197	113	-2.3%	$45,612	138	331	-5.9%
2007	$247,970	2,287	108	-4.0%	$47,209	147	321	-3.2%
Total Percent Change 1987- 2007	**98.9%**	**72.7%**	**15.2%**		**44.0%**	**-0.6%**	**44.9%**	
Total Percent Change 2000 - 2007	**8.3%**	**-1.7%**	**10.1%**		**27.0%**	**-3.8%**	**32.1%**	
Average Annual Growth Rate	**3.5%**	**2.8%**	**0.7%**		**1.8%**	**0.0%**	**1.9%**	

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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2F.3.5 Capital Expenditures

The profiled Food and Kindred Products Manufacturing industry is capital intensive, and has invested substantially in capital to implement automation, introduce process controls, and reduce inventories in order to ultimately improve yield and reduce labor costs. 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 2007, total capital expenditures for the Food Manufacturing and Beverage Manufacturing segments amounted to $16.7 billion. Approximately 82 percent of that spending (see *Table 2F-7*) occurred in the Food Manufacturing segment.

Between 1987 and 2007, capital expenditures in the Food Manufacturing segment increased by nearly 78 percent at an average annual rate of approximately 10 percent, peaking at $16.2 billion in 1999. The Beverage Manufacturing segment has also seen substantial growth in capital expenditures during this time period. Between 1987 and 2007, expenditures in this segment increased by nearly 51 percent at an average annual rate of 2 percent, peaking at $3.6 billion in 2002. During the last decade, however, capital expenditures in the Food and Beverage Manufacturing industry segments declined by approximately 10 and 6 percent, respectively, and appear to have leveled off at relatively constant values since the middle of the 2000s decade.

Table 2F-7: Capital Expenditures for Food and Beverage Manufacturing Segments (millions, $2009)[a]

Year	Food Manufacturing		Beverage Manufacturing	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	$7,653	n/a	$2,034	n/a
1988	$9,726	27.1%	$2,107	3.6%
1989	$10,419	7.1%	$2,035	-3.4%
1990	$11,079	6.3%	$1,790	-12.0%
1991	$10,967	-1.0%	$2,018	12.8%
1992	$11,628	6.0%	$2,077	2.9%
1993	$10,937	-5.9%	$1,831	-11.8%
1994	$11,278	3.1%	$2,142	16.9%
1995	$13,004	15.3%	$2,462	15.0%
1996	$12,301	-5.4%	$2,400	-2.5%
1997	$14,020	14.0%	$3,092	28.9%
1998	$14,778	5.4%	$2,852	-7.8%
1999	$16,210	9.7%	$2,890	1.3%
2000	$15,007	-7.4%	$3,254	12.6%
2001	$14,008	-6.7%	$3,042	-6.5%
2002	$13,136	-6.2%	$3,635	19.5%
2003	$12,730	-3.1%	$2,766	-23.9%
2004	$12,663	-0.5%	$2,742	-0.9%
2005	$13,247	4.6%	$3,285	19.8%
2006	$13,454	1.6%	$3,256	-0.9%
2007	$13,585	1.0%	$3,070	-5.7%
Total Percent Change 1987- 2007	**77.5%**		**50.9%**	
Total Percent Change 2000 - 2007	**-9.5%**		**-5.6%**	
Average Annual Growth Rate	**2.9%**		**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, 2002-2004, and 2005-2006 Annual Survey of Manufacturers; U.S. DOC, 1987, 1992, 1997, 2002, and 2007 Economic Census.

2F.3.6 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.

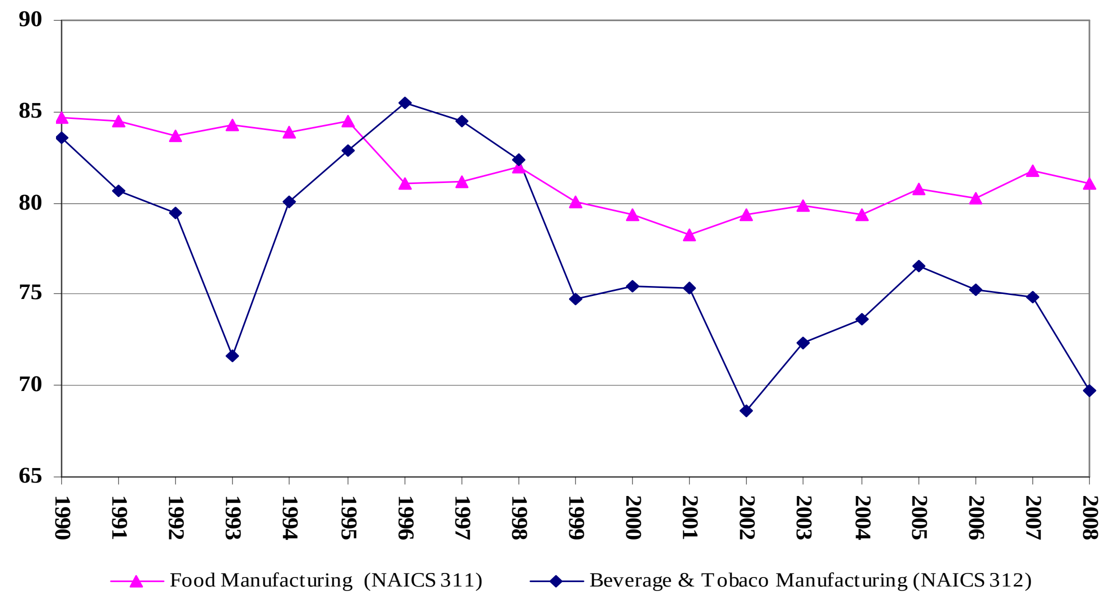
As shown in *Figure 2F-4*, between 1990 and 2008, capacity utilization in the Food Manufacturing and Beverage and Tobacco Manufacturing[23] industry segments generally trended downward. The Food Manufacturing segment, however, did not experience the volatility that the Beverage and Tobacco Manufacturing segment experienced over the same period. Food Manufacturing capacity utilization rates have generally remained within 80 and 85 percent range, while the Beverage and Tobacco Manufacturing segment experienced a high of over 85 percent in 1996, followed by a significant decline to below 70 percent by 2002. Further, the Beverage and Tobacco Manufacturing segment was significantly affected by economic downturns in the early 1990s and early and late 2000s, when its capacity utilization significantly dropped to 72, 69, and 70 percent, respectively. Between 1990 and 2008, capacity utilization increased in both segments, although the Beverage and Tobacco Manufacturing

23 The Census Bureau provides capacity utilization data are available only for the 3-digit NAICS sector NAICS 312: Beverage and Tobacco Manufacturing sector. The Census Bureau does not provide capacity utilization data for the 4-digit NAICS sector NAICS 3121: Beverage Manufacturing.

segment experienced a more substation drop: while capacity utilization in the Food Manufacturing segment declined by a little over 4 percent, capacity utilization in the Beverage and Tobacco Manufacturing declined by nearly 17 percent.

Again, significantly less fluctuation in capital utilization in the profiled Food Manufacturing segment during the analysis period, suggests that this segment is characterized by a lower degree of susceptibility to economic changes compared to the profiled Beverage Manufacturing segment. This pattern is likely to continue going forward. That overall capacity utilization remained at a moderate level throughout the analysis period for both profiled segments – low 70s to mid 80s percent – implies that the profiled Food and Beverage Manufacturing segments do not face requirements for large outlays for capital expansion in the near term.

Figure 2F-4: 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: U.S. DOC, Survey of Plant Capacity 1989-2009, U.S. Census Bureau.

2F.4 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. Because food is a necessary purchase, demand is less affected by the ups and downs of the economy than for other industries.

The Food Manufacturing segment has consolidated over the last two decades as companies moved to diversify their product offerings and gain market share. This segment has also looked abroad to tap into the emerging markets of foreign countries. According to the Food Institute, 99 mergers and acquisitions occurred among food processing companies in 2006, up from 94 in 2005, but down from 168 in 2000 (U.S. DOC, 2008). 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. In 2008 and 2009, mergers and acquisitions were concentrated in the restaurant industries with limited M&A activity among food processing companies (The Food Institute Report, 2009).

The Beverage Manufacturing segment recorded acquisitions and mergers during the last decade, although not nearly as many as the Food Manufacturing segment. Product differentiation is a key strategy for larger firms to increase brand awareness and market share (Yahoo, 2005a). As sales in the United States slowed, firms in the non-alcoholic beverage industry saw their largest gains from non-U.S. markets. In fact, in 2008 alone, PepsiCo had three international deals (Value Line, 2004).

In the alcoholic beverage sub-segment, 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 began to look for acquisitions in China, which is seen as an untapped market. Constellation Brands purchased the Robert Mondavi Corporation, a leader in wine making, and began to work 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. In recent years, Sazerac Company has purchased Constellation Brands' value spirits business, and Sabmiller and Molson Coors Brewing Company have merged (Yahoo, 2005a).

2F.4.1 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 2F-8* reports the size distribution of firms and facilities in the Food Manufacturing and Beverage Manufacturing segments for 2006. As shown in the table, small establishments dominate both segments:

- 20,625 of 21,170 (97 percent) firms in the *Food Manufacturing* segment had fewer than 500 employees. These small firms owned 21,675 facilities, or 85 percent of all facilities in the segment.
- 2,921 of 2,998 (97 percent) firms in the *Beverage Manufacturing* segment had fewer than 500 employees. These small firms owned 2,995 facilities, or 84 percent 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.

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 2006, approximately 97 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, 2006). 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 53 percent of shipments, while the 50 largest companies in Beverage Manufacturing producing an even greater share of shipments, at 82 percent of the total (see *Table 2F-9*, following page).

Table 2F-8: Number of Firms and Facilities by Size Category for Food and Beverage Manufacturing Segments, 2006

Employment Size Category	Food Manufacturing[a]		Beverage Manufacturing[b]	
	No. of Firms	No. of Facilities	No. of Firms	No. of Facilities
0-19	15,214	15,278	2,330	2,333
20-99	4,091	4,422	463	486
100-499	1,320	1,975	128	176
500+	545	3,707	77	561
Total	**21,170**	**25,382**	**2,998**	**3,556**

a. NAICS 311
b. NAICS 3121
Source: *U.S.DOC, Statistics of U.S. Businesses, 2006.*

2F.4.2 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.[24] 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 1,000 are considered unconcentrated, markets in which the HHI is between 1,000 and 1,800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 are considered to be concentrated.

As shown in *Table 2F-9*, based on the most recent data, the Food Manufacturing segment has an HHI of 119, and the Beverage Manufacturing segment has an HHI of 512. At these HHI levels, the two industry segments, especially the Food Manufacturing segment, appear 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 profiled segment operates in unconcentrated markets. The Beverage Manufacturing segment has the higher concentration of the two segments, with a CR4 of 40 percent. This is slightly lower than the 50 percent threshold, which would indicate some market concentration. The CR4 for the Food Manufacturing segment is considerably lower at only 17 percent. In this segment, the top 50 companies control roughly half of the market, indicating a relatively unconcentrated market segment. As noted above, however, mergers and acquisitions are occurring in both segments, which will likely lead to increased concentration in the future. Also, certain sub-segments within each segment can be highly concentrated. For

[24] 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.

example, within the soft drink market, Coca-Cola claims around 50 percent of the global market, followed by Pepsi with roughly 21 percent and Cadbury-Schweppes with 7 percent (Yahoo, 2005a).

Table 2F-9: Selected Ratios for Food Manufacturing and Beverage Manufacturing Segments

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	21958	14%	22%	35%	51%	91
	2002	23334	17%	25%	40%	53%	119
3121	1997	2169	41%	52%	66%	79%	532
	2002	2445	40%	53%	69%	82%	512

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

2F.4.3 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 Proposed Existing Facilities Rule. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) for 2007 is 27 percent. For characterizing the ability of industries to withstand compliance cost burdens, EPA judges that industries with import ratios close to or above 27 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 Proposed Existing Facilities Rule 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 2007 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 2F-10 presents trade statistics for the profiled Food and Kindred Products industry.[25] Imports and exports play a small role in this industry, with 2007 import penetration and export dependence ratios of 7.7 and 6.2 percent, respectively. Both measures of foreign competition are well below the 2007 U.S. manufacturing averages. 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

[25] Due to data limitations, it is not possible to accurately separate the Food and Beverage Manufacturing segments.

Manufacturing and Beverage Manufacturing segments is 119 and 512, respectively suggesting firms in these segments have low market power, limiting their ability to pass through any increase in production costs.

Table 2F-10: Trade Statistics for Profiled Food and Kindred Products Industry[a]

Year	Value of Imports (millions, $2009)	Value of Exports (millions, $2009)	Value of Shipments (millions, $2009)	Implied Domestic Consumption[b]	Import Penetration[c]	Export Dependence[d]
1990	$25,713	$24,368	$506,181	$507,527	5.1%	4.8%
1991	$24,105	$25,554	$491,448	$489,999	4.9%	5.2%
1992	$25,033	$28,198	$511,642	$508,476	4.9%	5.5%
1993	$24,198	$28,776	$517,776	$513,199	4.7%	5.6%
1994	$25,560	$31,725	$522,957	$516,792	4.9%	6.1%
1995	$26,405	$35,021	$535,438	$526,822	5.0%	6.5%
1996	$29,465	$35,717	$541,974	$535,723	5.5%	6.6%
1997	$30,784	$35,609	$626,558	$621,734	5.0%	5.7%
1998	$31,904	$33,700	$630,115	$628,319	5.1%	5.3%
1999	$34,017	$31,786	$616,891	$619,123	5.5%	5.2%
2000	$35,214	$32,833	$617,176	$619,557	5.7%	5.3%
2001	$35,795	$34,009	$625,583	$627,370	5.7%	5.4%
2002	$38,271	$31,919	$621,718	$628,071	6.1%	5.1%
2003	$42,144	$33,359	$651,620	$660,405	6.4%	5.1%
2004	$46,575	$31,735	$666,127	$680,967	6.8%	4.8%
2005	$48,909	$33,974	$675,964	$690,899	7.1%	5.0%
2006	$51,578	$36,921	$658,450	$673,108	7.7%	5.6%
2007	$54,656	$43,212	$697,164	$708,608	7.7%	6.2%
Total Percent Change 1990 - 2007	**112.6%**	**77.3%**	**37.7%**	**39.6%**		
Total Percent Change 2000 - 2007	**55.2%**	**31.6%**	**13.0%**	**14.4%**		
Average Annual Growth Rate	**5%**	**3%**	**2%**	**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.*

b. Calculated by EPA as shipments + imports - exports.

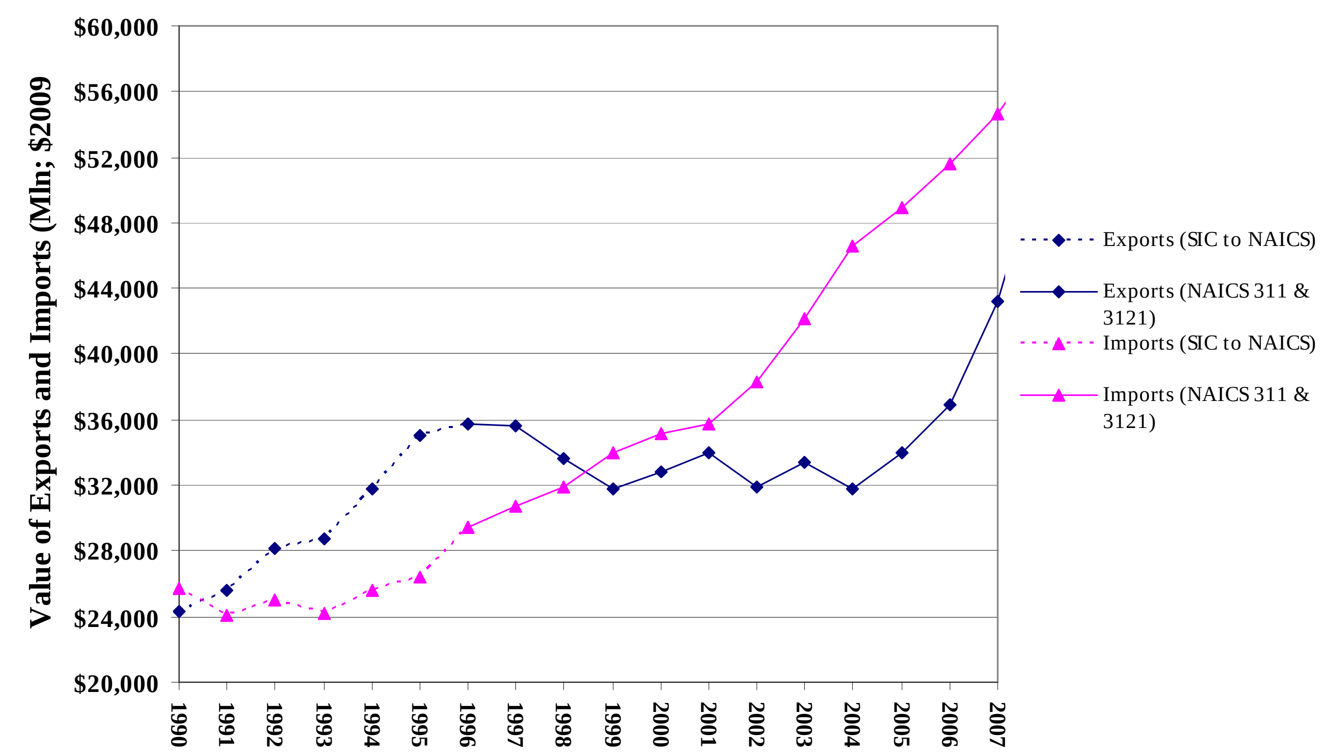
c. Calculated by EPA as imports divided by implied domestic consumption.

d. Calculated by EPA as exports divided by shipments.

Source: U.S. International Trade Commission, 1989-2007.

As shown in *Figure 2F-5*, between 1990 and 2007, imports of Food and Kindred Products steadily increased at an average annual rate of over 5 percent leading to an overall increase of approximately 113 percent (approximately 55 percent during the last decade). Exports of Food and Kindred Products also increased during this time period at an average annual rate of approximately 3 percent leading to an overall increase of approximately 77 percent (approximately 32 percent during the last decade). While imports experienced a relatively steady increase, exports fluctuated significantly during the analysis period: Exports increased between 1990 and 1996, declined for the next three years, remained relatively steady through 2004, when they increased through 2007. During most of the decade of the 1990s, the Food and Kindred Products industry recorded a trade surplus, even though the value of imports was steadily growing. However, in 1999, this trend reversed itself and during the last decade, the Food and Kindred Products industry was characterized by trade deficit. Starting in 2005, however, exports have been growing at a higher rate than imports, thereby shrinking the deficit.

Figure 2F-5: Value of Imports and Exports for Profiled Food and Kindred Products Industry (millions, $2009)[a]



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. International Trade Commission, 1989-2007.

2F.5 Financial Condition and Performance

As discussed above, the profiled Food and Kindred Products industry overall is not as susceptible to economic fluctuations and, consequently, its financial performance 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 strongly affected by swings in the U.S. economy as the other 5 Primary Manufacturing industries. As a result, businesses in these segments have been able to maintain a moderate level of positive financial performance over the analysis time period, including the U.S. recessions of early 1990 and early and late 2000s, which more substantially affected other profiled Primary Manufacturing industries such as Pulp and Paper Manufacturing and Steel Manufacturing.

This profile uses two measures of financial condition and performance: ***Net Profit Margin*** and ***Return on Total Capital***.

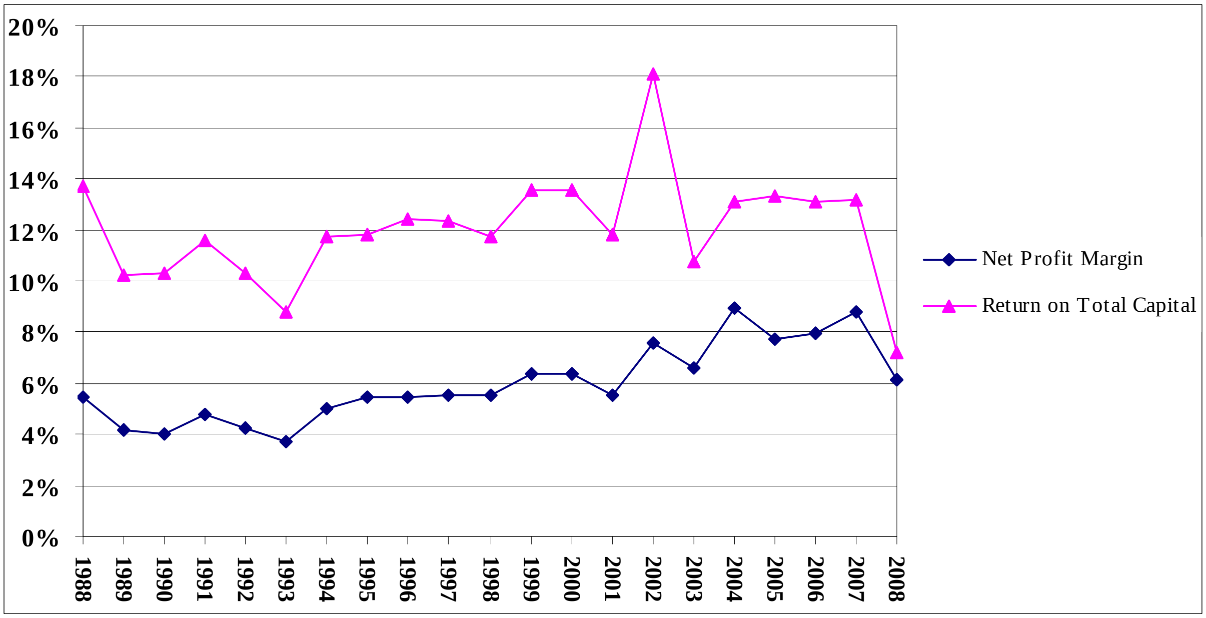
Net profit margin is calculated as after-tax income before nonrecurring gains and losses as a percentage of sales or revenue, and measures profitability, as reflected in the conventional accounting concept of net income. Over time, the firms in an industry, and the industry collectively, must generate 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 pre-tax income divided by the sum of current portion of long-term debt due in 1 year or less, long-term debt due in more that one year, all other noncurrent liabilities and total stockholders' equity (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 2F-6 shows a trend in net profit margins and return on total capital for Food and Kindred Products industry firms between 1988 and 2008. Despite some fluctuations in response to recessions in 1993, 2001, and 2008, when both profit margins and return on total capital fell slightly but recovered shortly after, this industry reported positive profit margins and return on total capital over the entire analysis period.

Industry analysts expect retail food prices to be higher in 2010 and U.S. packaged food companies' production volumes to remain relatively flat. With improved consumer demand and benefits from restructuring and other cost-saving activities, industry profit margins are expected to widen in 2010. That demand for food and beverages remains high during otherwise weak economic conditions, indicates that the profiled industry segments should be able to continue robust financial performance over the foreseeable future, thus suggesting strong ability to withstand the costs associated with the Proposed Existing Facilities Rule. In the long term, the Food and Beverage Manufacturing industry will continue to focus on and adjust to consumer lifestyles and tastes, including both opportunities in developing international markets and the particular needs of an aging U.S. population. Future growth opportunities might include introduction and distribution of products that appeal to consumers' interest in healthier eating and environmental sustainability (S&P, 2010d).

Figure 2F-6: Net Profit Margin and Return on Total Capital for Food and Beverage Manufacturers



Source: Quarterly Financial Report, 1988-2008; U.S. Census Bureau.

2F.6 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 sixth 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 coverage criteria for the proposed regulation specific regulatory analysis option in terms of design intake flow (i.e., 2 MGD).

EPA initially identified the set of facilities that were estimated to be *potentially* subject to the 316(b) Existing Facilities Regulation based on a minimum applicability threshold of 2 MGD; this section focuses on these facilities for the petroleum segment).[26]

2F.6.1 Waterbody and Cooling System Type

Table 2F-11, reports the distribution of the Food and Kindred Products industry facilities by type of water body and cooling water intake system.

Table 2F-11: Number of Food and Kindred Products Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Waterbody Type and Cooling Water Intake System

Waterbody Type	Recirculating		Combination		Once-Through		Other		Total
	No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total	
Estuary/Tidal River	0	0%	0	0%	7	50%	0	0%	6
Freshwater River/ Stream	14	100%	4	56%	7	50%	3	100%	28
Great Lake	0	0%	3	44%	0	0%	0	0%	3
Total[a]	**14**	**35%**	**8**	**20%**	**14**	**35%**	**3**	**9%**	**38**

Based on technical weights (See Appendix 3.A).

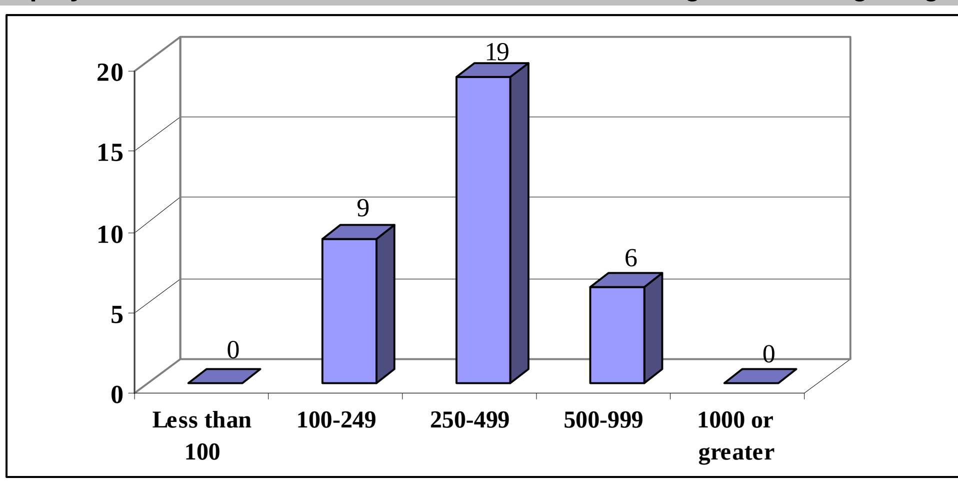
a. Individual numbers may not add up to total due to independent rounding.

Source: Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

2F.6.2 Facility Size

Figure 2F-7, shows the employment size category for the Food and Kindred Products industry facilities estimated subject to regulation under the regulatory analysis options.

Figure 2F-7: Number of Facilities Estimated Subject to the Proposed 316(b) Existing Facilities Regulation by Employment Size for the Combined Food Manufacturing and Beverage Segments



Source: U.S. EPA, 2000; U.S. EPA analysis, 2010.

[26] 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).

2F.6.3 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. EPA estimates that three small entity-owned facilities and 34 large entity-owned facilities in this industry segment will be subject to the proposed regulation.

2G Profile of Facilities in Other Industries

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 whose facilities are most likely, after electric power generators, to be within the scope of the 316(b) Existing Facilities 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 13 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 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 Electric Generators 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 13 sample facilities and is not presented as national estimates.

All of the 13 Other Industries facilities withdraw at least 2 million gallons of water a day and meet other in-scope criteria, and thus would be subject to regulation under the regulatory options considered for existing facilities. These facilities fall in a wide range of businesses, as defined by three-digit NAICS industry group. *Table 2G-1*, 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 Existing Facilities Rule options.

Table 2G-1: Facilities in Other Industries by 2-digit SIC code Estimated Subject to Regulation Under the Regulatory Analysis Options

No. of Facilities	NAICS Code	SIC Description	Important Operations
1	111	Crop production	Establishments, such as farms, orchards, groves, greenhouses, and nurseries, primarily engaged in growing crops, plants, vines, or trees and their seeds. Including biological and physiological characteristics and economic requirements, the length of growing season, degree of crop rotation, extent of input specialization, labor requirements, and capital demands production activities.
4	212	Mining (except oil and gas)	Mining, mine site development, and beneficiating (i.e., preparing) metallic minerals and nonmetallic minerals, including coal. Also includes ore extraction, quarrying, and beneficiating (e.g., crushing, screening, washing, sizing, concentrating, and flotation), customarily done at the mine site.
1	313	Textile mills	Transforming a basic fiber (natural or synthetic) into a product, such as yarn or fabric, that is further manufactured into usable items, such as apparel, sheets towels, and textile bags for individual or industrial consumption.
2	321	Wood product mfg.	Wood products, such as lumber, plywood, veneers, wood containers, wood flooring, wood trusses, manufactured homes (i.e., mobile home), and prefabricated wood buildings. Includes sawing, planing, shaping, laminating, and assembling of wood products starting from logs that are cut into bolts, or lumber that then may be further cut, or shaped by lathes or other shaping tools.
1	331	Primary metal mfg	Making (i.e., the primary production) nonferrous metals by smelting ore and/or the primary refining of nonferrous metals by electrolytic methods or other processes (except copper and aluminum).
1	336	Transportation equipment mfg.	Equipment for transporting people and goods for each mode of transport - road, rail, air and water. Land use motor vehicle equipment not designed for highway operation (e.g., agricultural equipment, construction equipment, and materials handling equipment).
1	339	Miscellaneous mfg.	A wide range of products that cannot readily be classified in specific NAICS subsectors in manufacturing. Processes used by these establishments vary significantly, both among and within industries.

Source: Executive Office of the President, 1987; U.S. EPA 2000; U.S. EPA analysis, 2010.

2G.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 regulatory coverage in terms of design intake flow (i.e., 2 MGD).

The regulatory options also cover substantial additions or modifications to operations undertaken at such facilities.

2G.1.1 Waterbody and Cooling System Types

Table 2G-2 summarizes information on the Other Industries facilities by type of water body and cooling system for each option.

Table 2G-2: Other Industries Facilities Estimated Subject to the 316(b) Existing Facilities Regulation by Water Body and Cooling Water Intake System Type

Waterbody Type	Recirculating		Once-Through		Other		Total[a]
	Number	% of Total	Number	% of Total	Number	% of Total	
Estuary/ Tidal River	1	33%	1	11%	0	0%	2
Freshwater Stream/River	2	67%	8	45%	1	100%	11
Great Lake	0	0%	2	22%	0	0%	2
Lake/Reservoir	0	0%	1	11%	0	0%	1
Ocean	0	0%	1	11%	0	0%	1
Total[a]	**3**	**18%**	**13**	**77%**	**1**	**6%**	**17**

Based on technical weights (See Appendix 3.A).

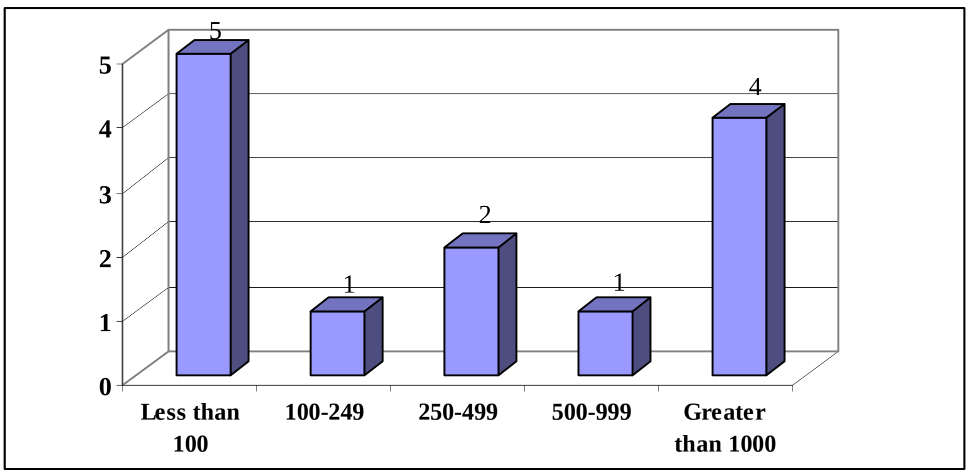
a. Individual numbers may not sum to total due to independent rounding.

Source: U.S. EPA, 2000; U.S. EPA Analysis, 2010.

2G.1.2 Facility Size

Figure 2G-1 shows the employment size category for the Other Industries facilities that EPA estimates will be subject to the regulation under each analysis option.

Figure 2G-1: Other Industries Facilities Estimated Subject to the Existing Facilities Regulation by Employment Size



Source: U.S. EPA, 2000; U.S. EPA Analysis, 2010.

2G.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. EPA estimates that four small entity-owned facilities and six large entity-owned facilities in the Other Industries facility group will be subject to the 316(b) Existing Facilities regulation. Insufficient survey data are available to classify the entity size of an additional three in-scope Other Industries facilities.

2H Profile of the Electric Power Industry

2H.1 Introduction

This profile compiles and analyzes economic and operational data for the electric power generating industry. It provides information on the structure and overall performance of the industry and describes important trends that may influence the nature and magnitude of the economic impacts from the Proposed CWA Section 316(b) Existing Facilities Regulation (Proposed 316(b) Regulation for Existing Facilities or Existing Facilities Regulation).

The electric power industry is one of the most extensively studied industries. The Energy Information Administration (EIA), among others, publishes a multitude of reports, documents, and studies on an annual basis. This profile is not intended to duplicate those efforts. Rather, this profile compiles, summarizes, and presents those industry data that are important in the context of the Existing Facilities Regulation.

The remainder of this profile is organized as follows:

- *Section 2H.2* provides a brief overview of the industry, including descriptions of major industry segments, types of generating facilities, and the entities that own generating facilities.
- *Section 2H.3* provides data on industry production, capacity, and geographic distribution.
- *Section 2H.4* focuses on the Section 316(b) Existing Facilities Regulation facilities; this section provides information on their physical, geographic, and ownership characteristics.
- *Section 2H.5* provides a brief discussion of factors affecting the future of the electric power industry, including the status of electric utility regulatory restructuring and ongoing changes in air quality regulations.
- *Section 2H.6* summarizes forecasts of market conditions through the year 2030 from the Annual Energy Outlook 2009.
- *Section 2H.7* provides a glossary of key terms used throughout the chapter.

2H.2 Industry Overview

This section provides a brief overview of the industry, including descriptions of major industry sectors, types of generating facilities, and the entities that own generating facilities.

2H.2.1 Industry Sectors

The electricity business is made up of three major functional service components or sectors: generation, transmission, and distribution. These terms are defined as follows (Beamon, 1998; Joskow, 1997; U.S. DOE, 2000):

- The generation sector includes the facilities that produce, or “generate,” electricity. Electric power is usually produced by a mechanically driven rotary generator. Generator drivers, also called prime movers, include gas or diesel internal combustion machines, as well as streams of moving fluid such as wind, water from a hydroelectric dam, or steam from a boiler. Most boilers are heated by direct combustion of fossil or biomass-derived fuels or waste heat from the exhaust of a gas turbine or diesel engine, but heat from nuclear, solar, and geothermal sources is also used. Electric power may also be produced without a generator by using electrochemical, thermoelectric, or photovoltaic (solar) technologies.

- The transmission sector is the large, high-voltage power lines that deliver electricity from facilities to local areas. Electricity transmission involves the "transportation" of electricity from facilities to distribution centers using a complex system. Transmission requires: interconnecting and integrating a number of generating facilities into a stable, synchronized, alternating current (AC) network; scheduling and dispatching all connected facilities to balance the demand and supply of electricity in real time; and managing the system for equipment failures, network constraints, and interaction with other transmission networks.

- The distribution sector can be thought of as the local delivery system – the relatively low-voltage power lines that bring power to homes and businesses. Electricity distribution relies on a system of wires and transformers along streets and underground to provide electricity to residential, commercial, and industrial consumers. The distribution system involves both the provision of the hardware (e.g., lines, poles, transformers) and a set of retailing functions, such as metering, billing, and various demand management services.

Of the three industry sectors, only electricity generation uses cooling water and is subject to section 316(b) regulations. The remainder of this profile will focus on the generation sector of the industry.

2H.2.2 Prime Movers

Electric power facilities use a variety of prime movers to generate electricity. The type of prime mover used at a given facility is determined based on the type of load the facility is designed to serve, the availability of fuels, and energy requirements. Most prime movers use fossil fuels (coal, oil, and natural gas) as an energy source and employ some type of turbine to produce electricity. According to the Department of Energy, the most common prime movers are (U.S. DOE, 2000):

- <u>Steam Turbine</u>: "Most of the electricity in the United States is produced with steam turbines. In a fossil-fueled steam turbine, the fuel is burned in a boiler to produce steam. The resulting steam then turns the turbine blades that turn the shaft of the generator to produce electricity. In a nuclear-powered steam turbine, the boiler is replaced by a reactor containing a core of nuclear fuel (primarily enriched uranium). Heat produced in the reactor by fission of the uranium is used to make steam. The steam is then passed through the turbine generator to produce electricity, as in the fossil-fueled steam turbine. Steam-turbine generating units are used primarily to serve the base load of electric utilities. Fossil-fueled steam-turbine generating units range in size (nameplate capacity) from 1 megawatt to more than 1,000 megawatts. The size of nuclear-powered steam-turbine generating units in operation today ranges from 75 megawatts to more than 1,400 megawatts."

- <u>Gas Turbine</u>: "In a gas turbine (combustion-turbine) unit, hot gases produced from the combustion of natural gas and distillate oil in a high-pressure combustion chamber are passed directly through the turbine, which spins the generator to produce electricity. Gas turbines are commonly used to serve the peak loads of the electric utility. Gas-turbine units can be installed at a variety of site locations, because their size is generally less than 100 megawatts. Gas-turbine units also have a quick startup time, compared with steam-turbine units. As a result, gas-turbine units are suitable for peak load, emergency, and reserve-power requirements. The gas turbine, as is typical with peaking units, has a lower efficiency than the steam turbine used for base load power."

- <u>Combined Cycle Turbine</u>: "The efficiency of the gas turbine is increased when coupled with a steam turbine in a combined cycle operation. In this operation, hot gases (which have already been used to spin one turbine generator) are moved to a waste-heat recovery steam boiler where the water is heated to produce steam that, in turn, produces electricity by running a second steam-turbine generator. In this way, two generators produce electricity from one initial fuel input. All or part of the heat required to produce steam may come from the exhaust of the gas turbine. Thus, the supplementary steam-turbine generator may be operated with the waste heat. Combined cycle generating units generally serve intermediate loads."

- Internal Combustion Engine: "These prime movers have one or more cylinders in which the combustion of fuel takes place. The engine, which is connected to the shaft of the generator, provides the mechanical energy to drive the generator to produce electricity. Internal-combustion (or diesel) generators can be easily transported, can be installed upon short notice, and can begin producing electricity nearly at the moment they start. Thus, like gas turbines, they are usually operated during periods of high demand for electricity. They are generally about 5 megawatts in size."
- Hydroelectric Generating Units: "Hydroelectric power is the result of a process in which flowing water is used to spin a turbine connected to a generator. The two basic types of hydroelectric systems are those based on falling water and natural river current. In the first system, water accumulates in reservoirs created by the use of dams. This water then falls through conduits (penstocks) and applies pressure against the turbine blades to drive the generator to produce electricity. In the second system, called a run-of-the-river system, the force of the river current (rather than falling water) applies pressure to the turbine blades to produce electricity. Since run-of-the-river systems do not usually have reservoirs and cannot store substantial quantities of water, power production from this type of system depends on seasonal changes and stream flow. These conventional hydroelectric generating units range in size from less than 1 megawatt to 700 megawatts. Because of their ability to start quickly and make rapid changes in power output, hydroelectric generating units are suitable for serving peak loads and providing immediately available back-up reserve power (spinning reserve), as well as serving base load requirements. Another kind of hydroelectric power generation is the pumped storage hydroelectric system. Pumped storage hydroelectric plants use the same principle for generation of power as the conventional hydroelectric operations based on falling water and river current. However, in a pumped storage operation, low-cost off-peak energy is used to pump water to an upper reservoir where it is stored as potential energy. The water is then released to flow back down through the turbine generator to produce electricity during periods of high demand for electricity."

In addition to those listed above there are a number of other less common prime movers:

- Other Prime Movers: "Other methods of electric power generation, which presently contribute only small amounts to total power production, have potential for expansion. These include geothermal, solar, wind, and biomass (wood, municipal solid waste, agricultural waste, etc.). Geothermal power comes from heat energy buried beneath the surface of the earth. Although most of this heat is at depths beyond current drilling methods, in some areas of the country, magma--the molten matter under the earth's crust from which igneous rock is formed by cooling--flows close enough to the surface of the earth to produce steam. That steam can then be harnessed for use in conventional steam-turbine plants. Solar power is derived from the energy (both light and heat) of the sun. Photovoltaic conversion generates electric power directly from the light of the sun; whereas, solar-thermal electric generators use the heat from the sun to produce steam to drive turbines. Wind power is derived from the conversion of the energy contained in wind into electricity. A wind turbine is similar to a typical wind mill. However, because of the intermittent nature of sunlight and wind, high capacity utilization factors cannot be achieved for these plants. Several electric utilities have incorporated wood and waste (for example, municipal waste, corn cobs, and oats) as energy sources for producing electricity at their power plants. These sources replace fossil fuels in the boiler. The combustion of wood and waste creates steam that is typically used in conventional steam-electric plants."

The section 316(b) regulation is only relevant for electric generators that use substantial amounts of cooling water, and not all prime movers require substantial amounts of cooling water. Only prime movers with a steam-electric generating cycle use large enough amounts of cooling water to fall under the scope of the Proposed Existing Facilities Rule. This profile, therefore, differentiates between steam-based generating capacity and other prime movers. EPA identified steam-electric prime movers using data collected by the EIA (U.S. DOE, 2007b).[27] For this profile, the following prime movers, including both steam turbines and combined cycle technologies, are classified as steam-electric:

- Steam Turbine, including coal, gas, oil, waste, nuclear, geothermal, and solar steam (not including combined cycle)
- Combined Cycle Steam Part
- Combined Cycle Combustion Turbine Part
- Combined Cycle Single Shaft (combustion turbine and steam turbine share a single generator)

Table 2H-1 provides data on the number of existing utility and nonutility power facilities by prime mover. This table includes all facilities that have at least one non-retired unit and that submitted Form EIA-860 (Annual Electric Generator Report) in 2007. For the purpose of this analysis, facilities were classified as "steam turbine" or "combined cycle" if they have at least one generating unit of that type; facilities with both steam turbine- and combined cycle-based capacity are classified as steam turbine capacity. Facilities that have no steam-electric units were classified under the prime mover that accounts for the largest share of the facility's total generating capacity. EPA identified a facility as a utility or a nonutility based on their regulatory status. An electric power generator operating under the traditional rate regulation framework is classified as a utility; a generator operating as a producer and seller of electricity outside of the traditional rate regulation framework is classified as a nonutility.

Table 2H-1: Number of Existing Utility and Nonutility Facilities by Prime Mover, 2007

Prime Mover	Number of Facilities		
	Utility[a]	Nonutility[a]	Total
Steam Electric Prime Movers			
Steam Turbine	513	799	1,312
Combined Cycle	113	338	451
Other Prime Movers			
Gas Turbine	414	454	868
Internal Combustion	649	379	1,028
Hydroelectric	882	518	1,400
Other	38	296	334
Total	**2,609**	**2,784**	**5,393**

a. See definition of utility and nonutility in *Section 2H.2.3*.
Source: U.S. DOE, 2007b.

2H.2.3 Ownership

The U.S. electric power industry consists of two broad categories of firms that own and operate electric generating facilities: utilities and nonutilities. Generally, they can be defined as follows (U.S. DOE, 2009c):

- Generating Utility: A regulated entity providing electric power in a rate regulation framework in which a government regulatory authority sets prices at which the regulated entity sells generated electricity or other electricity-related services. Electric utilities have traditionally operated in a vertically integrated framework including power generation, transmission and distribution. However, generating utilities, which are the focus of this profile within the utility segment, in some instances may provide only power generation and transmission services and not provide local distribution services. Vertically integrated utilities – i.e., those that include power generation, transmission and distribution – deliver electric energy to customers in a designated franchise service territory. Other electric utility segments include

[27] U.S. DOE collects data (EIA Form 860, Annual Electric Generator Report 2007) used to create an annual inventory of all units, plants, and utilities. The data collected includes: type of prime mover; nameplate rating; energy source; year of initial commercial operation; operating status; cooling water source, and NERC region.

"transmission utilities," which refers to the regulated owners/operators of transmission systems, and "distribution utilities," which refers to the regulated owners/operators of distribution systems serving retail customers.

- Nonutility: Entities that generate power for their own use and/or for sale to utilities and others in a non-regulated pricing environment. Nonutility power producers include independent power producers and cogenerators (combined heat and power producers). Nonutilities do not have a designated franchised service area and do not transmit or distribute electricity.

For this profile, the key distinction between utilities and nonutilities is that utilities operate in a rate regulation framework in which a regulatory body sets prices at which the regulated entity sells generated electricity or other electricity-related services, while nonutilities operate in a non-regulated pricing environment.

Generating utilities can be further divided into three major ownership categories: investor-owned utilities, publicly-owned utilities, and rural electric cooperatives. EPA identified a facility's ownership using data collected from EIA forms 860 and 861 (U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2006). Each category is discussed below (adapted from U.S. DOE, 2000):

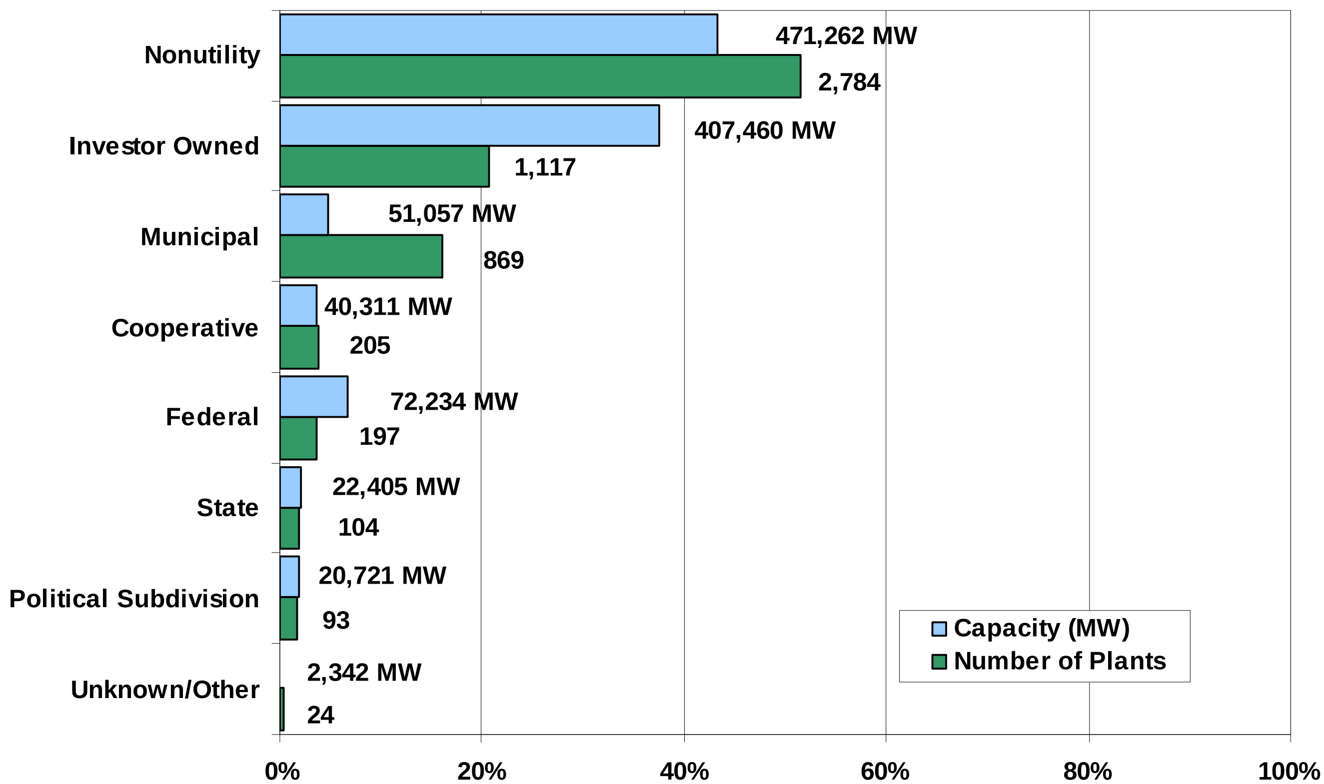
- Investor-owned utilities: Investor-owned utilities (IOUs) are for-profit businesses that can take two basic organizational forms: the individual corporation and the holding company. An individual corporation is a single utility company with its own investors; a holding company is a business entity that owns one or more utility companies and may have other diversified holdings as well. Like all businesses, the objective of an IOU is to produce a return for its investors. IOUs are entities with designated franchise areas. They are required to charge reasonable and comparable prices to similar classifications of consumers and to give consumers access to services under similar conditions. Most IOUs engage in generation, transmission, and distribution. In 2007, IOUs operated 1,117 facilities, which accounted for approximately 37 percent of all U.S. electric generation capacity (U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2006).

- Publicly-owned utilities: Publicly-owned electric utilities can be State authorities, municipalities, and political subdivisions (e.g., public power districts, irrigation projects, and other State agencies established to serve their local municipalities or nearby communities). This category also includes Federally-owned facilities. Excess funds or "profits" from the operation of these utilities are put toward reducing rates, increasing facility efficiency and capacity, and funding community programs and local government budgets. Smaller municipal utilities, which make up the majority municipal utilities, are nongenerators engaging solely in the purchase of wholesale electricity for resale and distribution. Larger municipal utilities, as well as State and Federal utilities, usually generate, transmit, and distribute electricity. In general, publicly-owned utilities have access to tax-free financing and do not pay certain taxes or dividends, giving them some cost advantages over IOUs. In 2007, the Federal government operated 197 facilities (accounting for 7 percent of total U.S. electric generation capacity), States owned 104 facilities (2 percent of U.S. capacity), and municipalities owned 869 facilities (5 percent of U.S. capacity) (U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2006).

- Rural electric cooperatives: Cooperative electric utilities ("coops") are member-owned entities created to provide electricity to those members. These utilities, established under the Rural Electrification Act of 1936, provide electricity to small rural and farming communities (usually fewer than 1,500 consumers). The National Rural Utilities Cooperative Finance Corporation, the Federal Financing Bank, and the Bank of Cooperatives are important sources of financing for these utilities. In 2007, rural electric cooperatives operated 205 generating facilities and accounted for approximately 4 percent of all U.S. electric generation capacity (U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2006).

Figure 2H-1 presents the number of generating facilities and their capacity in 2007, by type of ownership. The horizontal axis also presents the percentage of the U.S. total that each type represents. This figure is based on data for all electric power generating facilities that have at least one non-retired unit and that submitted Form EIA-860 for 2007. To determine the ownership type for each of these facilities, EPA relied on the information reported in the 2006 EIA-860 and the 2007 EIA-861 databases and additional research.[28] The chart shows that nonutilities account for the largest percentage of facilities (2,784, or 52 percent), but represent only 43 percent of total U.S. generating capacity. Investor-owned utilities operate the second largest number of facilities, 1,117, and account for 37 percent of total U.S. capacity.

Figure 2H-1: Distribution of Facilities and Capacity by Ownership Type, 2007



Source: U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2006

2H.3 Domestic Production

This section presents an overview of generating capacity and electricity generation. *Section 2H.3.1* provides data on capacity, and *Section 2H.3.2* provides data on generation. *Section 2H.3.3* presents an overview of the geographic distribution of generation facilities and capacity.

2H.3.1 Generating Capacity

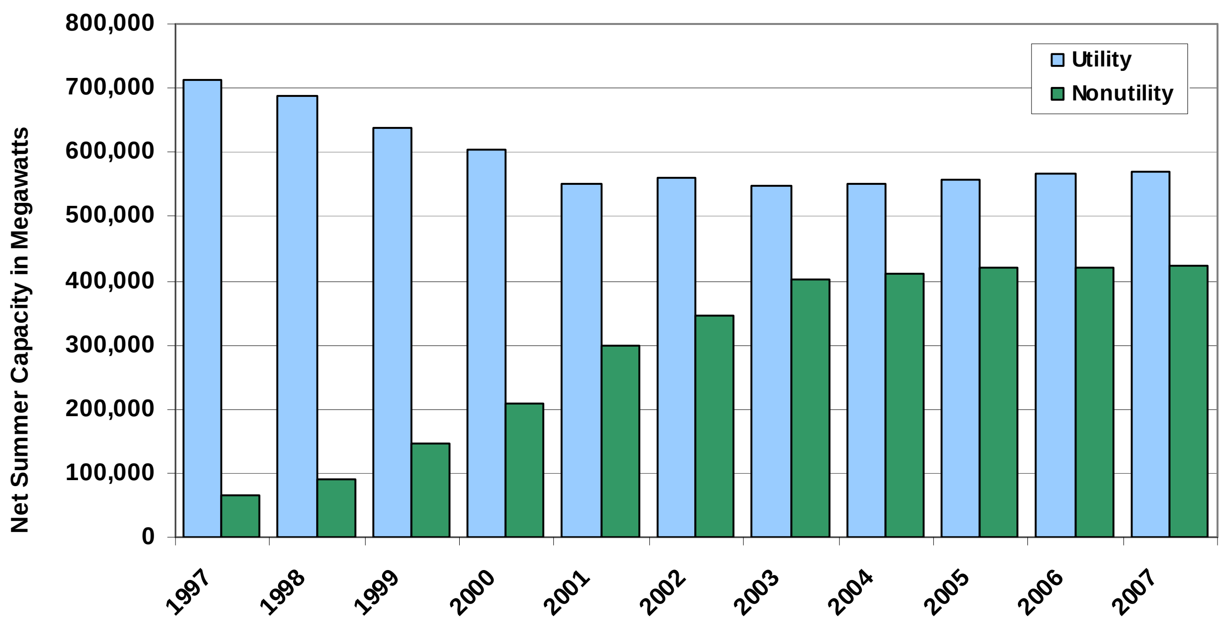
The rating of a generating unit, expressed in megawatts (MW), is a measure of its ability to produce electricity. Capacity and capability are the two most common measures. *Nameplate capacity*, which is generally greater than a generating unit's net summer or winter capacity, is the maximum rated (i.e., full-load) output of a generating

[28] Prior to 2007, ownership information at the utility/operator level was reported in the EIA-860 database; this information was reported for more facilities than in the EIA-861 database, which covers regulated facilities only.

unit under specified conditions, as designated by the manufacturer. Net summer capacity is the maximum output that a generating unit can supply to *system load* at the time of *summer* peak demand; it reflects a reduction in capacity due to electricity use for station service or auxiliaries.[29] *Net winter capacity* is the maximum output that a generating unit can supply to *system load* at the time of *winter* peak demand; it also reflects a reduction in capacity due to electricity use for station service or auxiliaries.[30] Because, in most of the United States, summer peak demand exceeds winter peak demand, aggregate net summer capacity exceeds net winter capacity. *Net capability* is the steady hourly output that a generating unit is expected to supply to the system load, as demonstrated by test procedures. The capability of the generating unit in the summer is generally less than in the winter due to higher ambient-air and cooling-water temperatures, which cause generating units to perform less efficiently in converting the input energy source to usable electricity (U.S. DOE, 2000).

In 2007, utilities owned and operated the majority of *net summer capacity* (57 percent), in the United States, with nonutilities owning the remaining 43 percent. Nonutility ownership of net summer capacity increased substantially in the last few years, following the passage of state legislation aimed at increasing competition in the electric power industry. Nonutility ownership of net summer capacity increased by 535 percent between 1997 and 2007, compared with a decrease in utility ownership of net summer capacity of 20 percent over the same time period, as traditional regulated utilities sold generating capacity to nonutility power producers to meet state-based deregulation requirements. Overall, total net summer capacity increased during this period, from approximately 776,000 MW in 1996 to 995,000 MW in 2007 (see *Figure 2H-2*).

Figure 2H-2: Net Summer Capacity, 1997 to 2007



Source: U.S. DOE, 2009c

2H.3.2 Electricity Generation

The production of electricity is referred to as generation and is measured in units of produced energy such as kilowatt-hours (kWh) or megawatt-hours (MWh). Generation can be measured by gross generation, net generation, or electricity available to consumers. *Gross generation* is the total amount of electricity produced by

29 In the United States, this is the period of June 1 through September 30.

30 In the United States, this is the period of December 1 through February 28(29).

an electric power facility whereas *net generation* is the electricity available to the transmission system beyond that needed to operate facility equipment. For example, approximately 7 percent of electricity generated by steam-electric units provides power for operation of the power generating station, including, for example, lights at the facility, operation of fuel supply systems, and cooling water intake-related equipment. An additional 8 to 9 percent of net generation is lost during the transmission and distribution process. *Electricity available to consumers* is the electricity available for sale to customers after accounting for these factors (U.S. DOE, 2000).

Total net electricity generation in the United States for 2007 was 4,157 TWh.[31] Utility-owned facilities accounted for 60 percent of this amount. Total net generation has increased by 19 percent over the 11-year period from 1997 to 2007. During this period, nonutilities increased their electricity generation by 347 percent while utilities decreased their generation by 20 percent (U.S. DOE, 2009c). This trend is expected to continue in the coming years, as more facilities are built by nonutility power producers or purchased from traditional integrated utilities (see *Table 2H-2)*, which summarizes the change in net generation between 1997 and 2007 by energy source and ownership type).

Table 2H-2: Net Generation by Energy Source and Ownership Type, 1997 to 2007 (TWh)

Energy Source	Utilities			Nonutilities			Total		
	1997	2007	% Change	1997	2007	% Change	1997	2007	% Change
Coal	1,788	1,491	-16.6%	57	525	818.5%	1,845	2,016	9.3%
Hydropower	337	221	-34.3%	15	19	26.5%	352	241	-31.7%
Nuclear	629	428	-32.0%	0	379	NA	629	806	28.3%
Petroleum	78	41	-47.6%	15	25	69.0%	93	66	-29.0%
Natural Gas	284	314	10.6%	196	583	197.7%	479	897	87.0%
Other Gases	0	0	NA	13	13	-0.3%	13	13	0.8%
Renewables[a]	7	9	20.0%	70	96	38.1%	77	105	36.3%
Other[b]	0	1	NA	4	12	222.4%	4	12	238.6%
Total	**3,123**	**2,504**	**-19.8%**	**370**	**1,653**	**347.1%**	**3,492**	**4,157**	**19.0%**

a Renewables include wind, solar thermal and photovoltaic, wood and wood derived fuels, geothermal, and other biomass.
b Other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels and miscellaneous technologies.
Source: U.S. DOE, 2009c.

As shown in *Table 2H-2*, not accounting for the "other" energy source category, natural gas-based electricity generation experienced the highest growth (87 percent) among fuel sources between 1997 and 2007. Although coal-based generation experienced the lowest growth (9 percent), it is still the largest energy source for electricity generation. Petroleum experienced the largest decline (29 percent). For utilities, generation using natural gas as a fuel source was relatively constant. Utility-owned generation from other sources fell, mostly because of sales of capacity to nonutilities. Nonutility generation grew quickly between 1997 and 2007. Nonutility coal generation grew the fastest among the energy source categories, increasing by over 800 percent during this period. Of these energy sources, coal, nuclear, natural gas, and petroleum are the sources that always (coal, nuclear) or frequently (natural gas, petroleum) depend on cooling water as part of the electricity production process.

Coal accounted for the largest share of total electricity generation (49 percent) in 2007, followed by natural gas at approximately 22 percent of total generation, and nuclear power at 19 percent. Other energy sources accounted for comparatively smaller amounts of total generation, with hydropower representing 6 percent; renewable energy, 2.5 percent; and petroleum, 1.6 percent (see *Figure 2H-3)*.

Overall, regulated utilities accounted for 60 percent of total electricity generation in 2007, with nonutilities accounting for 40 percent. However, the distribution of generation between utilities and nonutilities varies considerably by energy source. Energy inputs for which utilities had higher shares of generation than observed at the total generation level are as follows:

[31] One terawatt-hour is 10^{12} watt-hours.

- Hydropower, with 92 percent of generation from regulated utilities and 8 percent from nonutilities
- Coal, with 74 percent of generation from utilities and 26 percent from nonutilities
- Petroleum, with 62 percent of generation from utilities and 38 percent from nonutilities.

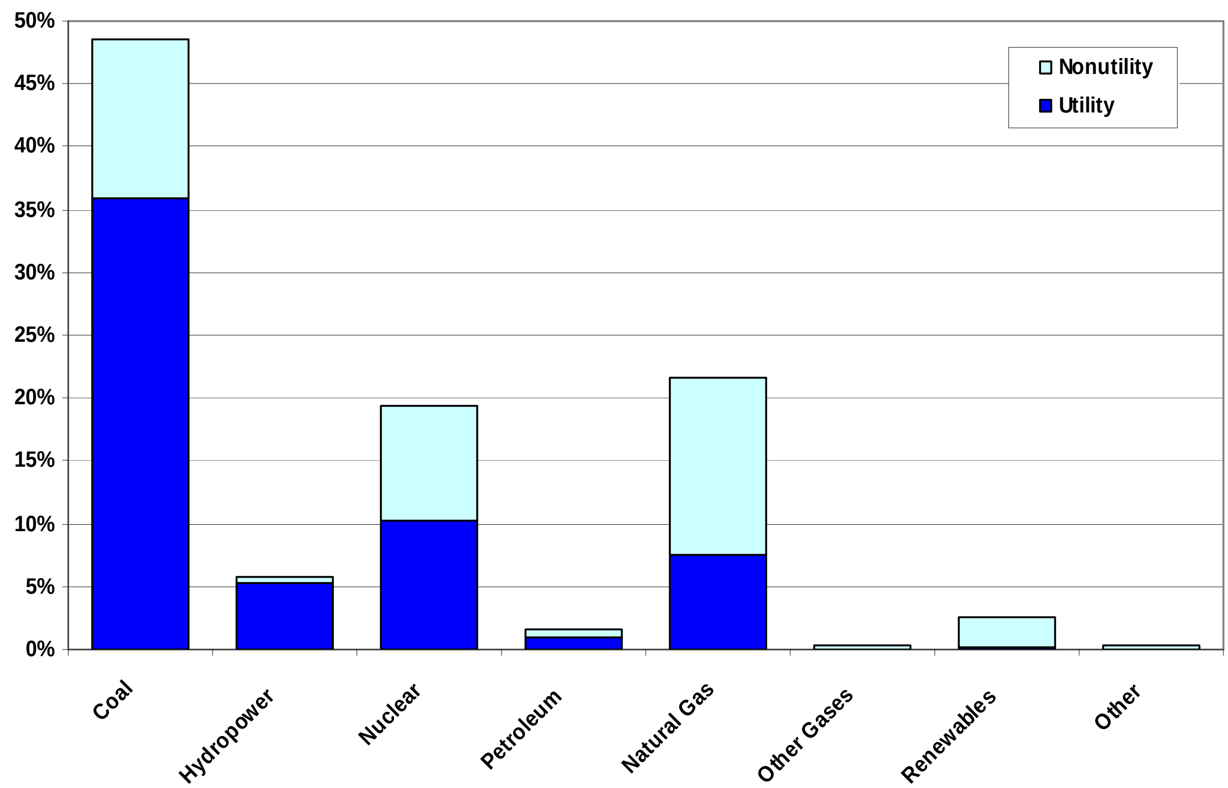
Energy inputs for which nonutilities had higher shares of generation than observed at the total generation level are as follows:

- Renewables, with 91 percent of generation from nonutilities and 9 percent from utilities
- Natural gas, with 65 percent of generation from nonutilities and 35 percent from utilities
- Nuclear, with 47 percent of generation from nonutilities and 53 percent from utilities.

The Other Gas and Other categories are also dominated by nonutilities, which account for 100 of generation in these categories; however, these energy source categories represent negligible shares of total generation.

The Proposed 316(b) Existing Facilities Regulation will affect electric power generating facilities differently based on the fuel sources and prime movers that facilities use to generate electricity. Only prime movers with a steam-electric generating cycle use substantial amounts of cooling water; consequently, these are the only units that will be directly affected by the Existing Facilities Proposed Rule. In addition, the Proposed Regulation specifies different compliance schedules based on the energy input source of the affected facilities.

Figure 2H-3: Percent of Electricity Generation by Primary Fuel Source and Facility Ownership Type, 2007



Source: U.S. DOE, 2009c.

2H.3.3 Geographic Distribution

Electricity is a commodity that cannot be stored or easily transported over long distances. As a result, the geographic distribution of power facilities is of primary importance to ensure a reliable supply of electricity to all customers. The U.S. bulk power system is composed of three major networks, or power grids:

- The *Eastern Interconnected System* covers the largest portion of the United States, from the eastern end of the Rocky Mountains and the northern borders to the Gulf of Mexico states (including parts of northern Texas) on to the Atlantic seaboard. This system contains six of the NERC regions defined below (the FRCC – Florida Reliability Coordinating Council, the MRO – Midwest Reliability Organization, the NPCC – Northeast Power Coordinating Council (U.S. component), the RFC – Reliability First Corporation, the SERC – Southeastern Electric Reliability Council, and the SPP – Southwest Power Pool).
- The *Western Interconnected System* covers nearly all of areas west of the Rocky Mountains, including the Southwest. The only NERC region within this system is the WECC – Western Energy Coordinating Council (U.S. component).
- The *Texas Interconnected System*, the smallest of the three, covers the majority of Texas. The only NERC region within this system is TRE – Texas Regional Entity.

The Texas system is not connected with the other two systems, while the other two have limited interconnection to each other. The Eastern and Western systems are integrated with or have links to the Canadian grid system. The Western and Texas systems have links with Mexico.

These major networks contain extra-high voltage connections that allow for power transmission from one part of the network to another. Wholesale transactions can take place within these networks to reduce power costs, increase supply options, and ensure system reliability.

Reliability refers to the ability of power systems to meet the demands of consumers at any given time. Efforts to enhance reliability reduce the chances of power outages. The North American Electric Reliability Corporation (NERC) is responsible for the overall reliability, planning, and coordination of the power grids. This voluntary organization was formed in 1968 by electric utilities, following a 1965 blackout in the Northeast. NERC is organized into eight regional organizations that cover the 48 contiguous States, and two affiliated councils that cover Hawaii, part of Alaska, and portions of Canada and Mexico.[32] These regional organizations are responsible for the overall coordination of bulk power policies that affect their regions' reliability and quality of service. As discussed above, interconnection *between* the bulk power networks is limited in comparison to the degree of interconnection *within* the major bulk power systems. Further, the degree of interconnection between NERC regions even within the same bulk power network is also limited. Consequently, each NERC region deals with electricity reliability issues in its own region, based on available capacity and transmission constraints. The regional organizations also aid in the exchange of information among member utilities in each region and among regions. Service areas of the member utilities determine the boundaries of the NERC regions. Though limited by the larger bulk power grids described above, NERC regions do not necessarily follow any State boundaries. *Figure 2H-4* provides a map of the 2009 NERC regions, which include: [33]

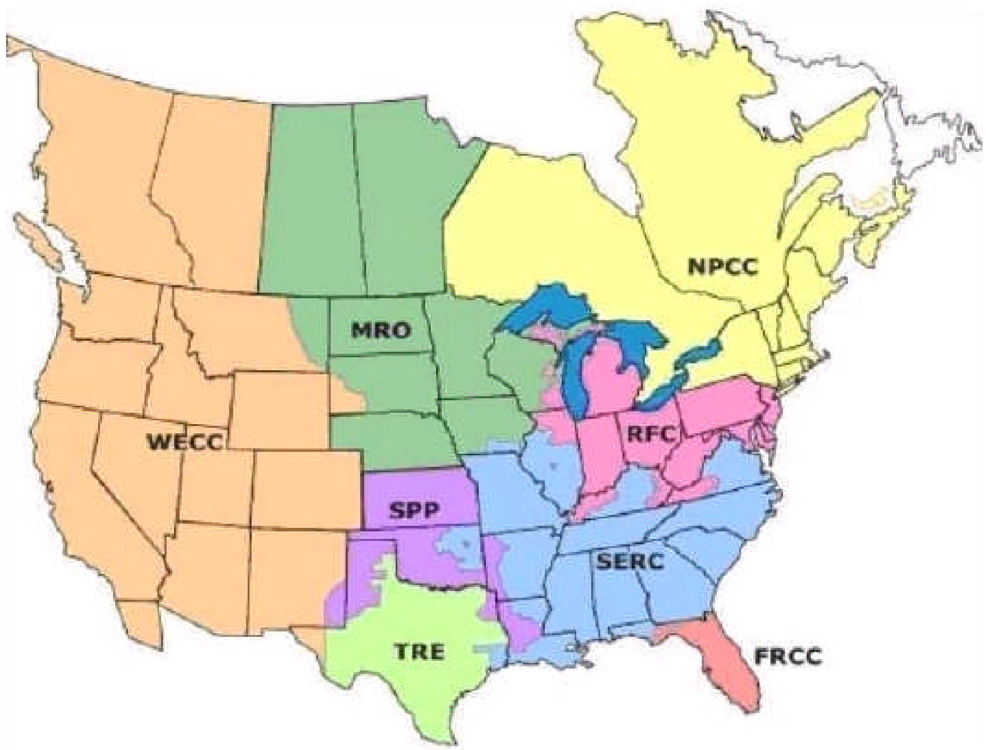
- ASCC – Alaska Systems Coordinating Council

[32] Energy concerns in the States of Alaska, Hawaii, the Dominion of Puerto Rico, and the Territories of American Samoa, Guam, and the Virgin Islands are not under reliability oversight by NERC.

[33] This chapter provides NERC region data by the 2009 NERC regions. Some NERC regions have been re-defined over the past few years; the NERC region definitions used in the proposed Existing Facilities regulation analyses vary by analysis depending on which region definition aligns better with the data elements underlying the analysis.

- FRCC – Florida Reliability Coordinating Council
- HICC – Hawaii Coordinating Council
- MRO – Midwest Reliability Organization
- NPCC – Northeast Power Coordinating Council (U.S.)
- RFC – Reliability First Corporation
- SERC – Southeastern Electric Reliability Council
- SPP – Southwest Power Pool
- TRE – Texas Regional Entity
- WECC – Western Energy Coordinating Council (U.S.)

Figure 2H-4: 2009 North American Electric Reliability Corporation (NERC) Regions



a The ASCC and HICC regions are not shown.

Source: U.S. DOE, 2009c.

The Proposed Existing Facilities Regulation may affect facilities located in different NERC regions differently. Because of differences in the economic characteristics of in-scope facilities across NERC regions and in the baseline economic characteristics of the NERC regions themselves, together with the market segmentation due to limited interconnectedness among NERC regions, the proposed regulation will have a different effect on profitability, electricity prices, and other impact measures across NERC regions.

Table 2H-3 shows the distribution of all existing facilities and total capacity by NERC region. As presented in *Table 2H-3,* 1,407 facilities (approximately 26 percent of all facilities in the United States) are located in WECC. However, these facilities account for only approximately 18 percent of total national capacity. Conversely, only 17 percent of generating facilities are located in the SERC, yet these facilities account for approximately 27 percent of total national capacity.

Table 2H-3: Distribution of Existing Facilities and Total Capacity by NERC Region, 2007

NERC Region	Facilities		Capacity	
	Number	% of Total	Total MW	% of Total
ASCC	105	1.9%	2,163	0.2%
FRCC	126	2.3%	60,457	5.6%
HICC	40	0.7%	2,674	0.2%
MRO	680	12.6%	53,467	4.9%
NPCC	708	13.1%	78,757	7.2%
RFC	899	16.7%	248,159	22.8%
SERC	912	16.9%	288,625	26.5%
SPP	286	5.3%	63,221	5.8%
TRE	230	4.3%	93,789	8.6%
WECC	1,407	26.1%	196,480	18.1%
TOTAL	**5,393**	**100%**	**1,087,791**	**100%**

Source: U.S. DOE, 2007b.

2H.4 Facilities Subject to the Proposed Existing Facilities Rule

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. Among power facilities, only those facilities employing a steam-based generating technology – i.e., steam turbine and combined cycle turbine generating units – require sufficient amounts of cooling water within scope of this proposed rulemaking and therefore are of interest to this analysis.

The following sections describe electric power facilities that are expected to be subject to the Proposed Existing Facilities Rule. This rule applies to existing steam-electric power generating facilities that meet the applicability criteria in section 316(b):

- Is a point source that uses or proposes to use a cooling water intake structure;
- Has at least one cooling water intake structure that uses at least 25 percent of the water it withdraws for cooling purposes;
- Has a National Pollutant Discharge Elimination System (NPDES) permit or is required to obtain one; and
- Has a design intake flow of two million gallons per day (MGD) or greater.

The Proposed Rule also covers substantial additions or modifications to operations undertaken at such facilities.

Based on (1) data collected from EPA's Section 316(b) 2000 Industry Surveys and (2) the above rule scoping requirements, EPA identified 559 facilities to which the Proposed Existing Facilities Rule is expected to apply (the "in-scope facilities").[34,35] All of these facilities are in the set of 671 facilities that were subject to the EPA's Section 316(b) Survey. However, according to the 2007 EIA database, 38 of these 671 facilities have retired, and 15 facilities will do so by 2012; in addition, 39 facilities are baseline closures according to the Integrated Planning

[34] The 2000 Industry Short Technical Questionnaire (STQ) and the 2000 Detailed Industry Questionnaire (DQ). As described in the 2002 Phase II Proposed and suspended 2004 Phase II Final Regulation analyses, these surveys collected technical and economic information from 372 STQ facilities and 284 DQ facilities that were expected to be within the scope of the Phase II Regulation. For more information on EPA's Section 316(b) Industry Surveys, see U.S. EPA, 2000.

[35] EPA developed the estimates of the number and characteristics of facilities expected to be within the scope of the Proposed 316(b) Existing Facilities Rule, based on the original Section 316(b) Industry Survey facility sample weights that were developed for the earlier 316(b) analyses. These original survey weights account for survey non-respondents and provide comprehensive estimates for the total of expected in-scope facilities based on the full set of facilities sampled in the Section 316(b) Industry Surveys. See *Chapter 3: Development of Costs for Regulatory Options* and *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses* for further discussion of the sample weights used in this analysis.

Model (IPM) baseline case analysis (see *Chapter 6: Electricity Market Model Analysis*).[36] EPA also excluded 19 Electric Generators that are located in California and that use coastal and estuarine waters for power plant cooling. These facilities are already required by the State of California to comply with standards that are similar to those under the Proposed Existing Facilities Rule and thus for regulatory analysis purposes, are not expected to be affected by the proposed rule. In particular, according to the California requirements, water intake velocity at these facilities must not exceed 0.5 feet per second and the intake flow rate at each unit must not exceed the level commensurate with the level that can be attained by a closed-cycle wet cooling system.[37] Based on the 2007 EIA database, EPA estimates that 388 of these in-scope facilities are owned by utilities and 171 in-scope facilities are owned by nonutilities.

The following sections present information on the physical and geographic characteristics, as well as, ownership of the facilities expected to be within the scope of the Proposed 316(b) Existing Facilities Rule. Topics discussed include:

- **Ownership type**: *Section 2H.4.1* presents a discussion on the distribution of all facilities and their parent-entities in the industry, as well as, facilities subject to this proposal and their parent-entities across ownership categories.
- **Parent-entity size**: *Section 2H.4.2* presents an assessment of the distribution of parent-entities across ownership categories by parent-entity size for the entire industry, as well as, parent-entities owning facilities subject to the Proposed Existing Facilities Rule.
- **Facility size**: *Section 2H.4.3* contains a size assessment for the in-scope Electric Generators based on generating capacity.
- **Geographic distribution**: *Section 2H.4.4* presents information on geographic distribution of in-scope Electric Generators across NERC regions.
- **Waterbody and cooling system type**: *Section 2H.4.5* presents information on the type of waterbody from which in-scope Electric Generators draw their cooling water and the type of cooling system they operate.

2H.4.1 Ownership Type

As described above, utilities can be divided into six major ownership categories: investor-owned utilities, nonutilities, federally-owned utilities, state-owned utilities, municipalities, and rural electric cooperatives. This classification is important because EPA has to assess the impact of the Proposed Rule on state, local, and tribal governments in accordance with the Unfunded Mandates Reform Act (UMRA) of 1995 (see *Chapter 8: UMRA Analysis)*.

Table 2H-4 reports the number of parent-entities, facilities, and capacity by ownership type for the total industry and for the subset of estimated in-scope facilities (for a discussion of the determination of parent-entities for in-scope facilities, see *Chapter 5: Cost and Economic Impact Analyses*; for a discussion of the determination of parent-entities for the entire industry, see *Chapter 7: Regulatory Flexibility Analysis (RFA)*). Overall, EPA estimates that 3 percent of all parent-entities, approximately 11 percent of all facilities, and over 45 percent of all electric power sector capacity will be subject to the Proposed Existing Facilities Rule. The majority of facilities expected to be subject to the Proposed Existing Facilities Rule, or 283 facilities, are investor-owned utilities, while nonutilities make up the second largest category. In-scope investor-owned and cooperative facilities

[36] For the purposes of this analysis an Electric Generator is considered retired even if it no longer operates any steam electric units even though it may still be operating non-steam electric units.

[37] Individual values do not sum to reported totals due to rounding as a result of the application of statistical weights.

represent the largest shares of their respective industry totals at over 25 percent and over 15 percent. In terms of in-scope capacity, investor-owned utilities account for the largest absolute quantity (291,051 MW) and also the largest single share of total capacity by ownership category, at over 71 percent. Substantial shares of the capacity in the other ownership categories– ranging from approximately 28 to 38 percent– are also estimated to be within the scope of the Proposed Existing Facilities Rule.

Table 2H-4: Existing Parent-Entities, Facilities, and Capacity by Ownership Type, 2010

	Parent-Entities			Facilities			Capacity (MW)		
		In-Scope[a]			In-Scope[a]			In-Scope[a]	
Ownership Type	Total[b]	Number	% of Total	Total[b]	Number[c]	% of Total	Total[b]	Number[c]	% of Total
Investor Owned	212	43	20.3%	1,117	283	25.5%	407,460	291,051	71.4%
Nonutility[d]	1,737	37	2.1%	2,784	171	6.6%	471,262	133,972	28.4%
Federal	9	1	11.1%	197	14	7.1%	72,234	24,612	34.1%
State	25	4	16.0%	104	9	8.7%	22,405	8,592	38.3%
Municipality	1,843	35	1.9%	869	44	5.4%	51,057	12,880	25.2%
Cooperative	883	20	2.3%	205	31	15.1%	40,311	14,028	34.8%
Political Subdivision	126	3	2.4%	93	7	7.5%	20,721	5,692	27.5%
Total	**4,835**	**143**	**3.0%**	**5,369**	**559**	**10.8%**	**1,085,449**	**490,827**	**45.2%**

a. Numbers may not add up to totals due to independent rounding.
b. Information on the total number of parent-entities is based on data from the 2007 EIA-861 database (U.S. DOE, 2007c). Information on facilities and capacity is based on data from the 2007 EIA-860 database (U.S. DOE, 2007b). These data sources report information for non-corresponding sets of power producers. Therefore, the total number of parent-entities is not directly comparable to the information on total facilities or total capacity.
c. The numbers of facilities and capacity are calculated on a sample-weighted basis.
d. Form EIA-861 does not provide information for nonutilities. This is the total number of non-regulated operators from the 2007 EIA-860 database.
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b; U.S. DOE, 2007c

2H.4.2 Ownership Size

EPA estimates that 33 of the 143 entities owning in-scope facilities (23 percent) are small-entities according to Small Business Administration business size criteria (*Table 2H-5*). The size distribution varies considerably by ownership type: only about 5 percent of 316(b) investor-owned utilities and slightly over 13 percent of 316(b) nonutilities are small-entities, compared to over 48 percent of 316(b) municipalities, 40 percent of 316(b) cooperatives, and over 33 percent of other political subdivisions. Across ownership categories, as well as in total, parent-entities that own in-scope facilities are on average larger than parent-entities in the whole industry: large parent-entities make up only 57 percent of all parent-entities in the industry compared to nearly 77 percent of entities owning in-scope facilities.

Of the 559 in-scope facilities, EPA estimates that 38 (nearly 7 percent) are owned by small entities (*Table 2H-6)*. The majority of the in-scope facilities owned by small entities are owned by municipalities (over 40 percent), while cooperatives, investor-owned, nonutilities, and other political subdivisions own the remaining 60 percent. By definition, States and the Federal government are considered large parent-entities. For a detailed discussion of the identification and size determination of parent-entities see *Chapter 7: Regulatory Flexibility Analysis (RFA)*.

Table 2H-5: Existing Parent-Entities by Ownership Type and Size, 2010

	Total Number of Parent-Entities[a]				Total Number of Parent-Entities That Own Section 316(b) In-Scope Facilities[b]				% of Small Entities Owning In-Scope Facilities
Ownership Type	Small	Large	Total	% Small	Small	Large	Total	% Small	
Investor-owned	18	194	212	8.7%	2	41	43	4.7%	10.9%
Nonutility[c]	131	1,606	1,737	7.5%	5	32	37	13.5%	3.8%
Federal	0	9	9	0.0%	0	1	1	0.0%	NA
State	0	25	25	0.0%	0	4	4	0.0%	NA
Other Political Subdivision	113	13	126	89.7%	1	2	3	33.3%	0.9%
Municipality	968	875	1,843	52.5%	17	18	35	48.6%	1.8%

Cooperative	848	35	883	96.0%	8	12	20	40.0%	0.9%
Total	**2,078**	**2,757**	**4,835**	**43.0%**	**33**	**110**	**143**	**23.1%**	**1.6%**

a. The total number of parent entities that own generation utilities is based on data from the 2007 EIA-861 database (U.S. DOE, 2007c). The total number of parent entities that own nonutilities, is based on data from the 2007 EIA-860 database (U.S. DOE, 2007b). Because these two databases report data for differing sets of facilities, the information in this table is not directly comparable to the other information presented in this profile.

b. Numbers may not add up to totals due to independent rounding.

c. Form EIA-861 does not provide data on nonutilities. This is the total number of nonregulated operators from the 2007 EIA-860 database; the number of small parent entities for nonregulated operators was determined using the 2007 EIA-906/920/923 database (U.S. DOE, 2007d).

Source: U.S. EPA Analysis, 2010; U.S. EPA, 2000; U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2007d

Table 2H-6: Section 316(b) In-Scope Facilities by Ownership Type and Size, 2010

Ownership Type	Number of In-Scope Facilities[a,b]			
	Small	**Large**	**Total**	**% Small**
Investor-owned	3	280	283	1.1%
Nonutility	8	162	171	5.0%
Federal	0	14	14	0.0%
State	0	9	9	0.0%
Municipality	18	26	44	40.3%
Other Political Subdivisions	1	6	7	14.3%
Cooperative	8	23	31	25.8%
Total	**38**	**521**	**559**	**6.8%**

a Numbers may not add up to totals due to independent rounding.

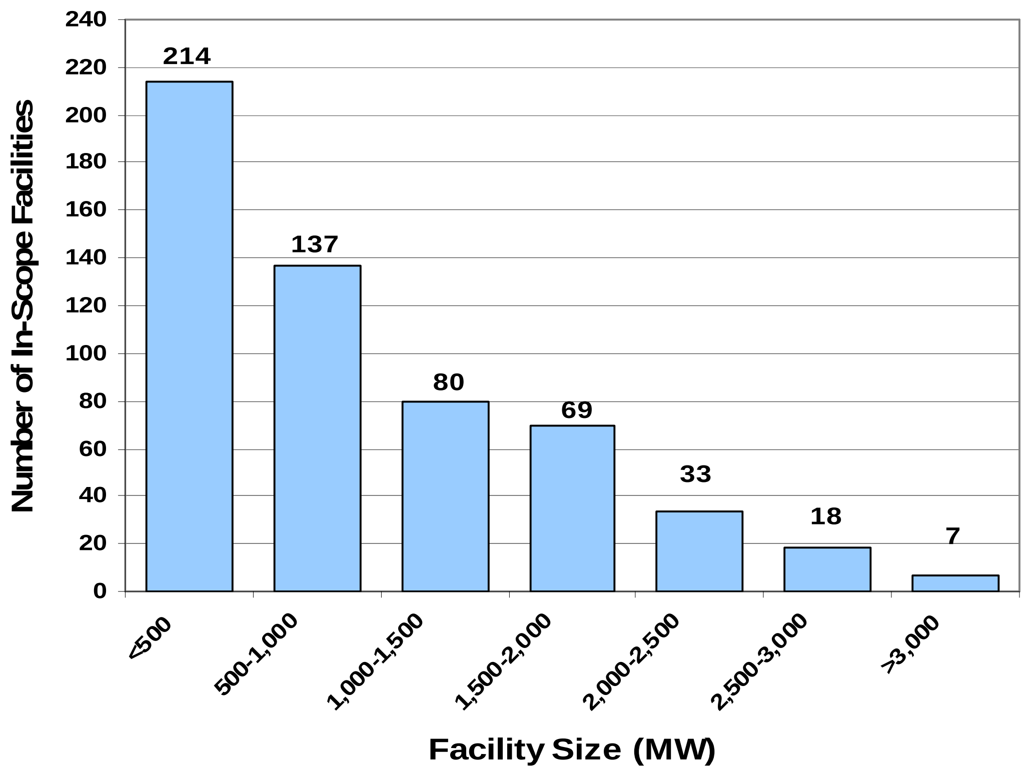
b The numbers of facilities and capacity are calculated on a sample-weighted basis.

Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b; U.S. DOE, 2007c

2H.4.3 Facility Size

EPA also analyzed the estimated in-scope facilities with respect to their generating capacity. Facility size is important because it partly determines the need of a given facility for cooling water, and its importance in meeting electricity demand and reliability needs. The majority of facilities expected to be subject to the Proposed Existing Facilities Rule (63 percent) are of relatively moderate size with capacity of less than 1,000 MW, while only a few facilities (4 percent) have a capacity of greater than 2,500 MW (*Figure 2H-5)*.

Figure 2H-5: Number of In-Scope Facilities by Size (in MW), 2007 [a,b]



a. Numbers may not add up to totals due to independent rounding.

b. The numbers of facilities and capacity are calculated on a sample-weighted basis using the original 316(b) Survey sample weights to account for non-respondents.

Source: U.S. EPA Analysis, 2000; U.S. DOE, 2007b

2H.4.4 Geographic Distribution

To assess the potential regional impact of *installation downtime* – the requirement of facilities to temporarily shut down their electricity generating operations due to the installation of certain compliance technologies – which may accompany regulatory compliance, EPA assessed the distribution of in-scope facilities and their capacity across NERC regions. As reported in *Table 2H-7*, considerable differences are present across the NERC regions in terms of the number of in-scope facilities and their capacity *and* the percentages of facilities and capacity represented by in-scope facilities. In the RFC region, in-scope facilities have the greatest regional capacity representation (over 62 percent of total RFC capacity), followed by SERC (over 54 percent of total SERC capacity); consequently, the potential downtime effect in these NERC regions is likely to be the greatest. In ASCC, in-scope facilities have the smallest representation of total regional capacity (approximately 1 percent of total ASCC capacity), followed by WECC (11 percent of total WECC capacity); therefore, the downtime effect in these NERC regions is likely to be of least consequence. Not all of the in-scope facilities will experience downtime; therefore, the percentage of facilities and regional capacity actually affected by downtime may be overstated by this assessment.[38]

[38] In particular, nuclear generating facilities are not expected to incur any additional downtime for installing technology for compliance with the Proposed Existing Facilities Rule.

Table 2H-7: Section 316(b) In-Scope Facilities and Capacity by NERC Region, 2010

NERC Region	Facilities			Capacity (MW)		
	Total Number of Facilities	In-Scope[a,b] Number	In-Scope[a,b] % of Total in Region	Total Capacity	In-Scope[a,b] MW	In-Scope[a,b] % of Total in Region
ASCC	105	1	1.0%	2,163	28	1.3%
FRCC	126	24	19.2%	60,457	30,923	51.1%
HICC	40	3	7.5%	2,674	1,086	40.6%
MRO	680	49	7.3%	53,467	20,512	38.4%
NPCC	708	60	8.5%	78,757	39,348	50.0%
RFC	899	172	19.2%	248,159	154,077	62.1%
SERC	912	147	16.1%	288,625	156,807	54.3%
SPP	286	31	10.8%	63,221	24,634	39.0%
TRE	230	43	18.7%	93,789	41,840	44.6%
WECC	1,407	27	1.9%	196,480	21,571	11.0%
TOTAL	**5,393**	**559**	**10.4%**	**1,087,791**	**490,827**	**45.1%**

a. Numbers may not add up to totals due to independent rounding.
b. The numbers of facilities and capacity are calculated on a sample-weighted basis.
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b

2H.4.5 Waterbody and Cooling System Type

As reported in *Table 2H-8*, most of the in-scope facilities draw water from a freshwater river (306 facilities or nearly 55 percent), followed by lakes or reservoirs (117 facilities or 21 percent) and estuaries or tidal rivers (83 facilities or nearly 15 percent). The table also shows that most of the in-scope facilities (355 facilities or over 63 percent) employ a once-through cooling system.

Table 2H-8: Number of In-Scope Facilities by Waterbody and Cooling System Type[a]

Waterbody Type	Recirculating Number	Recirculating % of Total	Once-Through Number	Once-Through % of Total	Combination Number	Combination % of Total	Other Number	Other % of Total	Total[b] Number	Total[b] % of Total
Estuary/Tidal River	5	3.5%	69	19.5%	8	16.3%	1	14.3%	83	14.9%
Ocean	0	0.0%	9	2.6%	0	0.0%	0	0.0%	9	1.7%
Lake/Reservoir	36	24.7%	73	20.5%	7	14.3%	1	14.3%	117	21.0%
Freshwater Stream/River	102	69.2%	166	46.9%	32	65.3%	5	71.4%	306	54.7%
Great Lake	4	2.7%	37	10.4%	2	4.1%	0	0.0%	43	7.7%
Total	148	100.0%	355	100%	49	100%	7	100%	559	100.0%

a. The numbers of facilities and capacity are calculated on a sample-weighted basis.
b. Numbers may not add up to totals due to independent rounding.
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b

2H.5 Industry Trends

Deregulation, along with several environmental regulations and programs, has had a significant impact on the electric power industry in recent years. *Section 2H.5.1* discusses the current status of industry deregulation, *Section 2H.5.2* discusses air emissions regulations, *Section 2H.5.3* discusses renewable portfolio standards, and *Section 2H.5.4* discusses carbon emissions regulations, all of which have affected and/or will affect the electric power industry.

2H.5.1 Current Status of Industry Deregulation

The electric power industry has been evolving from a highly regulated industry with traditionally-structured electric utilities to a less regulated, more competitive industry. Several key pieces of Federal legislation have made the changes in the industry's structure possible. The industry has traditionally been regulated based on the premise that the supply of electricity is a natural monopoly, where a single supplier could provide electric services at a lower total cost than could be provided by several competing suppliers. During the last two decades, the relationship between electricity consumers and suppliers has undergone substantial change, as governments and regulatory agencies recognized that electricity generation does not meet the definition of a natural monopoly. As a result, substantial steps have been undertaken to promote competition, thereby achieving better electricity production efficiency among electricity generators, while recognizing that the delivery of electricity via transmission and distribution systems does remain within the definition of a natural monopoly. A key step in this effort is the required unbundling of the traditional vertically integrated electric power business, with the electricity generation business (and therefore the electricity generating assets) being separated from the electricity transmission and distribution business. Electricity restructuring has two essential aspects: wholesale access and retail access. *Wholesale access* refers to the ability of electric power generating entities – utilities and independent power producers – to access *transmission systems* to compete for wholesale markets, i.e., distribution utilities and independent marketers buying and selling electricity. *Retail access* refers to the ability of marketers and retailing businesses of utilities to obtain access to *distribution systems* to sell electricity to end-use consumers, thereby introducing consumer choice of electricity supplier (or retail choice).

The initial actions promoting competition in the wholesale electric power markets began with the Public Utility Regulatory Policies Act of 1978 (PURPA), which established business terms by which certain nonutility electricity-generators – “qualifying facilities” or QFs – could sell electricity to utilities. Later, the Energy Policy Act of 1992 (EPACT) made it easier for nonutilities to enter the wholesale electricity market by creating a new category of nonutility power producers – exempt wholesale generators or EWGs – which were exempt from the Public Utility Holding Company Act of 1935 (PUHCA) regulation (EEMCTF, 2007).[39] In 1996, the Federal Energy Regulatory Commission (FERC) issued Order 888, promoting wholesale electric competition, by ensuring non-discriminatory open access transmission service, and, in some states, the introduction of retail choice. Order 888 also established guidelines for the formation of independent system operators (ISOs), independent, federally regulated entities established to coordinate regional transmission in a non-discriminatory manner.

Nearly a decade later, the Energy Policy Act of 2005 (EPAct 2005) repealed the original PUHCA of 1935, while enacting provisions to encourage investment in energy infrastructure and transfer certain consumer protection oversight authorities from the Security and Exchange Commission (SEC) to FERC and the states. Specifically, EPAct 2005 enacted a *new* PUHCA (PUHCA of 2005), which gives FERC, as opposed to SIC, jurisdiction over holding companies. EPAct 2005 also modified PURPA of 1978, removing some pricing requirements that had resulted in consumers paying above-market prices for some electricity. In addition, EPAct 2005 created the Electric Reliability Organization (ERO), now certified as the NERC, to enforce mandatory electric reliability rules on all users, owners, and operators of the transmission systems (FERC, 2006).

Key Changes in the Electric Power Industry Structure

Industry deregulation has already changed and continues to change the structure of the electric power industry. Some of the key changes include:

- <u>Provision of services</u>: Under the traditional regulatory system, the generation, transmission, and distribution of electric power were handled by vertically-integrated utilities. Since the mid-1990s, Federal and State policies have led to increased competition in the generation sector of the industry. Increased competition has resulted in a separation of power generation, transmission, and retail distribution services.

[39] PUHCA of 1935 was passed by the United States Congress to facilitate regulation of electric utilities, by either limiting their operations to a single state, and thus subjecting them to effective state regulation, or forcing divestitures so that each company became a single integrated system serving a limited geographic area. In addition, PUHCA of 1935 required holding companies to obtain permission from the Securities and Exchange Commission (SEC) prior to engaging in a non-utility business and further required that such businesses be kept separate from the regulated businesses.

Utilities that provide transmission and distribution services continue to be regulated and are required to divest their generation assets. In the deregulated framework, entities that generate electricity are no longer subject to rate regulation and do not operate in protected franchise markets.

- Relationship between electricity providers and consumers: Under traditional regulation, utilities were granted a geographic franchise area and provided electric service to all customers in that area at a rate approved by the regulatory commission. A consumer's electric supply choice was limited to the utility franchised to serve their area. Similarly, electricity suppliers were not free to pursue customers outside their designated service territories. Although most consumers continue to receive power through their local distribution company (LDC), retail competition has allowed some consumers to select the company that generates the electricity they purchase.
- Electricity prices: Under the traditional system, State and Federal authorities regulated many aspects of utilities' business operations, including, in particular, their prices. Electricity prices were determined administratively for each utility, based on the cost of producing and delivering power to customers and a reasonable rate of return on invested capital (i.e., under the cost-of-service framework). As a result of deregulation, competitive market forces set prices for generated electricity. Buyers and sellers of power negotiate through power pools or one-on-one to set the price of electricity. As in all competitive markets, prices reflect the interaction of supply and demand for electricity. During most time periods, the price of electricity in a given competitive wholesale electricity market (e.g., an integrated dispatch region) is set by the generating unit with the highest energy production cost that is dispatched to meet spot market electricity demand – i.e., the unit with the highest production cost determines the "marginal cost" of production and therefore the short-run energy price (Beamon, 1998).

New Industry Participants

As discussed above, PURPA and EPACT set business terms by which nonutility generators – QFs and EWGs, respectively – could enter the wholesale power market. Under PURPA, utilities are required to buy power that is produced by QFs (usually cogeneration or renewable energy) in their service area at a price equal to the avoided production cost of a buying utility. EPACT did not require utilities to purchase power from EWGs. Instead, EPACT gave FERC the authority to order utilities to provide access to their transmission systems on a case-by-case basis. However, access to the systems proved to be slow and burdensome. In response, FERC issued Order 888, which provides open access to the transmission systems by utilities that have filed open-access transmission tariffs by a specific deadline (OATTs). Furthermore, in 1999, FERC issued Order 2000, calling for the development of Regional Transmission Organizations (RTOs), which independently control and operate the transmission systems (EEMCTF, 2007).[40]

State Activities

The current status of electricity restructuring varies across states. Out of 50 states, 22 had initiated efforts to design restructured electricity markets and pass enabling legislation. However, eight of these 22 states – Virginia, Arkansas, New Mexico, Arizona, Nevada, California, Oregon, and Montana – experienced difficulties during the transition to a competitive electricity market, such as lack of competition for residential customers and substantial rate increases that have occurred or are anticipated to occur; consequently, these eight states suspended the restructuring process. As of January 2010, only 14 states and the District of Columbia were operating with some degree of competitive wholesale and retail electricity markets, in which some or all of the energy portion of the

[40] RTO is similar to ISO, with the main difference being the ability of RTO control and monitor of the electric power transmission system over a wider area across state borders.

retail electricity price is determined in a deregulated market.[41] The remaining 28 states have not introduced any electricity restructuring legislation. *Figure 2H-6*, provides a national map of the status of electricity restructuring. The 36 states in which electricity generation remains regulated under the cost-of-service framework, host 3,636 facilities (67 percent of all electric power generating facilities in the United States) and 693 GW of generating capacity (64 percent of total generating capacity in the United States) (U.S. DOE, 2007b).

The state of restructuring of the electric power industry is an important factor to consider when assessing the impact of the proposed Existing Facilities Regulation on in-scope electric power generating facilities and electricity consumers discussed in *Chapter 5: Cost Impact Analysis – Electric Power Generating Facilities*. In particular, the degree of competition affects the ability of in-scope facilities to pass cost increases to consumers via electricity rate increases, and consequently, affects their profitability and business viability (for more detail see *Chapter 5: Cost Impact Analysis – Electric Power Generating Facilities*). Most of the in-scope Electric Generators (316 out of 559 or 57 percent) are located in the states where electricity generation remains regulated under the cost-of-service framework; these facilities account for a large share of total in-scope generating capacity (293 GW out of 514 GW or 57 percent) and total in-scope generation (1,568 TWh out of 2,646 TWh or 59 percent).[42,43] EPA judges that these facilities should be able to recover any increases in their production costs resulting from compliance with the Proposed Existing Facilities Rule through higher electricity rates approved by utility regulatory authorities. The other 242 in-scope facilities (43 percent) are located in states in which electricity generation is deregulated and cost recovery is less certain; these facilities account for approximately 221 GW of total in-scope generating capacity (43 percent) and 1,078 TWh of total in-scope generation (41 percent) (U.S. DOE, 2007b).

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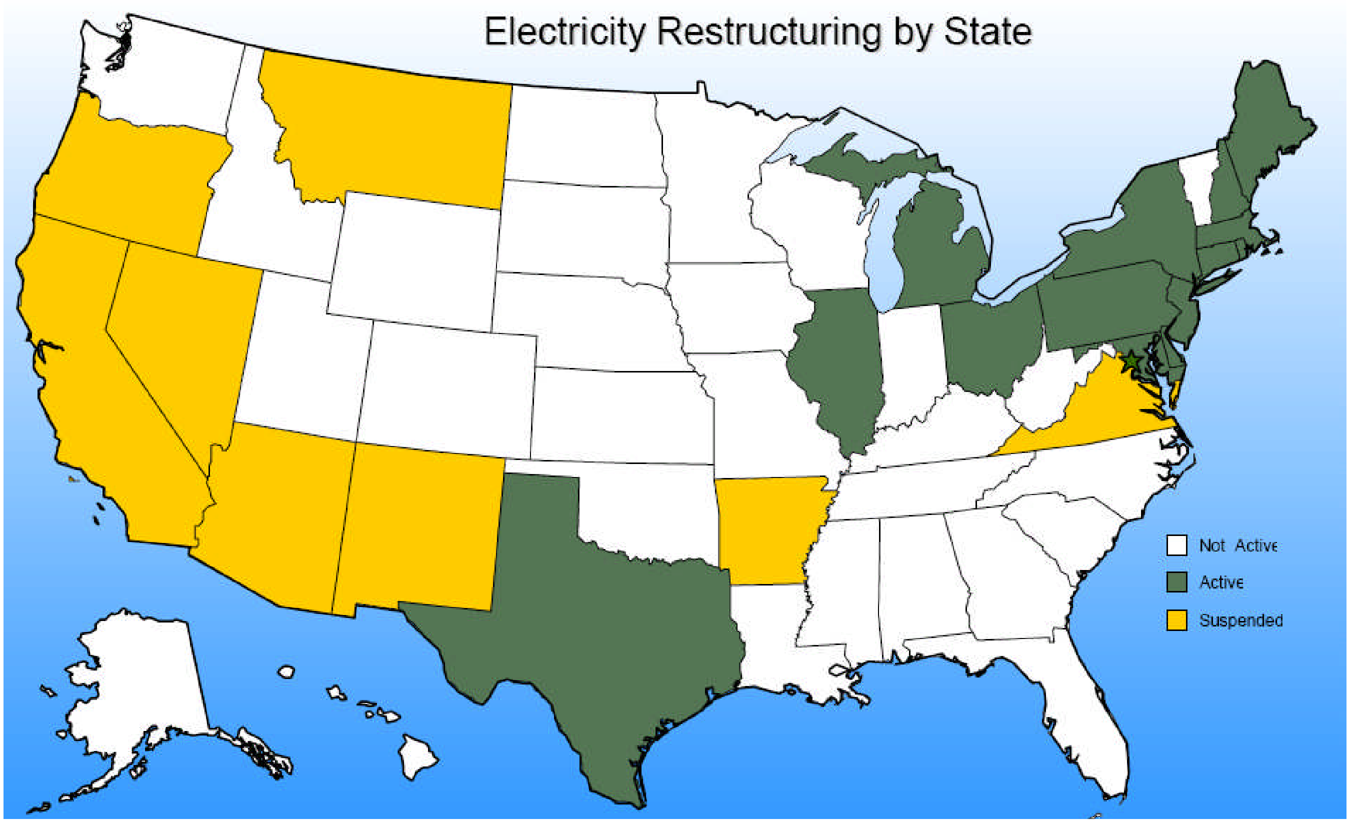
41 Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Illinois, Texas, and the District of Columbia.

42 EPA developed the estimates of the number and characteristics of facilities expected to be within the scope of the Proposed Existing Facilities Rule, based on the original 316(b) survey facility sample weights. These weights provide comprehensive estimates for the total of expected in-scope facilities based on the full set of facilities sampled in the Section 316(b) 2000 Industry Surveys. See *Chapter 3: Development of Costs for Regulatory Options* and *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses* for further discussion of the sample weights used in this analysis.

43 Capacity values are from the 2007 EIA-860 database. EPA calculated generation values as a 5-year average (2003-2007) using generation values from the EIA-906/920 database. In using the year-by-year generation values to develop an average over the data years, EPA set aside from the average calculation, generation values that are anomalously low. Such low generating output would likely result from a generating unit being out of service for maintenance.

Figure 2H-6: Electricity Restructuring by State as of January 2010



Source: U.S. DOE, 2009d

2H.5.2 Air Emissions Regulations

A number of recent air emission regulations significantly affect electric power generators. Under these regulations, power generators must meet emission limits by physically reducing emissions via air emission control technology or adjusting operations to reduce emissions (e.g., using lower sulfur coal), and/or by purchasing emissions allowances that permit release of pollutant emissions. These programs have significantly reduced emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx) from electricity generation. In some instances, these programs have caused, or are expected to cause in the future, relatively substantial changes in electric power sector operations, including increased use of lower pollution fuels, repowering of existing production capacity (e.g., converting natural gas-based steam capacity to a more energy efficiency combined cycle operation, which includes a steam and non-steam electricity production capability), accelerated development of new capacity, and earlier retirement of older, higher air pollution-intensive capacity for which substantial investments to reduce emissions are not economic to undertake. This Proposed Rule will overlap with these ongoing air emission regulatory programs in requiring further changes to facility operations and further affecting the economics of power production.

In 1995, Phase I of the Acid Rain Program was implemented to achieve significant environmental and health benefits by reducing SO_2 and NOx emissions and ambient concentrations. The Program affects over 2,000 electric utility facilities powered by coal, oil, or natural gas. The Program was the first to implement an allowance trading program in the United States. Instead of the standard command and control regulatory approach, the allowance trading program is market-based, allocating SO_2 emission credits to each utility and allowing the credits to be bought, sold, or banked (as long as emissions levels are met) for future use. The Acid Rain Program allows flexibility in selecting the most cost-effective approach to reduce emissions. While allowing flexibility in the approach to reducing emissions, the Program did not implement an allowance trading system for NOx emissions. During Phase II of the program (starting in 2000), the Program set a cap on the number of allowances, ensuring achievement of the intended reductions in pollutant emissions (U.S. EPA, 2009c).

Similar to the Acid Rain Program, the Clean Air Interstate Rule (CAIR) was promulgated to further reduce SO_2 and NOx emissions in 28 eastern states and the District of Columbia through an allowance trading program. On July 11, 2008, the U.S. Court of Appeals for the D.C. Circuit ruled to vacate CAIR. However, on December 23, 2008, the U.S. Court of Appeals issued a new ruling that repealed the vacatur and instead, remanded CAIR, noting that: "allowing CAIR to remain in effect until it is replaced by a rule consistent with our opinion would at least temporarily preserve the environmental values."[44] EPA was tasked with modifying CAIR to address the issues raised by the Court in its July 11th decision (U.S. EPA, 2010d).

Other rulemakings are based in part on the expected emissions reductions from CAIR.[45] Promulgated in 2005, CAIR established Phase I caps for NOx and SO_2 for 2009 and 2010, respectively, and Phase II caps for NOx and SO_2 for 2015. For SO_2 allowances, CAIR allocated the allowances that are used within the Acid Rain Program. However, since a NOx trading program was not in place in the Acid Rain Program, EPA provided new NOx emission allowances under CAIR. Each of the 28 eastern states and the District of Columbia were allowed to achieve emissions reductions by their own selected method. Most are expected to achieve the required levels by mandating reduced emissions from the power generation sector (U.S. EPA, 2009a).

On July 6, 2010, EPA proposed the Transport Rule to replace CAIR. If finalized, the Transport Rule will require 31 states and the District of Columbia to reduce electric power sector emissions that contribute to ozone and fine particle pollution in these and other states. Twenty-eight states would be required to reduce both annual SO_2 and NOx emissions. In addition, 26 states would be required to reduce NOx emissions during the summer, because these emissions contribute to downwind states' ozone pollution during the summer "smog season." EPA believes that by reducing the emissions from the upwind states, the Transport Rule would help downwind states attain air quality standards, specifically the 24-hour $PM_{2.5}$ standards established in 2006, the 1997 annual $PM_{2.5}$ standards, and the 1997 ground-level ozone standard. EPA proposed that the initial reductions occur during 2012 and 2013, with the second phase, which calls for additional emission reductions in some states, starting in 2014 (U.S. EPA, 2010a).[46]

The Clean Air Mercury Rule (CAMR), also promulgated in 2005, planned to build on CAIR to significantly reduce mercury emissions from coal-fired power facilities. However, on February 8, 2008, the D.C. Circuit Court vacated CAMR. Additionally, on February 6, 2009, the Department of Justice, on behalf of EPA, asked the Supreme Court to dismiss EPA's request that the Supreme Court review the D.C. Circuit Court's vacatur of CAMR. In addition, on February 23, 2009, the Supreme Court denied the Utility Air Regulatory Group's request for a review of the D.C. Circuit Court's decision (U.S. EPA, 2009c). In CAMR, states and tribes were given the option to adopt an allowance trading system, similar to the Acid Rain Program system, or to adopt emission regulations that would achieve CAMR requirements. During the first phase of the program, emissions were expected to be reduced by taking advantage of mercury reductions due to CAIR. During the second phase, coal-fired power facilities were to be subject to another mercury emissions cap. New facilities (construction starting on or after January 30, 2004) would also be subject to stringent new source performance standards (U.S. EPA, 2009a).

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44 United States Court of Appeals for the District of Columbia Circuit, No. 05-1244

45 Emissions reductions under the national ambient air quality standards (NAAQS) and the new source review (NSR) program are dependent in part to emissions reductions from CAIR.

46 For more information on the Transport Rule see http://www.epa.gov/airtransport/actions.html#jul10.

Because of the vacatur of CAMR's mercury emissions requirements, by March 2009, approximately one-half of the states (including most states in the Northeast) had moved to implement mercury emissions reduction programs independent of CAMR. However, without Federal monitoring requirements, many states have made or will have to make modifications to their guidelines. The other states without mercury emissions standards currently allow electricity generating units to emit mercury without limitations ((U.S. DOE, 2009d).

Also building off CAIR, the Clean Air Visibility Rule (CAVR), finalized on June 15, 2005, requires emission controls to reduce SO_2 and NOx emissions using Best Available Retrofit Technology (BART) for industrial and power generation facilities. Results of an EPA analysis showed that the CAIR allowance trading program for the power generation sector would result in greater visibility improvements than the BART requirements would provide. Therefore, states that are active in the CAIR allowance trading program are allowed to apply CAIR controls as an alternative for BART requirements under CAVR.[47]

Much like the requirements of the Proposed Existing Facilities Regulation, compliance with the above mentioned air emissions standards may require the owners of existing plants to install compliance technology and, as a consequence, change their operating practices. For example, according to the North American Electric Reliability Corporation's (NERC) report, *2008 Long-Term Reliability Assessment*, plants may need to be retired earlier than expected or need to be retrofitted with compliance technology, which can increase the generating facilities' own need for electricity and reduce the net electricity available for delivery to consumers. If these changes are necessary, according to NERC, "capacity margins would be reduced, increasing the need for more resources to meet resource adequacy requirements" (NERC, 2008).

2H.5.3 Renewable Portfolio Standards

In many states, Renewable Portfolio Standards (RPS) require electric utilities to generate a certain percentage of power from renewable sources. States have increasingly adopted RPS since the late 1990s: currently 31 states and Washington D.C. have mandatory RPS policies in effect, and four have voluntary utility commitments (PCGCC, 2009a). While the focus of most RPS activity in the United States has been at the state level, the U.S. House of Representatives and Senate have each, at different times, passed versions of Federal RPS; however, a Federal RPS has not yet been signed into law (U.S. DOE, 2008c). Typically, RPS aim to achieve 1 to 5 percent renewable power generation in the first year and then require increasing percentages every year thereafter, with most aiming for around 15 to 25 percent renewable power generation (PCGCC, 2009a). The definition of renewable sources differs among states. Some states allow only new renewables (renewable sources built after a certain year) while some allow all renewables, new and existing. Some RPS also involves credit trading programs, similar to the programs used in the air emissions regulations mentioned in *Section 2H.5.2.* Investors and power generators make the decision on what source of renewable energy to acquire or whether to purchase additional credits. Eventually, RPS should result in increased competition, efficiency, and innovation among the renewable energy sectors and should distribute renewable energy at the lowest possible cost (AWEA, 1997).

2H.5.4 Carbon Dioxide Emissions Regulations

Though not as prevalent as programs regulating emissions of SO_2 and NOx, carbon dioxide (CO2) emissions reduction programs are beginning to surface among states and on the national agenda. In the absence of federal action, five states[48] have adopted CO_2 caps or offset requirements for the power generation sector and regional cap and trade programs have begun to be implemented. Both the Northeast Regional Greenhouse Gas Initiative

[47] For more information on CAVR, see Regulatory Impact Analysis for the Final Clean Air Visibility Rule or the Guidelines for Best Available Retrofit Technology (BART) Determinations Under the Regional Haze Regulations available at: http://www.epa.gov/visibility/pdfs/bart_ria_2005_6_15.pdf (U.S. EPA, 2005)

[48] Oregon, Washington, California, Montana, and Illinois (PCGCC, 2009b).

(RGGI)[49] and the Western Climate Initiative (WCI)[50] were formed by groups of states in a given region to achieve reductions in CO_2. The RGGI program held its first auction of CO_2 credits on September 25, 2008, with the seventh auction planned for March, 2010. According to RGGI, these states have capped and will reduce CO_2 emissions from the power sector by 10 percent by 2018. The WCI looks to reduce greenhouse gas emissions to levels 15 percent below 2005 emissions by 2020 (U.S. DOE, 2009d). While several states are beginning to develop similar programs, Congress and the EPA are still deliberating on whether and how to implement mandatory CO2 reduction programs at the federal level.

Looking to the future, national CO_2 emissions cap and trade programs may be administered at the federal level. In addition, state and federal programs are likely to require increased reliance on renewable energy for electricity generation.

2H.6 Industry Outlook

Section 2H.6.1 presents a summary of forecasts from the Annual Energy Outlook 2009 (AEO2009) (U.S. DOE, 2009d).

2H.6.1 Energy Market Model Forecasts

This section discusses forecasts of electric energy supply, demand, and prices based on data and modeling by the EIA and presented in the AEO2009 (U.S. DOE, 2009d). AEO2009 projects future market conditions through the year 2030, based on a range of assumptions regarding overall economic growth, global fuel prices, and legislation and regulations affecting energy markets. The projections are based on the results from EIA’s National Energy Modeling System (NEMS), reflecting all Federal, State, and local laws and regulations in effect as of November 2008.[51]

Electricity Demand

AEO2009 projects electricity demand to grow by approximately 0.5 percent annually between 2007 and 2030. This growth is driven by an estimated 1.1 percent annual increase in commercial sector demand for electricity stemming from increases in demand for office equipment and growth in commercial floor space. Residential demand is expected to increase by 0.4 percent annually over the same forecast period; this increase is driven by a growing number of U.S. households, greater use of personal computers, and a shift to larger television formats; however, energy efficiency improvements offset this increased demand to a degree. EIA expects electricity demand from the industrial sector to increase by 0.1 percent annually.

Capacity Retirements

AEO2009 projects fossil fuel-fired generation to be the greatest share of capacity retirement. Overall, EIA forecasts 25.8 thousand MW of total fossil-steam capacity retirements between 2007 and 2030, including 18.3 thousand MW of oil and natural gas fired steam capacity. An additional 4.4 thousand MW of nuclear facility capacity are expected to retire during this period.

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49 The RGGI consists of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

50 The WCI consists of Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington.

51 The electricity market analysis undertaken by EPA for the analysis of this rule is based on AEO projections (see *Chapter 6: Electricity Market Model Analysis*).

Capacity Additions

Due to the estimated growth in electricity demand and the need to offset the retirement of 30 GW of existing capacity, AEO2009 expects that 259 thousand MW of new generating capacity will be needed by 2030. AEO2009 projects that these capacity requirements will be met by natural gas, coal, renewable energy, and nuclear power sources – in order of expected contribution. Of the new capacity projected to come on line between 2007 and 2030, approximately 53 percent is projected as natural gas-fired capacity, 22 percent is expected to be fueled by renewables, 18 percent by coal-fired plants, and 5 percent by nuclear energy. The increase in renewable capacity results in part from Renewable Portfolio Standards, as described in *Section 2H.5.3*.

Electricity Generation

AEO2009 projects increased electricity generation from both natural gas- and coal-fired facilities to meet growing demand and to offset lost capacity due to facility retirements. AEO2009 projects that coal-fired facilities will remain the largest source of generation throughout the forecast period. Natural gas-fired power facilities are expected to make up much of the new capacity over the next ten years, and coal-fired generation is predicted to decrease slightly between 2007 and 2030, reducing its share of total generation from 49 percent to an estimated 47 percent. The anticipated decrease in the share of coal generation results from concern regarding greenhouse gas emissions and the potential for emissions limits on CO_2. The share of total generation associated with natural gas-fired technologies is projected to stay approximately the same, increasing to 21 percent in 2027 but decreasing back to the 2007 level of 20 percent by 2030. The share of total generation from renewable power sources is expected to more than double over the analysis period, eventually accounting for 14 percent of total generation in 2030. Nuclear power generation, however, is expected to decrease from 19 percent to 18 percent as a share of total generation.

Electricity Prices

According to AEO2009, EIA expects the average inflation-adjusted price of electricity to stabilize in 2010 at an annual average of 9 cents per kilowatt-hour ($2007). After 2010, electricity prices are expected to stabilize and then rise steadily after 2015. This steady rise is due to the need for new capacity and the requirement for more renewables due to state mandates. Retail electricity prices are expected to reach an average price of 10.4 cents per kilowatt-hour in 2030.

2H.7 Glossary

Base Load: A baseload generating unit is normally used to satisfy all or part of the minimum or base load of the system and, as a consequence, produces electricity at an essentially constant rate and runs continuously. Baseload units are generally the newest, largest, and most efficient of the three types of units. (http://www.eia.doe.gov/cneaf/electricity/page/prim2/chapter2.html)

Combined Cycle Turbine: An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Distribution: The portion of an electric system that is dedicated to delivering electric energy to an end user.

Electricity Available to Consumers: Power available for sale to customers. Approximately 8 to 9 percent of net generation is lost during the transmission and distribution process.

Gas Turbine: A gas turbine typically consisting of an axial-flow air compressor and one or more combustion chambers, where liquid or gaseous fuel is burned and the hot gases are passed to the turbine. The hot gases expand to drive the generator and are then used to run the compressor.

Generation: The process of producing electric energy by transforming other forms of energy. Generation is also the amount of electric energy produced, expressed in watthours (Wh).

Gross Generation: The total amount of electric energy produced by the generating units at a generating station or stations, measured at the generator terminals.

Hydroelectric Generating Unit: A unit in which the turbine generator is driven by falling water.

Intermediate load: Intermediate-load generating units meet system requirements that are greater than baseload but less than peakload. Intermediate-load units are used during the transition between baseload and peak load requirements. (http://www.eia.doe.gov/cneaf/electricity/page/prim2/chapter2.html)

Internal Combustion Engine: An internal combustion engine has one or more cylinders in which the process of combustion takes place, converting energy released from the rapid burning of a fuel-air mixture into mechanical energy. Diesel or gas-fired engines are the principal fuel types used in these generators.

Kilowatt-hours (kWh): A measure of electric energy generated or consumed. The amount of energy generated from one Kilowatt of fully utilized capacity during one hour. A *Megawatt-hour* (MWh) is also an energy measure and equals 1,000 Kilowatt-hours.

Load: Refers to either demand for electricity or total electricity generated.

Megawatt (MW): Unit of power equal to one million watts. A watt is a measure of *power*, or the potential to produce or consume electricity (or other energy).

Nameplate Capacity: The amount of electric power delivered or required for which a generator, turbine, transformer, transmission circuit, station, or system is rated by the manufacturer.

Net Generation: Gross generation minus electricity used by the electricity generating facility (or company).

Nonutility: A corporation, person, agency, authority, or other legal entity or instrumentality that owns electric generating capacity and does not produce or sell electricity under a rate-regulation framework. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other nonutility generators (including independent power producers) without a designated franchised service area that do not file forms listed in the Code of Federal Regulations, Title 18, Part 141. (http://www.eia.doe.gov/emeu/iea/glossary.html)

Other Prime Movers: Methods of power generation other than steam turbines, combined cycles, gas combustion turbines, internal combustion engines, and hydroelectric generating units. Other prime movers include: geothermal, solar, wind, and biomass.

Peakload: A peakload generating unit, normally the least energy efficient of the three unit types, is used to meet requirements during the periods of greatest, or peak, load on the system. (http://www.eia.doe.gov/cneaf/electricity/page/prim2/chapter2.html)

Prime Movers: The engine, turbine, water wheel or similar machine that drives an electric generator. Also, for reporting purposes, a device that directly converts energy to electricity, e.g. photovoltaic, solar, and fuel cell(s).

Reliability: Electric system reliability has two components: adequacy and security. Adequacy is the ability of the electric system to supply customers at all times, taking into account scheduled and unscheduled outages of system facilities. Security is the ability of the electric system to withstand sudden disturbances, such as electric short circuits or unanticipated loss of system facilities. (http:/www.eia.doe.gov/cneaf/electricity/epav1/glossary.html)

Spinning Reserve: Reserve generating capacity running at a zero load and synchronized to the electric system. It is the unloaded section of synchronized generation that is able to respond immediately to serve load.

Steam Turbine: A generating unit in which the prime mover is a steam turbine. The turbines convert thermal energy (steam or hot water) produced by generators or boilers to mechanical energy or shaft torque. This mechanical energy is used to power electric generators, including combined cycle electric generating units that convert the mechanical energy to electricity.

System: Physically connected generation, transmission, and distribution facilities operated as an integrated unit under one central management or operating supervision.

Transmission: The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Utility: A corporation, person, agency, authority, or other legal entity or instrumentality that owns and/or operates facilities within the United States, its territories, or Puerto Rico for the generation, transmission, distribution, or sale of electric energy primarily for use by the public, and that files forms listed in the Code of Federal Regulations, Title 18, Part 141. Facilities that qualify as cogenerators or small power producers under the Public Utility Regulatory Policies Act (PURPA) are not considered electric utilities. Utility power generators produce and sell electricity at *cost-based* prices that are set under the traditional electricity rate regulation framework. http://www.eia.doe.gov/emeu/iea/glossary.html)

3 Development of Costs for Regulatory Options

In estimating the total cost of the proposed section 316(b) regulation for existing Electric Power Facilities (or Electric Generators) and Manufacturers, EPA developed costs both to facilities complying with the Proposed Section 316(b) Existing Facilities Rule (the Proposed Existing Facilities Rule, Proposed Rule, or Existing Facilities Rule) and to the State and federal governments to administer this rule. This chapter presents the details of the methodology and data inputs used in developing compliance costs for the regulatory options considered by EPA for the existing facilities rule. The discussion focuses specifically on cost development for the following three regulatory options that are presented in this chapter and the following chapters:

- **Option 1: IM Everywhere**
- **Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD**
- **Option 3: I&E Mortality Everywhere**

The following sections of this chapter describe:

1. The development of costs to existing facilities for complying with these regulatory options, including the compliance outlays of certain administrative activities incurred by complying facilities (*Section 3.1*)
2. The development of costs to State and Federal governments for administering the regulatory options (*Section 3.2*)
3. The development of costs to new units, reflecting the cost of installing EM technology for newly constructed generating units or increasing electric generating capacity at existing units (*Section 3.3*).

In developing compliance costs for Electric Generators and Manufacturers, and in performing the analysis of the Existing Facilities Rule options, generally, EPA followed closely the analysis approaches and impact evaluation concepts used in the analysis for the previous CWA 316(b) regulatory analyses, and to the extent possible relied on the same data sources.[52]

3.1 Development of Costs to Existing Facilities

EPA estimated costs to facilities for complying with the requirements of the Proposed Rule and the alternative regulatory options. The following discussion reviews four overall aspects of compliance cost development:

1. Determining the set of facilities potentially installing compliance technologies
2. Development of facility-level costs, which are broken into four main components:

- The cost of installing and operating compliance technology
- The cost of energy penalties
- The cost of installation downtime
- The cost of administrative activities.

3. Development of an estimated facility compliance schedule based on the period of years during which facilities would be required to meet regulatory requirements, which may vary depending

[52] For more details on these analyses, see *Chapter B1: Summary of Compliance Costs* in the suspended 2004 *Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule* report (U.S. EPA, 2004a) and *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* in the 2006 *Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule* report (U.S. EPA, 2006).

on the specific compliance technology adopted by a facility, facility type, and their NPDES permit expiration dates. This schedule supports analysis of the timing of compliance costs, benefits, and the potential impact on electricity supply resulting from shutdown of generating units during compliance technology installation.

4. Development of total costs to complying entities for each of the regulatory options.

3.1.1 Components of Facility-Level Compliance Costs: Installing and Operating Compliance Technologies

The three regulatory options would apply to existing facilities – Electric Generators and Manufacturers – with a design intake flow for cooling water exceeding 2 MGD (for more details on application of this Rule, see *Chapter 1: Introduction*). The following two sections describe the sets of facilities (potentially in-scope facilities) for which costs were estimated in order to assess the total impact on the electric power generating and manufacturing sectors.

Determination of In-Scope Manufacturers

EPA relied on information on cooling water systems and intake structures already in place collected in the Section 316(b) Industry Surveys (the 1999 Industry Screener Questionnaire (ISQ) and the 2000 Detailed Industry Questionnaire (DQ)) to estimate the number of manufacturing facilities that would potentially be in-scope of the regulatory options considered for the Proposed Existing Facilities Rule. Based on the criteria summarized in *Chapter 1*, EPA estimated that 592 manufacturing facilities would be potentially in-scope of the existing facilities rule.

Because the DQs were sent to a sample of the manufacturing industries that use cooling water, the respondents were assigned sample weights designed to represent other facilities that were not covered in the survey. Survey responses indicating that a facility was in-scope for the regulation are thus assumed to represent a sample-weighted number of facilities in the industry that would also be in-scope. Therefore, the compliance technology requirements and associated costs are weighted to represent the costs to these implicitly analyzed facilities. For more details on the manufacturers sample weighting, see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analysis*.

EPA determined that out of 592 Manufacturers, 72 facilities were baseline closures; therefore, the Agency excluded these Manufacturers from the cost and economic impact analyses.[53] EPA determined that 27 (weighted estimate) in-scope Manufacturers already have cooling towers installed and meet the water intake velocity requirement (see *Chapter 1: Introduction*), and thus will not have any further technology requirements under the Proposed Rule. These facilities would still incur administrative costs required to demonstrate compliance with the regulation.

Determination of In-scope Electric Generators

For the analysis of in-scope Electric Generators, EPA used information on cooling water systems and intake structures already in place, from 656 in-scope facilities that responded to the 2000 Section 316(b) Industry Short Technical Questionnaire (STQ) or the Detailed Industry Questionnaire (DQ): 284 facilities responded to the DQ and 372 facilities responded to the STQ. EPA also used photos and maps to supplement the questionnaire-based information where applicable and possible. Based on more recent data on these facilities from the Department of Energy's Energy Information Administration (EIA), EPA determined that 37 out of 656 facilities have terminated their steam operations since the time of the 316(b) Surveys and 15 out of 656 facilities are expected to retire

[53] A baseline closure is a facility that shows materially inadequate financial performance in the baseline and is at substantial risk of financial failure regardless of the 316(b) regulation (see *Chapter 10: Manufacturers Impact Analysis* for a more detailed discussion).

before the Rule's scheduled promulgation, i.e., 2012.[54] An additional 39 facilities are projected to close by the Integrated Planning Model (IPM), discussed in *Chapter 6: Electricity Market Analysis*.[55] All of these facilities were set aside from the analysis for the Proposed Rule. In addition, EPA excluded 19 Electric Generators located in California that use coastal and estuarine waters for power plant cooling. These facilities are already required by the State of California to comply with standards at least as stringent as the Proposed Existing Facilities Rule and thus are not expected to incur any compliance costs under any of the regulatory options considered in this economic analysis.[56] The Proposed Existing Facilities Rule analysis thus focused on the remaining 548 facilities.[57]

EPA determined that certain DQ and STQ Electric Generators would already meet compliance requirements under specific regulatory options, based on their having a recirculating cooling water system in place and/or meeting impingement and entrainment (I&E) mortality technology requirements in the baseline, as follows:

- **Option 1: IM Everywhere**. EPA estimates that 92 DQ and STQ Electric Generators already meet the IM technology requirements of this Option and thus will not incur additional compliance technology costs. Out of these 92 facilities, 39 have recirculating systems in their baseline and intake velocity less than or equal to 0.5 feet per second. The other 53 facilities do not have recirculating systems in their baseline, but have intake velocity equal to or less than 0.5 feet per second.
- **Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD**. EPA estimates that 58 DQ and STQ Electric Generators already meet the requirements of this option and thus will incur no additional compliance technology costs. Of these 58 facilities, 39 have recirculating systems in their baseline and intake velocity less than or equal to 0.5 feet per second and therefore fully meet the proposed I&E mortality requirements in the baseline and will incur no technology installation costs. The other 19 facilities have no baseline recirculating system, but have intake velocity equal to or less than 0.5 feet per second and DIF less than or equal to 125 MGD.
- **Option 3: I&E Mortality Everywhere**. For this option, EPA estimates that 39 DQ and STQ facilities already meet both the cooling tower and IM technology requirements and thus will not incur additional compliance technology costs. These facilities have recirculating systems in their baseline and intake velocity of less than or equal to 0.5 feet per second.

While these facilities will be subject to the requirements of the Proposed Rule, they are not expected to incur compliance technology costs as outlined above for the various regulatory options analyzed. However, all of these facilities would still incur administrative costs required to demonstrate compliance with the Proposed Rule.

In its analysis of facility-level cost and economic impacts, EPA estimated technology costs *explicitly* only for the DQ facilities that do not already meet the proposed I&E mortality technology requirements in their baseline: 189 under Option 1, 210 under Option 2, and 218 under Option 3. Estimated technology costs and impacts for the remaining 267, 280, and 291 STQ facilities under Options 1, 2, and 3, respectively, which do not already meet the proposed performance requirements in their baseline operations, were assessed by application of sample weights

[54] For this analysis, facilities that no longer operate steam capacity are considered retired for this analysis as long as any remaining water intake is for purposes other than cooling.

[55] For the purpose of this analysis, EPA identified a facility as fully closed if all of its steam electric generating units are reported as retired in IPM even if one or more units' capacity is reported as only partially retired in IPM. For the cost analyses presented in this report, EPA peformed an alternative analysis using a different unit closure defintion in which "partially retired" units were assumed to be fully operating. The results of this alternative analysis are reported in a memorandum to the record.

[56] Water intake velocity at these facilities must not exceed 0.5 feet per second and intake flow must not exceed the level commensurate with the level attained by a closed-cycle wet cooling system.

[57] These are non-retired Electric Generators that responded to *either* DQ or STQ, excluding coastal and estuarine Electric Generators located in California. This number is *not* a weighted estimate. See *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses* for information on facility-level weights.

to the estimates developed for the explicitly analyzed DQ facilities. EPA developed and applied three sets of sample weights according to the specific cost element or other facility characteristic for which the sample weights are intended to provide estimates. Specifically, the Agency developed sample weights on three extrapolation bases: (1) facility count, (2) electric generating capacity, and (3) design intake flow (DIF) (for a discussion on weights development and application refer to *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).

EPA also performed a *market-level* assessment of cost and economic impacts (see *Chapter 6: Electricity Market Analysis*). For this analysis, EPA used technology costs that were estimated for 533 existing Electric Generators that: (1) responded to the DQ *and STQ*, (2) lack a recirculating system and do not meet IM requirements in their baseline operation, and (3) were included in the Market Model Analysis system. EPA recognizes that the cost estimates for the STQ facilities contain greater uncertainty than those estimated for the DQ facilities. However, because the market-level analysis *requires compliance cost data for each individual in-scope facility and cannot be undertaken on the basis of a sample of facilities with application of sample weights to the in-scope population*, this approach was necessary.

As described in *Chapter 6: Electricity Market Model Analysis*, EPA performed a Market Model Analysis using the Integrated Planning Model (IPM), to assess the economic impact of the regulatory options within the context of regional and national electricity markets. The market model analysis baseline, which involves a projection of electricity markets and facility operations into the future, indicated that some of the currently operating in-scope electric generating units, and in some instances, the whole facilities, would close by the time those facilities would be expected to begin achievement of compliance with the proposed regulation. Consequently, for the Market Model Analysis, EPA treated these generating units as baseline closures and set them aside from that analysis. In addition, EPA removed *facilities* that IPM projects to retire *all* steam generating units from all other cost and economic impact analyses. Because compliance cost estimates were developed at the level of an intake structure and EPA was not able to link intake structures to the generating units, the Agency kept facilities projected to retire *some but not all* of their steam generators in the non-IPM analyses.

3.1.2 Components of Facility-Level Compliance Costs: Installing and Operating Compliance Technology

For each of the three regulatory options, EPA estimated compliance costs at manufacturing and power generating facilities based on the extent to which current technologies already comply with the requirements of a given option, and the additional technology that EPA estimated would be needed to meet requirements for that facility. When EPA judged that a facility already had technology in-place that would meet the performance requirements of a given regulatory option, EPA assigned no additional technology requirements or associated costs to that facility.

The specific technologies, while varying across different regulatory options considered by EPA, reduce impingement mortality and entrainment through one of two methods:

1. Exclusion through implementation of design and construction technologies to reduce IM
2. Flow reduction through conversion of cooling systems from once-through to re-circulating operation to reduce the design intake flow and impingement and entrainment.

EPA developed the following costing modules for assessing model-facility compliance costs under the three regulatory options:

- CT Cooling Tower
- #1 Add Fish Handling and Return System
- #3 Add New Larger Intake Structure with Fine Mesh, Handling and Return
- #4 Relocate Intake to Submerged Near-shore with passive fine mesh screen

- #5 Add Fish Barrier Net
- #8 Add Velocity Cap at Inlet
- #10.2 Modules 3 and 5
- #10.3 Module 1 plus Module 5

These costing modules are described in detail in the Technical Development Document for the Proposed Section 316(b) Existing Facilities Rule (EPA-821-R-11-003), hereafter referred to as the Technical Development Document (TDD).

The major components of technology costs are:

- *Capital costs*. These costs include the cost of designing and installing the assigned compliance technology. Facilities assigned cooling towers are assumed to incur these costs over two years starting one year before the year in which they achieve compliance, discussed in *Section 3*, below. Facilities assigned other compliance technologies incur all capital costs during the compliance year. Capital costs may repeat during the compliance analysis period – assumed 30 years – based on the estimated service life of the capital equipment.[58]

- *Recurring O&M costs*. These costs include regular *annual* maintenance and upgrading activities and consist of fixed and variable costs. In addition, these costs include the cost of initial and follow-up entrainment studies that Electric Generators and Manufacturers with average intake flow (AIF) exceeding 125 MGD are required to perform. Electric Generators with DIF exceeding 50 MGD are required to conduct the initial entrainment study over a three year period starting six months after rule promulgation; Manufacturers and all other Electric Generators are required to conduct the initial entrainment study over a three year period starting a year and a half after promulgation of the Rule. Although these initial study costs occur only once, they are included in the O&M cost pool. In addition, these facilities will submit follow-up entrainment studies of one year duration every third year after completion of the initial entrainment study (see the *Technical Development Document*).

In addition to these technology cost items, which were estimated as specific dollar values for each facility, EPA also accounted for two additional technology-related cost and operating effects for facilities assigned compliance technology:

1. *Energy Penalty.* Energy penalty effects arise from two factors: (1) an increase in auxiliary power required to operate an assigned compliance technology and (2) a reduction in the energy conversion efficiency of the power generating system, which occurs with operation of retrofitted recirculating system compliance technologies. Depending on generating unit type and baseline operating circumstances, the combination of these effects (referred to as the "energy penalty") is assessed as (1) a reduction in the generated electricity that is available for sale or (2) an increase in the production cost of sold electricity. The energy penalty effect is discussed in *Section 3.1.3*, below.

2. *Installation downtime.* Installation of certain compliance technologies will require a one-time, temporary downtime period for the facility; costs associated with this connection outage are discussed in *Section 3.1.4*, below.

For further discussion on compliance cost development, see the *Technical Development Document*.

[58] As discussed later in the report, 30 years is the analysis period used for all facility-related analyses and reflects the useful life of the longest lived 316(b) compliance technology – cooling tower and certain IM technologies.

3.1.3 Components of Facility-Level Compliance Costs: Energy Efficiency Penalty

Facilities assigned cooling towers will incur a permanent reduction in the electricity production efficiency of affected power generating units: for a given level of energy input to the generating unit, the quantity of electricity that is available to be sold for revenue or used beneficially by the power generator for onsite services (e.g., electricity for onsite offices) is reduced. As described above, the energy penalty assessed in this analysis includes two effects:

1. *Increased auxiliary power requirement*. Cooling towers require some of the facility's power output to operate the compliance technology (e.g., pumps and fans). This effect manifests itself as a reduction in produced power that is available for sale, given a baseline level of power generation. This effect is more substantial for cooling towers than for the IM technologies. For the analysis of cooling tower installations, the auxiliary power requirement was assessed as a percentage reduction in the generating capacity and electric generating output for any given level of energy input. For the analysis of IM technologies, the cost of the auxiliary power requirement was included in the estimated cost of technology operation and maintenance.
2. *Reduction in unit generating efficiency.* Operation of retrofitted recirculating or dry cooling systems causes an increase in turbine back-pressure, which reduces the amount of electricity that is produced by the electric generating unit for the same energy input. For this analysis, the reduction in unit generating efficiency was also assessed as a percentage reduction in the generating capacity and electric generating output for any given level of energy input.

The following sections explain the accounting for energy penalty effects for Electric Generators and Manufacturers.

Electric Generators

EPA assessed the impact of the energy penalty effects differently for Electric Generators depending on the type of generating unit affected and the unit's baseline operating circumstances in terms of capacity utilization:

- For generating units that operate at high capacity utilization (namely, nuclear units and base load fossil fuel units with capacity utilization exceeding 62 percent), EPA assumed that the energy penalty will manifest as a loss in generating capacity available for production of revenue. As a result, the financial effect of the energy penalty is to reduce the revenue otherwise received by the generating unit, but with no change in the cost of energy inputs to the generating unit.
- For units that operate at lower capacity utilization (i.e., less than or equal to capacity utilization rate of 62 percent), EPA assumed that the energy penalty effect can be offset by increasing the energy input to the unit, thereby avoiding a loss in revenue. In this case, although the generating unit does not lose revenue, the cost of generating electricity for sale from the unit will increase, and the financial effect is a reduction in the operating margin for electricity sales from the affected unit.

Regardless of the method for accounting for the energy penalty effect, EPA combined the separate operating effects to yield the total energy penalty effect as follows:

$$Total\ Penalty = Aux.\ Requirement + Eff.\ Loss + \left(Aux.\ Requirement * Eff.\ Loss\right) \qquad (3\text{-}1)$$

Where:

Total Penalty = Total percentage loss in generating unit production capability for a given level of energy input to the generating unit

Auxiliary Power Requirement	=	Energy required for operation of the compliance system, as a percentage of baseline generating unit capacity
Reduction in Unit Generating Efficiency	=	Reduction in generating unit energy conversion efficiency, as a percentage of baseline generating unit capacity.

EPA estimates that *increased auxiliary power requirements* will range from 0.0013 to 9.11 percent[59] of baseline steam generating capacity for Electric Generators. EPA estimated *unit generating efficiency loss* as 1.5 percent and 2.5 percent of baseline steam generating capacity for each non-nuclear and nuclear facility assigned a cooling tower, respectively. As described above, EPA assumed that nuclear Electric Generators and fossil Electric Generators with capacity utilization rate exceeding 62 percent will not to be able to increase their electricity generation to make-up this efficiency loss on site and that other Electric Generators supplying to the grid would have to increase their electricity production to ensure the adequate electricity supply. For these Electric Generators, EPA accounted for the energy penalty as revenue loss – i.e., revenue was reduced by the amount of the *Total Penalty* percentage as follows:

$$\textit{Adjusted Revenue} = \textit{Baseline Revenue x (1 - Total Penalty Percentage)} \qquad (3\text{-}2)$$

For all other in-scope Electric Power facilities, EPA assumed that the generating units would have sufficient excess generating capacity to be able to make up the potential loss in electricity generation on site. For these facilities EPA accounted for the energy penalty effect as an increase in fuel and other variable operation and maintenance costs. The increased value of these costs was calculated as follows:

$$\textit{Adjusted Fuel and Variable O\&M} = \textit{Baseline Fuel and Variable O\&M} \Big/ (1 - \textit{Total Penalty Percentage}) \qquad (3\text{-}3)$$

In these calculations, the baseline revenue, fuel and variable O&M are assumed to be as of the year of compliance (see *Section 3.1.4*, below, for discussion of revenue estimation and *Section 3.1.4*, for discussion of cost estimation).

Manufacturers

While the calculation of the *Total Penalty Percentage* loss is the same for both Electric Generators and Manufacturers, the economic value of this loss for Manufacturers is calculated differently. For Manufacturers, EPA estimates that *increased auxiliary power requirements* range from 0 to 48.5 percent[60] of baseline steam generating capacity and estimated the same *unit generating efficiency loss*, 1.5 percent of baseline steam generating capacity, for Manufacturers as estimated for Electric Generators

For Manufacturers, the economic value of energy is calculated in one of two ways, depending on the facility's characteristics. If a Manufacturer sells electricity to the grid, the cost of the energy penalty is valued as a reduction in revenue from electricity sales. If the manufacturer only generates power for its own use and does not sell electricity to the grid, EPA assumed that the energy penalty's reduction of the facility's electricity generation will be made up by purchasing an equivalent amount of electricity, effectively supplementing the facility's reduced output to keep its total electricity usage constant.

Facilities reported revenue from electricity sales, if any, for 1996, 1997, and 1998 on the 2000 316(b) DQ. EPA used the average of these reported values, adjusted for inflation to 2009, as the facilities' electricity sales revenue

59 Of the 559 Electric Generators, only 8 have increased auxiliary power requirements exceeding 5 percent..

60 Of the 592 Manufacturers, only 13 have increased auxiliary power requirements exceeding 10 percent.

values. For facilities that sold electricity, EPA multiplied the energy penalty percentage calculated in *Equation (3-3)* by this revenue value to determine the value of energy penalty losses.

Facilities also reported total electricity generated for 1996-1998 in the DQ, and EPA used the average of these values as facility-level generation in this analysis. For facilities that did not sell electricity and are assumed to need to purchase power to make up losses to energy penalty, EPA multiplied this generation value by the energy penalty percentage calculated in *Equation* (3-3*)* to determine the amount of electricity a given facility would have to purchase to meet its energy needs. EPA then used EIA-reported electricity prices for the industrial sector, by state for the year 2007 and adjusted for inflation to 2009, to determine the cost of purchasing this electricity, resulting in the value of the energy penalty at these facilities.

For a detailed discussion of the development of these energy penalty values, see the *Technical Development Document*.

3.1.4 Components of Facility-Level Compliance Costs: Installation Downtime

Installation of certain compliance technologies will require facilities to shut down temporarily their business operations (installation downtime). This downtime will lead to a loss in facility revenue and net income, which constitutes an additional regulation-induced cost to complying facilities.[61] In addition, specifically for electricity generation, depending on the extent and scheduling of installation downtime, the occurrence of these temporary reductions in electricity supply could create local electricity market imbalances, with undesirable reductions in system reliability reserve margins and/or short-term electricity price increases. EPA estimated downtime in weeks based on the type of compliance technology to be installed and the type of facility.

Manufacturers

The required downtime for other compliance technologies varies by module.[62] *Table 3-1*, below, presents the number of downtime weeks by technology module assigned to Manufacturers.

Table 3-1: Estimated Average Net Downtime for Technology Modules

Module	Description	Estimated Net Downtime (Weeks)
1	Add Fish Handling and Return System	0
3	Add New Larger Intake Structure with Fish Handling and Return	0,1
4	Relocate Intake to Submerged Near-shore with passive fine mesh screen	3,7
5	Add Fish Barrier Net	0
8	Add Velocity Cap at Inlet	0
10.2	Module 3 plus Module 5	0
10.3	Module 1 plus Module 5	0

Source: U.S. EPA analysis, 2010

Installation downtime may affect business operations at a manufacturing facility in several ways:

1. The facility may be unable to perform production or other business operations that depend on cooling water.

[61] EPA used a different method for calculating the *social cost* of installation downtime. The social cost analysis method recognizes that the cost to society of downtime is the differential cost of energy production from use of other electric generating units to meet energy demand instead of the 316(b) compliance units that are temporarily out of service during the period of technology installation. The social cost may differ, perhaps substantially, from the private cost to the entity incurring the installation downtime. EPA's estimate of the social cost of downtime is derived from the Market Model Analysis findings, which are documented in *Chapter 6: Market Model Analysis*. See *Chapter 11: Assessment of Total Social Costs* for discussion of the use of the Market Model Analysis findings in developing the estimated social cost of installation downtime for the regulatory options.

[62] For information on how these technology modules were assigned to in-scope facilities, see the Technical Development Document.

2. The facility may lose revenue from the production and sale of the goods and services that otherwise would have been produced by the affected production operations during the period of downtime.
3. The facility may shed the variable cost of producing the goods and services not able to be produced during the period of installation downtime. However, the facility will continue to incur the fixed costs of production associated with the affected operations.
4. If, as part of its cooling water dependent operations, the facility generates electricity for its own use, and some part of this self-generated electricity continues to be needed during the period of installation downtime, the facility may need to purchase replacement electricity.

Together, these effects may lead to a loss in pre-tax income, which EPA calculated and used as the cost of installation downtime in its analysis of facility impacts. For the options considered for this proposal, EPA estimates that facilities will not need to interrupt any manufacturing processes other than electricity generation. Thus the impact of downtime for Manufacturers is calculated as revenue lost from electricity sales and the cost of replacing electricity normally generated and consumed at the facility.

EPA used information from the 316(b) DQs to calculate the income loss in electric power-related operations. This includes: (1) annual electric revenue reported as cooling water dependent, (2) the fuel cost of electric power generation, which is assumed to be shed during the period of curtailed operations, (3) the quantity of electricity consumed by the facility, and (4) the quantity of electricity generated by the facility. The remaining key input required for this analysis is the unit price of replacement electricity: for this item, EPA used the average electricity price for industrial customers by state, using data reported by the EIA, for 2007 (the latest year available), adjusted to 2009 using the EIA's projection of electricity prices. EPA calculated the pre-tax income loss effect for electric power generation activities as follows.

1. Average annual electric revenue from cooling water-dependent generation is obtained from the facility questionnaire and adjusted for inflation to 2009. This value is assumed to be the annual revenue loss in electric power generation, from curtailment of cooling water-dependent operations.
2. Average annual fuel cost of electric power generation is obtained from the facility questionnaire and adjusted for inflation to 2009. EPA assumes that this value is shed during the period of curtailed operations.
3. Calculate self-generated electricity that is consumed by the facility as the lesser of (a) the facility's own electricity generation or (b) the electricity used within the facility.
4. Calculate the quantity of replacement electricity to be purchased by the facility, by multiplying the quantity of own-generated electricity that is consumed by the facility by the fraction of non-electric revenue that is cooling water dependent *but subject to* a maximum reduction in electricity need of 75 percent. That is, the facility is assumed to need replacement electricity in proportion to the fraction of non-electric revenue *that is not cooling water-dependent.*
5. Calculate the cost of electricity purchased to replace self-generated electricity used by the facility by multiplying the quantity of replacement electricity by the average electricity price, by state, for industrial customers.
6. Calculate *annual* loss in pre-tax income for electric power-related operations as estimated revenue loss from cooling water-dependent generation *less* estimated annual fuel cost of electric power generation *plus* cost of electricity purchased to replace own-generated electricity.

7. Calculate pre-tax income loss in electric power-related operations, from installation downtime, by multiplying the annual pre-tax income loss by the fraction of the year indicated as the net downtime required for installing compliance equipment.

In certain cases, the cost of replacement electricity was estimated to be less than a facility's indicated fuel costs, resulting in a negative cost of downtime. However, in order to avoid potentially understating the burden of installation downtime, EPA set a floor of $0 for the cost of downtime.

Electric Generators

Table 3-2, below, presents the number of downtime weeks by technology module assigned to Electric Generators. EPA assumed that in-scope Electric Generators would install 316(b) compliance technology – cooling tower and/or IM technology – during the spring and fall, when electricity demand is on average at its lowest. In assessing the impact of installation downtime for fossil fuel Electric Generators, EPA assumed that cooling tower and IM technology installation would occur at the same time as customary annual maintenance, which typically requires facilities to shut down their electricity generating units for a minimum duration of 4 weeks. As a result, for fossil fuel Electric Generators, EPA calculated the net additional downtime due to regulatory compliance as total downtime outage less the 4 weeks of customary annual maintenance.

In assessing the impact of installation downtime for nuclear Electric Generators, EPA assumed that IM technology installation would take place during In-Service Inspections (ISIs). ISIs occur at 5-year intervals and typically last 8 to 16 weeks; consequently, the Agency calculated the net additional downtime for IM technology installation as total downtime outage less the 8 weeks of periodic ISIs (i.e., the minimum ISI duration).[63] Because the *total* number of weeks of downtime required to install IM technology at a nuclear facility is expected to be less than 8 weeks, nuclear facilities are not expected to incur any *additional* downtime for IM installation. EPA assumed that cooling tower installation would take place during either extended capacity upratings (ECUs) or during ISIs. ECU takes place at most once during the life of a nuclear facility and lasts several months.EPA assumed that nuclear facilities that have not applied for ECUs with the Nuclear Regulatory Commission (NRC) will do so in the future and will install cooling towers during their ECUs; EPA expects that the length of the ECU will be sufficient to install a cooling tower and did not assign additional downtime to these nuclear facilities. The Agency assumed that nuclear facilities that applied for and were given permission by the Nuclear Regulatory Commission (NRC), have either gone through ECU or have completed all of the engineering developments for the ECU; EPA expects these facilities will install cooling towers during their ISIs; consequently, the Agency calculated the net additional downtime for IM technology installation as total downtime outage less the 8 weeks of periodic ISIs. To the extent that an ISI would require 16 weeks, EPA's estimate of downtime costs is an overestimate. (see *Technical Development Document* for more detail).

The required net downtime for compliance technology installation varies by module and facility type.[64] EPA assumed that nuclear facilities will incur no net downtime due to 316(b) technology installation (see *Technical Development Document* for more detail). Facilities required to install both cooling tower and IM reduction technologies are expected to do so during the same time. For details on the compliance schedule, see *Section 3.1.6, below.*

[63] For details see United States Nuclear Regulatory Commission. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437 Vol. 1). Available online at: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/v1/part02.html#_1_49

[64] For information on how these technology modules were assigned to in-scope facilities, see the *Technical Development Document*.

Table 3-2: Estimated Average Net Downtime for Technology Modules

Module	Description	Estimated Net Downtime (Weeks)
CT	Cooling Tower	0 or 24 for nuclear, 4 for non-nuclear
1	Add Fish Handling and Return System	0
3	Add New Larger Intake Structure with Fine Mesh, Handling and Return	2
4	Relocate Intake to Submerged Near-shore with passive fine mesh screen	0, 3, 9
5	Add Fish Barrier Net	0
8	Add Velocity Cap at Inlet	0
10.2	Module 3 and Module 5	2, 3
10.3	Module 1 and Module 5	0

Source: U.S. EPA analysis, 2010

EPA calculated the financial loss to complying facilities from installation downtime as lost revenue less variable production costs not incurred during the net installation downtime period, as follows:

- For facilities modeled in the Market Model Analysis system, EPA calculated the average of each downtime cost element – i.e., *winter* energy revenue, *total annual* capacity revenue, *winter* fuel costs, and *winter* variable O&M costs – over the years 2015, 2020, 2025, and 2028, for each generating unit.[65,66] EPA used these averages to develop downtime costs at the level of a generating unit, and then summed these estimates to the facility. For 216 out of the 223 explicitly analyzed facilities with assigned technology costs, installation downtime costs are based on the Market Model Analysis.
- To estimate potential plant-specific revenue loss for the remaining 7 facilities, EPA used generator-level data on electricity generation and utility-level electricity sales and revenue data, from two Energy Information Administration databases: EIA-906/920/923 (for steam generation) and EIA-861 (for electricity sales and revenue) databases. EPA used the utility-level revenue and sales quantity data to estimate electricity prices (revenue per MWh of sales) for each in-scope Electric Generator. As the measure of price, EPA used the average of *wholesale* prices (wholesale revenue per MWh of wholesale sales) for the preceding five years, 2003 through 2007, if these prices were below 2003-2007 average *retail* prices (retail revenue per MWh of retail sales); however, if *wholesale* prices exceeded *retail* prices, the Agency used *total* prices (total revenue from all sources per MWh of total sales). For the measure of generating output, EPA used the average of 2003-2007 prime mover-level steam generation values, which EPA then aggregated to the level of the facility to calculate facility-level steam generation.[67] EPA estimated the share of total power disposition sold through retail and wholesale operations for each facility using EIA-861 data as a 2003-2007 average and used these shares to adjust facility-level

65 In calculating these averages over the data years, EPA set aside from the averaging calculation values for years that are anomalously low, i.e., more than 30 percent below the 4-year average values.

66 The Integrated Planning Model (IPM), which is used for the Market Model Analysis (see *Chapter 6: Electricity Market Model Analysis*), reports generation, energy revenue, variable O&M and fuel costs for winter and summer seasons, but does not report information for the shoulder season demand periods – fall and spring – which are the periods when EPA expects that installation downtime would generally occur. EPA used information for the winter season because, for the United States, winter is generally a lower demand season than summer and therefore, would provide a better basis for assessing the impact of downtime-based capacity reductions *that would actually be expected to occur during the lower demand shoulder season operating periods.* IPM reports capacity revenue for the entire year, and not by season; thus, the potential capacity revenue loss was assessed on the basis of the annual value of capacity revenue. This assessment may overstate the revenue loss during off-peak periods, when capacity would generally be in greater supply relative to demand, and, as a consequence, capacity revenue would generally be lower per calendar period than in on-peak periods, and potentially zero.

67 As is the case with installation downtime calculation based on the IPM data, in the year-by-year generation values to develop an average over the data years, EPA set aside from the averaging calculation, generation values for years that are anomalously low. Such low generating output would likely result from a generating unit being out of service for maintenance.

electricity generation values. The product of the adjusted electricity generation and price values is the loss in revenue on an *annual* basis.[68]

- For the 7 facilities not modeled in IPM, EPA estimated variable that would be shed during downtime cost using the average of IPM-generated *total annual* variable cost values – fuel and variable O&M – by North American Electric Reliability Council (NERC) region and/or steam plant type, expressed on a per-unit of generated energy basis, and facility-level 2003-2007 average steam generation from the EIA-906/920/923 database. Facilities are assumed to be able to shed the variable cost of energy production for affected capacity during the installation downtime period; the product of electricity generation and variable cost per MWh is unincured variable costs on an annual basis.
- EPA performed all revenue and cost effect calculations on a per-week basis (i.e., annual values divided by the number of weeks a given facility is available for electricity generation in a given year, which assumes that all revenue and cost values occur uniformly over this availability time period).[69] Subtracting variable cost reduction from revenue, on a per-week basis, yields the net income loss per week from installation downtime.
- EPA multiplied these *per-week* net revenue loss values by the estimated net downtime weeks to yield the one-time net income loss from installation downtime.

EPA decided not to assign any downtime costs to facilities with very low capacity utilization rates, i.e., less than 15 percent.[70] Given the low frequency of utilization of these units, the Agency determined that these facilities would very likely be able to schedule downtime at a time that will not result in any revenue loss. For facilities modeled by IPM, to estimate capacity utilization rates, EPA used the average of the IPM projections of electricity generation and capacity for 2015, 2020, 2025, and 2028 (see *Chapter 6: Electricity Market Model Analysis*).[71] For facilities not modeled in IPM, EPA calculated capacity utilization rates based on two EIA databases: 2007 EIA-860 (for capacity) and 2003-2007 EIA-861 (for generation).[72]

For this analysis and other dollar value analyses, EPA expressed all annualized cost and revenue values as of 2015 in 2009 dollars. EPA selected 2015 as the adjustment year for two reasons. First, 2015 is approximately mid-way through the period in which facilities assigned only IM technology are expected to achieve compliance (2013-2017), which is the first 5-year compliance window and therefore closely reflects the operating conditions of these in-scope facilities at the time of compliance (see *Section 3.1.6*, below, for discussion of compliance schedule). Second, although facilities assigned cooling towers are expected to comply during windows of time that are farther into the future (2018-2022 for non-nuclear Electric Generators and 2023-2027 for nuclear Electric Generators and Manufacturers), EPA was not confident in the reliability of projecting compliance cost and revenue values beyond 2015; consequently, the Agency used 2015 as the adjustment year for all in-scope facilities regardless of assigned compliance technology.

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68 The EIA-861 database does not provide data by season; consequently, EPA calculated cost of installation downtime for the 7 DQ facilities not modeled in IPM on an annual, as opposed to seasonal, basis.

69 For facilities for which downtime costs were estimated using IPM data, the number of availability weeks may vary across the generating units within a facility. For all other facilities, EPA assumed that generating units are available 48 weeks, i.e., total number of weeks in the entire year (i.e., 52 weeks) less 4 weeks of assumed baseline customary maintenance downtime.

70 Only steam generating units were included in the calculation of capacity utilization rate.

71 In the same way as described above for calculating installation downtime costs, in developing average generation and capacity values for CUR generation, EPA set aside from the averaging calculation, values for years that are anomalously low, i.e., more than 30 percent below the 4-year average values.

72 EPA set aside from the averaging calculation, values for years that are anomalously low, i.e. more than 30 percent below the 4-year average values.

The adjustments of cost and revenue values to state them as of 2015 in 2009 dollars account for two concepts of price and/or cost change over time:

1. The historical or expected change in prices or costs for outlays of a given cost category (e.g., electricity prices, construction costs) from the year at which costs or prices were initially estimated to the estimated year of their occurrence. The methodology of bringing all cost and revenue values to 2015 is based on the assumption of zero real growth rate after 2015.
2. A general inflation adjustment to state values in constant 2009 dollars.

The net effect of these adjustments is to account for the possibility that certain cost categories (e.g., electricity prices) may change over time at rates that differ, perhaps substantially, from the general rate of inflation.

These adjustments were performed as follows:

- For facilities for which electricity revenue values were developed from EIA data (i.e., not obtained from the Market Model Analysis), EPA developed these values using the average of utility-level or NERC-level, depending on data availability, 2003-2007 electricity prices. Because these individual yearly prices were in dollars of each of the reporting years, EPA's first step in this calculation was to state these prices in dollars of the year 2009 using the GDP Deflator published by the U.S. Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce (DOC). These individual yearly values were then averaged and brought forward to 2015, using electricity price projections from the Annual Energy Outlook publication for 2009 (*AEO2009*).[73] Because the AEO2009 electricity price projections are in constant dollars, these adjustments yield revenue values as of 2015, in dollars of the year 2009.
- For facilities for which electricity revenue and variable cost values were obtained from the Market Model Analysis, the values are assumed to be as of 2015 but in dollars of the year 2006. Thus, no adjustment was needed to bring the values to 2015. However, as described below, a further adjustment was needed to state these revenue estimates in 2009 dollars.
- Compliance technology cost values, which were originally estimated as of February of 2009, were adjusted over time to 2015 for all facilities regardless of technology and/or facility type using the Construction Cost Index (CCI) from McGraw Hill Construction. The average of the year-to-year changes in the CCI over the most recent ten-year reporting period was used to estimate these values in the year in which the costs would be incurred. The resulting values are as of 2015 and in 2015 dollars.
- The above adjustments yield revenue and cost values as of 2015 but in dollars of varying years, depending on the underlying estimation approach and adjustment concept. For example, the revenue values based on EIA data are in 2009 dollars while the Market Model Analysis-based revenue and variable cost values are in 2006 dollars. Because EPA performed the cost and economic impact analysis in constant 2009 dollars, a further adjustment was needed to restate these projected cost and revenue values in 2009 dollars. For this adjustment, EPA used the average of the year-to-year changes in the GDP Deflator over the most recent ten-year reporting period to restate dollars of a future year to 2009 dollars.

3.1.5 Components of Facility-Level Compliance Costs: Administrative Costs

The suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule included a range of administrative activities that in-scope facilities would need to perform to establish compliance requirements, obtain needed

[73] Annual Energy Outlook is published by the Energy Information Administration (EIA). AEO2009 contains projections and analysis of US energy supply, demand, and prices through 2030; these projections are based on results from the Energy Information Administration's National Energy Modeling System.

permits, and perform periodic monitoring, reporting, and re-permitting subsequent to initial compliance efforts.[74] For the Proposed 316(b) Existing Facilities Rule, EPA significantly reduced the administrative burden on facilities, eliminating many of the activities required by the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule. For the remaining administrative requirements, EPA used the hourly burdens estimated for these activities in the suspended 2004 Phase II Final analysis and updated labor rates and other costs as described at the end of this subsection. EPA applied the same methodology and assumptions to the Electric Generators with design intake flow (DIF) of 2 to 50 MGD and Manufacturers, which were not part of the suspended 2004 Phase II Final Rule (U.S. EPA, 2004a). The principal areas of change in administrative requirements and the updating of the cost estimation framework for this proposed rule are summarized below.

Administrative activities

EPA reviewed activities associated with the initial NPDES permit application and permit renewal as well as annual monitoring, record-keeping, and reporting activities (monitoring activities). To accommodate the revised language of the Proposed Existing Facilities Rule, EPA modified the assignment of administrative costs based on the requirements of the regulation. The two factors that determine administrative costs of a given in-scope facility are: (1) its waterbody type (freshwater or marine) and (2) whether it has/is required to install a cooling tower or will install other BTA.[75] Facilities that have or are required to install cooling towers are exempted from the monitoring requirements.[76]

Table 3-3 below presents a list of initial permitting activities and estimated administrative costs associated with these activities; these costs are the same for all options and for all categories, as all facilities are required to perform these activities. All of these costs are expected to be incurred one year before the facility's compliance year. EPA estimates that initial post-promulgation permit application will cost $33,737 per facility.

Table 3-3: Cost of Initial Post-Promulgation NPDES Permit Application Activities ($2009)

Activity	Freshwater		Marine	
	IM Requirements	Cooling Tower	IM Requirements	Cooling Tower
Start-up activities	$2,958	$2,958	$2,958	$2,958
Permit application activities	$14,176	$14,176	$14,176	$14,176
Source water Baseline Biological Characterization	$16,603	$16,603	$16,603	$16,603
Total	**$33,737**	**$33,737**	**$33,737**	**$33,737**

Source: U.S. EPA analysis, 2010

Table 3-4 below lists relevant NPDES permit renewal activities and estimated administrative costs associated with these activities. These activities are the same as those for the initial post-promulgation permit, but are estimated to cost less in subsequent permit applications. As with the cost for the initial post-promulgation permit, these costs do not vary by option or by category, as all facilities are required to perform these activities. EPA assumed that facilities will incur these costs in the year prior to the application for a permit renewal. EPA estimates that subsequent post-promulgation permit applications will cost $14,789 per facility.

74 For details see *Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule* report available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/phase2/upload/2009_03_26_316b_phase2_econbenefits_final_toc.pdf

75 Freshwaters includes streams, rivers, lakes, and reservoirs, except for the Great Lakes. Marine waters include estuaries and tidal rivers, oceans, and the Great Lakes.

76 For the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule, these facilities were assigned additional administrative costs (U.S. EPA, 2004a).

Table 3-4: Cost of Subsequent Post-Promulgation NPDES Permit Application Activities ($2009)

Activity	Freshwater		Marine	
	IM Requirements	Cooling Tower	IM Requirements	Cooling Tower
Start-up activities	$989	$989	$989	$989
Permit application activities	$8,813	$8,813	$8,813	$8,813
Source water Baseline Biological Characterization	$4,986	$4,986	$4,986	$4,986
Total	**$14,789**	**$14,789**	**$14,789**	**$14,789**

Source: U.S. EPA analysis, 2010

Table 3-5 below lists monitoring, record-keeping, and reporting activities and estimated administrative costs associated with these activities. Facilities required to install *only* cooling towers and facilities with baseline recirculating systems in place and no IM requirements are not required to perform monitoring. For all other facilities with monitoring requirements, the cost per facility is estimated to be approximately $60,176 for freshwater facilities and $66,542 for marine facilities.

Table 3-5: Cost of Subsequent Post-Promulgation NPDES Permit Application Activities ($2009)

Activity	Freshwater		Marine	
	IM Requirements	Cooling Tower	IM Requirements	Cooling Tower
Biological Monitoring for Impingement	$23,382	$0	$29,747	$0
Visual or Remote Inspections	$13,430	$0	$13,430	$0
Yearly Status Report Activities	$23,364	$0	$23,364	$0
Total	**$60,176**	**$0**	**$66,542**	**$0**

Source: U.S. EPA analysis, 2010

Several activities that were required for the suspended 2004 Phase II regulation are not required under the current regulatory options, and were excluded from the analysis. In addition, monitoring for entrainment is only required for certain compliance alternatives, with which facilities may elect to comply, but are not required; thus, these costs also are not included in the analysis.

EPA developed unit labor costs as of 2015, i.e., adjustment year, in 2009 dollars, as follows:

- EPA obtained unloaded wage rates (i.e., wages and salaries not including benefits, overhead, or fee) for all facility and contracted employees from Bureau of Labor Statistics Occupational Outlook Handbook, 2008-2009 Edition (http://www.bls.gov/oco/home.htm). Most wages were presented as annual earnings, which EPA converted into hourly wages assuming 2080 hours per year. EPA brought these hourly wages forward from Q1 2006 to Q4 2009 using the Bureau of Labor Statistics' Employment Cost Index (http://www.bls.gov/ncs/ect/home.htm).

- EPA obtained all state government wage rates from the BLS Employer Costs for Employee Compensation as of March 2001.[77] EPA brought hourly wage rates forward from Q1 2001 to Q4 2009 using the Bureau of Labor Statistics Employment Cost Index. http://www.bls.gov/news.release/History/ecec_06292001.txt

- In the same way as for the suspended Final Phase II Rule analysis, EPA assumed indirect costs to be 15 percent of the unloaded wage values for facilities and states, and 50 percent of the unloaded wage values for contract services.

- In the same way as for the suspended Final Phase II Rule analysis, EPA assumed a contractor fee of 8 percent of unloaded wage values.

[77] More recent data do not contain appropriate occupation categories.

- Non-labor costs (laboratory analysis costs and other direct costs) were adjusted from 2002 to 2009 using the BEA's GDP Deflator.
- EPA brought the resulting administrative costs forward to the adjustment year of 2015 using the Employment Cost Index (ECI) published by the Bureau of Labor Statistics. This adjustment was performed using the average of the year-to-year changes in the ECI over the most recent ten-year reporting period. The resulting values are as of 2015 and in 2015 dollars. The costs presented above do not reflect this adjustment, as it was applied after these individual activity costs were summed.
- Because EPA performed the cost and economic impact analysis in constant dollars of the year 2009, a further adjustment was needed to restate costs that were developed in a different dollar year, in 2009 dollars. For this adjustment, EPA used the average of the year-to-year changes in the GDP Deflator over the most recent ten-year reporting period.

3.1.6 Development of Compliance Years

The estimated compliance years for facilities subject to the Proposed 316 (b) Existing Facilities Rule are important for two reasons:

1. Compliance years are used to determine by how much compliance costs are discounted in the national cost estimate.
2. A high concentration of facilities estimated to be out of service for cooling tower connection or other compliance technology installation at the same time in a given electricity production region (North American Electric Reliability Council Region or NERC Region) could lead to reduced reserve margins and jeopardize the reliability of power operations in that NERC region. Electricity production costs could also increase in the short term in an affected region if a substantial fraction of lower production cost capacity were out of service at the same time. Thus, the years in which in-scope plants are expected to achieve compliance and potentially be out of service during technology installation are important for the impact analysis.

Analysis Approach and Data Inputs

The development of compliance years varies depending on whether a facility is assigned a cooling tower or a non-cooling tower technology or is assumed to meet compliance requirements in its baseline operations as well as facility type.

1. EPA expects facilities – Electric Generators and Manufacturers – assigned *only* non-cooling tower technologies to comply within 5 years after this rule is promulgated, i.e., by 2017. For the compliance cost analysis, EPA assumed that nuclear electric generators would comply in the year of their first post-promulgation ISI and all other facilities would comply in the year of their first post-promulgation NPDES permit renewal, which results in a 5-year compliance schedule of 2013 through 2017. EPA performed the cost and economic impact analyses using 2015 as a proxy compliance year for these facilities because this year is approximately mid-way through the compliance window, i.e., 2013-2017, for this category of facilities, and therefore reflects the operating conditions of in-scope facilities at the time of compliance.
2. Under the two options that would require cooling towers, EPA assumed non-nuclear Electric Generators assigned cooling towers to achieve compliance with this rule within 10 years after promulgation, i.e., by 2022. EPA assumed Manufacturers and nuclear Electric Generators assigned cooling towers to achieve compliance with this rule within 15 years after promulgation, i.e., 2027. For the cost and economic impact analysis, EPA assumed that non-nuclear Electric Generators would comply during the 5 years of their second post-promulgation NPDES permit

period – i.e., between 2017 and 2022 – and Manufacturers and nuclear Electric Generators would comply during the 5 years of their third post-promulgation NPDES permit period and during their third post-promulgation ISI, respectively – i.e., between 2023 and 2027. Further, EPA assumed that two years would be needed for these facilities to complete cooling tower installation.[78] For the cost and economic impact analyses, EPA used 2020 for non-nuclear Electric Generators and 2025 for nuclear Electric Generators and Manufacturers to represent facility-specific compliance years. These years are approximately mid-way through the compliance windows of 2017-2022 and 2023-2027, respectively, and therefore reflect the operating conditions of in-scope facilities at the time of compliance. EPA notes that these assumed compliance years will not generally be the actual years in which facilities would be specified to meet compliance in permits. However, these assumptions reflect the approximate years in which compliance would reasonably be expected to occur, and thus provide a practical basis for the cost and economic impact analysis.

3. EPA assumed that facilities assigned both cooling towers and IM technologies would install both technologies at the same time and, therefore, comply during their cooling tower compliance window, i.e., during 2017 through 2022 for non-nuclear Electric Generators and during 2023 and 2027 for Manufacturers and nuclear Electric Generators. Consequently, the Agency used 2020 and 2025 as proxy compliance years, respectively, for these installations.
4. For facilities with baseline re-circulating systems in place and no IM requirements or that are otherwise assumed to meet BTA in their baseline, the Agency also used 2015 as a proxy compliance year; because these facilities are not required to install any compliance technology, they need no extended period of time to comply.

These assumptions result in an overall compliance window of 15 years, 2013 through 2027, for all in-scope facilities.

For the Market Model Analysis, EPA needed to assign an individual compliance year to each Electric Generator. Consequently, for the Market Model Analysis the Agency assumed that non-nuclear and nuclear Electric Generators assigned either only IM technology or no compliance technology would comply in the year of their first post-promulgation permit and first post-promulgation ISI, respectively. Further, the Agency assumed that non-nuclear and nuclear Electric Generators assigned cooling towers regardless of whether they were also assigned IM technologies would comply in the year of their second post-promulgation permit and third post-promulgation ISI, respectively (see *Chapter 6: Electricity Market Model Analysis*).

For Electric Generators, EPA also performed a separate assessment of the impact of downtime on capacity availability in each NERC region using a 5-year compliance window of 2013 through 2017 for Electric Generators assigned non-cooling tower technologies, a 5-year compliance window of 2018 through 2022 for non-nuclear Electric Generators assigned cooling towers or cooling towers together with IM technologies, and a 5-year compliance window of 2023 through 2027 for nuclear Electric Generators assigned cooling towers or cooling towers together with IM technologies. This analysis is discussed in *Chapter 5: Cost and Economic Impact Analysis – Electric Generators*.

3.1.7 Development of Total Compliance Costs

EPA aggregated compliance cost components as described in the preceding sections (i.e., compliance technology costs (one-time and periodic recurring costs), administrative costs (one-time and periodic recurring costs), and installation downtime costs) to develop total costs of compliance with this proposed rule, on the basis of costs as

78 As assumed in the previous 316(b) rule analyses.

incurred and recognized by complying facilities. The development of *total* compliance costs follows the same approach for both electric power generating facilities and manufacturers.

Analysis approach and data inputs

EPA aggregated compliance cost components for the assessment of facility impact based on the following methodology and assumptions:

- First, EPA calculated total compliance costs for the 460 in-scope facilities (257 Electric Generators and 203 Manufacturers) that were explicitly analyzed in the compliance assessment and cost estimation process.[79]
- The Agency calculated compliance costs on a "year-explicit" basis relative to the assumed promulgation year of 2012 for the entrainment study portion of O&M costs, and relative to the assumed compliance year of 2015, 2020 or 2025 for all other compliance cost components. The assignment of year-explicit cost for these compliance cost components is based on the assigned technology and facility type, accounting for the specific years in which facilities were estimated to undertake pre-compliance studies, obtain necessary permits, implement compliance technology, and undertake periodic recurring activities after initial outlays (e.g., for re-permitting and replacement/reinstallation of compliance technology components with shorter useful lives than the full analysis period).
- All cost values were discounted to 2012, the assumed year of rule promulgation, at a 7 percent discount rate. The 7 percent discount rate was used in the cost impact analysis since it is intended to reflect the opportunity cost of capital to society, per Office of Management and Budget guidance.
- EPA analyzed costs over a 30-year post-compliance operating period for each in-scope facility.
- Within the 30-year period, EPA annualized one-time and recurring (on other than an annual basis) cost components over specific useful life, implementation, and/or event recurrence periods, using a 7 percent discount rate:
  - Capital costs of non-cooling tower technologies: 20, 25, or 30 years
  - Capital costs of cooling tower technologies: 30 years
  - Downtime, the initial entrainment study portion of the O&M costs, and initial permitting costs: 30 years
  - Re-permitting costs: 5 years
  - The follow-up entrainment study portion of the O&M costs: 3 years
- EPA than added annualized capital, downtime, permitting and re-permitting costs to annual O&M and administrative costs to derive total annualized compliance costs, where costs are expressed on an equivalent annual cost basis.
- To calculate annualized costs as of the compliance year or a different analysis year, depending on the analysis, EPA first discounted the year-explicit stream of costs for each facility to each facility's compliance year, i.e., 2015, 2020, or 2025, or the different analysis year, depending on the analysis, and then annualized these costs over the assumed 30 years of technology operation. EPA discounted and annualized these costs at a 7 percent discount rate.
- EPA applied sample weights to these cost values to extend the analysis to the total of 1,077 estimated in-scope facilities – 518 Manufacturers and 559 Electric Generators – as follows (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*):
  - Manufacturers:

[79] Facility counts exclude baseline closures.

  - *Tech Weights* were applied to industry profiles, cost compliance assessment, UMRA analysis, Executive Order analysis, and social cost assessment.
  - *Econ Weights* were applied to cost and economic impact assessment and RFA analysis.
- Electric Generators:
  - *Facility Count-Based Weights* were applied to initial permitting, re-permitting, monitoring, and pilot study costs.
  - *DIF-Based Weights* were applied to downtime costs and energy penalty.
  - *Capacity-Based Weights* were applied to capital and O&M costs.

For the facility impact assessment, EPA considered costs on both a pre-tax and after-tax basis. EPA calculated the after-tax value of compliance costs by applying combined federal and State tax rates to the pre-tax cost values for privately owned facilities.[80] EPA used after-tax costs, which is a more meaningful measure of compliance impact on privately-owned facilities, to estimate compliance costs to private, for-profit facilities as well as to approximate capital depreciation treatment. For this adjustment, EPA used State corporate rates from the Federation of Tax Administrators (http://www.taxadmin.org/) combined with federal corporate tax rate schedules from the Department of the Treasury, Internal Revenue Service.

The methodology used for the assessment of *total social costs* differs slightly from the methodology used for the assessment of *compliance costs to facilities*. For a detailed discussion on development of social costs, see *Chapter 11: Assessment of Total Social Costs*.

Key findings for regulatory options – Manufacturers

Table 3-6 presents total compliance costs for Manufacturers by industry sector.

[80] Government-owned entities and cooperatives are not subject to income taxes. To distinguish among the government-owned, privately owned, and cooperative ownership categories, EPA relied on the 2006 EIA-860, and 2007 EIA-861 databases and additional research. See *Chapter 5: Cost and Economic Impact Analyses – Electric Generators* for further discussion of these determinations.

Table 3-6: Annualized Compliance Costs by Industry Sector for Manufacturers (in millions, $2009, at 2012)

Sector	One-Time Costs			Recurring Costs				Total
	Capital Technology	Connection Outage	Initial Permit Application	O&M	Monitoring, Record Keeping, and Reporting	Energy Penalty	Permit Renewal	
Option 1: IM Everywhere								
Pre-Tax Compliance Costs								
Aluminum	$0.31	$0.04	$0.06	$0.68	$0.54	$0.00	$0.05	$1.68
Chemicals and Allied Products	$8.73	$0.00	$0.44	$6.13	$6.85	$0.00	$0.42	$22.57
Food and Kindred Products	$1.50	$0.01	$0.08	$1.16	$1.26	$0.00	$0.07	$4.08
Paper and Allied Products	$6.26	$1.26	$0.49	$5.97	$7.95	$0.00	$0.47	$22.38
Petroleum Refining	$1.96	$0.00	$0.08	$2.46	$1.56	$0.00	$0.08	$6.14
Steel	$3.57	$0.00	$0.12	$4.80	$1.91	$0.00	$0.11	$10.51
Other (Misc)	$0.43	$0.03	$0.04	$0.71	$0.64	$0.00	$0.03	$1.89
Total	**$22.76**	**$1.34**	**$1.31**	**$21.91**	**$20.71**	**$0.00**	**$1.24**	**$69.26**
After-Tax Compliance Costs								
Aluminum	$0.20	$0.03	$0.04	$0.44	$0.34	$0.00	$0.03	$1.07
Chemicals and Allied Products	$5.37	$0.00	$0.27	$3.77	$4.18	$0.00	$0.25	$13.84
Food and Kindred Products	$0.87	$0.01	$0.05	$0.67	$0.74	$0.00	$0.04	$2.39
Paper and Allied Products	$3.76	$0.75	$0.30	$3.59	$4.80	$0.00	$0.28	$13.48
Petroleum Refining	$1.17	$0.00	$0.05	$1.47	$0.94	$0.00	$0.05	$3.68
Steel	$2.16	$0.00	$0.07	$2.88	$1.14	$0.00	$0.07	$6.32
Other (Misc)	$0.26	$0.02	$0.02	$0.42	$0.39	$0.00	$0.02	$1.13
Total	**$13.79**	**$0.80**	**$0.79**	**$13.25**	**$12.53**	**$0.00**	**$0.75**	**$41.92**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Pre-Tax Compliance Costs								
Aluminum	$1.51	$0.02	$0.06	$0.37	$0.48	$1.88	$0.05	$4.37
Chemicals and Allied Products	$38.27	$0.00	$0.42	$4.63	$6.31	$29.66	$0.40	$79.68
Food and Kindred Products	$9.75	$0.01	$0.07	$1.10	$1.17	$7.97	$0.06	$20.13
Paper and Allied Products	$8.47	$1.26	$0.48	$4.56	$7.71	$0.80	$0.46	$23.74
Petroleum Refining	$8.72	$0.00	$0.08	$1.03	$1.34	$2.41	$0.07	$13.66
Steel	$29.58	$0.00	$0.10	$1.99	$1.41	$4.14	$0.09	$37.31
Other (Misc)	$1.39	$0.02	$0.03	$0.36	$0.56	$0.16	$0.03	$2.55
Total	**$97.69**	**$1.31**	**$1.24**	**$14.04**	**$18.97**	**$47.03**	**$1.17**	**$181.44**
After-Tax Compliance Costs								
Aluminum	$0.98	$0.01	$0.03	$0.24	$0.30	$1.22	$0.03	$2.82
Chemicals and Allied Products	$23.43	$0.00	$0.25	$2.84	$3.84	$18.67	$0.24	$49.28
Food and Kindred Products	$5.75	$0.01	$0.04	$0.64	$0.69	$4.76	$0.04	$11.93
Paper and Allied Products	$5.11	$0.75	$0.29	$2.75	$4.65	$0.49	$0.28	$14.32
Petroleum Refining	$5.18	$0.00	$0.05	$0.62	$0.81	$1.43	$0.04	$8.14
Steel	$17.62	$0.00	$0.06	$1.19	$0.84	$2.46	$0.06	$22.23
Other (Misc)	$0.82	$0.01	$0.02	$0.22	$0.34	$0.10	$0.02	$1.52
Total	**$58.89**	**$0.78**	**$0.75**	**$8.50**	**$11.48**	**$29.14**	**$0.71**	**$110.24**

Table 3-6: Annualized Compliance Costs by Industry Sector for Manufacturers (in millions, $2009, at 2012)

Sector	One-Time Costs: Capital Technology	One-Time Costs: Connection Outage	One-Time Costs: Initial Permit Application	Recurring Costs: O&M	Recurring Costs: Monitoring, Record Keeping, and Reporting	Recurring Costs: Energy Penalty	Recurring Costs: Permit Renewal	Total
Option 3: I&E Mortality Everywhere								
Pre-Tax Compliance Costs								
Aluminum	$3.75	$0.02	$0.03	$0.17	$0.00	$1.88	$0.03	$5.88
Chemicals and Allied Products	$64.61	$0.00	$0.26	$3.98	$2.25	$31.74	$0.24	$103.08
Food and Kindred Products	$12.78	$0.01	$0.05	$0.90	$0.53	$8.70	$0.04	$23.01
Paper and Allied Products	$32.00	$0.67	$0.28	$3.11	$2.04	$16.10	$0.26	$54.46
Petroleum Refining	$12.82	$0.00	$0.07	$0.83	$0.94	$2.45	$0.06	$17.17
Steel	$32.78	$0.00	$0.07	$1.70	$0.62	$4.69	$0.06	$39.93
Other (Misc)	$2.71	$0.02	$0.02	$0.21	$0.07	$0.30	$0.02	$3.35
Total	**$161.45**	**$0.72**	**$0.76**	**$10.91**	**$6.46**	**$65.86**	**$0.72**	**$246.88**
After-Tax Compliance Costs								
Aluminum	$2.37	$0.01	$0.02	$0.11	$0.00	$1.22	$0.02	$3.74
Chemicals and Allied Products	$39.48	$0.00	$0.16	$2.45	$1.38	$19.93	$0.15	$63.54
Food and Kindred Products	$7.57	$0.01	$0.03	$0.53	$0.31	$5.20	$0.03	$13.67
Paper and Allied Products	$19.34	$0.40	$0.17	$1.88	$1.23	$9.67	$0.16	$32.85
Petroleum Refining	$7.68	$0.00	$0.04	$0.50	$0.57	$1.46	$0.04	$10.28
Steel	$19.53	$0.00	$0.04	$1.02	$0.37	$2.79	$0.04	$23.79
Other (Misc)	$1.61	$0.01	$0.01	$0.12	$0.04	$0.18	$0.01	$1.99
Total	**$97.57**	**$0.43**	**$0.46**	**$6.61**	**$3.90**	**$40.45**	**$0.44**	**$149.86**

Source: U.S. EPA analysis, 2010

Key findings for regulatory options – Electric Power Generating Facilities

As explained in *Chapter 2.H: Profile of the Electric Power Industry*, North American Electric Reliability Corporation (NERC) is responsible for the overall reliability, planning, and coordination of the power grids; NERC is organized into regional organizations that are responsible for the overall coordination of bulk power policies that affect their regions' reliability and quality of service. Each NERC region has full responsibility for dealing with electricity reliability issues in its region, based on available capacity and transmission constraints. Service areas of the member facilities determine the boundaries of the NERC regions. Because of differences in economic characteristics of in-scope facilities across NERC regions, as well as differences in the baseline economic characteristics of the NERC regions themselves, this proposed rule may have a different impact on profitability, electricity prices, and other impact measures across NERC regions (*Chapter 2.H: Profile of the Electric Power Industry).* Consequently, EPA evaluated compliance costs of the Proposed 316(b) Existing Facilities Rule at both the national level and by NERC region. The NERC regions used for the analysis of compliance costs to existing Electric Generators include:[81]

- ASCC – Alaska Systems Coordinating Council
- ERCOT – Electric Reliability Council of Texas
- FRCC – Florida Reliability Coordinating Council
- HICC – Hawaii Coordinating Council
- MRO – Midwest Reliability Organization

[81] As noted previously, NERC region defitions have changed recently.

- NPCC – Northeast Power Coordinating Council
- RFC – ReliabilityFirst Corporation
- SERC – Southeastern Electric Reliability Council
- SPP – Southwest Power Pool
- WECC – Western Energy Coordinating Council

As reported in *Table 3-7*, EPA estimates that the 559 in-scope Electric Generators will incur annualized costs of complying with the proposed regulatory options of $406 million on a pre-tax basis and $264 million on an after-tax basis under the proposed Option 1, $4.9 billion on a pre-tax basis and $3.3 billion on an after-tax basis under Option 2, and $5.1 billion on a pre-tax basis and $3.4 billion on an after-tax basis under Option 3. The burden of these compliance costs is expected to be the highest in the RFC and SERC region and the lowest in the WECC region under all three options. These annualized costs are calculated on a present value basis as of the promulgation year of 2012, in 2009 dollars; these costs are then annualized over a period of 30 years, the assumed "compliance life" in this regulatory analysis. The 30-year annualization period is the longest expected service life of the technology equipment components that would be expected to be installed for compliance with the regulatory options.

All three regulatory options include a provision for required installation of EM technology at new Electric Generators – i.e., newly constructed generating units at existing units. However, *Table 3-7* does not include costs associated with this *New Unit* EM technology requirement. Instead the new unit costs are discussed and presented in *Section 3.3*.

Table 3-7: Annualized Compliance Costs by NERC Region (in millions, $2009, at 2012)[a]

	One-Time Costs			Recurring Costs				
NERC Region	Capital Technology	Connection Outage	Initial Permit Application	O&M	Monitoring, Record Keeping, and Reporting	Energy Penalty	Permit Renewal	Total
Option 1: IM Everywhere								
Pre-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$12.07	$3.59	$0.11	$15.03	$1.79	$0.00	$0.10	$32.68
FRCC	$15.84	$6.21	$0.06	$10.46	$1.05	$0.00	$0.06	$33.68
HICC	$1.38	$0.00	$0.01	$1.91	$0.17	$0.00	$0.01	$3.48
MRO	$6.19	$5.82	$0.12	$8.91	$2.09	$0.00	$0.11	$23.24
NPCC	$14.31	$0.00	$0.16	$24.89	$2.66	$0.00	$0.15	$42.16
RFC	$46.85	$6.15	$0.41	$56.26	$7.85	$0.00	$0.39	$117.91
SERC	$35.49	$6.60	$0.40	$47.63	$6.78	$0.00	$0.38	$97.28
SPP	$6.56	$31.17	$0.09	$12.62	$1.57	$0.00	$0.08	$52.09
WECC	$1.05	$0.44	$0.06	$0.83	$0.85	$0.00	$0.06	$3.28
Total	**$139.73**	**$59.99**	**$1.41**	**$178.53**	**$24.80**	**$0.00**	**$1.33**	**$405.78**
After-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$8.43	$2.33	$0.08	$11.12	$1.33	$0.00	$0.07	$23.36
FRCC	$9.75	$3.81	$0.04	$6.44	$0.69	$0.00	$0.04	$20.77
HICC	$0.84	$0.00	$0.00	$1.16	$0.11	$0.00	$0.00	$2.12
MRO	$4.68	$5.76	$0.08	$5.99	$1.38	$0.00	$0.07	$17.96
NPCC	$8.54	$0.00	$0.10	$14.82	$1.61	$0.00	$0.09	$25.16
RFC	$28.14	$3.72	$0.26	$34.04	$4.96	$0.00	$0.25	$71.37
SERC	$25.17	$4.00	$0.28	$34.25	$4.73	$0.00	$0.26	$68.70
SPP	$4.22	$19.05	$0.06	$8.14	$1.03	$0.00	$0.05	$32.55
WECC	$0.72	$0.26	$0.04	$0.55	$0.56	$0.00	$0.04	$2.17
Total	**$90.49**	**$38.94**	**$0.94**	**$116.51**	**$16.40**	**$0.00**	**$0.89**	**$264.16**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Pre-Tax Compliance Costs[b]								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$302.99	$11.91	$0.08	$34.32	$0.19	$142.44	$0.07	$492.00
FRCC	$140.87	$11.37	$0.05	$16.84	$0.18	$85.08	$0.05	$254.44
HICC	$17.82	$1.44	$0.01	$2.02	$0.00	$4.89	$0.01	$26.18
MRO	$114.59	$10.69	$0.10	$13.30	$0.89	$62.32	$0.09	$201.99
NPCC	$332.23	$34.23	$0.12	$38.33	$0.55	$202.34	$0.12	$607.93
RFC	$819.05	$61.55	$0.33	$94.39	$2.50	$453.51	$0.32	$1,431.64
SERC	$822.70	$133.62	$0.31	$94.59	$2.04	$573.96	$0.30	$1,627.53
SPP	$183.97	$14.59	$0.07	$21.30	$0.37	$65.54	$0.07	$285.90
WECC	$2.98	$0.44	$0.06	$0.99	$0.74	$0.39	$0.05	$5.66
Total	**$2,737.20**	**$279.84**	**$1.12**	**$316.09**	**$7.46**	**$1,590.47**	**$1.06**	**$4,933.26**
After-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$214.03	$8.75	$0.06	$24.25	$0.12	$100.25	$0.05	$347.51
FRCC	$88.44	$7.03	$0.03	$10.56	$0.11	$52.57	$0.03	$158.78
HICC	$10.84	$0.88	$0.00	$1.23	$0.00	$2.97	$0.00	$15.93
MRO	$79.48	$7.58	$0.06	$9.20	$0.53	$43.32	$0.06	$140.23
NPCC	$197.67	$20.31	$0.08	$22.82	$0.36	$120.47	$0.07	$361.78
RFC	$491.93	$37.07	$0.21	$56.82	$1.73	$272.43	$0.20	$860.39
SERC	$602.35	$104.09	$0.22	$69.24	$1.48	$421.28	$0.21	$1,198.87
SPP	$117.20	$9.07	$0.05	$13.66	$0.27	$41.07	$0.04	$181.36
WECC	$1.92	$0.26	$0.04	$0.65	$0.50	$0.24	$0.04	$3.65
Total	**$1,803.87**	**$195.05**	**$0.75**	**$208.42**	**$5.10**	**$1,054.61**	**$0.71**	**$3,268.50**

Table 3-7: Annualized Compliance Costs by NERC Region (in millions, $2009, at 2012)[a]

NERC Region	One-Time Costs: Capital Technology	One-Time Costs: Connection Outage	One-Time Costs: Initial Permit Application	Recurring Costs: O&M	Recurring Costs: Monitoring, Record Keeping, and Reporting	Recurring Costs: Energy Penalty	Recurring Costs: Permit Renewal	Total
Option 3: I&E Mortality Everywhere								
Pre-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$302.99	$11.91	$0.08	$34.32	$0.19	$142.44	$0.07	$492.00
FRCC	$142.16	$12.04	$0.05	$16.95	$0.08	$87.79	$0.04	$259.11
HICC	$17.82	$1.44	$0.01	$2.02	$0.00	$4.89	$0.01	$26.18
MRO	$123.57	$11.69	$0.09	$14.13	$0.22	$67.77	$0.08	$217.55
NPCC	$345.15	$37.42	$0.11	$39.12	$0.00	$223.94	$0.10	$645.86
RFC	$831.15	$63.89	$0.32	$94.81	$1.47	$469.53	$0.30	$1,461.46
SERC	$837.34	$142.44	$0.30	$95.62	$1.22	$606.98	$0.28	$1,684.17
SPP	$183.97	$14.59	$0.07	$21.30	$0.37	$65.54	$0.07	$285.90
WECC	$4.01	$0.54	$0.05	$0.93	$0.53	$0.93	$0.05	$7.05
Total	**$2,788.16**	**$295.96**	**$1.06**	**$319.20**	**$4.07**	**$1,669.82**	**$1.01**	**$5,079.28**
After-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$214.03	$8.75	$0.06	$24.25	$0.12	$100.25	$0.05	$347.51
FRCC	$89.23	$7.44	$0.03	$10.63	$0.05	$54.24	$0.03	$161.65
HICC	$10.84	$0.88	$0.00	$1.23	$0.00	$2.97	$0.00	$15.93
MRO	$84.85	$8.21	$0.06	$9.69	$0.13	$46.67	$0.05	$149.66
NPCC	$205.80	$22.25	$0.07	$23.33	$0.00	$133.69	$0.06	$385.20
RFC	$500.98	$38.69	$0.20	$57.17	$0.93	$284.31	$0.19	$882.47
SERC	$614.70	$111.67	$0.21	$70.11	$0.80	$448.66	$0.20	$1,246.34
SPP	$117.20	$9.07	$0.05	$13.66	$0.27	$41.07	$0.04	$181.36
WECC	$2.70	$0.32	$0.04	$0.60	$0.33	$0.60	$0.04	$4.62
Total	**$1,840.33**	**$207.29**	**$0.71**	**$210.67**	**$2.63**	**$1,112.45**	**$0.67**	**$3,374.74**

a. EPA data indicate that no DQ in-scope facilities are located in the ASCC NERC region; an STQ facility in ASCC facility was grouped with STQ facilities in the WECC region (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses).*

Source: U.S. EPA analysis, 2010

Table 3-8 presents total compliance costs for Manufacturers and Electric Generators.

Table 3-8: Annualized Compliance Costs For Manufacturers and Electric Generators (in millions, $2009, at 2012)[a]

Facility Group	One-Time Costs: Capital Technology	One-Time Costs: Connection Outage	One-Time Costs: Initial Permit Application	Recurring Costs: O&M	Recurring Costs: Monitoring, Record Keeping, and Reporting	Recurring Costs: Energy Penalty	Recurring Costs: Permit Renewal	Total
Option 1: IM Everywhere								
Pre-Tax Compliance Costs								
Manufacturers	$22.76	$1.34	$1.31	$21.91	$20.71	$0.00	$1.24	$69.26
Generators	$139.73	$59.99	$1.41	$178.53	$24.80	$0.00	$1.33	$405.78
Total	**$162.49**	**$61.33**	**$2.72**	**$200.44**	**$45.51**	**$0.00**	**$2.57**	**$475.04**
After-Tax Compliance Costs								
Manufacturers	$13.79	$0.80	$0.79	$13.25	$12.53	$0.00	$0.75	$41.92
Generators	$90.49	$38.94	$0.94	$116.51	$16.40	$0.00	$0.89	$264.16
Total	**$104.28**	**$39.74**	**$1.73**	**$129.76**	**$28.93**	**$0.00**	**$1.64**	**$306.08**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Pre-Tax Compliance Costs								
Manufacturers	$97.69	$1.31	$1.24	$14.04	$18.97	$47.03	$1.17	$181.44
Generators	$2,737.20	$279.84	$1.12	$316.09	$7.46	$1,590.47	$1.06	$4,933.26
Total	$2,834.89	$281.15	$2.36	$330.13	$26.43	$1,637.50	$2.23	$5,114.70
After-Tax Compliance Costs								
Manufacturers	$58.89	$0.78	$0.75	$8.50	$11.48	$29.14	$0.71	$110.24
Generators	$1,803.87	$195.05	$0.75	$208.42	$5.10	$1,054.61	$0.71	$3,268.50
Total	$1,862.76	$195.83	$1.50	$216.92	$16.58	$1,083.75	$1.42	$3,378.74
Option 3: I&E Mortality Everywhere								
Pre-Tax Compliance Costs								
Manufacturers	$161.45	$0.72	$0.76	$10.91	$6.46	$65.86	$0.72	$246.88
Generators	$2,788.16	$295.96	$1.06	$319.20	$4.07	$1,669.82	$1.01	$5,079.28
Total	**$2,949.61**	**$296.68**	**$1.82**	**$330.11**	**$10.53**	**$1,735.68**	**$1.73**	**$5,326.16**
After-Tax Compliance Costs								
Manufacturers	$97.57	$0.43	$0.46	$6.61	$3.90	$40.45	$0.44	$149.86
Generators	$1,840.33	$207.29	$0.71	$210.67	$2.63	$1,112.45	$0.67	$3,374.74
Total	**$1,937.90**	**$207.72**	**$1.17**	**$217.28**	**$6.53**	**$1,152.90**	**$1.11**	**$3,524.60**

Source: U.S. EPA analysis, 2010

3.1.8 Uncertainties and Limitations

- Data on cooling water systems at in-scope facilities may not reflect the current circumstances of some facilities, given the passage of time since completion of the 316(b) facility survey. In addition, it is possible that the set of facilities in the earlier survey may differ from the set of facilities that would be within the scope of the regulatory options, due either to retirement of facilities from operation or addition of generating units since that time.
- As the detailed questionnaire was administered by EPA in 1999-2000 for the original 316(b) rulemakings, the data may no longer accurately represent the business conditions or cooling water usage of the sampled facilities. For generators, EPA supplemented the survey information with the most recent information available from the EIA. However, for manufacturers, no public or private source of data contains the type of information collected by the survey, so EPA used the original survey data, updating it where possible based on overall trends in the regulated industries.
- To the extent that EPA used the same set of facilities for the analysis of this regulation as the one used for the previous 316(b) analyses, the same set of uncertainties regarding the facility sample and cost estimates apply. In particular, EPA's compliance cost estimates are subject to uncertainties about the number and characteristics of the existing facilities that will be subject to the rule. Projecting the number of existing facilities that meet the design intake flow threshold is subject to uncertainties associated with the quality

of data reported by facilities in the original questionnaire surveys (see *Chapter B1: Summary of Compliance Costs* in the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule report).

- Given the large number of *implicitly analyzed electric power facilities*, it is impossible to develop sample weights that accurately account for all economic and operating differences of these facilities (see memorandum dated June 18, 2008). Consequently, the estimated national facility compliance costs may be over- or under-estimated due to statistical error in the facility sample weights.
- Additional uncertainties are associated with downtime cost estimates. In its analysis of connection outage, EPA relied on either IPM-projected estimates of electricity generation, prices, and variable production costs or historical EIA electricity generation and prices, which may not be representative of actual electricity market conditions when facilities comply with this proposed regulation. Further, to the extent that technology installation occurs during the shoulder months of spring and fall, when electricity demand is on average below that during winter, the downtime costs for IPM-modeled Electric Generators, which are estimated using winter cost and revenue values, are likely to be over-stated. For IPM-modeled Electric Generators there is also an uncertainty of how much capacity revenue complying facilities will actually lose as the result of addition downtime; to the extent that this value is less than the amount calculated from *total annual* capacity revenue, the impact of technology installation downtime for these facilities may be overstated. Overall, these uncertainties point to overestimation of the impact of downtime on complying facilities.
- Due to time constraints, EPA was not able to perform a full reassessment of the administrative costs that will be required of facilities and state and federal governments for the proposed regulation. Though EPA was able to eliminate activities related to initial and subsequent permit issuance for facilities with cooling towers, the assumption that administrative activities required under this proposed regulation would be the same as those under the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule, may be inaccurate. Further, to the extent that EPA used suspended 2004 Phase II Final Administrative Cost framework, the uncertainties with that framework still apply (*Chapter B1: Summary of Compliance Costs* in the suspended 2004 Phase II Final EA Report).

3.2 Development of Administrative Costs to State and Federal Governments

This section presents the estimated costs to State and federal governments administering the Proposed 316 (b) Existing Facilities Rule. EPA developed costs of administering the requirements of the Proposed Rule and the alternative regulatory options.

In developing these costs, EPA closely followed the methodologies used in support of the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule and to the extent possible relied on the same data sources.[82] For those parts of analysis related to cooling tower technologies, which were not a part of the suspended 2004 Phase II Final Rule, but were a part of the original 2002 Proposed Section 316(b) Phase II Existing Facilities Rule, EPA closely followed these methodologies, and to the extent possible, relied on the same data sources.[83]

Administrative costs to State and federal governments are closely related to the administrative costs to complying facilities, and are primarily based on labor costs to review information produced by complying facilities and to write the necessary permits. State governments incur start-up costs in the year of promulgation, i.e., 2012, costs

82 For details see *Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule*. U.S. EPA, 2004. Office of Water. EPA-821-R-04-005 available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/phase2/upload/2009_03_26_316b_phase2_econbenefits_final_toc.pdf

83 For details see *Economic and Benefits Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule*. U.S. EPA, 2002. Office of Water. EPA-821-R-02-001 available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/phase2/upload/toc.pdf

for permit issuance in and after the compliance year, annual monitoring costs, and costs for permit renewal. The federal government is assumed to incur only costs for permit review, which occurs in the compliance year. Details of these costs are presented below.

3.2.1 Administrative Costs to State and Territorial Governments

EPA assessed total administrative costs for National Pollutant Discharge Elimination System (NPDES) permitting authorities for states (45) and territories (1) under section 402(c) of the Clean Water Act (CWA).[84,85] EPA evaluated costs associated with three distinct periods of rule administration:

- *Initial Permitting activities*: costs including start-up activities, review of permit applications and other information compiled by complying facilities during the permitting process, and are incurred for every permit
- *Annual activities*: costs incurred to review annual monitoring data and other information produced by complying facilities on an annual basis, which are incurred for every permit
- *Permit renewal activities*: includes activities similar to permitting activities, incurred every 5 years as facilities renew their NPDES permits.

Individual activities associated with each activity group have been modified to correspond to the activities now required of the facilities; costs to review activities that are no longer required have been excluded from the analysis of this proposed regulation. Costs were updated from the values used for the suspended Phase II Final regulation using the same methods as for private administrative costs described in *Section 3.1.5*. As with the administrative costs to facilities, the administrative costs to governments presented below do not reflect the adjustment for real changes in labor costs using the Employment Cost Index; this adjustment was applied after summing the individual activity costs.

Table 3-9 presents the groups of activities required for NPDES permitting authorities for each period of administration. Costs per permit vary based on a facility's performance requirement (I&E mortality, cooling tower). Start-up costs are estimated to be $5,024 for each of the 46 NPDES authorities. Permit issuance activities are estimated to cost $5,089 for a facility either having or required to install a cooling tower *only* and $67,168 for a facility required to either install new IM technology *only* or *both* IM technology and cooling tower. Annual activities are estimated to cost approximately $2,375 per facility. Facilities with AIF exceeding 125 MGD and not installing a cooling tower are required to performance an Initial Entrainment Study, which is estimated to impose a cost on the permitting authority of approximately $26,912 per facility. In addition, these facilities are expected to conduct Follow-Up Entrainment studies every third year after they complete the Initial Entrainment Study; processing of these Follow-Up Entrainment Studies is estimated to result in a cost to the NPDES permitting authority of approximately $8,971 per facility per year in which the Follow-Up Entrainment Study is performed. Permit reissuance costs vary based on the same facility characteristics as the permitting costs, and are expected to be $1,786 for facilities with cooling towers *only* and $20,444 for facilities having installed either new IM technology *only* or *both* IM technology and cooling tower, recurring every 5 years after the initial post-promulgation permit is issued.

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84 EPA incurs the costs assigned to facilities located in states without NPDES permitting authority. The labor costs are assumed to be the same as those for the State governments incurring these administrative costs.

85 Since the time of this analysis, Alaska was also granted NPDES permitting authority. Only one in-scope generator is located in Alaska.

Table 3-9: Administrative Activity Groups and Costs for NPDES Permitting Authorities ($2009)

Activity Group	Facilities Installing IM Technology Only	Facilities Installing Cooling Towers
First Post-Promulgation Permit Issuance		
Start-up Activities[a]	$5,024	
Permit Issuance Activities[b]	67,168	5,089
Annual		
Annual Monitoring Review	2,375	2,375
Entrainment Study		
Initial[c]	$26,912	None
Follow-Up[d]	$8,971	None
Permit Reissuance		
Permit Issuance Activities	20,444	1,786

a. Start-up Activities are incurred for each of the 46 Permitting Authorities in the year before facility compliance activities begin, while all other activities are incurred per permit

b. Incurred in the compliance year

c. Permitting authority costs for the Initial Entrainment Study costs are incurred once for all Electric Generator and Manufacturers.

d. The Follow-Up Entrainment Study costs are incurred every third year after completion of the Initial Entrainment Study.

Source: U.S. EPA analysis, 2010

3.2.2 Administrative Costs to the Federal Government

The federal government is expected to incur costs for program oversight only in the initial compliance year for facilities. Its role is to review certain permit issuance activities performed by the NPDES permitting authorities, and it incurs labor costs and O&M costs for these activities. The federal government is expected to incur costs of $830 per facility before adjustment for real changes in labor costs.[86]

3.2.3 Total Administrative Costs

Total State and federal administrative costs were calculated for the social cost analysis. For more details see *Chapter 11: Assessment of Total Social Costs*.

3.2.4 Uncertainties and Limitations

- There is a significant uncertainty associated with the estimates of time required to complete each administrative activity, the number of these activities, the type of personnel administrating these activities as well as associated labor rates and/or other costs.
- Annualized cost of administrative activities depends on when they are incurred. If facilities come into compliance later or earlier than assumed in this analysis, permitting authorities' administrative activities will also occur in later or earlier years, respectively. Consequently, the annualized costs of the Proposed Existing Facilities Rule to permitting authorities will be lower or higher because administrative costs incurred in later years have lower or higher, respectively, net present values.
- The incremental administrative burden on States will also depends 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 Proposed Existing Facilities Rule than are required under their current programs. Conversely, States that currently require very detailed analysis may require fewer permitting resources to implement the Proposed Rule than are currently required.

[86] In addition to these costs, the federal government (EPA) may also incur costs for permitting-related activities on behalf of the five states that have not been delegated NPDES permitting authority under the Clean Water Act (see *footnote 84*, above). The initial and ongoing permitting costs are accounted for under state costs. EPA is assumed not to incur additional start-up costs for these otherwise state-assigned activities.

- To the extent that EPA used the 2004 Phase II Final Administrative Cost framework, the uncertainties of that framework still apply (see *Chapter B5: UMRA Analysis* in the suspended 2004 Phase II Final EA Report).

3.3 Development of Costs for New Units

The regulatory options analyzed for the Proposed Existing Facilities Rule include provisions for installation of entrainment mortality technology (closed cycle cooling system) at newly constructed generating units at existing facilities. The practical effect of the new facilities provision is the same for all three regulatory options; all new generating units at existing facilities would be subject to the EM technology requirement.

Analysis of the cost of the new facilities provision involves:

- Estimating the occurrence of new facilities over time that would be subject to the requirement for installation of EM technology.
- Estimating the unit costs that would be incurred for EM technology installation and operation for the new units.
- Estimating the total costs based on the occurrence of new unit EM technology installation.

The Agency expects that for Manufacturers compliance costs associated with new units will be negligible. Consequently, the discussion of the *New Unit* provision cost development in this *Section 3.3* focuses on costs for Electric Generators only.

3.3.1 Estimating Costs for New Generating Units

Estimating the Occurrence of New Generating Units Subject to the New Unit EM Technology Requirement

For estimating the occurrence of new generating units that would be subject to the new units EM technology requirement, EPA began from projections of new steam generating capacity as reported in the Integrated Planning Model baseline for the existing facilities rule analysis (see *Chapter 6*). This baseline projection of new capacity covers the period 2012 through 2035, and includes three steam capacity types: coal, combined cycle, and nuclear. EPA used the annual average of new capacity additions in these capacity types as the starting point for the new generating units analysis. EPA assumed that this rate of new capacity addition would continue on a constant annual basis beginning with the first year after promulgation, i.e., 2013, and through the remainder of the rule analysis period:

- Coal: 3,573 MW
- Combined cycle: 1,491 MW
- Nuclear: 1,938 MW.

These values overstate the quantity of capacity in new units that would be subject to the new units EM technology requirement of the existing facilities rule for several reasons:

- Some of this capacity will be subject to the 316(b) Phase I requirement for closed cycle cooling system installation at new generating facilities; the requirement in the existing facilities rule will thus not affect these facilities.
  - New coal and combined cycle capacity: EPA estimates that approximately 70 percent of this capacity will be subject to the Phase I requirements, with the residual of 30 percent potentially affected by the new units EM technology requirement.

- New nuclear unit capacity: EPA estimates that all of this capacity will occur at existing nuclear facility sites, and therefore not be subject to 316(b) Phase I requirements. Thus, all of this capacity would be potentially affected by the new units EM technology requirement.

➢ Within the new generating unit capacity that would be subject to the new units EM technology requirement, EPA further estimates that approximately half of this capacity would be required to install closed cycle cooling systems independent of the new facility requirements of the existing facilities rule. Accordingly, this capacity would not incur additional costs because of the new units EM technology requirement *since the new capacity is already expected to install closed cycle cooling system based on local permitting requirements.* The remaining 50 percent of this capacity would be affected by the new units EM technology requirement

➢ Finally, EPA set aside from the remaining residual, the new capacity that is expected to be accomplished via capacity increases at existing units. Specifically, EPA estimated that approximately 90 percent of the remaining new *coal capacity* would be accomplished in new generating units; 15 percent of the remaining new *combined cycle capacity* would be accomplished in new generating units; and *none* of the remaining new *nuclear capacity* would be accomplished in new generating units. In each case, the residual of new capacity is expected to occur in new generating units and represents the annual average addition to capacity that would be subject to the new units provision of the existing facilities rule.

These estimates and the associated calculations yield the following estimates of annual capacity installation *as new generating units* that would be subject to the new units EM technology requirement (see *Table 3-10*). In summary, EPA estimates that 482 MW of coal capacity, 34 MW of combined cycle, and *no* nuclear capacity will occur in new generating units. These estimates of new generating unit capacity that would be subject to the new units EM technology requirement do not vary by regulatory option since these capacity additions occur as *new generating units*, and thus do not have a baseline intake flow, etc., which could lead to varying applicability of the regulatory options' direct requirements to these new facility capacity installations. (See Technical Development Document for additional information on the estimation of these capacity values).

Table 3-10: Annual Capacity Installation Subject to New Units EM Technology Requirement in New Generating Units (MW)

	Projected Annual Average New Capacity	Subject to Phase I New Facility Requirements	Residual Subject to Existing Facilities Rule Requirements	Install EM Technology Independent of Rule Requirements	Residual Incurring Cost due to Existing Facilities Rule Requirements	Capacity Increase in Existing Units	Capacity Increase in New Units
Coal	3,573	2,501	1,072	536	536	54	**482**
Combined Cycle	1,491	1,044	447	224	224	190	**34**
Nuclear	1,938	-	1,938	969	969	969	-

Source: U.S. EPA Analysis, 2010

Estimating Unit Costs for New Generating Units Subject to the New Units EM Technology Requirement

EPA estimated that new generating units subject to the new units EM technology requirement would incur additional fixed and variable O&M costs, and additional costs from auxiliary energy requirements from installation and operation of EM technology. Auxiliary energy requirements are assumed to be factored into the planning and development of new generating units and are valued as an increment to baseline energy costs. EPA estimated that these generating units would not incur additional capital costs, downtime, or costs from reduced energy conversion efficiency in the generating system due to installation of EM technology. Accordingly, all cost effects occur in *annually recurring* cost elements. EPA estimated these costs and energy penalty effects on a per

MW basis. The cost and energy penalty effects vary by fuel type (see Technical Development Document for additional information on this cost estimation).

Estimating Total Costs for New Generating Units Subject to the New Units EM Technology Requirement

EPA combined the estimates of annual average capacity installation in new generating units and the unit cost estimates to yield the streams of costs that occur over time from installation of EM technology at new generating units. In each year following rule promulgation, the estimated installation of new capacity initiates a stream of annually recurring costs (fixed O&M, variable O&M, and auxiliary energy requirements) estimated to occur over the life of the analysis. As a result, the aggregate costs from installation and operation of EM technology at new generating units cumulate into the future as new cohorts of generating units come on line in each successive year. EPA tallied these costs on a present value basis for each year of new generating unit installation activity – beginning with the first year following rule promulgation, i.e., 2013, and continuing through the remainder of the regulatory analysis period – and then calculated a total present value and annualized cost as the year of rule promulgation.

The resulting annualized cost values for the new units EM technology requirement at *new generating units* are $11.3 million pre-tax and $7.72 million after-tax ($2009, at 2012). These values *are not included* in the summary of rule cost totals presented in *Table 3-7* earlier in this chapter because these costs would not be incurred for installation and operation of compliance technology at *existing units,* but would occur only as a result of the construction of *new generating units*, as described above.

Appendix 3A Use of Sample Weights in the Proposed Existing Facilities Rule Analyses

In the analyses for the Proposed Section 316(b) Existing Facilities regulation, EPA used sample weights to estimate costs and impacts on the Electric Generator and Manufacturer facilities for which detailed analysis was not performed. Sample weights were also used to estimate impacts on entities that own 316(b) in-scope facilities. The first section of this appendix discusses facility-level weights; the second section discusses entity-level weights.

At the time of the 2000 316(b) Detailed Industry Questionnaire (DQ), survey sample weights were developed for Manufacturer facilities and for Electric Generator facilities, and were used in the earlier analyses for the 316(b) Phase II and Phase III regulations. These weights, which accounted for non-sampled facilities and non-respondents, are referred to in this appendix as the *original survey weights*. For *manufacturing facilities*, EPA continues to use these original weights in the current rule analyses. However, because of differences in some of the current rule analyses for *electric power generating facilities*, it was necessary to develop additional weights for the electric power facility analyses. In particular, it was necessary to develop new weights to account for different analytic approaches for Electric Generators that received the DQ from those that received the Short Technical Questionnaire (STQ). These new weights, which provide a basis for extrapolating analyses from facilities that received the DQ to represent facilities that received the STQ, are referred to as the *new DQ weights*. Development of these weights and their use in the current rule analyses are explained in this appendix (see *Section 3A.1.2*).

Table 3A-4 at the end of this appendix, summarizes the various weighting concepts used in the current analyses and in the relevant chapters of this report.

3A.1 Facility-Level Weights

3A.1.1 Manufacturers

Original survey weights

EPA applied sample weights to the Manufacturers survey respondents to account for non-sampled facilities and non-responding facilities. For more information on EPA's Section 316(b) Industry Surveys, please refer to the Information Collection Request (U.S. EPA, 2000). For the analyses presented in this document, EPA continues to use the weights developed for the 2006 Final Section 316(b) Phase III Existing Facilities Rule. These weights consist of two parallel subsets of weights. One set is used for analyses that use the engineering information from the 316(b) Manufacturers Questionnaire, including assessment of the number of affected facilities and the costs of installing new technology, and are referred to as the "technical weights." The second set of weights is used in analyses that rely on facility financial information, including analyses that assess the impact of the rule on a facility's financial health. These weights are referred to as the "economic weights."

In the responses to the 316(b) Manufacturers Questionnaire, EPA found that 14 facilities provided insufficient financial information to support impact analyses. Therefore, these 14 facilities were removed from the economic impact assessment; these facilities plus the sample-weighted facilities that they would otherwise represent were redistributed among the remaining facilities in their sector.

Facilities in other industries

As discussed in the earlier 316(b) Phase III rule analyses, EPA received survey questionnaires from facilities with business operations in manufacturing industries other than the set of industries on which EPA had stratified the 2000 Section 316(b) Industry Survey (referred to in the Phase III rule analysis documents as 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 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 earlier Phase III rule analysis documents, 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 earlier 316(b) analyses and treated them as "additional known facility" observations with a sample weight of one. Except for the facilities in the Food and Kindred Products industry, EPA followed this same convention in its analysis for the Proposed Existing Facilities Rule – i.e., assigning a sample weight of one to these observations.

For the analysis conducted for the 2006 Final Section 316(b) Phase III Existing Facilities Rule, EPA included the Food and Kindred Products industry in the set of Primary Manufacturing Industries and used the cooling water usage-based multiplier of 3.11 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.

For the current analysis, EPA kept the Food and Kindred Products industry in the set of Primary Manufacturing Industries. However, because EPA did not have sufficient survey data for 1 of the 12 sampled facilities, EPA adjusted both "economic" and "technical" weights to reflect the fact that only 11 of the 12 questionnaires had sufficient information for completing the impact analysis.

3A.1.2 Electric Power Generating Facilities

For the facility-level Electric Generator analyses, EPA used a combination of weights from the earlier 316(b) Phase II and Phase III analyses (*Original Survey Weights*), and sample weights that were newly developed to support the Proposed Rule analyses.

Original survey weights

As described in the regulatory analysis documents for the earlier 316(b) regulations, EPA collected technical and economic information from the expected in-scope facilities through the Short Technical Questionnaire (STQ) and the Detailed Questionnaire (DQ). Based on these survey responses, EPA developed facility-level sample weights that account for those facilities in the total in-scope population that either were not surveyed or did not respond. These weights use the total of DQ and STQ facilities as the underlying sample facility set, and account only for the non-respondents to the original 316(b) survey. In general, these weights are numerically close to one, as EPA had either DQ or STQ information for 656 facilities out of the 671 facilities presumed to be in-scope of the earlier 316(b) regulations.[87]

For the 2010 Proposed Rule analyses *that did not rely on cost information for facilities*, such as the Industry Profile, EPA continued to use these *Original Survey Weights*, excluding weights for facilities that have since closed or are expected to close according to either the Energy Information Administration (EIA) or the Integrated

[87] Includes all Electric Generators in the 2000 316(b) Survey as opposed to only those facilities that are within the scope of the Proposed Existing Facilities Rule.

Planning Model (IPM), which EPA used to assess the impact of the Proposed Rule on electricity market (see *Chapter 6: Electricity Market Model Analysis*). As noted in *Table 3A-4*, EPA also incorporated these weights into the sample weights used for the economic analysis of the Existing Facilities Proposed Rule (*New DQ Weights*, described below), for those DQ and STQ facilities that are known to have a re-circulating system in place or have water intake velocity less than or equal to 0.5 feet per second, and therefore will have no technology-related costs for compliance. Assigning the *Original Survey Weights* to these DQ and STQ facilities eliminates the need to extrapolate information for the STQ facilities in this facility group, and ensures that these facilities are not disproportionately represented.

New facility-level weights for the Proposed Existing Facilities Rule analyses

As described above, the earlier 316(b) rule analyses were based on facility-level data obtained through the STQs and DQs. For the current analysis, EPA explicitly estimated costs for installing and operating compliance technology for *only those facilities that responded to the DQ*. To extrapolate these compliance cost estimates to *all expected in-scope facilities* (i.e., including the STQ facilities and survey non-respondents), EPA therefore developed and applied the *New DQ Weights* to estimate costs and other facility-level information (e.g., facility counts, generating capacity, design intake flow (DIF)) from the DQ facilities.

Throughout this document, EPA refers to those facilities for which compliance costs *were* specifically estimated as the “explicitly analyzed” facilities. The facilities for which compliance costs *were not* specifically estimated are referred to as the “implicitly analyzed” facilities. As described in this Appendix, explicitly analyzed facilities include (1) all DQ facilities and (2) STQ facilities with a re-circulating system in the baseline and intake velocity of less than or equal to 0.5 feet per second. The implicitly analyzed facilities include all other STQ facilities. In the analysis of cost and economic impacts for the Proposed Existing Facilities Rule, the implicitly analyzed facilities are accounted for by applying the appropriate facility-level weights to the findings for the explicitly analyzed facilities.[88]

Development of Proposed Existing Facilities Rule facility-level weights

Extrapolating costs and other information from DQ facilities to STQ facilities required the development of a new set of facility-level weights, as the *Original Survey Weights* were designed only to account for survey non-respondents because, in the previous 316(b) rule analyses, EPA developed costs for STQ facilities.

In developing weights for the current rule analyses, EPA considered several approaches attempting to account simultaneously for:

Three Control Variables	*And*	Four Classification Variables
➢ Generating capacity		➢ NERC region
➢ Number of facilities		➢ Capacity/fuel type (coal steam, combined cycle, etc.)
➢ Design intake capacity		➢ Ownership (investor-owned, nonutility, etc.)
		➢ Baseline cooling water intake structure specifications and related compliance requirements (Technology Group)

EPA was unable to develop a single set of weights that accurately accounted for all of the control variables according to each of the classification variables, and therefore chose to develop three sets of weights, one based on each of the three control variables. Even with this approach, EPA was unable to develop weights that

88 The DQ and STQ facilities with a re-circulating systems in place and intake velocity of less than or equal to 0.5 feet per second are assumed to meet compliance requirements in their baseline; therefore, these facilities are not expected to incur any technology costs and no extrapolation was necessary.

accurately accounted for facilities in all four of the classification variables, and chose to focus on weights that represented the NERC region classification and Compliance Requirements as accurately as possible, which EPA believes are the more important classifications for understanding the economic implications of this action.[89,90]

For the extrapolation of compliance costs to the full set of expected in-scope facilities, EPA developed weights to account for only the DQ and total of DQ/STQ facilities that are estimated to be in-scope of the Proposed Rule *and* that may need to undertake a compliance technology response to the regulatory options considered for this analysis.[91] The three sets of sample weights differ according to the specific cost element or other facility characteristic for which the sample weights are intended to provide estimates.

To ensure proper representation of STQ facilities by DQ facilities in terms of 316(b) compliance requirements under each of the three proposed options, EPA grouped in-scope Electric Generators into seven Technology Groups (*Table 3A-1*).[92]

Table 3A-1: Use of Weights in the Cost and Economic Impact Analysis for the Proposed Existing Facilities Rule

Technology Group			Compliance Requirements		
Has Baseline Recirculating System	Water Intake Velocity	DIF Group	Option 1	Option 2	Option 3
Yes[a]	<=0.5	2+ MGD	No Technology	No Technology	No Technology
Yes	>0.5	2-10 MGD	IM Assigned	IM Assigned	IM Assigned
Yes	>0.5	10+ MGD	IM Assigned	IM Assigned	IM Assigned
No	<=0.5	<=125 MGD	No Technology	No Technology	CT Assigned
No	>0.5	<=125 MGD	IM Assigned	IM Assigned	CT Assigned
No	<=0.5	>125 MGD	No Technology	CT Assigned	CT Assigned
No	>0.5	>125 MGD	IM Assigned	CT Assigned	CT Assigned

a. Because these facilities are assumed to be in compliance with the requirements of all three options, EPA did not have to extrapolate compliance costs for these facilities. These facilities are *explicitly analyzed DQ and STQ facilities*.

EPA developed sample weights on three extrapolation bases (the control variables listed above): (1) facility count, (2) electric generating capacity, and (3) design intake flow. Although the underlying set of DQ Electric Generators and the set of total in-scope Electric Generators on which these weights were developed are the same for each weight set, the weights for any DQ facility may differ by weight set: each weight set is intended to provide an accurate estimate for only one facility concept. For each weighting concept, EPA developed weights that accurately account for that control variable (i.e. number of facilities, total generating capacity, or total intake flow) in each NERC region and Technology Group. For example, using facility count-based weights accurately

89 For more details of the approaches considered by EPA see memorandum dated June 18, 2008

90 Accounting for NERC regions is particularly important for the electricity rate and household impact analyses (see *Chapter 5: Cost and Economic Impact Analysis – Electric Generators*). Consequently, to develop *New DQ Weights* EPA relied on sets of NERC region assignments for Electric Generators facilities in these analyses. As noted previously, NERC region definitions have changed recently.

91 In developing these sample weights, EPA accounted for known changes in the universe of DQ and STQ facilities that are expected to be within the scope of the Proposed Existing Facilities Rule options. In particular, EPA set aside from the weights development effort, and the cost and impact analysis generally, facilities that are documented in 2007 EIA database to retire by 2012 (15 facilities) or to have already retired all cooling water-dependent (steam-based) electric generating capacity (38 facilities). In addition, EPA excluded 39 facilities projected to retire all steam-based electric generating capacity by IPM.

92 Because 23 in-scope STQ facilities did not have a DQ representation in their respective NERC regions and compliance requirements groups, EPA re-assigned these STQ facilities to the NERC regions with relatively more substantial DQ representation in their respective compliance requirements groups. In addition, to ensure a better representation of 5 STQ facilities in the WECC NERC region in Technology Groups 5 and 6, EPA assigned these facilities to other NERC regions in these Technology Groups with substantial DQ representation.

represents the number of facilities in each region and requirements group, but may misrepresent the region's total capacity or intake flow, whereas using capacity-based weights will accurately represent the total capacity in a given NERC region and compliance group, but may distort its number of facilities and total flow. Cost elements were thus weighted based on the concept corresponding to the parameters underlying the cost. A schedule of weight concepts employed for each cost element is provided in *Table 3A-2*, below. The use of these separate weight sets for extrapolating from the DQ-facility set to the total in-scope facility set improves the overall accuracy of the sample-weighted estimates.

Based on the DQ and STQ responses, EPA determined that some in-scope DQ and STQ facilities already operate a re-circulating system and have intake flow of not more than 0.5 feet per second, and that these facilities would therefore not be expected to require additional compliance technology for compliance with any of the regulatory options. Although these facilities would not be expected to incur costs for installation of compliance technology, they would incur certain administrative costs as a result of the Proposed Existing Facilities Rule. For these facilities, EPA used the Original Survey Weights, as described in *Section 3A.1*. Thus, a facility with a re-circulating system in place and intake flow of no more than 0.5 feet per second receives its sample weight from the Original Survey Weights in all three of the weight sets used for the Existing Facilities Rule analysis, regardless of whether the facility replied to the DQ or STQ.

Use of newly developed facility-level weights

The different weight sets are used to estimate technology and other compliance-related costs or other complying facility characteristics according to the primary driver of a given cost element or of a given facility characteristic. For example, *once a given compliance technology has been assigned to a facility*, the primary driver of technology capital cost is the facility's design intake flow. Accordingly, EPA used the *design intake flow*-based weight set for extrapolating technology capital costs from the DQ facility set to the total of in-scope facilities. Similarly, to estimate total affected intake flow for a given regulatory option, EPA again used the design intake flow-based weight set to extrapolate from the DQ facility set to the total of in-scope facilities. On the other hand, some cost elements depend more on the affected electric generating capacity – for example, installation downtime costs. For estimating these costs and for estimating total affected electric generating capacity, EPA used the *electric generating capacity*-based weights. Finally, for estimating cost elements that are facility count-dependent (e.g., a fixed cost of compliance activity, such as initial permitting) and for estimating total affected facilities, EPA used the *facility count*-based weights. *Table 3A-2* details the weight set used for each component of costs considered by EPA in analyzing the costs of the proposed regulation.

Table 3A-2: Weights Applied to Each Cost Component

Weight Set	Cost Component
Capacity-based	Downtime Impact Costs
	Energy Penalty Turbine (Auxiliary Requirements and Backpressure)
DIF-based	Capital Costs
	O&M Costs
Facility Count-based	Initial Permitting Costs
	Monitoring Costs
	Permit Reissuance Costs
	State Initial Permitting Costs
	State Monitoring Costs
	State Permit Reissuance Costs
	Federal Initial Permitting Costs

3A.2 Entity-Level Analysis

3A.2.1 Manufacturers

EPA's sample-based facility analysis supports specific estimates of (1) the number of facilities expected to be subject to the regulation and (2) the total compliance costs expected to be incurred in these facilities. However, the sample-based analysis does not support specific estimates of the number of entities – or firms – that own Manufacturer facilities. In addition, the sample-based analysis does not support specific estimates of the number of regulated facilities that may be owned by a single firm, or the total of compliance costs across regulated facilities that may be owned by a single firm.

For the firm-level analysis, EPA therefore considered two cases based on the sample weights developed from the facility survey. These cases provide approximate upper and lower bound estimates on: (1) the number of firms incurring compliance costs and (2) the costs incurred by any firm owning a regulated facility.[93] The cases are as follows:

Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; upper bound estimate of total compliance costs that a firm may incur.

For this case, EPA assumed that any firm owning a regulated sample facility(ies), owns the known sample facility(ies) and all of the sample weight associated with the sample facility(ies). This case minimizes the count of affected firms, as the weight for each known affected firm is 1, while tending to maximize the potential cost burden to any single firm as they are assumed to own all the facilities represented by the sample weights of the facility(ies) they are known to own.

Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulation; lower bound estimate of total compliance costs that a firm may incur.

For this case, which is an inversion of the assumption underlying Case 1, EPA assumed (1) that a firm owns only the regulated sample facility(ies) that it is known to own from the sample analysis and (2) that this pattern of ownership, observed for sampled facilities and their owning firms, extends over the facility population represented by the Manufacturers sample facilities. This case minimizes the possibility of multi-facility ownership by a single firm and thus maximizes the count of affected firms, but also minimizes the potential cost burden to any single firm. In this case, the parent firms are weighted based on the weight(s) of the facility(ies) they own; details on the analytical methods behind this procedure are described in *Chapter 4, Section 4.5.1*.

3A.2.2 Electric Power Generators

In addition to the use of facility-based weights as described in *Section 3A.1.2*, EPA also developed and used sample weights for estimating *owning entity*-level effects for Electric Generators that extend from the DQ facilities, and the identified parent entities that own them, to the estimated population of parent entities that own in-scope DQ *and STQ* facilities. These entity-level weights are needed because a number of owning entities own *only* implicitly analyzed facilities. The parent entities that own only these implicitly analyzed facilities would therefore not be accounted for by an analysis that focuses only on explicitly analyzed facilities and, and as a result, only on their parent entities. The use of entity-level weights allows EPA to more precisely estimate the impacts on entities owning only implicitly analyzed facilities by taking into account important entity characteristics (such as business size size and type) in the development of the weights. The assessment of impact at the level of the owning entity is important in EPA's analysis of firm/owning entity-level effects for Electric

[93] The application of sample weights in the firm-level analyses for manufacturing facilities is the same as that followed in the earlier 316(b) Phase III rule analyses.

Generators as part of the general cost and economic impact analysis (*Chapter 5: Cost and Economic Impact Analyses – Electric Generators*) and for the analysis of the small entity impacts for the Regulatory Flexibility Act analysis (*Chapter 7: Regulatory Flexibility Act (RFA) Analysis*).

Development of entity-level weights

EPA developed these weights from research to identify the current owning parent entity for all DQ and STQ facilities currently in operation. In this effort, EPA also identified the entity-ownership type – such as private firm, municipality, co-operative, etc. – and whether the owning parent entity would be classified as a small entity based on Small Business Administration entity size criteria. The sample weights were developed in accordance with this classification framework – by entity-ownership type and by entity size classification. *Table 3A-3* presents the number of entities falling into each classification both for entities owning at least one explicitly analyzed facility and for all entities.

Table 3A-3: Proposed Existing Facilities Rule Unique Parent Entities and Facilities (by Entity Type and Size)

Parent Entity Type	Small Entity Size Standard	Number of Parent Entities[a,b]			Number of Facilities		
		Large	Small	Total	Large	Small	Total[c]
Parent Entities Owning at Least One Explicitly Analyzed Facility							
Rural Electric Cooperative	4,000 MWh output	9	2	11	11	2	13
Federal	assumed large	1	0	1	7	0	7
Investor-Owned Utilities	4,000 MWh output	38	1	39	137	1	138
Municipality	50,000 population served	7	6	13	7	6	13
Nonutility	4,000 MWh output	26	3	29	73	5	82
Other Political Subdivision	50,000 population served	0	0	0	0	0	0
State	assumed large	4	0	4	8	0	8
Total		**85**	**12**	**98**	**243**	**14**	**257**
All Known Parent Entities[d] – i.e., Parent Entities Owning Only Implicitly Analyzed Facilities *or* at Least One Explicitly Analyzed Facility							
Rural Electric Cooperative	4,000 MWh output	12	8	20	23	8	31
Federal	assumed large	1	0	1	14	0	14
Investor-Owned Utilities	4,000 MWh output	41	2	43	280	3	283
Municipality	50,000 population served	18	17	35	26	17	43
Nonutility	4,000 MWh output	32	5	37	153	8	161
Other Political Subdivision	50,000 population served	2	1	3	6	1	7
State	assumed large	4	0	4	9	0	9
Total		**110**	**33**	**143**	**511**	**37**	**548**

a. For 8 parent entities, EPA was unable to find the entity revenue values needed to determine the size of these entities; consequently, EPA used the total revenue for all facilities owned by these entities to determine entity size

b. In 3 instances, an Electric Generator is owned by a joint venture of two entities.

c. 548 facilities include (1) explicitly analyzed facilities and (2) implicitly analyzed facilities that responded to the 2000 316(b) Surveys.

d. These counts are unweighted and reflect the known universe of facilities and their parent entities expected to be in scope of Proposed Existing Facilities Rule.

Source: U.S. EPA Analysis, 2010

EPA developed the entity-level weights for each combination category of *entity size* and *entity type* by dividing the number of parent entities at the total population level (i.e., parent entities owning at least one explicitly analyzed facility *and* parent entities owning only implicitly analyzed facilities) by the number of parent entities owning at least one explicitly analyzed facility. Applying these entity-level weights to the numbers of *explicitly analyzed* facility-based parent entities assessed in the various cost impact categories yields an estimate of the number of parent entities including the *implicitly analyzed* facility-based parent entities.

Application of entity-level weights

EPA applied entity-level weights in assessing impacts on owning entities for the cost impact analysis (*Chapter 5, Section 3*) and in the RFA analysis (*Chapter 7*). Thus, the findings of impacts to entities owning explicitly analyzed facilities (i.e., the number of parent entities in a given impact category) were extrapolated to entities owning implicitly analyzed facilities with the same characteristics by multiplying by the appropriate weight.

As described in *Chapter 5, Section 3* and *Chapter 7*, the entity-level impact analyses were performed in two weighting configurations: (1) using only entity-level weights and (2) using only facility-level weights. The Agency notes that using only entity-level weights may understate the impact on an individual entity, while using only facility-level weights may overstate the impact on a given entity. For this reason, EPA performed and presents results for entity-level analyses using both of these weighting concepts. EPA chose not to combine the entity-level weights with the facility level weights, as this has the potential to overestimate the effects on both the facilities and their owning entities. The relevant chapters present more information on how entity-level weights were used in the analysis.

3A.3 Summary

Table 3A-4, following page, shows which weights were used in each of the analyses conducted for Electric Generators and Manufacturers.

Table 3A-4: Use of Weights in the Cost and Economic Impact Analysis for the Proposed Existing Facilities Rule

Chapter	Weights Used	
	Generators[a]	Manufacturers[b]
2: Industry Profile	➢ Original Survey Weights	➢ Original Survey Weights (T)
3: Compliance Cost Assessment	➢ *New DQ Weights* for all facilities except those with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second, which use *Original Survey Weights*	➢ Original Survey Weights (T)
4: Cost and Economic Impact Assessment		
➢ Facility-Level Analysis	➢ *New DQ Weights* for all facilities except those with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second, which use *Original Survey Weights*	➢ Original Survey Weights (E)
➢ Entity-Level Analysis	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second), *without using Entity-level weights* ➢ Entity-level weights, *without using Facility-level weights*	➢ Original Survey Weights (E)
5: Market Model Analysis	➢ No weights[c]	➢ Not included
6: Regulatory Flexibility Act (RFA) Analysis		
➢ Facility-Level Analysis	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second)	➢ Original Survey Weights (E)
➢ Entity-Level Analysis	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second), *without using Entity-level weights* ➢ Entity-level weights, *without using Facility-level weights*	➢ Original Survey Weights (E)
7: Unfunded Mandates Reform Act (UMRA) Analysis	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second) for impacts to facilities owned by governments and small governments	➢ Original Survey Weights (T)
8: Other Administrative Requirements	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second) for E.O. 13132: Federalism ➢ No weights for E.O. 13211: Energy Effects ➢ *Original Survey Weights* for Sort-Term Reliability Assessment	➢ Original Survey Weights (T)
9: Social Cost Assessment	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second) for cost development	➢ Original Survey Weights (T)
10: Cost and Benefits	➢ *New DQ Weights* (*Original Survey Weights* for Facilities with re-circulating systems in the baseline and intake velocity of less than or equal to 0.5 feet per second) used in Social Cost Assessment	➢ Original Survey Weights (T)

a. "DQ" refers to the Detailed Questionnaire.

b. Manufacturers survey sample weights consist of two sets, one used for economic impact analysis (denoted by an E), and another set used for all other analyses (denoted by a T). For details on these two weight sets, see *Section 3A.1.1*.

c. "No weights" means that the analyses in a chapter do not use weights.

Appendix 3B Mapping Manufacturers’ Standard Industrial Classification Codes to North American Industry Classification System Codes

At the time of the 2000 316(b) Detailed Industry Questionnaire (DQ), industry information was collected and analyzed within the Standard Industry Classification (SIC) framework, which was the standard until 1997. In that year, the United States switched to the North American Industry Classification System (NAICS) framework for industrial classification. In the earlier 316(b) rulemaking analyses, data from years after 1997 were translated from the NAICS framework back into the SIC framework for reporting historical industry trends. Now that more than a decade of historical data is available in the NAICS framework, EPA determined that it was appropriate to use the NAICS framework for all industry-level analyses. At the time of the 316(b) Industry Survey, surveyed Manufacturers provided their primary SIC codes, which EPA used to categorize them into industries. To use the 316(b) Survey-based facility information in the current analyses, the Agency mapped facility-level 4-digit SIC codes onto 6-digit NAICS codes to determine the industry to which to assign in-scope Manufacturers and for which public industry data to collect.

Because there is not always a one-to-one relationship between a SIC and NAICS code, EPA first used a Manufacturer’s NPDES permit identification number to obtain current information about the facility, including the facility’s primary NAICS code. In the event that these data were not available or are unclear in the NPDES database, EPA used the SIC code provided in the facilities’ survey responses and mapping provided by the U.S. Census Bureau to determine the appropriate NAICS code. In cases where the mapping between SIC and NAICS was not one-to-one, EPA assigned the NAICS code with the highest value of shipments share according to the *1997 Economic Census: Bridge Between NAICS and SIC* published by the U.S. Census.[94]

94 This bridge is available online at http://www.census.gov/epcd/ec97brdg/

4 Cost and Economic Impact Analysis - Manufacturers

4.1 Analysis Overview

This chapter assesses the expected economic impact of the 316(b) Existing Facilities Rule options on the Manufacturers segment of in-scope facilities. In the same way as undertaken for the previous 316(b) Phase III regulatory analyses, the analysis for the Manufacturers segment of the 316(b) existing facilities rule focuses on impacts in six key manufacturing industries – Paper, Chemicals, Petroleum, Aluminum, Steel, and Food and Kindred Products (the "Primary Manufacturing Industries") – in which a substantial number of facilities are expected to be subject to regulation. EPA's analysis of the regulation's expected impact in these industries is based on a statistically valid sample survey of facilities in these six industries. EPA's previous industry surveys indicate that the regulation would potentially bring as many as 569 facilities in the Primary Manufacturing Industries under national requirements. [95]

This chapter also considers the effect of the regulation on facilities in other industries ("Other Industries") that would be within the scope of the regulatory options. The facility impact analysis for Other Industries is restricted to a sample of 6 facilities for which EPA received surveys, but which are not part of the statistically valid sample. As a result, EPA's analysis for the Other Industries group is limited to these known facilities. EPA has not estimated the number of facilities in the Other Industries group that may be subject to the regulation because EPA does not believe that this number can be reliably extrapolated from the sample of known facilities in this group. However, because the statistically valid survey group of industries (i.e., Electric Generators and the six Primary Manufacturing Industries) reflects 99 percent of total estimated cooling water withdrawals, EPA believes that few additional facilities in the Other Industries group are potentially subject to the regulatory analysis options.

Although EPA was able to undertake impact analysis for the Other Industries group using only the sample of known facilities for this group, EPA believes that its analysis for the Other Industries group provides a sufficient basis for regulation development. EPA's review of the engineering characteristics of cooling water intake and use in the Other Industries group indicates 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.

Based on the sum of the sample-weighted estimate of 569 facilities in the Primary Manufacturing Industries and the 10 known facilities in the Other Industries group, EPA included a total of 579 potentially regulated facilities in the economic impact analysis for the Manufacturer. The total number of Manufacturer facilities considered in the economic impact analysis (579) differs from the number of facilities potentially subject to regulation (592), as reported in *Chapter 1: Introduction*, and as used as the basis for calculating the social costs of the regulatory analysis options. EPA determined that the survey responses of 14[96] sample facilities lacked certain financial data needed for the facility impact analysis while containing sufficient data to support estimates of facility counts and compliance costs. EPA therefore retained these sample facilities (37 sample weighted facilities) in the analyses to estimate the total number of Manufacturers facilities potentially subject to regulation and for the calculation of social cost but excluded them from the economic impact analysis. When these sample facilities were excluded from the impact analysis, the sample weights for remaining facilities within the affected sample frames were adjusted upwards to account for their removal. The difference in the reported facility totals in the impact and

95 EPA applied sample weights to 222 sample 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, 1999).

96 The numbers of facilities reported in the social cost chapter and in this chapter may differ due to independent rounding.

social cost analyses reflects the removal of these 14 facilities and the use of adjusted sample weights. Both values are valid statistical estimates of the same, but unknown, value of the Manufacturers' facility population.

EPA undertook the economic impact analysis for the Manufacturers segment to aid in assessing the economic impact of alternative regulatory options and, on the basis of that assessment, to aid in defining a potential regulation. Measures of economic impact for this segment include facility closures and associated losses in employment, financial stress short of closure ("moderate impacts"), and firm-level impacts. ***Severe impacts*** are facility closures and the associated losses in jobs at facilities that would close due to the regulation. EPA also assessed moderate economic impacts to support its evaluation of regulatory options and to understand better the regulation's economic impacts. ***Moderate impacts*** are adverse changes in a facility's financial position that are not threatening to its short-term viability. The firm impact analysis assesses whether firms that own multiple facilities are likely to incur more significant impacts than indicated by the facility impact analysis. Impacts may be more significant at the firm level than at the facility level if a firm owns a number of facilities that incur significant cost. In addition, a firm-level analysis is needed to assess impacts on small businesses, as required by the Regulatory Flexibility Act. Other chapters consider the impacts on small entities (*Chapter 7: Regulatory Flexibility Analysis*).[97]

In conducting these analyses, EPA closely followed the methodologies used to conduct analyses in support of the previous 316(b) rule analyses and, to the extent practicable, relied on similar data sources.

4.2 Overview and Data Sources

The economic impact analyses for the Manufacturers segment of the 316(b) existing facilities rule rely on data provided in the financial portion of the detailed questionnaires distributed by EPA to facilities potentially subject to the previous 316(b) Phase III regulation. The survey financial data included facility and parent firm income statements and balance sheets for the three years 1996, 1997, and 1998.

In addition to the survey data, a number of secondary sources were used to characterize economic and financial conditions in the industries for this regulatory analysis. Secondary sources used in the analyses include:

- Department of Commerce economic census and survey data, including the *Census of Manufactures, Annual Surveys of Manufactures,* international trade data; and quarterly financial reports (QFR);
- U.S. *Industry and Trade Outlook*, published by McGraw-Hill and the U.S. Department of Commerce;
- *Annual Statement Studies*, published by Risk Management Association (RMA); and
- Statistics of U.S. Businesses (SUSB).

For the facility-level impact analysis, EPA first eliminated from analysis those facilities showing materially inadequate financial performance in the baseline, that is, in the absence of the regulation. EPA judged these facilities, which are referred to as ***baseline closures***, to be at substantial risk of financial failure regardless of any financial impacts of the 316(b) regulation (see *Table 4-1*). Second, for the remaining facilities, EPA evaluated how compliance costs would likely affect facility financial health. A facility is identified as a ***regulatory closure*** if it would have operated under baseline conditions but would fall below an acceptable financial performance level when subject to the new regulatory requirements. The closure test, or test of severe impacts, is detailed in *Section 4.3*. EPA's analysis also identified facilities that would likely incur moderate impacts from compliance with the regulation. EPA anticipates that these facilities would experience moderate deterioration of financial performance but not at a level sufficient to cause the facility to fail financially. The test of moderate impacts is detailed in *Section 4.4*.

[97] This chapter also includes 4 appendixes, which address particular elements of the Manufacturers cost and economic impact analysis.

Table 4-1: Summary of Baseline Closures by Sector for Manufacturers Segment Facilities Estimated Subject to the 316(b) Existing Facilities Rule

Sector	Total Number of Facilities	Number of Baseline Closures	Percentage Closing in Baseline	Number Operating in Baseline
Paper	230	32	14%	198
Chemicals	171	4	3%	167
Petroleum	36	5	15%	30
Steel	68	22	32%	46
Aluminum	27	3	12%	24
Food	37	6	17%	31
Total Facilities in Primary Manufacturing Industries	569	73	13%	496
Additional known facilities in Other Industries[a]	10	3	30%	7

a. Totals may not sum due to independent rounding.

Source: U.S. EPA analysis, 2010

For the assessment of firm-level effects, EPA compared annualized after-tax compliance cost to firm revenue and reports the estimated number and percentage of firms incurring compliance cost in three cost-to-revenue ranges: less than one percent; at least one percent but less than three percent; and three percent or greater. Although EPA's sample-based data support specific estimates of the number of facilities, these data do not support a specific estimate of the number of entities that own these facilities. As a result, EPA estimated the number of entities owning facilities in the Manufacturers segment as a range, based on alternative assumptions about the potential ownership of regulated facilities. In its comparison of compliance cost to firm revenue, EPA also used this same range concept, which yields approximate upper and lower bound estimates of the value of compliance cost that might be incurred by an entity, based on the number of regulated facilities that it owns.

The following sections detail the calculations and results of the severe and moderate facility-level impact assessments and the firm-level impact assessment.

4.3 Facility-Level Impacts: Severe Impact Analysis

4.3.1 Analysis Approach and Data Inputs

The assessment of severe impacts for facilities in the Manufacturers segment is based on the change in the facility's estimated business value, as determined from a discounted present value analysis of baseline cash flow and the change in cash flow resulting from regulatory compliance. If the estimated discounted cash flow value of the facility is positive before considering the effects of regulatory compliance but becomes negative as a result of compliance outlays, then the facility is considered a regulatory closure. In this impact test, the estimated ongoing business value of the facility is compared with a threshold value of zero for the closure decision: as long as the discounted cash flow value of the facility is greater than zero, the business is earning its cost of invested capital and continuation of the business is warranted. If the discounted cash flow value of the facility is less than zero in the baseline or becomes less than zero as a result of compliance outlays, then the business would not earn its cost of invested capital and the business owners would be better off financially by terminating the business. As noted in earlier discussion, facilities for which EPA estimated a negative baseline value were considered baseline closures and were not tested for additional adverse impacts from regulatory compliance.

In an alternative formulation of this concept, business owners would compare the discounted cash flow value of the facility with the value that the facility's assets would bring in liquidation. In this case, the estimated ongoing business value would be compared with a value that may be different from zero: *liquidation value* could be positive or negative. When liquidation value is positive, business owners might benefit financially by terminating a business and seeking its liquidation value even when the ongoing business value is positive but less than the estimated liquidation value. With negative liquidation value – which generally would result from business termination liabilities (e.g., site clean-up) – the opposite result could occur: business owners may find it financially advantageous to remain in business *even though the business earns less than its cost of invested capital*, if the liquidation value of the business is "more negative," and thus less in value, than the ongoing business based on the discounted cash flow analysis. EPA considered this alternative impact test formulation for the previous 316(b) Manufacturers analyses. However, EPA judges that the liquidation value estimates are substantially speculative and subject to considerable error because such an assessment requires detailed facility-specific financial and operational history, and projections of future asset values and liabilities that are considerably uncertain. For these reasons, EPA decided against using liquidation value for comparison with ongoing business value in the closure test.

The cash flow concept used in calculating ongoing business value for the closure analysis is *free cash flow* available to all capital. Free cash flow is the cash available to the providers of capital – both equity owners and creditors – on an after-tax basis from business operations, and takes into account the cash required for ongoing replacement of the facility's capital equipment. Free cash flow is discounted at an estimated after-tax total *cost of capital* to yield the estimated business value of the facility. The baseline and post-compliance cash flow concepts are outlined below. Details of these calculations can be found in *Appendix 4E: Economic Impact Methodology – Manufacturers*.

Calculation of Baseline Free Cash Flow and Performance of Baseline Closure Test

Calculation of baseline free cash flow and performance of the baseline closure test involved the following steps:

- Average survey income statement data over response years and convert to 2009 dollars.
- Adjust after-tax income to exclude the effects of financial structure.
- Calculate after-tax cash flow from operations, before interest, by adjusting income for non-cash charges such as depreciation and amortization.
- Remove the implied cash flow benefit of any negative taxes, as reported in the facility's income statement after adjustment for removal of interest. This assumption is consistent with a later step in the post-compliance analysis in which EPA limited the cash flow benefit of tax deductions on compliance outlays not to exceed the amount of taxes paid as reported in the baseline income statement (and adjusted for interest).
- Adjust after-tax cash flow to reflect estimated real change in business performance, as reflected in baseline cash flow, from the time of survey data collection to the present (see *Appendix 4.B: Adjusting Baseline Facility Cash Flow*). This adjustment is intended to address two concerns: (1) that facility survey data might have been collected during a period that deviated cyclically from the longer-term trend of business performance for the 316(b) manufacturing industries; and (2) that some of the industries might be experiencing a longer-term trend of deteriorating economic performance. In both cases, using the survey-based data for the current analysis – *without accounting for these possible effects* – could lead to misleading estimates of the affected industries' ability to withstand the compliance cost burdens of the proposed existing facilities rule.
- Calculate free cash flow by adjusting after-tax cash flow from operations for estimated ongoing capital equipment outlays (see Appendix 4.B). [98]

[98] In the primary analysis, the cash flow analysis did not consider potential costs from other environmental regulations that might be affect these industries at approximately the same time that the 316(b) regulatory requirements would come into effect. Recognizing this potential impact, EPA also undertook an alternative case analysis in which it further adjusted baseline cash flow to reflect costs that facilities might incur from compliance with Federal environmental regulations that were recently promulgated and whose costs are not likely to be reflected fully in the ATCF adjustment analysis. This analysis, which is documented in *Appendix 4.D: Analysis of*

- Calculate baseline facility value as the present value of free cash flow over a 30-year analysis horizon, using an estimated real (i.e., excluding the effects of inflation), after-tax cost of capital of 7.0 percent. The use of 30 years as the time horizon reflects the facility-level analysis period for the 316(b) existing facilities rule.

As explained above, EPA considered a facility to be a baseline closure if its estimated business value was negative before incurring regulatory compliance costs. Baseline closures were neither tested for adverse impact in the post-compliance impact analysis nor were their compliance costs included in the tally of total costs of 316(b) regulatory compliance.

Calculation of Post-Compliance Free Cash Flow and Performance of Post-Compliance Closure Test

For the post-compliance closure analysis, EPA recalculated annual free cash flow, accounting for changes in revenue, annual expenses and taxes that are estimated to result from compliance-related outlays. EPA combined the post-compliance free cash flow value and the estimated compliance capital outlay in the present value framework to calculate business value on a post-compliance basis.

For the post-compliance analysis, EPA considered whether in-scope Manufacturers would be able to pass forward compliance costs to customers through increased prices. From the analyses presented in *Appendix 4A: Cost Pass-Through Analysis*, EPA concluded that an assumption of zero cost pass-through is appropriate for analyzing the impact of the regulatory analysis options on facilities in the six Primary Manufacturing Industries (this is the same assumption as applied in the previous analysis conducted in support of the 2006 Final Section 316(b) Phase III Existing Facilities Rule). Performance of the impact analysis under this assumption means that facilities must absorb all compliance-related costs and operating effects (e.g., income loss from facility shutdown during equipment installation) within their baseline cash flow and financial condition. To the extent that facilities would be able to pass on some of the compliance costs to customers through price increases, the analysis may overstate the potential impact on complying facilities.

Calculation of post-compliance free cash flow and performance of the post-compliance closure test involved the following steps:

- Adjust baseline annual free cash flow to reflect compliance outlay effects. As outlined previously, compliance cost and other operating effects include annual change in revenue; annually recurring operating and maintenance costs; the annual equivalent of permitting and re-permitting costs, which recur on other than an annual basis over the life of the analysis; the annual equivalent of the income loss from installation downtime; and related changes in taxes.[99]

- Limit tax adjustment not to exceed taxes as reported in baseline financial statement.

Other Regulations, found no material effect on the facility impact analysis, as reported in this chapter. The alternative case analysis, which incorporated estimated compliance costs from the recent Federal environmental regulations, found one additional baseline closure and no change in post-compliance closures.

99 For the facility cash flow analysis, EPA treated the income loss from installation downtime on an annual equivalent basis even though this financial event occurs only once, and at the beginning of the assumed analysis period. EPA treated the installation downtime on an annualized basis for two reasons. First, the installation downtime is assumed to have a useful "financial life" of 30 years to reflect the total potential business life of the facility with the installed compliance technology (note that reinstallation of the basic capital equipment other than cooling towers, which is assumed to recur on a 10-, 20-, or 25-year interval depending on the specific technology, does not require a new round of downtime). Since compliance capital equipment is assumed to have a specific useful life and the discounted cash flow analysis is accordingly structured around this period, including the income loss from installation downtime (which is assumed to have a 30-year useful life) as a one-time up-front cost would overstate its impact in the discounted cash flow calculation. Second, calculation of the downtime cost on an annual basis allows the tax effect from the one-time income loss to be summed with other annual tax effects for applying the limit to tax offsets, as explained in the next step of the analysis.

- Calculate post-compliance facility value, including post-compliance free cash flow and the compliance capital outlay. As in the baseline analysis, EPA calculated post-compliance facility value as the present value of free cash flow and accounting for the compliance capital outlay as an undiscounted cash outlay in the first analysis period. As before, a 7 percent discount rate was used in this present value calculation.

EPA considered a facility to be a post-compliance closure if its estimated business value was positive in the baseline but became negative after adjusting for compliance-related cost, revenue and tax effects. In addition to tallying closure impacts in terms of the number of estimated facility closures, EPA also measured the significance of closures in terms of losses in employment and output. Employment losses equal the number of employees reported by closure facilities in survey responses; output losses equal total revenue reported for regulatory closure facilities. EPA estimated national results by multiplying facility results by facility sample weights.[100]

4.3.2 Key Findings for Regulatory Options

Table 4-2 reports the estimated severe impacts of the proposed rule on Manufacturing facilities by option. Of the 504 Manufacturers facilities potentially subject to regulation after excluding baseline closures, EPA estimated that no facilities would close or incur employment losses as a result of the proposed Options.

Table 4-2: Number of Facilities with Severe Impacts by Sector and Option

Sector	Total Operating in Baseline	Number of Facilities with Severe Impacts					
		Option 1		Option 2		Option 3	
		Number	Percentage	Number	Percentage	Number	Percentage
Paper	198	0	0%	0	0%	0	0%
Chemicals	167	0	0%	0	0%	0	0%
Petroleum	30	0	0%	0	0%	0	0%
Steel	46	0	0%	0	0%	0	0%
Aluminum	24	0	0%	0	0%	0	0%
Food	31	0	0%	0	0%	0	0%
Total Facilities in Primary Manufacturing Industries	**496**	**0**	**0%**	**0**	**0%**	**0**	**0%**
Additional known facilities in Other Industries	*7*	*0*	*0%*	*0*	*0%*	*0*	*0%*

Source: U.S. EPA analysis, 2010

4.4 Facility-Level Impacts: Moderate Impact Analysis

4.4.1 Analysis Approach and Data Inputs

EPA also conducted an analysis of financial stress short of closure to assess the occurrence of moderate impacts on facilities in the Manufacturers segment. Facilities incurring moderate impacts are not projected to close due to the regulatory analysis options. The regulation, however, might reduce their financial performance to the point where they incur greater difficulty and higher costs in obtaining financing for future investments. As above, the following discussion outlines the calculations undertaken for this assessment; detailed discussion of this analysis is contained in *Appendix 4E: Economic Impact Methodology – Manufacturers.*

The analysis of moderate impacts examined two financial measures:

Pre-Tax Return on Assets (PTRA): ratio of pre-tax operating income – earnings before interest and taxes (EBIT) – to assets. This ratio measures the operating performance and profitability of a business' assets independent of financial structure and tax circumstances. PTRA is a comprehensive measure of a firm's

[100] For the analysis of options presented in this chapter, none of these impact measures (e.g., employment loss, output loss) were in fact relevant because none of the three regulatory analysis options resulted in regulatory closures.

economic and financial performance. If a firm cannot sustain a competitive PTRA on a post-compliance basis, it will likely face difficulty financing its investments, including the outlay for compliance equipment.

Interest Coverage Ratio (ICR): ratio of pre-tax operating cash flow – earnings before interest, taxes, and depreciation (EBITDA) – to interest expense. This ratio measures the facility's ability to service its debt on the basis of current, ongoing financial performance and to borrow for capital investments. Investors and creditors will be concerned about a firm whose operating cash flow does not comfortably exceed its contractual obligations. As ICR increases, the firm's general ability to meet interest payments and carry credit also increases. ICR also provides a measure of the amount of cash flow available for equity after interest payments.

Creditors and equity investors review the above two measures as criteria to determine whether and under what terms they will finance a business. PTRA and ICR also provide insight into a firm's ability to generate funds for compliance investments from internally generated equity, i.e., from after-tax cash flow.

Calculation of Moderate Impact Metrics

EPA calculated a firm's PTRA and ICR measures using data collected from the 316(b) industry survey, adjusted for inflation to 2009. EPA calculated these measures on a baseline and post-compliance basis. In calculating the baseline values of the PTRA and ICR measures, EPA applied the same cash flow adjustments as described above for the Manufacturers facility closure analysis, to the numerators of the PTRA and ICR measures. In the same way as described for the closure analysis, these adjustments are intended to capture the change in the financial performance of firms in the Primary Manufacturing Industries between the time of the 316(b) Phase III survey and the present (see *Appendix 4.B: Adjusting Baseline Facility Cash Flow*).

Developing Threshold Values for Pre-Tax Return on Assets (PTRA) and Interest Coverage Ratio (ICR)

For evaluating 316(b) manufacturing facilities according to the moderate impact measures, EPA compared baseline and post-compliance PTRA and ICR to 316(b) industry-specific thresholds that were developed from data compiled by Risk Management Association, Inc. (RMA). RMA compiles and reports financial statement information by industry as provided by member commercial lending institutions. The threshold values represent the lowest 25th percentile values of PTRA and ICR for statements received by RMA for the 11 years from 1998 to 2008 within relevant industries (RMA, 2009). EPA developed 316(b) industry-level values by weighting and summing the RMA industry values according to the definition of 316(b) industries. Thresholds by sector ranged from 0.5 percent to 2.8 percent for PTRA and from 1.5 to 2.7 for ICR. Because the financial statements received by RMA are for businesses applying for credit from member institutions, the data do not represent a random sample. In particular, the RMA data likely exclude representation from the financially weakest businesses, which are unlikely to seek financing from RMA member lending institutions. As a result, EPA views the threshold values as somewhat likely to overestimate the occurrence of moderate impacts.

Both measures are important to financial success and firms' ability to attract capital. Facilities failing at least one of the moderate impact measures in the baseline were deemed to be already experiencing moderate financial weakness and were not tested for additional financial impact in the moderate impact analysis. Facilities that passed both moderate impact tests in the baseline but failed one or both threshold comparisons, post-compliance, were considered to incur moderate financial impacts short of closure as a result of the final Section 316(b) regulation.

The 6-digit NAICS code data were consolidated into weighted industry averages, weighted by 2002 value of shipments from the Economic Censuses (U.S. DOC, 2002).[101] For each industry and impact measure, a separate

[101] 2002 is the most recent year for which value of shipments is available for all industries, as the 2007 economic census data was not yet available at the time of this writing.

threshold was calculated. The use of the RMA data for calculating the threshold values for pre-tax return on assets and interest coverage ratio is described in detail in *Appendix 4E: Economic Impact Methodology – Manufacturers*.

Summary of Threshold Values

Table 4-1 reports the resulting threshold values for PTRA and ICR by industry. The PTRA values range from 0.5 percent for the Other industries to 2.8 percent for Petroleum. The ICR values range from 1.5 for Other industries to 2.7 for Petroleum.

Table 4-3: Summary of Moderate Impact Thresholds by Manufacturers Industry *based on 25th percentile value of firms reporting data to RMA*

Industry	Pre-Tax Return on Assets (PTRA)	Interest Coverage Ratio (ICR)
Food	1.3	2.4
Paper	0.8	1.9
Petroleum	2.8	2.7
Chemicals	1.5	2.0
Steel	1.1	1.7
Aluminum	0.8	1.8
Other	0.5	1.5

Source: RMA, 2009; U.S. Economics Census, 2002; U.S. EPA Analysis, 2010.

Calculation of Moderate Impacts

In a similar way as described for the analysis of severe impacts, EPA compared the baseline and post-compliance values for the two moderate impact measures to the moderate impact thresholds summarized above. Facilities falling below one or both thresholds in the baseline were considered baseline failures and removed from the post-compliance impact analysis. Facilities failing one or both thresholds in the post-compliance analysis are considered post-compliance failures for the moderate impact test.

4.4.2 Key Findings for Regulatory Options

Table 4-4 reports the estimated moderate impacts of the proposed rule on Manufacturing facilities by option. Of the 504 Manufacturers facilities potentially subject to regulation after excluding baseline closures, EPA estimated that no facilities would incur moderate impacts under Options 1 and 2, and 17 facilities would incur moderate impacts under Option 3.

Table 4-4: Number of Facilities with Moderate Impacts by Sector and Option

Sector	Total Operating in Baseline	Number of Facilities with Moderate Impacts					
		Option 1: IM Everywhere		Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD		Option 3: I&E Mortality Everywhere	
		Number	Percentage	Number	Percentage	Number	Percentage
Paper	198	0	0%	0	0%	3	0.6%
Chemicals	167	0	0%	0	0%	13	2.6%
Petroleum	30	0	0%	0	0%	1	0.2%
Steel	46	0	0%	0	0%	0	0%
Aluminum	24	0	0%	0	0%	0	0%
Food	31	0	0%	0	0%	0	0%
Total Facilities in Primary Manufacturing Industries	**496**	**0**	**0%**	**0**	**0%**	**17**	**3.4%**
Additional known facilities in Other Industries	*7*	*0*	*0%*	*0*	*0%*	*0*	*0%*

Source: U.S. EPA analysis, 2010

4.5 Firm-Level Impacts

The analysis of impact on Manufacturers segment firms builds on the facility impact analysis to assess whether firms that own multiple facilities are likely to incur impacts in a way that is not revealed by the facility impact analysis. For the assessment of firm-level effects, EPA calculated annualized after-tax compliance costs as a percentage of firm revenue and reports the estimated number and percentage of affected firms incurring compliance costs in three cost-to-revenue ranges: less than one percent; at least one percent but less than three percent; and three percent or greater. These ranges are accepted by EPA for screening of firm-level impacts.

EPA's sample-based facility analysis supports specific estimates of (1) the number of facilities expected to be subject to the regulation and (2) the total compliance costs expected to be incurred in these facilities. However, the sample-based analysis does not support specific estimates of the number of firms that own manufacturing facilities. In addition, the sample-based analysis does not support specific estimates of the number of regulated facilities that may be owned by a single firm, or the total of compliance costs across regulated facilities that may be owned by a single firm.

For the firm level analysis, EPA therefore considered two cases based on the sample weights developed from the facility survey. These cases provide approximate upper and lower bound estimates on: (1) the number of firms incurring compliance costs and (2) the costs incurred by any firm owning a regulated facility. The cases are laid out in the following sections.

4.5.1 Analysis Approach and Data Inputs

Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulation; upper bound estimate of total compliance costs that a firm may incur.

For this case, EPA inverted the prior assumption and assumed that any firm owning a regulated sample facility(ies), owns the known sample facility(ies) and all of the sample weight associated with the sample facility(ies). This case minimizes the count of affected firms, while tending to maximize the potential cost burden to any single firm.

For this case, EPA grouped together all facilities with a common parent firm from the surveys and sample weighted the facility compliance costs. EPA calculated the firm-level compliance cost as:

$$CC_{firm} = \sum_{i} CC_i \qquad (4\text{-}4)$$

where:

CC_{firm}	=	firm-level compliance cost
CC_i	=	compliance cost for surveyed facility *i* owned by the firm
W_i	=	sample weight for surveyed facility *i* owned by the firm

As stated above, for the analysis of firm-level impacts, EPA calculated annualized after-tax compliance costs as a percentage of firm revenue. EPA judged that firms with annualized after-tax compliance cost of less than one percent of revenue would not be materially affected by the regulation. EPA identified firms as subject to potentially more serious impacts if annualized compliance cost exceeded three percent of revenue.

Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulation; lower bound estimate of total compliance costs that a firm may incur.

For this case, EPA assumed (1) that a firm owns only the regulated sample facility(ies) that it is known to own from the sample analysis and (2) that this pattern of ownership, observed for sampled facilities and their owning firms, extends over the facility population represented by the sample facilities. This case minimizes the possibility of multi-facility ownership by a single firm and thus maximizes the count of affected firms, but also minimizes the potential cost burden to any single firm.

For each firm that owns one sample facility, no firm is assumed to own more than one regulated facility, and the analysis is straightforward: the firm owns one regulated facility and incurs compliance costs only for that facility. This configuration is assumed to exist as many as times as the facility's sample weight. However, EPA found that 28 percent of the firms identified as owning a sample facility, own more than one sample facility. Where the multiple facilities owned by the same firm have the same sample weight, the analysis is also straightforward: the firm is assumed to own and incur the compliance costs of the identified sample facilities, and the configuration is assumed to exist as many times as many times as the uniform sample weight of the multiple facilities.

In some instances, however, the sample facilities that are owned by the same firm have different sample weights. In these cases, which required a more complex analysis, EPA accounted for the ownership of multiple sample facilities by a single firm, but restricted the count of the multiple facilities and their configuration of ownership for the firm-level cost analysis based on the sample weights of the individual sample facilities. Specifically, the *firm* is assumed to exist on a sample-weighted basis as many times as the *highest* of the sample weights among the sample facilities known to be owned by the firm. However, sample facilities with a smaller sample weight, *and their compliance costs*, can be included in the total instances of ownership by the firm for only as many times as their sample weights. Otherwise, the total facility count implied in the firm analysis would exceed the sample-based estimated total of facilities; correspondingly, the total of compliance costs accounted for in the firm level analysis would exceed the sample-based estimated total of facility compliance costs. For implementation, this concept means that *all* of the sample facilities known to be owned by the same firm, *and their compliance costs*, can be included in the ownership configuration for only as many sample weighted instances as the smallest sample weight among the multiple facilities owned by the firm. Once the sample weight of the smallest sample weight facility is "used up," a new multiple facility ownership is configured including only the costs for those facilities with weights greater than the weight of the smallest sample weight facility. This configuration is assumed to exist for as many sample weighted instances as the difference between the lowest sample weight and the next higher sample weight among the facilities owned by the firm. This process is repeated – with successive removal of the new lowest sample weight facility, and its compliance cost– as many times as necessary until only the highest sample weight facility remains in the ownership configuration.

The survey asked respondents to provide firm-level revenue for the parent firm. For single-facility firms, firm revenue and compliance costs are identical to those for the facility. For multi-facility firms, EPA grouped together all facilities with a common parent firm from the surveys. For each firm in the analysis, firm-level compliance cost is:

$$CC_{firm} = \sum_{i} CC_i \qquad (4\text{-}5)$$

where:

CC_{firm}	=	firm-level compliance cost
CC_i	=	compliance cost for the surveyed facility *i*, known to be owned by the *firm*

4.5.2 Key Findings for Regulatory Options

Table 4-5 summarizes the results from the firm impact analysis assuming that facilities represented by sample weights are owned by the same firm that owns the sample facility (Case 1). The following table, Table 4-6, reports the results from the firm impact analysis assuming that the facilities presented by sample weights are owned by different firms than that owning the sample facility (Case 2). Both tables show the number of firms that incur costs in three ranges: less than 1 percent of a firm's revenue, within 1 and 3 percent of revenue, and greater than 3 percent of revenue.

Under Case 1 Options 1, 2, and 3, of the 123 entities subject to the proposed regulation, 118 incur costs less than 1 percent of revenue, zero incur costs between 1 and 3 percent of revenue, and one incurs costs greater than 3 percent revenue. Under Case 2 Option 1, 2, and 3, 356 entities are subject to regulation and 346 incur costs less than 1 percent revenue, zero incur costs between 1 and 3 percent revenue, and one incurs costs greater than 3 percent revenue.

Table 4-5: Entity-Level Cost-to-Revenue Analysis Results, Assuming that Facilities Represented by Sample Weights are Owned by the Same Firm that Owns the Sample Facility (Case 1)

Entity Type	Total Number of Facilities	Total Number of Entities	Number of Firms with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[a]		
Option 1: IM Everywhere								
Food	31	8	8	0	0	0	0	0.01
Paper	198	42	40	0	0	2	0	0.37
Petroleum	30	17	15	0	1	1	0	11.73
Chemicals	167	26	26	0	0	0	0	0.35
Steel	46	16	16	0	0	0	0	0.09
Aluminum	24	5	5	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.25
Total	**504**	**123**	**118**	**0**	**1**	**3**	**0**	**11.73**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Food	31	8	8	0	0	0	0	0.01
Paper	198	42	40	0	0	2	0	0.37
Petroleum	30	17	15	0	1	1	0	11.73
Chemicals	167	26	26	0	0	0	0	0.35
Steel	46	16	16	0	0	0	0	0.09
Aluminum	24	5	5	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.25
Total	**504**	**123**	**118**	**0**	**1**	**3**	**0**	**11.73**
Option 3: I&E Mortality Everywhere								
Food	31	8	8	0	0	0	0	0.01
Paper	198	42	40	0	0	2	0	0.03
Petroleum	30	17	15	0	1	1	0	11.73
Chemicals	167	26	26	0	0	0	0	0.01
Steel	46	16	16	0	0	0	0	0.07
Aluminum	24	5	5	0	0	0	0	0.00
Other	7	9	9	0	0	0	0	0.00
Total	**504**	**123**	**118**	**0**	**1**	**3**	**0**	**11.73**

a. EPA was unable to determine revenues for 3 parent entities.

Source: U.S. EPA Analysis, 2010

Table 4-6: Entity-Level Cost-to-Revenue Analysis Results, Assuming that Facilities Represented by Sample Weights are Owned by Different Firms than those Owning the Sample Facility (Case 2)

Entity Type	Total Number of Facilities	Total Number of Entities	Number of Firms with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[a]		
Option 1: IM Everywhere								
Food	31	24	24	0	0	0	0	0.00
Paper	198	126	118	0	0	8	0	0.13
Petroleum	30	24	22	0	1	1	0	11.12
Chemicals	167	116	116	0	0	0	0	0.08
Steel	46	43	43	0	0	0	0	0.05
Aluminum	24	14	14	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.25
Total	**504**	**356**	**346**	**0**	**1**	**9**	**0**	**11.12**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Food	31	24	24	0	0	0	0	0.00
Paper	198	126	118	0	0	8	0	0.13
Petroleum	30	24	22	0	1	1	0	11.12
Chemicals	167	116	116	0	0	0	0	0.08
Steel	46	43	43	0	0	0	0	0.05
Aluminum	24	14	14	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.25
Total	**504**	**356**	**346**	**0**	**1**	**9**	**0**	**11.12**
Option 3: I&E Mortality Everywhere								
Food	31	24	24	0	0	0	0	0.00
Paper	198	126	118	0	0	8	0	0.01
Petroleum	30	24	22	0	1	1	0	11.12
Chemicals	167	116	116	0	0	0	0	0.00
Steel	46	43	43	0	0	0	0	0.03
Aluminum	24	14	14	0	0	0	0	0.00
Other	7	9	9	0	0	0	0	0.00
Total	**504**	**356**	**346**	**0**	**1**	**9**	**0**	**11.12**

a. EPA was unable to determine revenues for 9 parent entities.

Source: U.S. EPA Analysis, 2010

4.6 Uncertainties and Limitations

The analyses of facility-level and firm-level impacts for the Manufacturers segment are subject to a range of uncertainties and limitations, including:

- The facility-level data for these analyses is based on surveys conducted by EPA in 1999 and reflects reporting years of 1996, 1997, 1998. Recognizing the length of time since collection of these data, EPA adjusted facility financial data to account for changes in overall economic conditions and industry performance since the time of the original survey (see *Appendix 4.B: Adjusting Baseline Facility Cash Flow*). This adjustment concept improves the validity of using these data for the current analyses, but introduces uncertainty and inevitably cannot account for all facility-level financial and overall economic/financial changes since the time of the original 316(b) Phase III survey.

- The analyses of facility-level and firm-level costs and impacts rely on sample surveys of estimated in-scope facilities, as outlined above. The use of data from surveyed facilities to support the cost and economic impact analysis is an appropriate and valid approach for assessing the impact of the proposed 316(b) existing facilities rule: the sampled facilities serve as models for assessing cost and impact across the rule's expected universe of in-scope facilities. Inevitably, however, use of sampled facilities as the basis for the analysis introduces uncertainty in the estimates of the number of in-scope facilities and the estimates of total costs and impacts across the in-scope facility universe.

- The assessment of firm-level impacts relies on approximate *upper* and *lower* bound concepts of the number of affected parent entities and the numbers of in-scope facilities that these entities may own. EPA judges that the *range* of results from these analyses provides appropriate insight into the overall extent of firm-level effects.

- The use of RMA data as the basis for the moderate impact thresholds provides an approximate basis for the assessment of moderate financial impacts. As described, the RMA data are not based on a statistically valid sample, and, further, may introduce bias in the quartile values, given the characteristics of businesses that are represented in the RMA data. Finally, the 25th percentile value is not a perfect indicator of the occurrence of adverse financial condition, and therefore occurrence of adverse impact from the 316(b) regulatory options. The value is indicative of weak financial condition and performance *relative to other businesses present in the RMA data*, but is not an absolute indicator of financial weakness.

Appendix 4A Cost Pass-Through Analysis

The impact of the existing facilities rule's compliance requirements on Manufacturers will depend on the extent to which affected facilities are able to pass forward compliance costs to customers in increased prices (cost pass-through). This appendix presents the assessment of cost pass-through (CPT) potential for six Primary Manufacturing industry sectors in which a substantial number of facilities are expected to be subject to the Proposed 316(b) Existing Facilities Rule. This analysis considered the following six industry sectors:

- NAICS 311/3121: Food and kindred products
- NAICS 322: Paper and allied products
- NAICS 325: Chemicals and allied products
- NAICS 3241: Petroleum Refining
- NAICS 3311/2: Steel
- NAICS 3313: Aluminum

In performing this analysis, EPA closely followed the methodology and, to the extent possible, relied on the same data sources used for the CPT analysis in support of the 2006 Phase III Final Rule. This appendix begins with a review of approaches for assessing CPT potential associated with market-wide cost increase scenarios. Next, a description of the methodology and specific metrics used to assess CPT potential are discussed and the results for each sector provided. Finally, conclusions are presented.

From this analysis, as was the case with the analysis conducted in support of the 2006 Phase III Final Rule, EPA concluded that an assumption of zero cost pass-through is appropriate for analyzing the impact of the regulatory analysis options on facilities in these six manufacturing industries. Performance of the financial impact analysis under this assumption means that facilities must absorb all compliance-related costs and operating effects (e.g., income loss from facility shutdown during equipment installation) within their baseline cash flow and financial condition. To the extent that facilities would be able to pass on some of the compliance costs to customers through price increases, the analysis may overstate the potential impact on complying facilities.

4A.1 The Choice of Firm-Specific Versus Sector-Specific CPT Coefficients

One method of examining the ability of a firm to pass-through compliance-related cost increases associated with the Proposed Existing Facilities Regulation is to review the firm's historical performance in passing on previous cost increases to consumers. For example, Ashenfelter *et al.* (1998) estimate the cost pass-through rate facing an individual firm, and distinguish that rate from the rate at which a firm passes through cost changes common to all firms in an industry, by regressing the price a firm charges on both its costs and the costs of another firm in the industry. The firm-specific CPT rate would relate a change in the prices charged by a specific firm to a change in its production costs, assuming no changes in the production cost for rival producers of that product. However, estimating firm specific CPT rates is extremely complex. For example, in order to estimate firm-specific CPT rates for every manufacturing firm included in the sample of 316(b) Detailed Industry Questionnaire (DQ) respondents, EPA would require, for each firm, detailed information on the products sold, the markets in which these products are sold, as well as information identifying major competitors in each market. The DQ did not obtain this information from surveyed facilities. And even if such information were available, the analysis would remain highly challenging and subject to significant analytic error. As such, it is neither possible nor practical to develop firm-specific CPT coefficients for the sample of analyzed manufacturers.

Moreover, even if the Agency possessed the data necessary to estimate firm-specific CPT rates, it is questionable whether these rates would be the appropriate measure of CPT potential for compliance-related cost increases stemming from the proposed regulation. This regulation would force multiple firms in each of the industry sectors considered in this analysis to incur compliance-related cost increases, which implies that for most firms the cost increases would not only apply to them, but also to several of their competitors. Not surprisingly, previous studies have found that the CPT rate for changes to an individual firm's cost differs from the rate at which a firm would pass through cost changes that are common to all, or a substantial fraction of, firms in an industry (Ashenfelter et al., 1998). It can be reasonably expected that the higher the share of firms incurring the cost increase, or more appropriately the higher the share of total output produced by such firms, the greater the ability of those firms to pass on a greater portion of those costs to the consumer.

In cases where an industry-wide cost shock occurs, an industry-wide CPT rate would be an appropriate and practical way of assessing the potential of all firms in that industry to pass through that cost increase to consumers (EPA, 2003). An industry-wide CPT rate provides an estimate of the change in each facility's output prices as a function of the increase in its production costs, assuming that the same cost increase is experienced by all firms in the industry. Such an industry-wide rate is relatively easier to estimate than firm-specific cost pass-through rates if one assumes that perfect competition exists in the industry. Among other things, perfect competition implies the existence of product homogeneity within the industry, homogeneity of production technology among firms in the industry, and homogeneity of production costs among firms (i.e., pricing is at marginal cost). Under these conditions, the price response to a general industry-wide change in production costs is likely to be industry-wide and similar across all firms. For example, in support of the Economic, Environmental, and Benefits Analysis of the Final Metal Products & Machinery Rule (MP&M), promulgated in 2003,[102] EPA estimated industry-specific CPT rates since a large fraction of establishments in these industries were expected to be subject to the regulation. EPA estimated these CPT rates by regressing annual output price indices on annual input cost indices for the MP&M industry (U.S. EPA, 2003). The estimated CPT coefficients were validated by a market structure analysis that assessed, for each industry, the potential market power enjoyed by firms in the industry and the consequent implications it had on their ability to pass through compliance-related costs.

Industry-wide CPT rates can be estimated for the analyzed manufacturing sectors based on the methodology used for deriving industry-wide CPT rates for industries covered by the MP&M regulation and the 2006 Phase III Final Rule. As was the case with the 2006 Phase III Final Rule, because the regulatory analysis options will affect only those facilities that operate a CWIS to withdraw cooling water from surface water bodies, only a subset of facilities in each industry sector would incur compliance-related cost increases. As the cost increase associated with the regulatory analysis options is not industry-wide, it is questionable whether industry-wide CPT rates are appropriate for estimating the price response of firms in the five industry sectors considered in the analysis of Existing Facilities Rule impacts. If a substantial portion of production in each industry occurs at facilities not subject to the regulation under each analysis option, then the use of industry-wide CPT rates may grossly overestimate the ability of firms in these industries to pass-through compliance-related costs to consumers.

To assess the reasonableness of using industry-wide CPT rates in the analysis of impacts to in-scope manufacturers, EPA estimated the percentage of total production in each of the six Primary Manufacturing Industries sectors that occurs at facilities that are estimated to be subject to the regulatory analysis options. 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 Existing Facilities Rule Manufacturers facilities potentially subject to the regulatory analysis options. As such, total revenue, as reported on the DQ, was used as a close approximation to value of shipments for these facilities. EPA estimated the total revenue subject to the regulatory options by multiplying the revenue of facilities (in $2009) in the sample of Manufacturers that were determined to be potentially subject to each option by their facility sample weights and summing across all facilities. Total value of shipment estimates for each industry were obtained from the 2007 Economic Census. *Table 4A-1* summarizes the findings of this analysis.

[102] For details see *Economic, Environmental, and Benefits Analysis of the Final Metal Products & Machinery Rule* report available online at http://water.epa.gov/scitech/wastetech/guide/mpm/upload/2003_1_31_guide_mpm_eeba_part1.pdf

Table 4A-1: Proportion of Value of Shipments Potentially Subject to Compliance-Related Costs Associated with the Proposed Existing Facilities Regulation (Millions; $2009)

NAICS	Industry	Revenue for Manufacturers Subject to Proposed Existing Facilities Regulation[a,b]	Total Value of Shipments	Proportion of Total Value of Shipments Subject to Regulation
311/3121	Food and Kindred Products	$11,603	$697,164	1.7%
322	Paper and Allied Products	$61,128	$181,911	33.6%
3241	Chemicals and Allied Products	$68,442	$748,681	9.1%
325	Petroleum Refining	$174,378	$626,293	27.8%
3311/2	Steel	$55,241	$128,082	43.1%
3313	Aluminum	$16,792	$45,513	36.9%

a. For the purpose of this analysis, facility revenue was used as an appropriate surrogate in the absence of value of shipments for sample facilities. Revenue estimates are the sum of weighted facility-level revenue values and includes revenue for baseline closures.
b. To compare in-scope revenue values with the industry value of shipments, EPA brought in-scope revenue values forward to 2007 using industry-specific Producer Price Index (PPI) values published by the Bureau of Labor Statistics (BLS) and stated in 2009 dollars using GDP deflator published by the Bureau of Economic Analysis (BEA).
Source: Economic Census, 2007; U.S. EPA, 2000

As shown in *Table 4A-1*, the proportion of total value of shipments estimated subject to the regulation under the regulatory analysis options ranges from 1.7 percent to 43.1 percent depending on the industry. Given that less than 45 percent of the total value of shipments in any of the six industries considered in this analysis would be subject to regulation induced compliance costs, EPA believes that the theoretical threshold for justifying the use of industry-wide CPT rates in the Phase II impact analysis has not been met. As it was the case with the 2006 Phase III Final Rule, the Agency believes that using industry-wide CPT rates in the analysis of Proposed Existing Facilities Rule impacts would overestimate the cost pass-through ability of firms incurring regulation-induced compliance costs, and thus underestimate impacts. At the other end of the spectrum, however, an assumption of zero CPT would avoid the risk of understating impacts, as it would assume that all in-scope facilities absorb one hundred percent of cost impacts.

Given the inability to estimate firm-specific CPT rates and the finding that the use of industry-wide CPT rates would not be appropriate, EPA next conducted a market structure analysis to investigate the extent to which firms in the six industry sectors enjoy sufficient market power to pass compliance-related costs on to consumers in the form of higher prices.

4A.2 Market Structure Analysis

Information on the competitive structure and market characteristics of an industry provide insight into the likely ranges of supply and demand elasticities and the sensitivity of output prices to input costs. For example, when input costs increase, the profit-maximizing firm attempts to maintain its profits by increasing output prices, to the extent permitted by market power. The amount of the cost increase that the firm can pass on as higher prices depends on the relative market power of the firm and its customers. The market structure analysis described in this section attempts to measure the market power enjoyed by firms in each of the six industries. This analysis is combined with information from industry review documents such as *McGraw-Hill's U.S. Industry and Trade Outlook* to reach conclusions regarding the CPT ability of firms in each industry. The market structure analysis consists of a review of economic data for the following four indicators of market power: industry concentration; import competition; export competition; and long term growth. Each of these indicators is discussed in detail below. EPA notes that the impact of each of these four indicators of market power varies from industry to industry. Furthermore, the results presented for each indicator must be interpreted with caution because even though for a particular industry an indicator may predict high cost pass-through potential, the specific features of the industry may result in the indicator having diminished significance in predicting market power.

4A.2.1 Industry Concentration

The extent of concentration among a group of market participants is an important determinant of that group's market power. A group of many small firms typically has less market power than a group of a few large firms, because the latter are in a more advantageous position to collude with each other. All else being equal, highly concentrated industries are therefore expected to pass-through a higher proportion of the compliance costs that would result from the proposed regulation.

This analysis uses the Herfindahl-Hirschman Index (HHI) as a measure of market concentration. The HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers.[103] For example, for a market consisting of four firms with shares of thirty, thirty, twenty and twenty percent, the HHI is 2600 ($30^2 + 30^2 + 20^2 + 20^2 = 2600$). The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. Based on the U.S. Department of Justice's guidelines for evaluating mergers, markets in which the HHI is under 1,000 are considered unconcentrated, markets in which the HHI is between 1,000 and 1,800 are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 are considered to be concentrated.

The accuracy of any analysis of market power originating from industry concentration depends to a large extent on properly defining the relevant market. A well-defined market requires the inclusion of all competitors and the exclusion of all non-competitors. Defining the relevant market too narrowly overstates market power, while defining the market too broadly would underestimate it. The four-digit SIC category and six-digit NAICS, while not a perfect delineation, is most often used by industrial organization economists in their studies because, among publicly available data sources, these industries appear to correspond most closely to economic markets (Waldman & Jensen, 1997). Therefore, in *Table 4A-2* below, industry concentration data is presented for each of the six-digit NAICS codes that include at least one potentially regulated manufacturing facility for which DQ data are available.

As shown in *Table 4A-2*, based on their HHI, 20 six-digit NAICS markets[104] can be classified as unconcentrated, five can be classified as moderately concentrated, and only six can be classified as concentrated. Notably, four out of six six-digit NAICS categories listed as being concentrated belong to the Chemicals and Allied Products industry; the other two sectors are in Aluminum and Steel industries. From a market power perspective, in *Table 4A-2* seems to suggest that at the six-digit NAICS level, only six NAICS categories are sufficiently concentrated to argue that firms may possess sufficient market power to pass-through a portion of their compliance-related costs assuming that competitor firms in the same industry do not incur similar cost increases.

[103] The Herfindahl-Hirschman Index was chosen because it provides a more complete picture of industry concentration compared to other measures such as the four-firm and eight-firm concentration ratios. In contrast, the four- and eight-firm concentration ratios do not use the market share of all firms in the industry, and nor do they provide information about the distribution of firm size. For example, if there were a significant change in the market shares among the firms included in the ratio, the value of the concentration ratio would not change.

[104] This includes three-digit and four-digit NAICS for Food and Beverage industries, respectively, because every six-digit NAICS sector covered by these two industries are expected to be affected by the Proposed 316(b) Existing Facilities Regulation.

Table 4A-2: Herfindahl-Hirschman Index for Six-Digit NAICS Sectors

NAICS	NAICS Description	Industry	HHI[ab]
Unconcentrated Markets (HHI < 1,000)			
311	Food Manufacturing	Food	119
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	Chemicals	188
322299	All Other Converted Paper Product Manufacturing	Paper	192
325188	All Other Basic Inorganic Chemical Manufacturing	Chemicals	217
325199	All Other Basic Organic Chemical Manufacturing	Chemicals	238
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	Steel	279
331222	Steel Wire Drawing	Steel	326
325211	Plastics Material and Resin Manufacturing	Chemicals	443
331221	Rolled Steel Shape Manufacturing	Steel	491
3121	Beverage Manufacturing	Food	512
325412	Pharmaceutical Preparation Manufacturing	Chemicals	530
322222	Coated and Laminated Paper Manufacturing	Paper	569
324110	Petroleum Refineries	Petroleum	640
331111	Iron and Steel Mills	Steel	657
331314	Secondary Smelting and Alloying of Aluminum	Aluminum	694
322130	Paperboard Mills	Paper	749
322121	Paper (except Newsprint) Mills	Paper	810
322224	Uncoated Paper and Multiwall Bag Manufacturing	Paper	864
322122	Newsprint Mills	Paper	977
325311	Nitrogenous Fertilizer Manufacturing	Chemicals	977
Moderately Concentrated Markets (1,000 < HHI < 1,800)			
322110	Pulp Mills	Paper	1,175
325120	Industrial Gas Manufacturing	Chemicals	1,218
325222	Noncellulosic Organic Fiber Manufacturing	Chemicals	1,262
325131	Inorganic Dye and Pigment Manufacturing	Chemicals	1,704
325181	Alkalies and Chlorine Manufacturing	Chemicals	1,786
Concentrated Markets (1,800 < HHI)			
325312	Phosphatic Fertilizer Manufacturing	Chemicals	1,853
331315	Aluminum Sheet, Plate, and Foil Manufacturing	Aluminum	1,856
325611	Soap and Other Detergent Manufacturing	Chemicals	2,006
331112	Electrometallurgical Ferroalloy Product Manufacturing	Steel	2,196
325110	Petrochemical Manufacturing	Chemicals	2,662
325411	Medicinal and Botanical Manufacturing	Chemicals	2,704

a. The 2002 Economic Census is the most recent concentration data available.

b. 2002 Economic Census does not disclose HHI values for three of the analyzed 6-digit NAICS sectors: (1) NAICS 325221: Cellulosic Organic Fiber Manufacturing (a total of eight companies), (2) NAICS 331311: Alumina Refining (a total of eight companies), and (3) 331312: Primary Aluminum Production (a total of 26 companies).

Source: Economic Census, 2002

To further examine the level of concentration in each of the analyzed six industry sectors, EPA decided to analyze HHI at the industry level as well. In general, these estimates understate market power. Nonetheless, industry HHI should still provide a meaningful insight into the market power of firms in the industry because firms in each industry still produce similar or related products (for example, paper products, chemicals, etc.). Industry HHIs are presented below in *Table 4A-3*

Table 4A-3: Herfindahl-Hirschman Index by Industry

NAICS	Industry	HHI[a,b]
311/3121	Food and Kindred Products	190
322	Paper and Allied Products	259
325	Chemicals and Allied Products	100
3241	Petroleum Refining	543
3311/2	Steel	547
3313	Aluminum	1,185

a. The 2002 Economic Census is the most recent concentration data available.
b. HHI values are as reported in the 2002 Economic Census for the 3- and 4-digit NAICS codes and not value of shipments-weighted HHI values for the profiled 6- and 5-digit NAICS codes.
Source: Economic Census, 2002; U.S. EPA Analysis, 2010

Table 4A-3 reveals that, at the industry level, the estimated HHI for five of the six industries are quite small, implying that they are unconcentrated markets and within these industries, individual firms do not enjoy much market power. Notably, the Chemicals and Allied Products industry has a low HHI, which suggests that the four six-digit NAICS categories that were classified as having concentrated markets in reality make up a very small segment of the Chemicals and Allied Products industry. The same conclusion holds for the Steel industry. Thus, from the perspective of the Proposed Existing Facilities Rule analysis, the majority of firms in these two industries have low market power. In addition, EPA notes that only 9 percent of production in the Chemicals and Allied Products industry would potentially be subject to compliance-related cost increases, which suggests that the cost pass-through potential of firms from this sector incurring such expenses would be severely curtailed. An important finding in *Table 4A-3* is that the Aluminum industry appears to be moderately concentrated. Thus, based solely on an analysis of industry concentration, it would appear that firms in the Aluminum industry might enjoy moderate amounts of market power, which may enable them to pass through costs at a more than negligible rate. However, as cautioned at the beginning of the market structure analysis, an accurate judgment of the market power enjoyed by firms in an industry must be reserved until all indicators have been analyzed.

4A.2.2 Import Competition

Theory suggests that imports as a percent of domestic sales are negatively associated with market power because competition from foreign firms limits domestic firms' ability to exercise such power. Firms belonging to sectors in which imports make up a relatively large proportion of domestic sales would therefore be at a relative disadvantage in their ability to pass through costs compared to firms belonging to sectors with lower levels of import penetration, the measure of import competition used in this analysis. Import penetration, the ratio of imports in a sector to the total value of domestic consumption in that sector, is particularly relevant because foreign producers would not incur costs as a result of the proposed 316(b) Existing Facilities Regulation. In this market structure analysis, EPA assumes that higher import penetration will generally imply that firms are exposed to greater competition from foreign producers and would thus possess less market power to increase prices in response to regulation-induced increases in production costs. EPA estimated import penetration ratios for each industry as total imports in an industry divided by total value of domestic consumption in that industry; where domestic consumption equals domestic production plus imports minus exports. Import penetration ratios estimated using 2007 Economic Census data for the six industry sectors considered in this analysis are presented below in *Table 4A-4* below.

Table 4A-4: Import Penetration by Industry, 2007

NAICS	Industry	Value of Imports (Millions; $2009)[a]	Implied Domestic Consumption (Millions ;$2009)[b,a]	Import Penetration[c,a]
311/3121	Food and Kindred Products	$54,655	$708,604	7.71%
322	Paper and Allied Products	$25,688	$187,271	13.72%
325	Chemicals and Allied Products	$169,885	$766,269	22.17%
3241	Petroleum Refining	$109,796	$704,211	15.59%
3311/2	Steel	$39,080	$153,640	25.44%
3313	Aluminum	$15,254	$54,203	28.14%

a. These values are the totals reported for the entire 3- and 4-digit NAICS codes and not just the sum of in-scope 6-digit NAICS codes.
b. Implied Domestic Consumption = Value of Shipments + Value of Imports – Value of Exports.
c. Import Penetration = Value of Imports / Implied Domestic Consumption
Source: Economic Census, 2007; U.S. ITC, 2007; U.S. EPA Analysis, 2010

The estimated import penetration ratios for the six industries range from 8 percent to 28 percent for the year 2007. The estimated import penetration ratio for the entire U.S. manufacturing sector (NAICS 31-33) is 27 percent. Considering that the United States is an open economy, EPA believes it is reasonable to assume that in industries with import penetration ratios close to or above 27- percent domestic firms most likely face stiff competition from foreign firms. Such competition is likely to curtail the market power enjoyed by domestic firms and, given the scenario that regulation-induced cost increases are not incurred by foreign producers, would limit the ability of domestic firms to pass-through such costs. Thus, based on the import penetration ratios presented in *Table 4A-4*, firms in all of the industries except Aluminum appear to be in a position to pass-through to consumers a significant portion of compliance-related costs associated with the Proposed Existing Facilities regulatory options. However, given the relatively low HHIs for these industries, 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. EPA also highlights the above average import penetration ratio for the Aluminum industry, which suggests low market power for firms in this industry. With respect to the Aluminum industry, this fact may offset – from a market power perspective – the finding that the industry was identified above as being moderately concentrated. Thus, even though there are relatively few domestic producers in the U.S. Aluminum industry, the notable presence of foreign producers in U.S. markets is likely to markedly reduce their the market power.

4A.2.3 Export Competition

The proposed Existing Facilities Rule would not increase the production costs of foreign producers with which 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. They would therefore have a lower CPT potential, all else being equal. This analysis uses export dependence, defined as the percentage of shipments from an industry that is exported, to measure the degree to which a sector is exposed to competitive pressures abroad in export sales. Firms in industries with relatively high export dependence are expected to have lesser market power than those in industries with relatively low export dependence due to their relatively larger reliance on sales in export markets. Estimated export dependence ratios for the six industry sectors considered in this analysis are presented below in *Table 4A-5*.

Table 4A-5: Export Dependence by Industry, 2007

NAICS	Industry	Value of Export (Millions; $2009)[a]	Value of Shipments (Millions; $2009)[a]	Export Dependence[b]
311/3121	Food and Kindred Products	$43,215	$697,164	6.20%
322	Paper and Allied Products	$20,328	$181,911	11.17%
325	Chemicals and Allied Products	$152,297	$748,681	20.34%
3241	Petroleum Refining	$31,878	$626,293	5.09%
3311/2	Steel	$13,522	$128,082	10.56%
3313	Aluminum	$6,564	$45,513	14.42%

a. These values are the totals reported for the entire 3- and 4-digit NAICS codes and not just the sum of in-scope 6-digit NAICS codes.
b. Export Dependence = Value of Exports / Value of Shipments.
Source: Economic Census, 2007; U.S. ITC, 2007; U.S. EPA Analysis, 2010

The estimated export dependence ratios for the six industries in 2007 range from 5 percent to 20 percent. The estimated export dependence ratio for the entire U.S. manufacturing sector for the same year is 17 percent. Thus, for all but one industry (Chemicals and Allied Products), the export dependence ratio is below the average for the U.S. manufacturing sector. This finding implies that none of these industries are characterized by strong competitive pressures from foreign firms/markets, and thus market power and CPT potential are not diminished by export dependence. However, it is questionable whether this effect works as strongly in the opposite direction, i.e., 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 an indicator of market power. Thus, the other three indicators must be relied upon to gauge the amount of market power that firms in each industry are expected to hold. For example, even though the Petroleum Refining and Food and Kindred Products industries have extremely low export dependence, the low market concentration in these industries leads EPA to believe that market power held by individual firms is likely to be quite small.

4A.2.4 Long-Term Industry Growth

An industry's competitiveness and the ability of firms to engage in price competition are likely to differ between declining and growing industries. Most studies have found that recent growth in revenue is positively related to profitability (Waldman & Jensen, 1997), which suggests a greater ability to recover costs fully. To examine trends in long-term growth for each of the six industry sectors considered in this analysis, EPA estimated the average annual growth rate in the constant dollar value of shipments between 1989 and 2007 for each industry using data available from the U.S. Bureau of Census.[105] EPA expects firms in sectors with higher growth rates to be better positioned to pass through compliance costs rather than being forced to absorb such cost increases in order to retain market share and revenue. *Table 4A-6* shows that of the six industries specifically considered for this analysis, two industries – Paper and Allied Products and Aluminum – experienced negative growth over the 1989 to 2007 time period. The Petroleum Refining industry experienced the largest growth, displaying an average annual growth rate of 5.8 percent. In the absence of strong growth performance during the analysis period for all six industries, it is unlikely that firms in any of these industries possess significant market power based on growing demand for their products. In effect, the long-term growth performance of all six industries does not support a conclusion that firms in these industries could be in a strong position to pass on a significant portion of their compliance costs.

105 The period from 1989 to 2007 represents the two most recent decades that includes data consistent with the survey period for the 2000 Detailed Industry Questionnaire (1996-1998).

Table 4A-6: Average Annual Growth Rate by Industry

NAICS	Industry	Average Annual Growth Rate in Value of Shipments 1989 to 2007	Average Annual Growth Rate in Value of Shipments 2000 to 2007
311/3121	Food and Kindred Products	1.1%	1.8%
322	Paper and Allied Products	-0.7%	-1.7%
325	Chemicals and Allied Products	3.0%	4.3%
3241	Petroleum Refining	5.8%	11.6%
3311/2	Steel	1.3%	5.6%
3313	Aluminum	-3.8%	2.3%

Source: Economic Census, 2007; Annual Survey of Manufacturers. 1989 and 2000; U.S. EPA Analysis, 2010

4A.3 Conclusions

Given that less than 30 percent of the total value of shipments in each of the six industries considered in this analysis is estimated to be subject to regulation under the regulatory analysis options, and the likelihood that these percentages represent upper bound estimates, the likelihood that firms incurring such costs would be able to pass through to consumers a material portion of 316(b) compliance costs is small. To validate this hypothesis, EPA undertook the market structure analysis presented in the previous section. In general, the weight of evidence from the market structure analysis suggests that firms in all six industries are unlikely to possess significant amounts of market power, thereby lending support to EPA's hypothesis that most firms would not be in a position to pass-through a significant portion of compliance costs. The analysis of individual indicators under the market structure analysis did reveal a few exceptions to the general finding of low market power in all industries. However, considering the combined impact of all four indicators of market power together with information on recent economic trends in these industries suggests that on the whole, firms in each of the six industries hold relatively low market power and CPT potential. For example, the HHI for the Aluminum industry indicated that this sector is moderately concentrated, which would potentially allow firms in this industry to pass through a significant portion of their compliance-related costs. In contrast, however, the market structure analysis also found that the domestic Aluminum industry witnessed a sustained decline in production during the 1990s and also faces stiff competition from foreign producers in its U.S. markets. As discussed in the profile of this industry, in the early 1990s the domestic Aluminum industry was affected by reduced U.S. demand and the dissolution of the Soviet Union, which resulted in substantial increases in Russian exports of aluminum. The recovery that followed was subsequently affected by the economic crises in Asian markets in the second-half of the 1990s, which along with growing Russian exports, again resulted in a period of oversupply. 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. In 2003, the U.S. economy began to recover and continued to do so through 2007, resulting in higher demand for aluminum and improving financial condition for the aluminum industry. However, the recession that began in 2008 resulted in lower demand for and production of aluminum, both in the United States and worldwide, and a consequent decline in the financial performance of the aluminum industry.

In-scope facilities in the Aluminum industry belong to either the Primary Aluminum Production segment (NAICS 331311: Alumina Refining and NAICS 331312: Primary Aluminum Production) or the Secondary Aluminum Production segment (NAICS 331314: Secondary Smelting and Alloying of Aluminum and NAICS 331315: Aluminum Sheet, Plate, and Foil Manufacturing) (for more information see *Chapter 2: IndustryProfiles*). The Secondary Aluminum Production segment on average has been less affected by the economic fluctuations thereby on average performing better than the Primary Aluminum Production segment. In addition, data reported in the Aluminum Industry Profile indicate the Secondary Aluminum Production segment is less import dependent and less concentrated than the Primary Aluminum Production segment. Further, while the Secondary Aluminum Production segment has grown over the last two decades and especially in the last decade, the Primary Aluminum Production segment has declined. Consequently, while domestic firms in the Secondary Aluminum Production segment may be in a better position to pass some compliance-related costs to consumers than firms in the Primary Aluminum Production segment, several factors combine to suggest that the Secondary Aluminum Production segment has relatively low cost pass-through potential. Specifically, the general economic condition of the U.S. Aluminum industry as a whole throughout the last two decades, the moderate-to-high market concentration, and a rather high degree of import penetration and export dependence, suggest that domestic firms in this industry hold relatively low market power and are not likely to have the ability to pass through *significant* portions of their compliance-related cost increases.

Based on the findings of the market structure analysis, EPA decided to assume a zero CPT rate for all six industries in the analysis of the Proposed 316(b) Existing Facilities Rule impacts. EPA believes that this assumption is reasonable given the results of the market structure analysis and is superior to using industry-wide CPT rates (see *Chapter 2: Industry Profiles*). In addition, EPA notes that by assuming a CPT rate of zero for all industries, the analysis of Proposed Existing Facilities Rule impacts is less likely to underestimate facility impacts in that the analysis assumes that facilities would incur one hundred percent of compliance costs. Thus, whereas an overstated CPT rate may erroneously underestimate impacts for facilities incurring compliance-related cost increases, the use of a CPT rate of zero errs on the side of caution, thus potentially overstating impacts to affected facilities.

Appendix 4B Adjusting Baseline Facility Cash Flow

This appendix documents EPA's development and analysis of adjustment factors for the manufacturing industries expected to be within the scope of the Proposed Existing Facilities Regulation. *This analysis presents an updated version of the analysis conducted for the previous 316(b) Phase III proposed and final rules.* The analysis incorporates three additional years of data, for 2006, 2007, and 2008, which reflect the time span between the 2006 Phase III Final Rule and the Proposed 316(b) Existing Facilities Rule. In addition to these extra years of data, EPA also identified and added to the analysis one business sector – Pesticides and Fertilizers – that was not previously included in the Primary Manufacturing Industries. Further, EPA used a different data source– Quarterly Financial Report (QFR) published by the U.S. Census Bureau as opposed to the Value Line Investment Survey firm financial dataset published by the private independent financial research firm Value Line – to develop these adjustment factors.

To support its analysis of the potential economic impact of the 316(b) regulations – including the previous 316(b) Phase III regulations and now the Proposed 316(b) Existing Facilities Rule, EPA collected economic/financial data for the three years 1996-1998 from a sample of facilities in the manufacturing industries primarily expected to have been subject to the regulation. These facility economic/financial data are used to gauge the potential economic/financial impact of regulatory compliance: the facilities and their financial data serve as models for testing the financial effect of regulatory alternatives. For this analysis to provide valid insight into the ability of the affected industries to meet regulatory requirements without material adverse impact, the sample facility data should reflect business conditions that might be reasonably anticipated at the time of compliance.

In performing the previous and current impact analyses using these data, EPA was concerned in two ways that the facility survey data might yield erroneous conclusions:

1. Knowing that U.S. business conditions during the latter half of the 1990s were cyclically strong, EPA was concerned that business conditions during the 316(b) Survey period (1996-1998) might be abnormally favorable for some of the six Primary Manufacturing Industries sectors covered in the 316(b) rule analyses. In this case, the business performance and valuation measures, which are based on survey data, used to assess the burden of regulatory compliance costs might overstate industry's ability to bear these costs and therefore understate the potential impact of the regulatory analysis options considered for the 316(b) regulations.
2. Apart from the issue of short-term deviation from trend caused by a cyclically strong economy, EPA was also aware from its profile analyses that some of the industries might be experiencing a longer term trend of deteriorating performance. Using sample facility data that don't reflect such possible trends would again potentially overstate industry's ability to bear compliance costs and therefore understate the potential impact of the regulatory analysis options considered for the Proposed Existing Facilities Rule.

Given these concerns, EPA analyzed for the manufacturing industries (1) whether business conditions were "abnormally favorable" during the survey period and (2) whether business performance over a longer term might be following a non-neutral – in particular, negative performance – trend. This analysis validated EPA's concerns that use of unadjusted survey data might yield erroneous conclusions from the facility impact analysis. From the findings of this analysis, EPA developed a basis for adjusting survey financial data to account for these effects: short-term deviation from trend and non-neutral long-term trend.

4B.1 Background: Review of Overall Business Conditions

As background for its analysis, EPA reviewed general economic data over the past several years to assess whether business conditions during the survey data collection period of 1996-1998 might be generally perceived as abnormally favorable for the U.S. economy, as a whole. This review confirmed the concern that business conditions in 1996-1998 were generally more favorable than the average of conditions over a longer time period.

Figure 4B-1 - Figure 4B-3 present annual and average values for the period 1985-2009 for three measures of general economic performance:

> *Figure 4B-1*. This exhibit, based on data published by the Department of Commerce, Bureau of Economic Analysis, focuses on the growth trend of the broad economy, including all sectors. Growth stronger than the average trend would indicate a strongly expanding economy and would generally indicate strong business performance.

> *Figure 4B-2.* This exhibit, based on U.S. Federal Reserve Bank data, reports the rate of capital utilization for all manufacturing sectors. All else equal, when the rate of capital utilization is higher than the average trend, demand for manufacturing output is strong and manufacturing business performance would be generally strong.

> *Figure 4B-3.* Like the preceding exhibit, this exhibit is based on data published by the U.S. Federal Reserve Bank and reports the rate of growth in the Federal Reserve's Industrial Production Index, which is a measure of the real output of the manufacturing industries. Growth stronger than the average trend would indicate a strong expansion in the manufacturing industries and would generally indicate strong manufacturing business performance.

In each case, the annual values in the period 1996-1998 are above the average trend line, indicating stronger overall economic performance in the survey data collection period than for the longer period presented in the charts. The data show a consistent year-by-year pattern over the 1996-1998 period:

- 1996: The values for 1996 are above the longer-term average trend but are the lower than the values for 1997, indicating that manufacturing economy was in an upswing from 1996 to 1997.
- 1997: The values for 1997 are the highest of the values for the three years.
- 1998: The values for 1998 are all lower than the values for 1997 and generally appear to be the beginning of the downswing in economic performance that occurred in the latter part of the 1990s. In the case of *industrial production* and *capacity utilization in manufacturing industries*, 1997 is the peak performance year over the 1990s decade and is followed by a decline in 1998 and subsequent years leading to the recession period in 2001. In the case of *GDP growth*, the fall-off in 1998 (from 1997) is followed by one more year of strong growth in 1999. GDP growth turns sharply lower during 2000 and the recession year of 2001. As the U.S. economy began to recover during the first half of the last decade following the recession of 2001, so did manufacturing production. The second half of the decade, however, once again experienced economic slowdown leading to the recession of 2008-2009. Even though the U.S. manufacturing sector experienced some recovery after the recession of 2001, its performance never achieved the level of performance in 1997.

Figure 4B-1: Growth in Real Domestic Product, 1985-2009

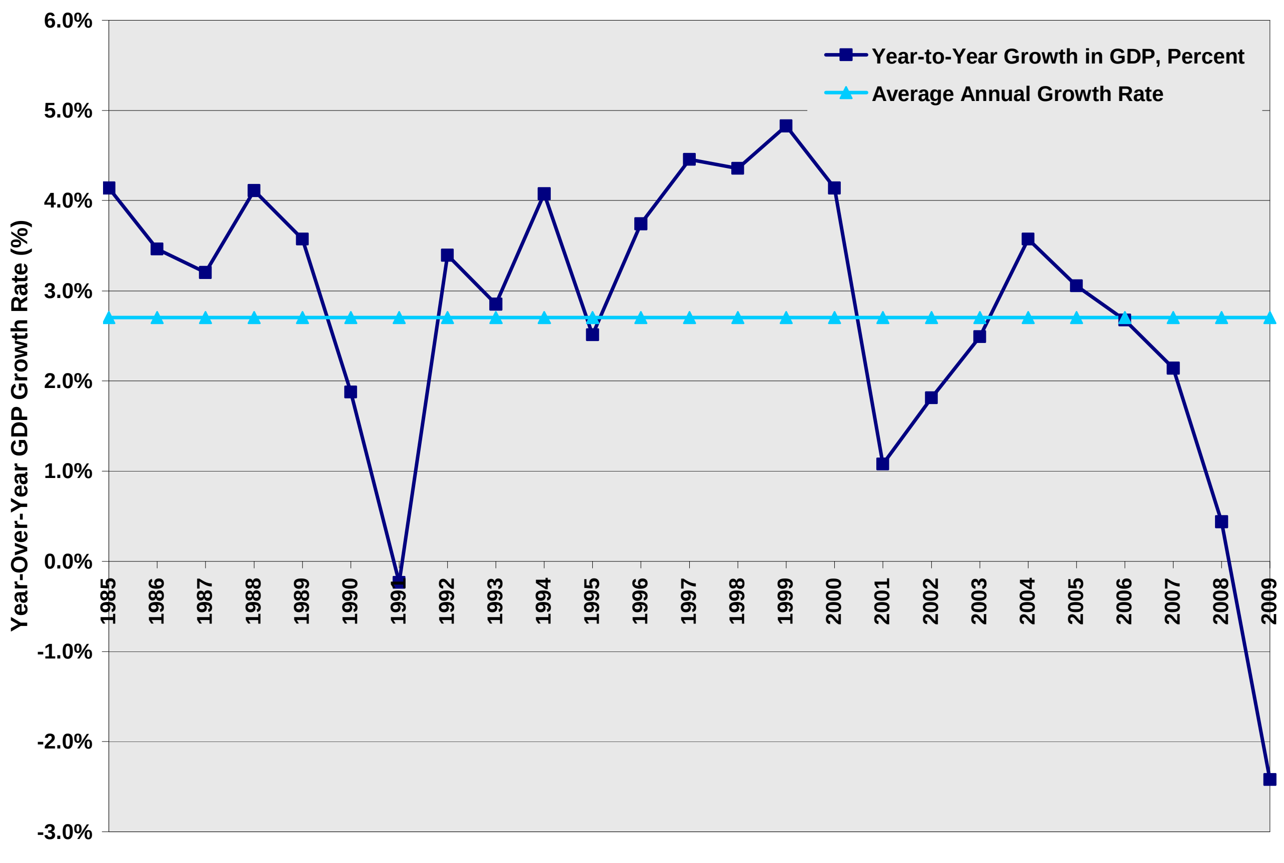


Figure 4B-2: Capacity Utilization in Manufacturing Industries, 1985-2009

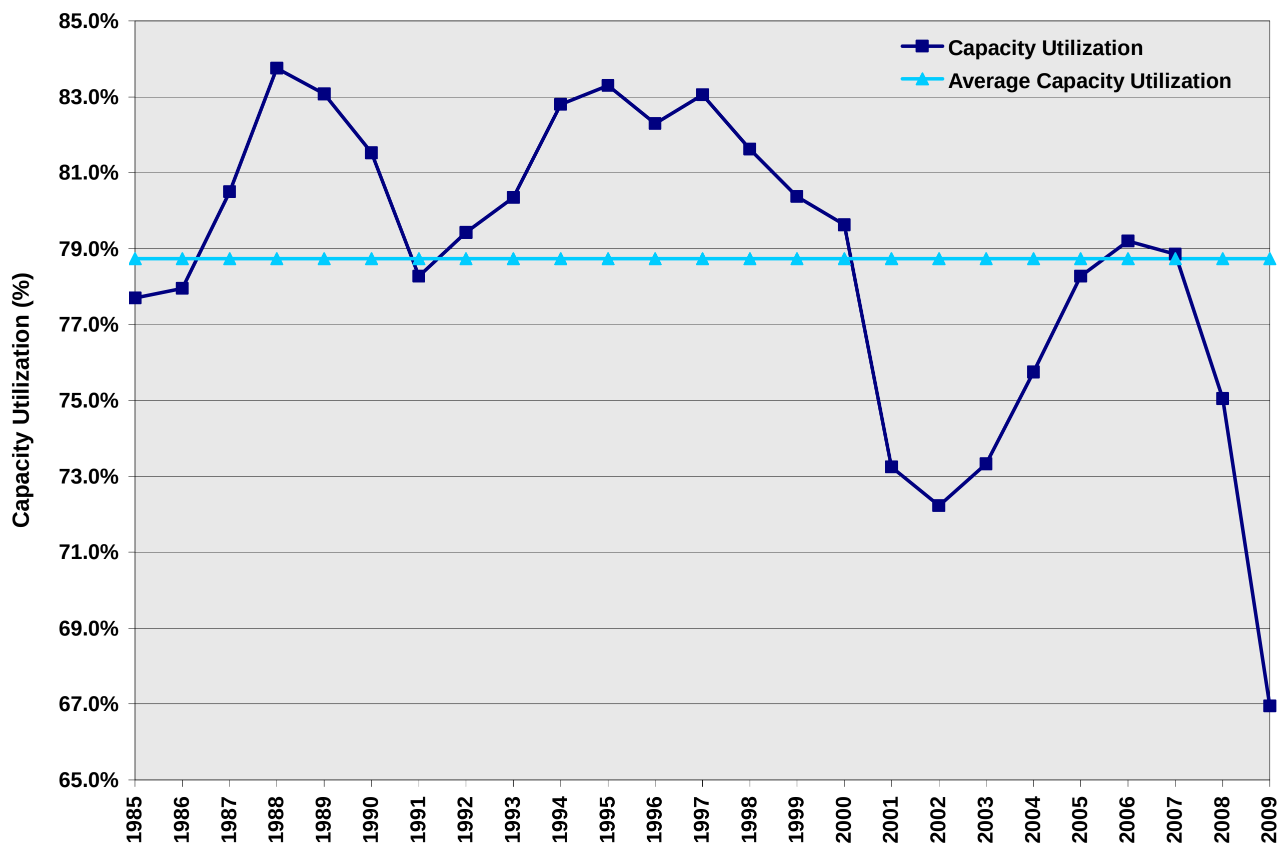
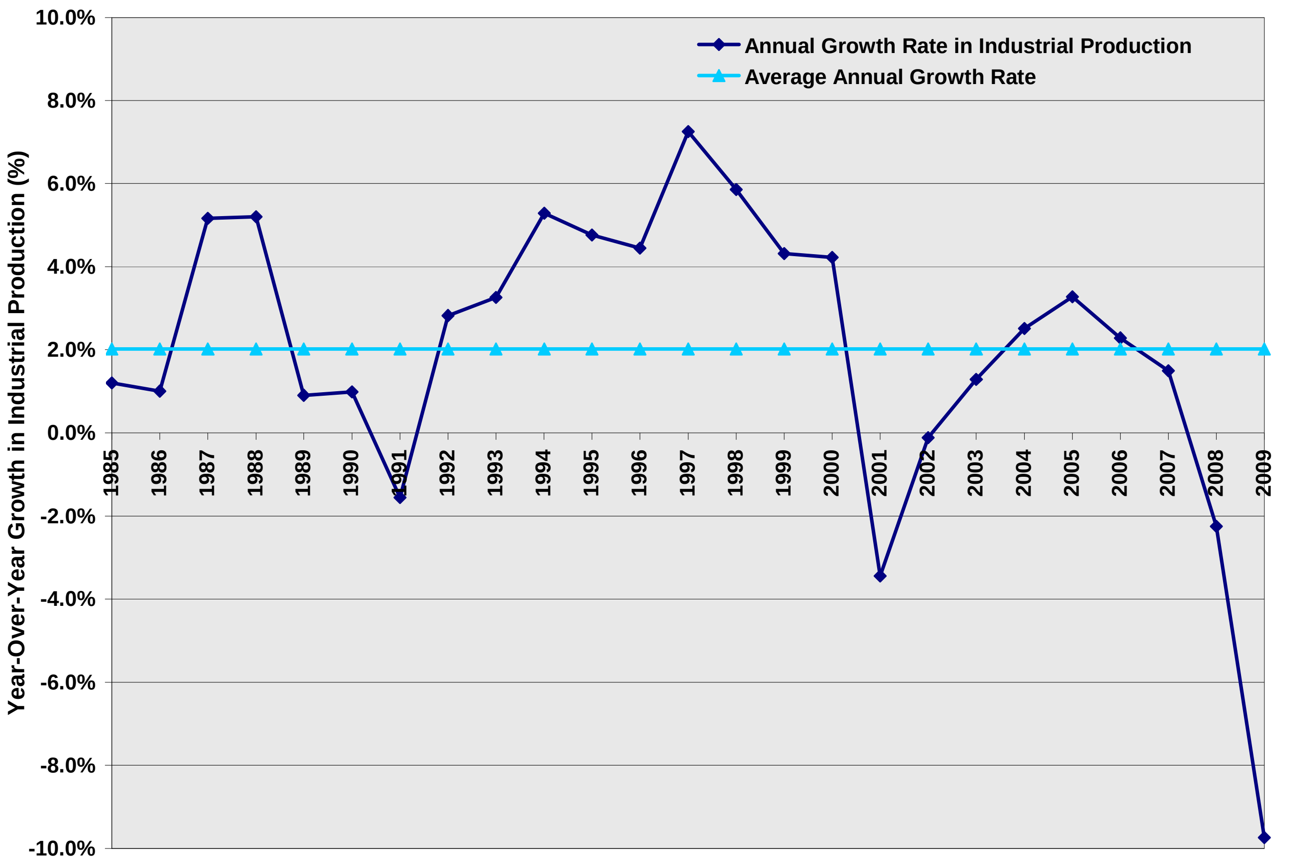


Figure 4B-3: Growth in Industrial Production, 1985-2009



4B.2 Framing and Executing the Analysis

The objective of this analysis was to understand (1) the extent to which the business conditions and financial performance of the Manufacturing industries expected to be in scope of the Proposed Existing Facilities Rule reflected cyclically favorable conditions during the 316(b)Survey period and (2) whether these industries show a non-neutral longer term trend in economic/financial performance – e.g., deterioration in performance over time independent of cyclical variation. If either or both of these conditions were found, then the data used to test for these conditions would be used to adjust relevant survey data items to a level consistent with normal business conditions and/or the longer term of performance.

To meet these objectives, EPA set, as its overall approach, identification and analysis of a financial performance data series for the in-scope Manufacturing industries. This data series would be used to test whether financial performance at the time of the 316(b) Survey differed from the longer term trend. At the outset, EPA recognized that, in all likelihood, such a data series would not report financial performance at the level of the individual facility – which is the unit of analysis for the 316(b) facility impact analysis (see *Chapter 4: Cost and Economic Impact Analysis for Manufacturers*) – but would report performance for individual firms or for some industry aggregate. As a result, EPA would need to infer the trend of performance in facility financial performance from firm- or industry-level performance and, in turn, apply adjustments, if needed, to facility financial data based on analysis of the firm- or industry-level performance. Although the use of firm- or industry-level information for adjusting facility data necessarily represents a limitation in this analysis, EPA judges that the effort is warranted given: (1) the potential for the facility impact analysis to yield erroneous findings if it is based on data that reflect cyclically favorable conditions and (2) the absence of facility data to support a more precise analysis.

Key steps in framing and executing the analysis are described below.

4B.2.1 Identifying the Financial Data Concept to Be Analyzed

EPA determined that the financial data concept to be analyzed should be equivalent, or close in concept, to the business performance and valuation metrics used in the 316(b) rule impact analyses. For the facility impact analysis, the key financial metric is after-tax, pre-interest cash flow, calculated as income before interest, depreciation and amortization, and adjusted to be on an after-tax basis. In the facility impact analysis, this metric is used to calculate the business value of a sample facility, on both a baseline – i.e., before imposition of compliance costs – and post-compliance basis. Using this, or a closely related, measure in the analysis of financial performance at the time of the facility survey would therefore support a direct test of whether and how the survey financial data – *to be subsequently used in the facility impact analysis* – might reflect cyclically favorable conditions or differ from the longer term trend of financial performance in an analysis. If either or both of these conditions were found, the data would also readily support development of a necessary adjustment to offset these potential biases in the survey data.

EPA recognized that the after-tax, pre-interest cash flow measure used in the facility impact analysis would very likely not be directly available from financial datasets that might be practically used in this analysis. However, reasonable surrogates for this measure that would likely be available include: after-tax cash flow from operations (net income plus depreciation and amortization); earnings before interest, taxes, depreciation and amortization (EBITDA); net income; and earnings before interest and taxes (EBIT).

4B.2.2 Selecting Appropriate Data

Other key requirements of the data to be used in the analysis include:

- The financial data need to be a time series, preferably annual, over a sufficiently long period (and including the survey period) to allow testing of (1) whether survey period business conditions were cyclically favorable; and (2) whether financial performance in the industries exhibits a longer-term, non-neutral trend.
- The data need to be at a sufficient level of industry resolution to account for variations in business conditions and performance not only across the six manufacturing sectors but also within certain sectors, where there may be substantial variation in performance by important segments. Of particular importance is the ability to segment the chemicals sector into its segments such as basic chemicals, plastic materials and resins, and pharmaceuticals.

For the previous 316(b) Phase III rule analyses, EPA considered several data sources, but settled on the *Value Line Investment Survey* firm financial dataset as the best choice for this analysis given the requirements above.[106] For the current analysis, the Agency again reviewed alternative sources including *Value Line* and one of the sources considered for the earlier analyses, the Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations (QFR) published by the U.S. Census Bureau. For the current analysis, EPA decided to use *QFR* data instead of *Value Line*. In reaching this decision, EPA understood that its earlier reasons for choosing the Value Line data over the QFR data were still valid, namely:

- While both QFR and Value Line data are reported over the desired analysis period, QFR data are reported in inconsistent economic classification frameworks over the desired analysis period, thereby creating a data break (SIC to NAICS) in the time series. Value Line, on the other hand, identifies and groups companies in a business content classification scheme that *approximates* 3-digit SIC or 4-digit NAICS

[106] For more information see the *2004 Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities* and the *2006 Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule.*

classifications. Because the Value Line business classifications are defined by practical business content instead of in a rigid SIC or NAICS classification scheme, the Value Line dataset would avoid the challenge of adjusting for changing economic classification schemes.[107]

- QFR data are reported at the level of the industry while the Value Line data are reported by company. For the previous 316(b) rule analyses, EPA judged that Value Line's firm-level reporting would provide a better basis for identifying firms within the in-scope manufacturing industries at a level of sector detail sufficient for this analysis.

However, the fact that Value Line data are reported at the firm level, presents a problem given the longer time period (an additional four years since the previous 316(b) Phase III rule analysis in 2006) that would need to be covered by the financial data for the current analysis. Specifically, in developing adjustment factors for the earlier Phase III rule analyses, EPA had to closely review the financial data reported for each firm in the Value Line dataset to exclude firms that had experienced significant business structural changes, such as mergers, acquisitions, or bankruptcies. Consequently, the set of firms included in the analysis of the 2004 Phase III Proposed Rule was smaller than the set of firms included in the analysis of the 2006 Phase III Final Rule. After carefully reviewing Value Line data for the current effort, EPA determined that the set of the remaining firms *without major business structural changes* would not be sufficient to develop reliable adjustment factors. In addition, given the additional years in the analysis period, the Agency was concerned that, even for the small number of remaining firms with relatively minor business structural changes, it would be increasingly unreasonable to assume that changes in firm-level cash flow could be attributed to changes in the business performance of the individual facilities that comprise the firms, as opposed to reflecting changes in the number and size of facilities in operation. Consequently, EPA decided that for this analysis, the uncertainty and issues of the Value Line data outweighed that of the QFR data and developed adjustment factors using QFR data.

4B.2.3 Methodology for Development of ATCF Adjustment Factors

As stated above, the overall approach to the analysis was to analyze, for each industry group, the trend of financial performance over the 21-year analysis period – 1988 through 2008 – and to assess where the industry's financial performance lay relative to that trend during the 316(b) survey data collection years of 1996-1998. For each industry group, EPA used as analysis observations an index of constant dollar-adjusted after-tax cash flow for the relevant industry groups. To analyze the trend, EPA calculated a simple regression of the index values against time. The estimated regression relationship provides a direct measure of the real (i.e., inflation-adjusted) trend of financial performance over time for each industry group. The 1996-1998 average of index values for each industry group were then compared with the trend values predicted from the estimated regression coefficients – both for the 1996-1998 years and for 2008, which is the end of the analysis period – to determine the extent to which 1996-1998 survey values should be adjusted to reflect (1) the deviation from trend at 1996-1998 and (2) the trend from 1996-1998 to the end of the analysis period.

EPA used the following steps to calculate After-Tax Cash Flow (ATCF) adjustment factors using QFR:

- **Choose variables, period of analysis, and industries**: EPA used quarterly *Income (or Loss) After Income Taxes* (ATI) and *Depreciation, Depletion, and Amortization of Property, Plant, and Equipment* (DDA) values as the basis for calculating ATCF, for 21 years – 1988 through 2008 – for all of the industries in the following table except for Pesticides and Fertilizers and Resins and Synthetics. For the Pesticides and Fertilizers sector, QFR data are available only starting 1992. Consequently, EPA developed ATCF adjustment factor for this industry using only 17 years of QFR data. QFR does not

[107] As described in the industry profiles, the change from SIC-based to NAICS-based reporting of economic data by federal government and other data sources at around 1997/98 created difficulties in aligning and ensuring consistency of time series data that are organized within these frameworks.

provide data specifically for the Resins and Synthetics sector. Instead, these data are a part of the Basic Chemicals, Resins and Synthetics sector. Therefore, EPA was unable to perform a separate QFR-based analysis for this industry and used ATCF adjustment factor calculated for the Basic Chemicals sector for the Resins and Synthetics sector (*Table 4B-1*).

Table 4B-1: Analysis Sectors and Corresponding Sectors Covered by QFR

Analysis Sector Name	QFR SIC Sector	SIC Description	QFR NAICS Sector	NAICS Description
	Available for 1998 Q1 through 2001 Q3		Available for 2000 Q4 through 2008 Q4	
Aluminum	333-336	Nonferrous Metals	3313, 3314	Nonferrous Metals
Basic Chemicals; Resins and Synthetics	281, 282, 286	Industrial Chemicals and Synthetics	3251, 3252	Basic Chemicals, Resins, and Synthetics
Food and Kindred Products	22, 21	Food & Kindred Products (Incl. Tobacco)	311, 312	Food, Beverage, & Tobacco Products
Paper and Allied Products	26	Paper & Allied Products	322	Paper
Pesticides and Fertilizers[a]	284, 285, 287, 289	Residual of Chemicals	3253, 3255, 3256, and 3259	Other Chemicals
Petroleum Refining	29	Petroleum & Coal Products	324	Petroleum & Coal Products
Pharmaceuticals	283	Drugs	3254	Pharmaceuticals & Medicines
Resins and Synthetics[b]	NA	NA	NA	NA
Steel	331, 332, 329	Iron & Steel	3311, 3312	Iron, Steel, & Ferroalloys

a. QFR does not provide data specifically for the Pesticides and Fertilizers sector. Instead, these data are a part of the Other Chemicals sector (SIC 284, 285, 287, and 289; NAICS 3253, 3255, 3256, and 3259)

b. QFR does not provide data specifically for the Resins and Synthetics sector. Instead, these data are a part of the Basic Chemicals, Resins and Synthetics sector.

Source: U.S. Census Bureau, 1998-2008 Quarterly Financial Report; U.S. EPA Analysis, 2010

- **Adjust ATI and DDA values to constant dollars in 2008**: EPA deflated all values to 2008 using the GDP Deflator series published by the Bureau of Economic Analysis.
- **Calculate ATCF**: EPA calculated quarterly ATCF values as *quarterly* ATI *plus* DDA for each industry, and summed the resulting *quarterly* ATCF values to calculate *annual* ATCF values for 1988 through 2008.
- **Generate ATCF index series**:
  - EPA first adjusted the ATCF series to eliminate negative values for each industry by adding to each ATCF value in a given industry's 21-year series, the absolute value of the most negative ATCF value for this industry plus one. This adjustment has the effect of "vertically" shifting the ATCF values for a given industry so that all values are positive while retaining the mathematical "shape" of the series as needed for the trend analysis. This adjustment was necessary to prevent the undesirable inversion of the ATCF index trend – calculated in the next step below – that would occur if a negative index numerator is combined with a positive series in calculating the ATCF index series.
  - EPA calculated ATCF index values for each year and industry by dividing each adjusted ATCF value by the 21-year average of adjusted ATCF values.
- **Calculate the time trend of ATCF index series**: EPA regressed ATCF index values against year by industry, to calculate the time trend of constant dollar ATCF over the period 1988 – 2008 (1992 – 2008 for the Pesticides and Fertilizers sector).

4B.3 Analysis Results

Table 4B-2, below, summarizes the analysis results together with potential adjustments under varying interpretations of the findings.

Table 4B-2: Statistical Significance of Regression Results and Potential Adjustments

Analysis Sector	P-Value	Statistically Significant?	Difference in Trend-Predicted ATCF Index and Actual Index Values – both at 1996-1998[a]	Difference in Trend-Predicted ATCF Index *at 2008* and Actual Index Value at 1996-1998[b]
Aluminum	0.7747	no	-9.6%	NA
Basic Chemicals; Resins and Synthetics	0.3871	no	-15.0%	NA
Food and Kindred Products	0.0000	yes	3.5%	41.4%
Paper and Allied Products	0.1116	no	-12.6%	NA
Pesticides and Fertilizers	0.0126	yes	-25.8%	4.6%
Petroleum Refining	0.0018	yes	23.0%	85.1%
Pharmaceuticals	0.0000	yes	20.0%	144.4%
Resins and Synthetics[c]	NA	NA	NA	NA
Steel	0.1742	no	-24.6%	NA

a. For sectors with statistically *significant* estimated trend factors, the "trend-predicted ATCF values" are the average of 1996-1998 predicted ATCF values using the estimated *non-zero* time-trend factor. For sectors for which the estimated trend factor is *not* statistically significant, the "trend-predicted ATCF values" are the simple 21-year average of ATCF index values – i.e., the time-trend factor is assumed to be zero.
A negative value indicates that the *actual* value exceeds the *trend-predicted ATCF value*; a positive value indicates that the *trend-predicted ATCF value* exceeds the *actual* value. In both instances, the reported percentage value is the adjustment that would be applied to bring the actual index value to the 1996-1998 trend-predicted value.
b. The "trend-predicted ATCF values" are at 2008 and are reported only for sectors for which the estimated time-trend factor is statistically significant. In all instances, the estimated time-trend factor is positive and the trend-predicted ATCF index values at 2008 are higher than the actual index values at 1996-1998.
c. QFR does not provide data specifically for the Resins and Synthetics sector. Instead, these data are a part of the Basic Chemicals, Resins and Synthetics sector.
Source: U.S. Census Bureau, 1998-2008 Quarterly Financial Report; U.S. EPA Analysis, 2010

Several observations are relevant:

- The estimated trend value is *not* statistically significant for four of the eight analyzed sectors: *Aluminum* (*Figure 4B-4*), *Basic Chemicals, Resins and Synthetics* (*Figure 4B-5*), *Steel* (*Figure 4B-11*), and *Paper and Allied Products* (*Figure 4B-7*)
  - For these sectors, EPA decided *not* to use the estimated trend value in any adjustments, but to use simply the average ATCF index values over the 21 years – i.e., a zero slope trend line – as the basis of any adjustment.
  - For each of these four sectors, the indicated direction of adjustment to bring these sectors' ATCF values to the 1996-1998 trend value is negative – i.e., the ATCF adjustment would lower the estimated ATCF values for facilities in these sectors.
  - Consequently, EPA decided to adjust ATCF values for facilities in these four sectors *only* to the 1996-1998 trend value. The downward adjustment of the ATCF values avoids *overstating* the ability of facilities in these industries to comply with rule requirements.
- The estimated trend value is statistically significant for the other four out of eight sectors: *Food and Kindred Products* (*Figure 4B-6*), *Pesticides and Fertilizers* (*Figure 4B-8*), *Petroleum Refining* (*Figure 4B-9*), and *Pharmaceuticals* (*Figure 4B-10*)
  - For these sectors, it would be possible to use the estimated trend line as the basis for adjustment whether (1) to adjust the survey-based ATCF values to trend at 1996-1998 or (2) to adjust ATCF values for the trend over time since the survey.
  - For each of these sectors, the calculated ATCF index values for 1996 through 1998 are below the estimated trend line at 1996-1998 *and* the estimated trend shows a steep increase in ATCF from 1996-1998 to 2008.
  - Although the trend values are statistically significant, EPA decided not to adjust the survey-based ATCF values *along the trend* – i.e., from 1996-1998 to 2008 – because the implied change in ATCF

occurs over too long a period and is too large to reflect unchanging capital in an industry, in terms of number and/or size of facilities. As a result, the Agency decided to bring survey-based ATCF values for these sectors *only* to the estimated trend at 1996-1998 and *not* adjust along the trend. Consequently, from the standpoint of adjusting financial statement information from the original survey, this adjustment avoids overstating the potential of facilities in these industries to comply with rule requirements.

Table 4B-3, below, summarizes the resulting adjustment factors based on the preceding findings and judgments. The table also reports the adjustment factors used in the previous 316(b) Phase III cost and economic impact analyses. For *Aluminum*, *Paper and Allied Products*, *Basic Chemicals*, *Resins and Synthetics*, and *Steel*, the potential adjustment would *reduce* the survey-based ATCF values by the multiplicative factor. For *Food and Kindred Products*, *Pesticides and Fertilizers*, *Petroleum Refining*, and *Pharmaceuticals* the potential adjustment would *increase* the survey-based ATCF values by the multiplicative factor. Because QFR does not provide information for the *Resins and Synthetics* sector, EPA was not able to calculate an adjustment factor *specifically* for this sector. Consequently, for the *Resins and Synthetics* sector, EPA used the adjustment factor calculated for the *Basic Chemicals, Resins and Synthetics* sector.

Table 4B-3: : Potential ATCF Adjustment Factors

Analysis Sector	Adjustment Factors		
	Adjustments in Previous Analyses		To 1996-1998 Trend - Current
	To 2003 – P3P[a]	To 2005 – P3F[b]	
Aluminum	NA	NA	0.9044
Basic Chemicals; Resins and Synthetics	0.9228	1.1543	0.8501
Food and Kindred Products	NA	NA	**1.0355**
Beverages	NA	1.3076	NA
Food	NA	1.3835	NA
Paper and Allied Products	1.0397	1.0386	0.8737
Pesticides and Fertilizers	NA	NA	**0.7420**
Petroleum Refining	1.2480	1.4914	**1.2304**
Pharmaceuticals	1.3171	1.2526	**1.2004**
Resins and Synthetics	1.1398	1.1948	0.8501
Steel	0.8056	0.9096	0.7539

a. For more information on the development of these adjustments factors see the 2004 Economic Analysis for the Proposed Section 316(b) Rule for Phase III Facilities

b. For more information on the development of these adjustments factors see the 2006 Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule.

Source: U.S. Census Bureau, 1998-2008 Quarterly Financial Report; U.S. EPA Analysis, 2010

The charts below and on the following pages show the calculated ATCF Index Series and Trend-Predicted ATCF Index series. For sectors for which the estimated time-trend factor is statistically significant, the Trend-Predicted ATCF Index series is a *non-zero* slope line and is labeled “Calculated Trend.” For sectors for which the estimated time-trend factor is *not* significantly significant, the Trend-Predicted Index series is a *zero* slope line and is labeled “21-Yr Ave ATCF Index.”

Figure 4B-4: ATCF Index Series and Calculated Trend - Aluminum

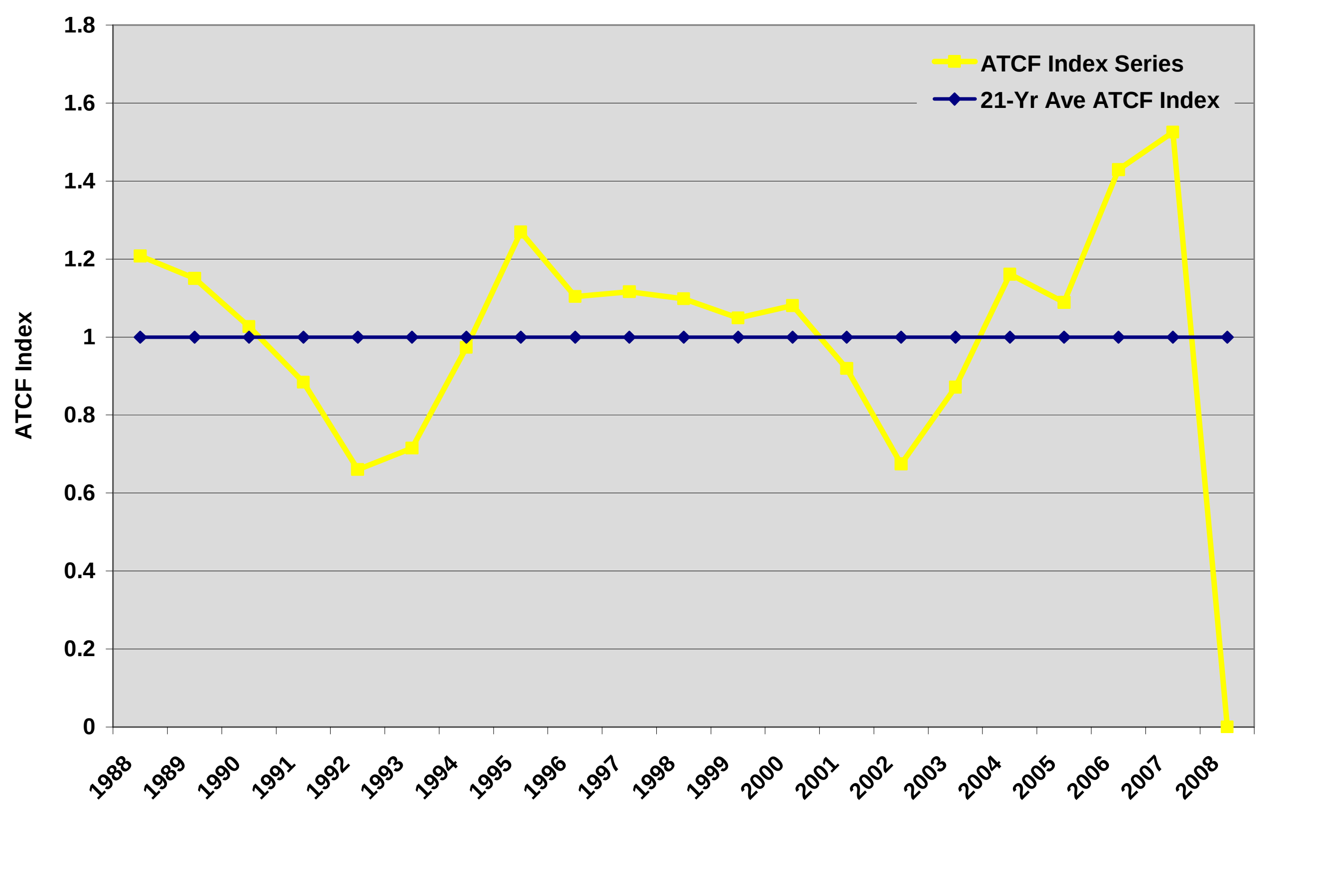


Figure 4B-5: ATCF Index Series and Calculated Trend – Basic Chemicals, Resins and Synthetics

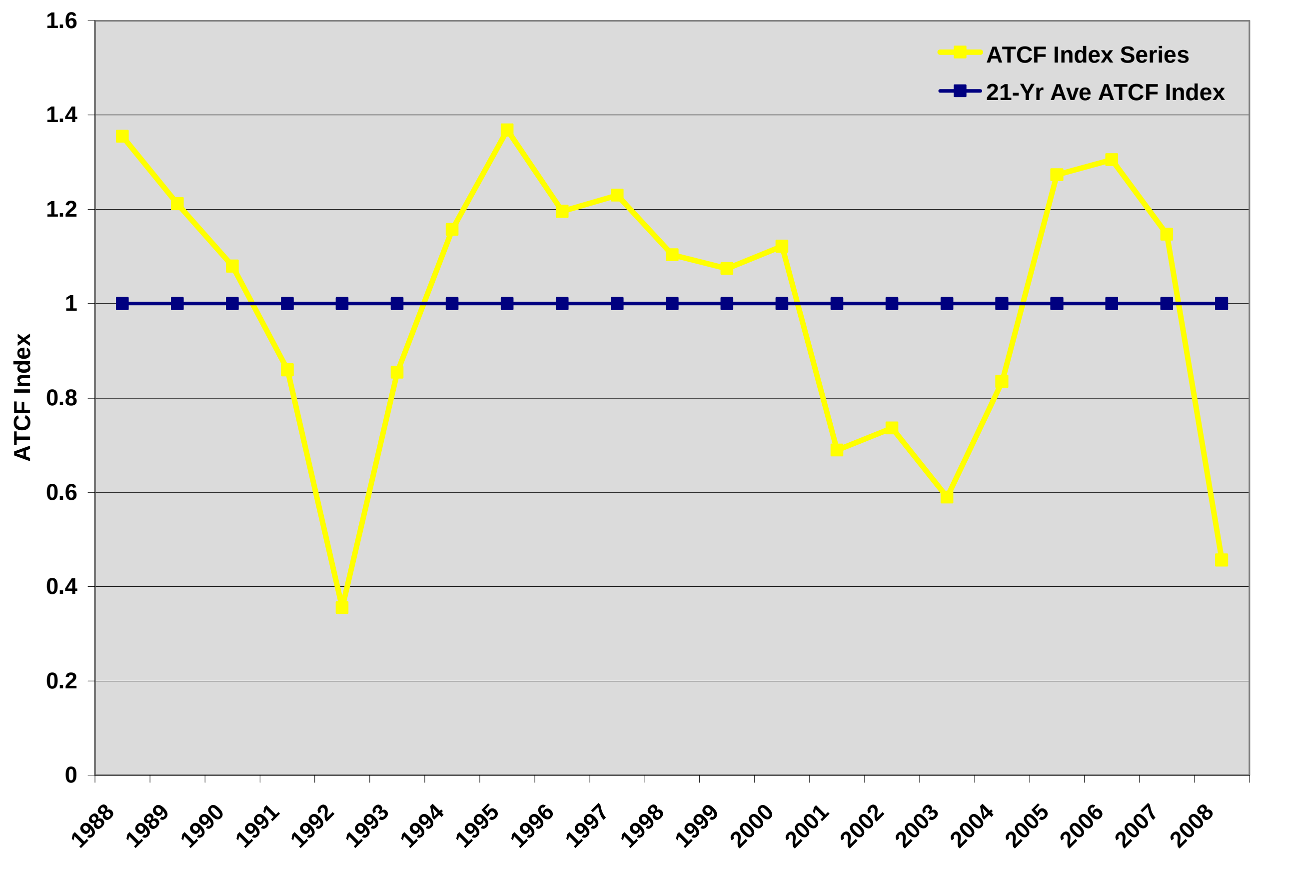


Figure 4B-6: ATCF Index Series and Calculated Trend – Food and Kindred Products

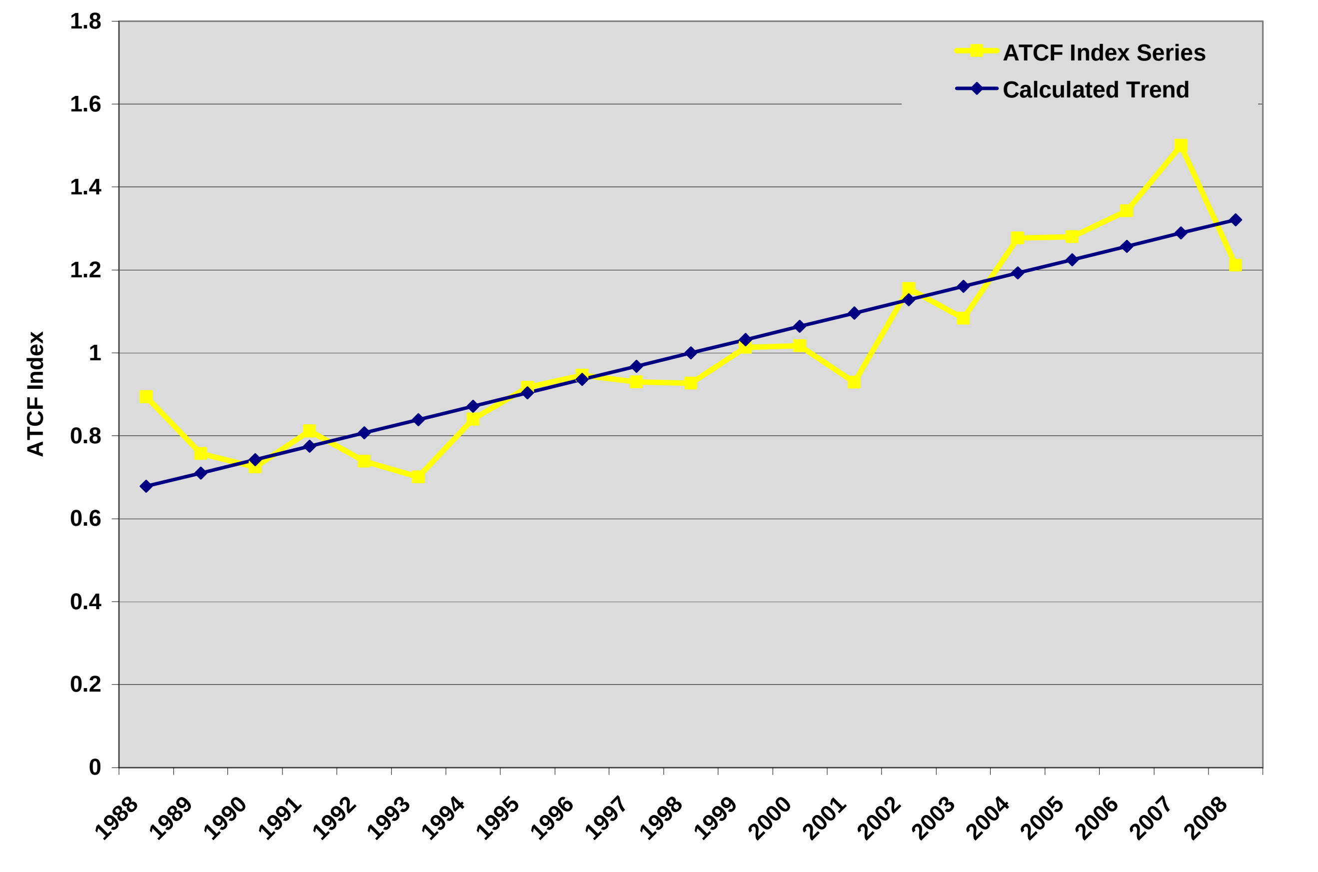


Figure 4B-7: ATCF Index Series and Calculated Trend – Paper and Allied Products

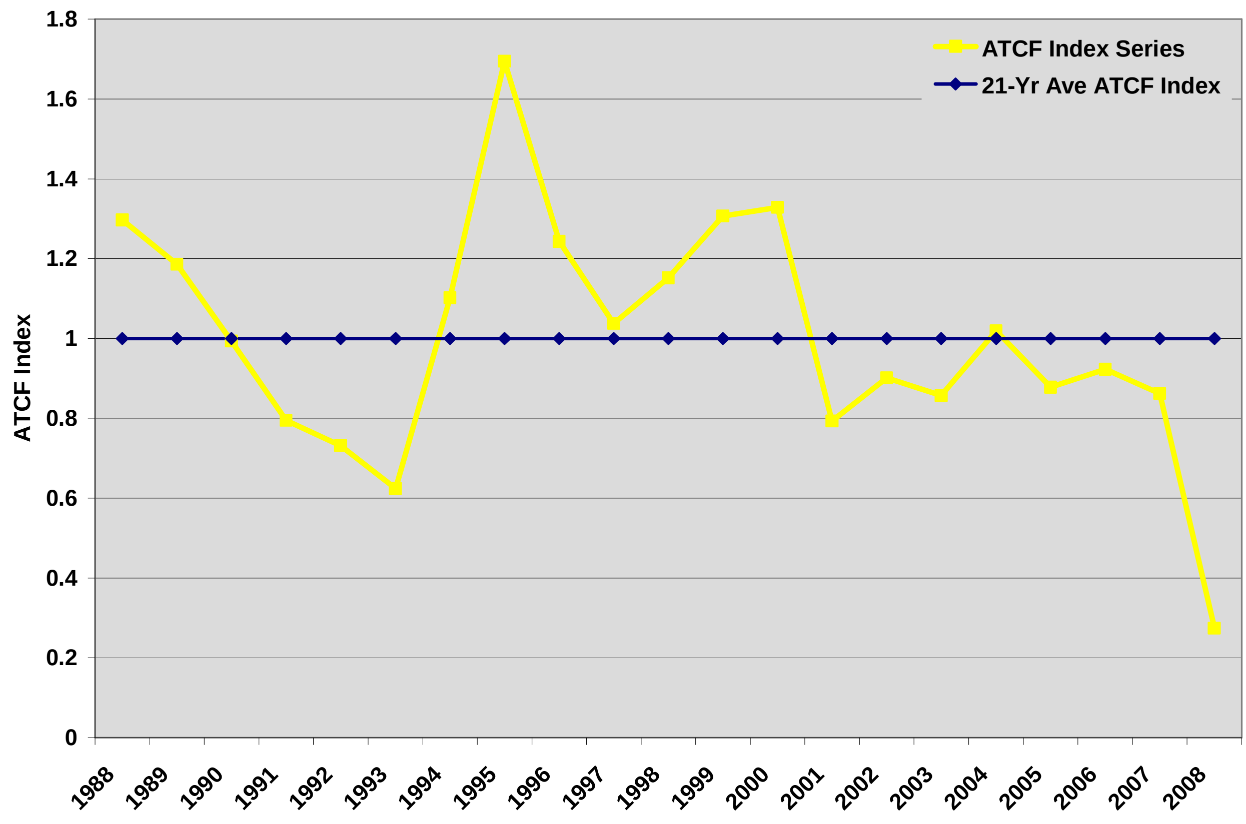


Figure 4B-8: ATCF Index Series and Calculated Trend – Pesticides and Fertilizers

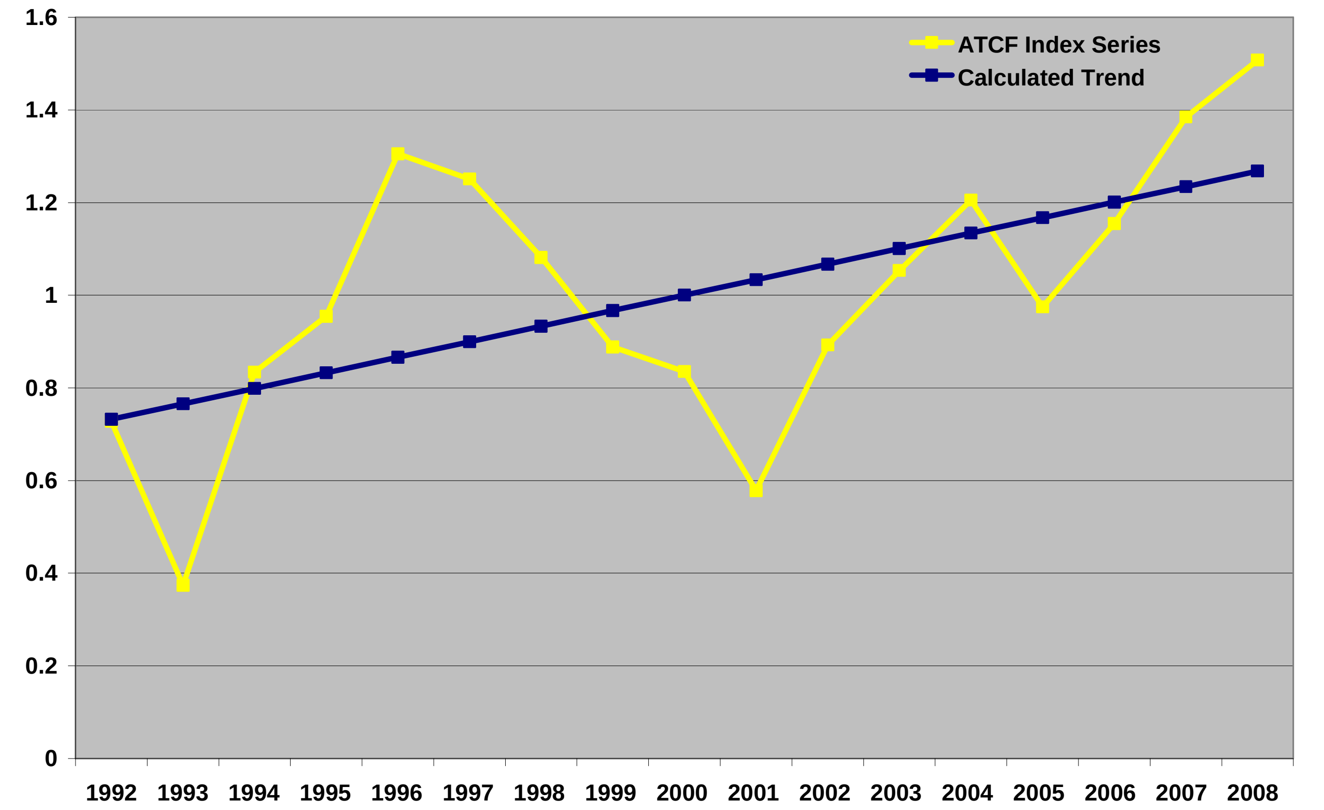


Figure 4B-9: ATCF Index Series and Calculated Trend – Petroleum Refining

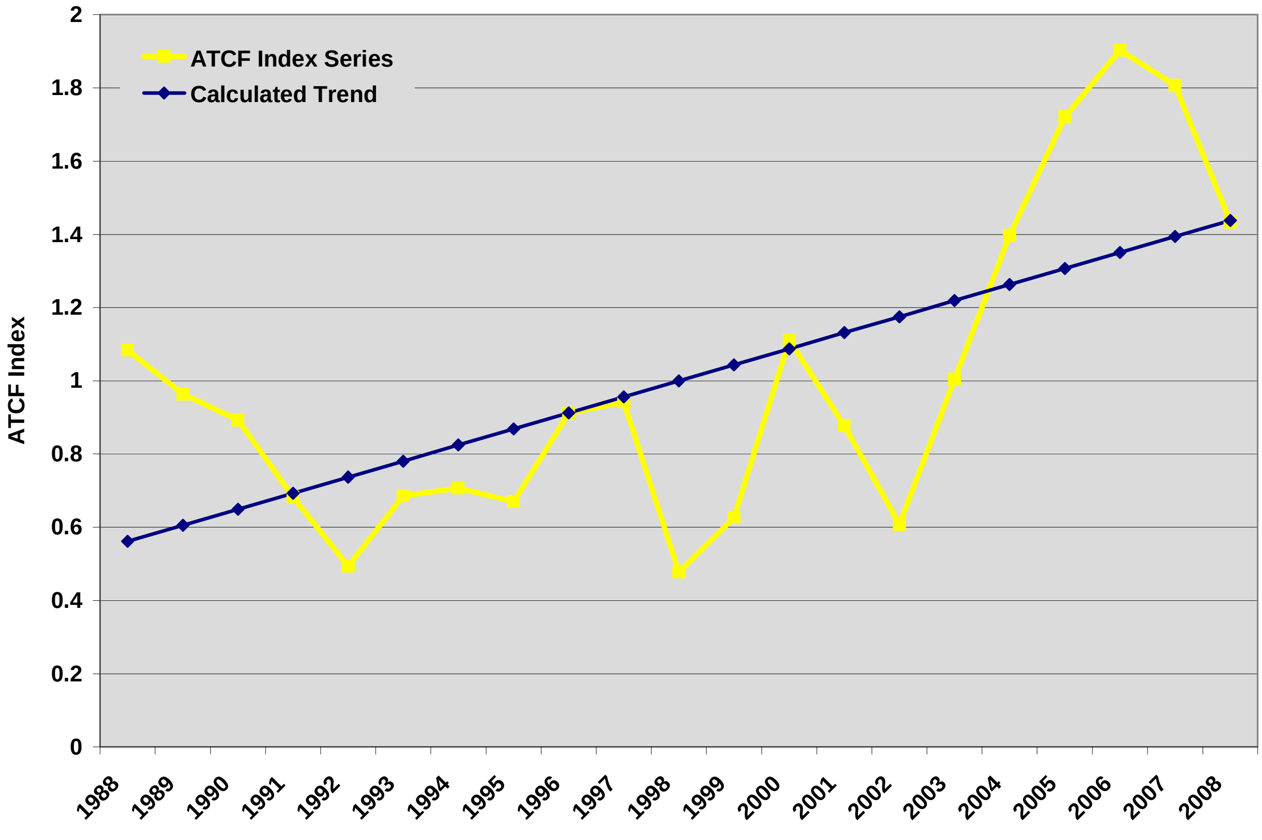


Figure 4B-10: ATCF Index Series and Calculated Trend – Pharmaceuticals

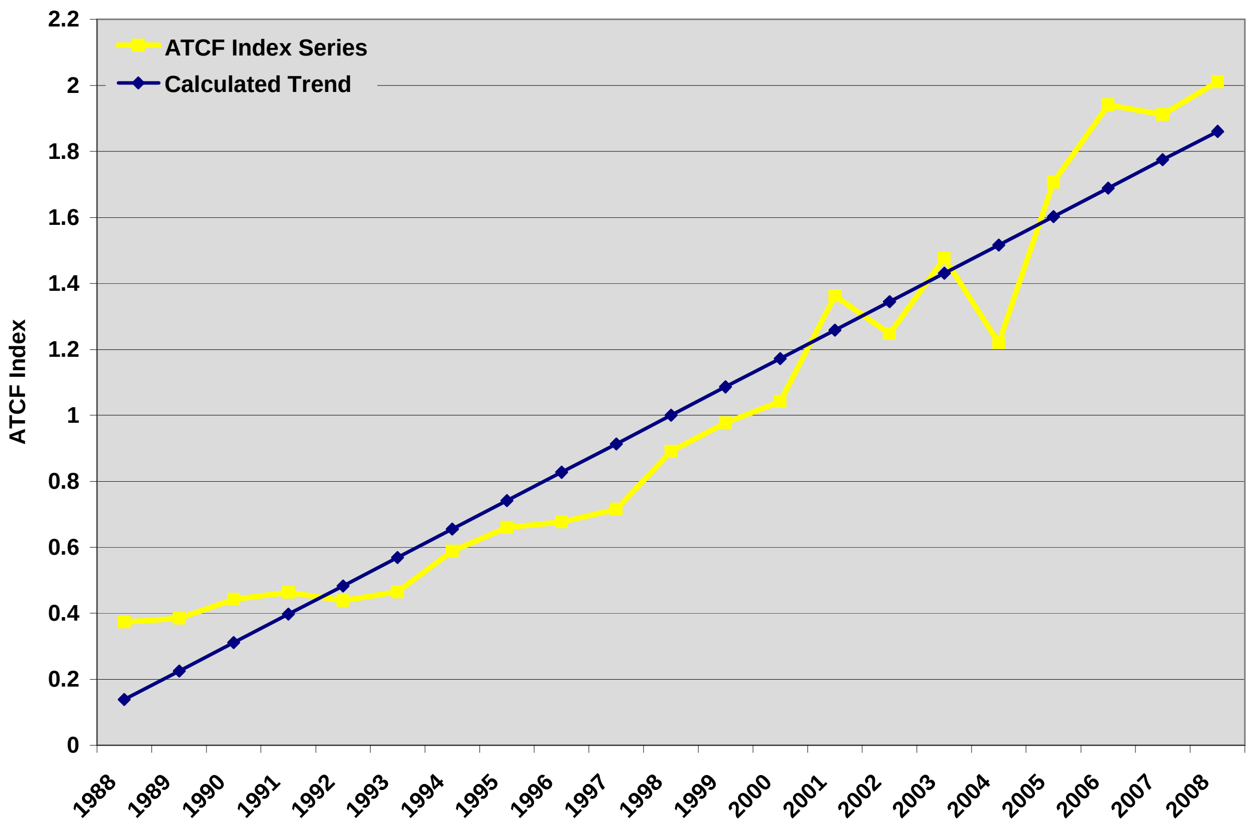
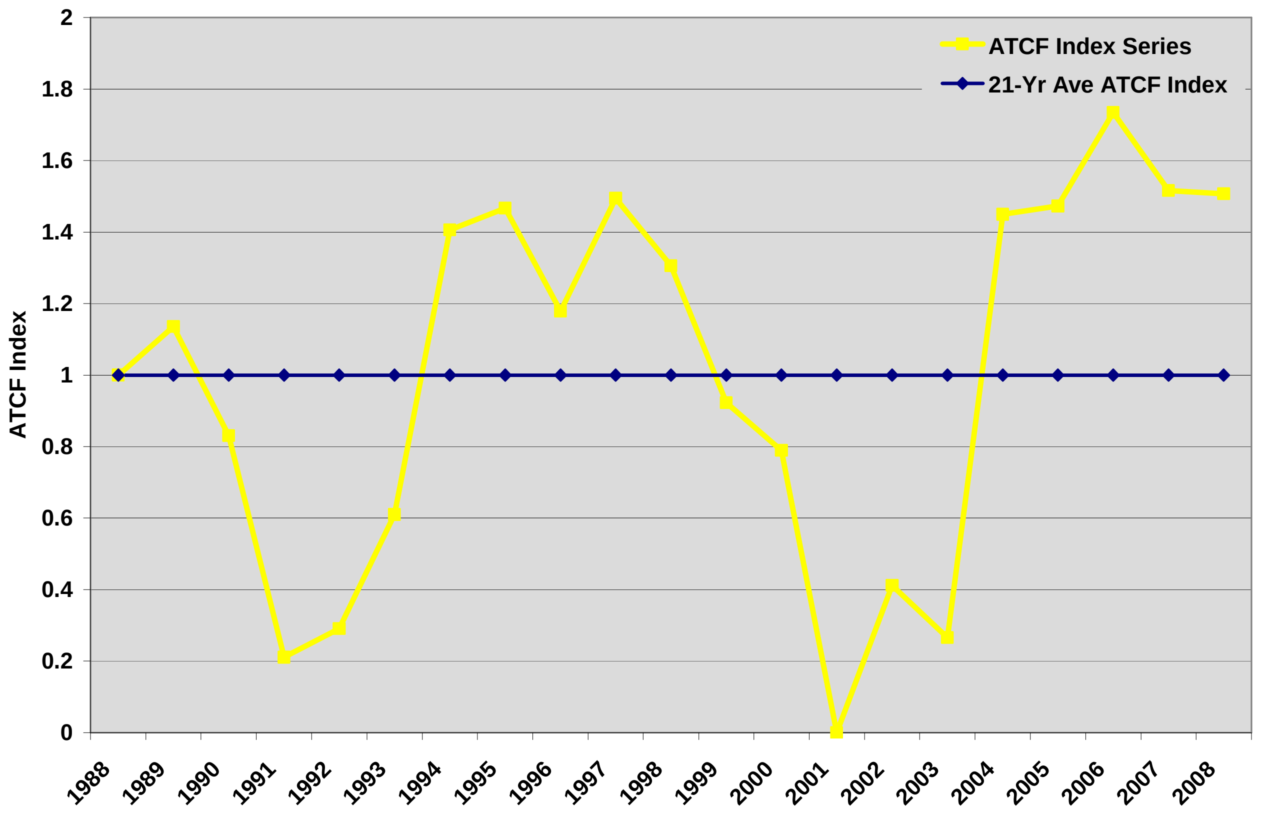


Figure 4B-11: ATCF Index Series and Calculated Trend – Steel



Appendix 4C Estimating Capital Outlays for Section 316(b) Manufacturing Sectors Discounted Cash Flow Analyses

The analysis of economic impacts to manufacturing facilities expected to be subject to the proposed Section 316(b) Regulation involves calculation of the business value of sample facilities on the basis of a discounted cash flow (DCF) analysis of operating cash flow as developed from industry questionnaires.[108] This appendix presents the details of the Capital Expenditure analysis, as performed and documented for the previous 316(b) Phase III Rule analyses. This analysis approach has been carried over into the current analysis of impact on manufacturing facilities for the proposed 316(b) Existing Facilities rule. EPA did not re-estimate the regression equation for the current analyses, but did update some of the input data that is used to estimate Capital Expenditure based on the regression analysis. These updates are described in *Section 4C.6.* While the estimation of capital outlays relies in part on data in the SIC framework and uses data from the Value Line dataset, which have been replaced respectively by the NAICS framework and the Bureau of the Census's Quarterly Financial Reports, EPA judges that the estimations of capital expenditures remain valid for the analysis of the current proposed rule.[109]

Business value is calculated on a pre- and post-compliance basis and the change in this value serves as an important factor in estimating regulatory impacts in terms of potential facility closures. To be accurate in concept, the business value calculation should recognize cash outlays for capital acquisition as a component of cash flow. However, the Section 316(b) Industry Questionnaire did not request information from surveyed facilities on their cash outlays for capital acquisition. Absent this data, EPA developed an estimate of cash outlays for capital acquisition. This appendix describes the methodology EPA used to derive, for each sample facility, an estimate of cash outlays for capital acquisition.

EPA Office of Water (OW) previously identified that the omission of cash outlays for capital acquisition from DCF analyses may lead to overstatement of the business value of sample facilities and, as a consequence, understatement of regulatory impacts in terms of estimated facility closures (EPA, 2003). In response to this omission, the Office of Management and Budget suggested the adoption of depreciation expense as a surrogate for cash outlays for capital replacement and additions. However, for several reasons EPA believes depreciation is a poor surrogate. First, depreciation is meant to capture the consumption/use of previously acquired assets, *not* the cost of replacing, or adding to, the existing capital base. Therefore, depreciation is fundamentally the wrong concept to use as a surrogate for capital outlays for capital replacement and additions. Second, depreciation is estimated based on the historical asset cost, which may understate or overstate the real replacement cost of assets. Third, both book and tax depreciation schedules generally understate the assets' useful life. Thus, reported depreciation will overstate real depreciation value for recently acquired assets that are still in the depreciable asset base, and conversely, understate the real depreciation value of assets that have expired from the depreciable asset base but still remain in valuable use. Finally, depreciation does not capture the important variations in capital outlays that result from differences in revenue growth and financial performance among firms. Businesses with real growth in revenue will need to expand both their fixed and working capital assets to support business growth, and all else being equal, growing businesses will have higher ongoing outlays for fixed and working capital assets. Similarly, the ability of businesses to renew and expand their asset base depends on the financial productivity of the deployed capital as indicated by measures such as return on assets or return on invested capital. As a result, businesses with "strong" asset productivity will attract capital for renewal and expansion of

[108] This analysis is limited to potentially affected facilities in SIC codes 26, 28, 29, and 33.

[109] The prior analysis, and therefore this appendix, relied on classification of businesses in the SIC framework. Although other analyses and presentations for the 316(b) existing facilities rule have been updated to the NAICS, this appendix continues to the use the SIC framework as the basis for business classification.

their asset base, while businesses with "weak" asset productivity will have difficulty attracting the capital for renewal and expansion of the business' asset base. All else being equal, businesses with strong asset productivity will have higher ongoing outlays for capital assets; businesses with weak asset productivity will have lower ongoing outlays for capital assets.

As an approach to addressing the absence of capital acquisition cash outlay data to support the 316(b) manufacturers DCF analysis, EPA estimated a regression model of capital outlays using reported capital expenditures and relevant explanatory financial and business environment information for public-reporting firms in the original, primary 316(b) manufacturing sectors. The resulting estimated model is used to estimate capital outlays for facilities in the 316(b) manufacturers sample dataset. The estimated capital outlay values were then used in the DCF analyses to calculate business value of sample facilities and estimate regulatory impacts in terms of facility closures.

The approach and regression model described above are based largely on the approach and regression model developed in support of the analysis of economic impacts for the Metal Products and Machinery Regulation (MP&M), which provides a recent example of the need to address the omission of capital acquisition cash outlay data from a DCF analysis. EPA notes that the facilities/industry sectors examined in the Section 316(b) manufacturers analysis are similar to those analyzed in the MP&M analysis: both analyses estimate impacts to facilities in manufacturing industries only and facilities in SIC 33 are covered under both regulations. In addition, the Section 316(b) Industry Questionnaire and the MP&M survey instruments are similar; therefore, similar data are available for the 316(b) manufacturers and MP&M survey facilities. As such, EPA relied heavily on prior experience from the MP&M final regulation in estimating the regression model used to estimate of capital outlays for facilities in the 316(b) manufacturers sample dataset.

This appendix reports the results of the effort to estimate capital outlays for 316(b) manufacturing facilities, including: an overview of the analytic concepts underlying the analysis of capital outlays; specific variables included in the regression analysis; summary of data selection and preparation; general specification of regression models to be tested; and the findings from the regression analyses. The model estimation does not include sector information for the Food and Kindred Products industry, which was added as a primary industry for the Section 316(b) Phase III final rule analysis.[110]

4C.1 Analytic Concepts Underlying Analysis of Capital Outlays

On the basis of general economic and financial concepts of investment behavior, EPA began its analysis by outlining a framework relating the level of a firm's capital outlays to explanatory factors that:

- Can be observed for public-reporting firms – either as firm-specific information or general business environment information – and thus be included in a regression analysis; and
- For firm-specific information, are also available from the 316(b) manufacturers sample facility dataset.

To aid in identifying the explanatory concepts and variables that might be used in the analysis and as well in specifying the models for analysis, EPA reviewed recent studies of the determinants of capital outlays. EPA's review of this literature generally confirmed the overall approach in seeking to estimate capital outlays and helped to identify additional specific variables that other analysts found to contribute important information in the

110 Since the estimated regression model for the 316(b) manufacturers facilities is based on an earlier model developed for the MP&M final regulation, much of the underlying research involved in the analytic development of the model had been previously completed and was not required to be redone. Nonetheless, in order to present a lucid discussion of the analytic concepts underlying the model and the rationale behind specifying variables for the analysis and specification of the regression model, a complete discussion of how the regression model was developed is presented. During the course of the discussion, instances where prior experience gained during estimating the regression model for the MP&M final regulation had a significant influence in the development of the current model are clearly highlighted.

analysis of capital outlays (e.g., the decision to test capacity utilization as an explanatory variable, see below, resulted from the literature review). Articles reviewed are listed in Attachment 4C-1 to this Appendix 4C .

Table 4C-1, beginning on the subsequent page, summarizes the conceptual relationships between a firm's capital outlays and explanatory factors that EPA sought to capture in this analysis. In the table, EPA outlines the concept of influence on capital outlays, the general explanatory variable(s) that EPA identified to capture the concept in a regression analysis, and the hypothesized mathematical relationship (sign of estimated coefficients) between the concept and capital outlays. *Table 4C-2* identifies the specific variables included in the analysis, including any needed manipulations and the correspondence of the variables to 316(b) manufacturers survey information.

Table 4C-1: Summary of Factors Influencing Capital Outlays

Explanatory Factor/Concept To Be Captured in Analysis	Translation of Concept to Explanatory Variable(s)	Expected Relationship
Availability of attractive opportunities for additional capital investment. A firm's owners, or management acting on behalf of owners, should expend cash for capital outlays only to the extent that the expected return on the capital outlays – whether for replacement of, or additions to, existing capital stock – are sufficient to compensate providers of capital for the expected return on alternative, competing investment opportunities, taking into account the risk of investment opportunities.	Historical ***Return On Assets*** of establishment as a indicator of investment opportunities and management effectiveness, and, hence, of desirability to expand capital stock and ability to attract capital investment. Use of a historical variable implicitly assumes past performance is indicative of future expectations.	Positive
Business growth and outlook as a determinant of need for capital expansion and attractiveness of investment opportunities. All else equal, a firm is more likely to have attractive investment opportunities and need to expand its capital base if the business is growing and the outlook for business performance is favorable.	***Revenue Growth***, from the prior time period(s) to the present, provides a *historical* measure of business growth and is a potential indicator of need for capital expansion. Use of a historical variable implicitly assumes past performance is indicative of future expectations.	Positive
	Clearly, the theoretical preference is for a forward-looking indicator of business growth and need for capital expansion. Options EPA identified include ***Index of Leading Indicators*** and current ***Capacity Utilization***, by industry. Higher current *Capacity Utilization* may presage need for capital expansion.	Positive
Importance of capital in business production. All else equal, the more capital intensive the production activities of a business, the greater will be the need for capital outlay to replenish, and add to, the existing capital stock. More capital intensive businesses will spend more in capital outlays to sustain a given level of revenue over time.	The ***Capital Intensity*** of production as measured by the production capital required to produce a dollar of revenue provides an indicator of the level of capital outlay needed to sustain and grow production. As an alternative to a firm-specific concept such as Capital Intensity of production, differences in business characteristics might be captured by an ***Industry Classification*** variable.	Positive
Life of capital equipment in the business. All else equal, the shorter the useful life of the capital equipment in a business, the greater will be the need for capital outlay to replenish, and add to, the existing capital stock.	No information is available on the actual useful life of capital equipment by business or industry classification. However, the ***Capital Turnover Rate***, as calculated by the ratio of book depreciation to net capital assets, provides an indicator of the rate at which capital is depleted, according to book accounting principles: the higher the turnover rate, the shorter the life of the capital equipment. However, the measure is imperfect for reasons of both the inaccuracies of book reporting as a measure of useful life, and as well the confounding effects of growth in the asset base due to business expansion – which will tend to lower the indicated turnover rate, all else equal, without a real reduction in life of capital equipment. As above, an alternative to a firm-specific concept, differences in business characteristics might be captured by an ***Industry Classification*** variable.	Positive, generally, but with recognition of the potential for counter-trend effects
The cost of financial capital. The cost at which capital – both debt and equity – is made available to a firm will determine which investment opportunities can be expected to generate sufficient return to warrant use of the financial capital for equipment purchases. All else equal, the higher the cost of financial capital, the fewer	Preferably, measures of cost-of-capital would be developed separately for debt and equity. The ***Cost of Debt Capital***, as measured by an appropriate benchmark interest rate, provides an indication of the terms of debt availability and how those terms are changing over time. Preferably, the debt cost/terms would reflect the credit condition of the firm, which could be based on a credit safety rating (e.g., S&P Debt Rating).	Negative

Table 4C-1: Summary of Factors Influencing Capital Outlays

Explanatory Factor/Concept To Be Captured in Analysis	Translation of Concept to Explanatory Variable(s)	Expected Relationship
the investment/capital outlay opportunities that would be expected to be profitable and the lower the level of outlays for replacement of, or additions to, capital stock.	The cost of equity capital is more problematic than the cost of debt capital since it is not directly observable for either public-reporting firms or, in particular, private firms in the 316(b) manufacturers dataset. However, a readily available surrogate such as ***Market-to-Book Ratio*** provides insight into the terms at which capital markets are providing equity capital to *public-reporting firms*: the higher the Market-to-Book Ratio, the more favorable the terms of equity availability.	Negative
The price of capital equipment. The price of capital equipment – in particular, how capital equipment prices are changing over time – will influence the expected return from capital outlays. All else equal, when capital equipment prices are increasing, the expected return from incremental capital outlays will decline and vice versa. However, although the generally expected effect of higher capital equipment prices is to remove certain investment opportunities from consideration, the potential effect on *total capital outlay* may be mixed. If expected returns are such that the demand to invest in capital projects is relatively inelastic, the effect of higher prices for capital equipment may be to raise, instead of lower, the total capital outlay for a firm.	Index provides an indicator of the change in capital equipment prices.	Negative, generally, but with recognition of the potential for counter-trend effects

Source: U.S. EPA analysis, 2004.

4C.2 Specifying Variables for the Analysis

Working from the general concepts of explanatory variables outlined above, EPA defined the specific explanatory variables to be included in the analysis. A key requirement of the regression analysis is that the firm-specific explanatory variables included in the regression analysis later be able to be used as the basis for estimating capital expenditures for facilities in the 316(b) manufacturers dataset. As a result, in defining the firm-specific variables, it was necessary to ensure that the definition of variables selected for the regression analysis using data on public-reporting firms be consistent with the data items available for facilities in the 316(b) manufacturers dataset.

Also, EPA's selection of firm-specific variables was further constrained by the decision to use the Value Line Investment Survey (VL) as the source of firm-specific information for the regression analysis. The decision to use VL as the source of firm-specific data for the analysis was driven by several considerations:

- Reasonable breadth of public-reporting firm coverage. The VL dataset includes 8,500 firms.
- Reasonable breadth of temporal coverage. VL provides data for 11 years – i.e., 1992-2002. Although ideally EPA would have preferred a longer time series to include more years not in the "boom" business investment period of the mid- to late-1990s.
- Reasonable coverage of concepts/data needed for analysis. The VL data includes a wide range of financial data that are applicable to the analysis (VL provides 37 data items over the 11 reporting years; see Attachment DB). However, because of the pre-packaged nature of the VL data, it was not possible to customize any data items to support more precise definition of variables in the analysis. In particular, EPA found that certain balance sheet items were not reported to the level of specificity preferred for the analysis. Overall, though, EPA expects the consequence of using more aggregate, less-refined concepts should be minor.

The decision to use VL data for the analysis constrained, in some instances, EPA's choice of variables for the analysis.

Table 4C-2 reports the specific definitions of variables included in the analysis (both the dependent variable and explanatory variables), including any needed manipulations, the data source, the 316(b) manufacturers estimation analysis equivalent (either the corresponding variable(s) in the Section 316(b) Industry Questionnaire or other source outside the questionnaire), and any issues in variable definition.

Table 4C-2: Variables For Capital Expenditure Modeling Analysis

Variables for Regression Analysis			316(b) Manufacturers Analysis Equivalent	Comment / Issue
Variable	**Source**	**Calculation**		
Dependent Variable				
Gross expenditures on fixed assets: CAPEX, includes outlays to replace, and add to, existing capital stock	Value Line	Obtained from VL as Capital Spending per Share. CAPEX calculated by multiplying by Average Shares Outstanding.	None: to be estimated based on estimated coefficients.	*This value and all other dollar values in the regression analysis were deflated to 2002 using 2-digit SIC PPI values.*
Explanatory Variables				
Firm-Specific Variables				
Return On Assets: ROA	Value Line	ROA = Operating Income / Total Assets. Both Operating Income, defined as Revenue less Operating Expenses (CoGS+SG&A), and Total Assets were obtained directly from VL.	From Survey: Revenue *less* Total Operating Expenses (Material & Product Costs + Production Labor + Cost of Contract Work + Fixed Overhead + R&D + Other Costs & Expenses)	Would have preferred an after-tax concept in numerator *and* a deployed production capital concept in denominator. However, VL provides no tax value *per se* and would require calculation of tax using an estimated tax rate, which could introduce error. Also neither VL nor 316(b) manufacturers survey data provide sufficient information to get at deployed production capital.
Revenue: REV	Value Line	REV = Revenues. Revenues directly available from VL.	From Survey: Revenue	In the log-linear formulation this variable captures percent change/growth in revenues. However, the use of the log-linear formulation, eliminates the potential to set the growth term to zero in estimating baseline capital outlays for 316(b) manufacturers facilities. During the specification of the regression model for the MP&M final regulation, Total Assets was also tested as a scale variable. Since it provided a good, but not as strong, an explanation, as REV it was not included in the final specification. Based on this previous finding, Total Assets was not considered while specifying the 316(b) manufacturers regression model.
Capital Turnover Rate: CAPT	Value Line	CAPT = Depreciation / Total Assets. Depreciation and Total Assets directly available from VL.	From Survey: Depreciation / Total Assets	Would have preferred denominator of *net fixed assets* instead of *total assets*. However, VL provides detailed balance sheet information for only the four most recent years. Not possible to separate current assets and intangibles from total assets.

Table 4C-2: Variables For Capital Expenditure Modeling Analysis				
Variables for Regression Analysis			**316(b) Manufacturers Analysis Equivalent**	**Comment / Issue**
Variable	**Source**	**Calculation**		
Capital Intensity: CAPI	Value Line	CAPI = Total Assets / Revenue. Total Assets and Revenue directly available from VL	From Survey: Total Assets / Revenue	As above, would have preferred *net fixed assets* instead of *total assets*, but needed data are not available from VL for the full analysis period.
Market-to-Book Ratio: MV/B	Value Line	MV/B = average market price of common equity (Price) divided by book value of common equity (Book Value per Share). Price and Book Value per Share directly available from VL.	N/A (see Comment/Issue)	During specification of the MP&M regression model, MV/B was found to highly correlated with other, more important explanatory variables, which makes sense, given that equity terms would be derived from more fundamental factors, such as ROA. Thus, MV/B was omitted from the MP&M regression model. As a result, MV/B was not considered during the specification of the 316(b) manufacturers regression model which eliminated the need to define an approach to use this variable with 316(b) manufacturers survey data.
General Business Environment Variables				
Interest on 10-year, A-rated industrial debt: DEBTCST	Moody's Investor Services	DEBTCST = annual average of rates for each data year	Use average of DEBTCST rates at time of 316(b) manufacturers survey.	10-year maturity, industry debt selected as reasonable benchmark for industry debt costs. 10 years became "standard" maturity for industrial debt during 1990s.
Index of Leading Indicators: ILI	Conference Board	Monthly index series available from Conference Board. ILI = geometric mean of current year values.	Use average of ILI values at time of 316(b) manufacturers survey.	During specification of the MP&M regression model, EPA found that ILI and the CAPPRC (see below) are highly correlated. Thus, ILI was omitted from the MP&M regression model. As a result, ILI was not considered during the specification of the 316(b) manufacturers regression model.
Capacity Utilization by Industry: CAPUTIL	Federal Reserve Board (Dallas Federal Reserve)	Monthly index series available from Federal Reserve. CAPUTIL = current year average value.	Use average of CAPUTIL values at time of 316(b) manufacturers survey.	
Producer Price Index series for capital equipment: CAPPRC	Bureau of Labor Statistics (BLS)	Annual average values available from BLS. CAPPRC = current year average value as reported by BLS.	Use average of CAPPRC values at time of 316(b) manufacturers survey.	BLS reports PPI series for capital equipment based on "consumption bundles" defined for manufacturing and non-manufacturing industries. For this analysis, EPA used the PPI series based on the manufacturing industry bundle.

Source: U.S. EPA analysis, 2004.

4C.3 Selecting the Regression Analysis Dataset

In addition to specifying the variables to be used in the regression analysis, EPA also needed to select the public firm dataset on which the analysis would be performed.

As noted above, EPA used the Value Line Investment Survey as the source for public firm data. VL includes over 8,500 publicly traded firms and identifies firms' principal business both by a broad industry classification (e.g., Paper/Forest) and by an SIC code assignment. Value Line's SIC code definitions do not match the U.S. Census Bureau's SIC code definitions; however, in most instances a Value Line SIC code can be reasonably matched to one or several U.S. Census Bureau defined SIC codes. To build the public firm dataset corresponding to the original 316(b) Phase III manufacturing sectors (SIC 26: Paper and allied products, SIC 28: Chemicals and allied products, SIC 29: Petroleum and coal products, and SIC 33 Primary metal industries), EPA initially selected all firms included in the Value Line SIC code families:

- 2600: Paper/forest products,
- 2640: Packaging and container,
- 2810: Chemical (basic),
- 2813: Chemical (diversified),
- 2820: Chemical (specialty),
- 2830: Biotechnology,
- 2834: Drug,
- 2840: Household products,
- 2844: Toiletries/cosmetics,
- 2900: Petroleum (integrated),
- 3311: Steel (general), and
- 3312: Steel (integrated).

This is the same dataset used in the previous 316(b) Phase III rule analyses. Although the Food and Kindred Products sector was ultimately included as a primary sector for the Section 316(b) Phase III final rule analysis, EPA judged that it was not necessary to re-estimate the model with data this additional industry because the model coefficients estimated at Phase III proposal did not vary by industry in a statistically significant way. EPA continues to rely on this judgment as the basis for carrying forward the previously estimated regression relationship without inclusion of the Food and Kindred Products sector as an explicitly analyzed sector. The current model's applicability across industries is detailed further in the next section of this appendix.

In order to derive a dataset of firms whose business activities closely match the activities of firms included in the 316(b) manufacturers survey, EPA made or attempted to make the following revisions to the initial dataset:

- EPA found that the VL SIC code definition does not include categories that match SIC 331 and SIC 335 (combined together to form the aluminum sector in the original Phase III analysis). Since U.S. aluminum companies are generally vertically integrated (S&P, 2001), most aluminum companies own large bauxite reserves and mine bauxite ore. As such, these firms are classified in VL under SIC 1000: Metals and mining. EPA reviewed the business activities of firms listed in SIC 1000: Metals and mining, and included only those firms described as aluminum companies in the regression analysis dataset.
- EPA reviewed the business activities of firms listed in SIC 3400: Metal fabricating; however, no firms whose activities matched those described within the profiles of the 316(b) Manufacturing Sectors were found.[111]
- EPA reviewed the business activities of firms listed in SIC 2840: Household products and SIC 2844: Toiletries/cosmetics, and retained only those firms in the dataset whose activities matched those described within the profiles of the 316(b) Manufacturing Sectors (see footnote 4).
- EPA deleted firms within SIC 2600: Paper/forest products whose business activities are solely limited to timber/lumber production. These facilities are unlikely to use cooling water intake structures and therefore fall outside the 316(b) Manufacturing Sectors.
- EPA reviewed the business activities of firms listed in SIC 2830: Biotechnology and SIC 2834: Drug in order to exclude firms that are exclusively research and development (R&D) firms and are unlikely to use cooling water intake structures. However, based on the information provided by Value Line EPA was unable to segregate R&D firms from the rest of the firms listed in these SIC codes.
- EPA only retained firms in the VL dataset if they are situated in the U.S. or Canada, and for whom financial information is available in U.S. dollars.

On inspection, EPA found that a substantial number of firms did not have data for the full 11 years of the analysis period. The general reason for the omission of some years of data is that the firms did not become publicly listed in their current operating structure – whether through an initial public offering, spin-off, divestiture of business assets, or other significant corporate restructuring that renders earlier year data inconsistent with more recent data – until after the beginning of the 11-year data period.[112] As a result, the omission of observation years for a firm always starts at the beginning of the data analysis period. This systematic front-end truncation of firm observations in the dataset could be expected to bias the analysis in favor of the capital expenditure behavior nearer the end of the 1990s decade. To avoid this problem, EPA removed all firm observations that have fewer than 11 years of data. As a result, the dataset used in the analysis has a total of 2,244 yearly data observations and represents 204 firms.

[111] The profiles only focus on 4-digit SIC categories represented in the sample of facilities which received the Section 316(b) detailed industry questionnaire.

[112] When VL adds a firm to its dataset, it fills in the public-reported data history for the firm for the lesser of 11 years or the length of time that the firm has been publicly listed and thus subject to SEC public reporting requirements.

Table 4C-3 presents the number of firms by industry classifications.

Table 4C-3: Number of Firms by Industry Classifications

SIC Industry Classification	Number of Firms
26: Paper and allied products	24
28: Chemicals and allied products	136
29: Petroleum and coal products	20
33: Primary metal industries	24

U.S. EPA Analysis, 2004

4C.4 Specification of Models to be Tested

On the basis of the variables listed above and their hypothesized relationship to capital outlays, EPA specified a time-series, cross sectional model to be tested in the regression analysis. EPA's dataset consisted of 204 cross sections observed at 11 years (1992 through 2002). The general structure of this model was as follows:

$$CAPEX_{i,t} = f(ROA_{i,t}, REV_{i,t}, CAPT_{i,t}, CAPI_{i,t}, DEBTCST_{i,t}, CAPPRC_{t}, CAPUTIL_{j,t}) \quad \text{(Equation } 4C\text{ -1)}$$

Where:

$CAPEX_{i,t}$ = capital expenditures of firm *i*, in time period *t*;113

t = year (year = 1992, . . . , 2002);

i = firm *i* (*i* = 1, . . . , 204);

j = industry classification *j*

$ROA_{i,t}$ = return on total assets for firm *i* in year *t*;

$REV_{i,t}$ = revenue ($ millions) for firm *i* in year *t*;

$CAPT_{i,t}$ = capital turnover rate for firm *i* in year *t*;

$CAPI_{i,t}$ = capital intensity for firm *i* in year *t*;

$DEBTCST_{t}$ = financial cost of capital in year *t*;

$CAPPRC_{t}$ = price of capital goods in year *t*;

$CAPUTIL_{j,t}$ = the Federal Reserve Board's Index of Capacity utilization for a given industry *j* in year *t*.

EPA only tested log-linear model specifications for this analysis.[114] The main advantage of the log-linear model is that it incorporates directly the concept of percent change in the explanatory variables. Specifying the key regression variables as logarithms permitted EPA to estimate directly as the coefficients of the model, the

113 All dollar values were deflated to 2002 using 2-digit PPI values.

114 While specifying the MP&M regression model, EPA tested both linear and log-linear model specifications. The pattern of coefficient significance was found to be better in the log-linear model. In addition, the log-linear model offered advantages in terms of retention of early time period observations (by eliminating the need to use percent change variables) and variable specifications, and helped to reduce outlier effects in the model. As a result, EPA selected a log-linear specification as the final regression model for the MP&M final regulation. Based on these reasons and the similarity of industry sectors analyzed for the two regulations, EPA decided to test only log-linear model specifications for the Phase III regression model.

elasticities of capital expenditures with respect to firm financial characteristics and general business environment factors. The following paragraphs briefly discuss testing of the log-linear forms of the model. Parameter estimates are presented for the final log-linear model only.

EPA specified a log-linear model, as follows:

$$\ln(CAPEX_{i,t}) = \alpha + \Sigma[\beta_x \ln(X_{i,t})] + \Sigma[\gamma_y \ln(Y_t)] + \varepsilon \qquad \text{(Equation } 4C\text{ -2)}$$

Where:

$CAPEX_{i,t}$ = capital expenditures of firm *i*, year *t*;

β_x = elasticity of capital expenditures with respect to firm characteristic X;

$X_{i,t}$, = a vector of financial characteristics of firm *i*, year *t*;

γ_y = elasticity of capital expenditures with respect to economic indicator Y;

Y_t = a vector of economic indicators, year *t*; for CAPUTIL, Y is also differentiated by industry classification

ε = an error term; and

ln(*x*) = natural log of *x*

Based on this model, the elasticity of capital expenditures with respect to an explanatory variable, for example, return on assets is calculated as follows:

$$E(CAPEX) = \frac{d\ln(CAPEX)}{d\ln(ROA)} = \frac{d(CAPEX)/CAPEX}{d(ROA)/ROA} \qquad \text{(Equation } 4C\text{ -3)}$$

Since logarithmic transformation is not feasible for negative and zero values, such values in the VL public firm dataset required linear transformation to be included in the analysis. The following variables in the sample required transformation:

- CAPEX: Eighteen firms in the sample reported zero capital expenditures at least in one time period. EPA set these expenditures to $1.
- REVENUE: Seven firms reported negative revenues in at least one time period. Because these are likely due to accounting adjustments from prior period reporting, EPA set negative revenues for these firms to $1.
- ROA: the values for return on assets in the public firm sample range from -2.9 to 0.7. Approximately 34 percent of the firms in the dataset reported negative ROAs in at least one year. To address this issue while reducing potential effects of data transformation on the modeling results, EPA used the following data transformation approach:[115]

[115] While specifying the MP&M regression model EPA conducted a sensitivity analysis to examine the degree to which the estimated model was affected by this data transformation. Results of this analysis showed that the data transformation produces results that are compatible with a model considering only positive ROA values and a model considering all ROA values. As a result, the Phase III regression model utilized the same data transformation procedure.

- EPA excluded 27 firms with *any* annual ROA values below the 95th percentile of the ROA distribution (i.e., ROA # - 0.51).
- EPA used an additive data transformation to ensure that remaining negative ROA values were positive in the logarithm transformation. The additive transformation was performed by adding 0.51 to all ROA values.

As a result of the data transformation procedures outlined above, the VL public firm dataset on which the regression model is based was reduced to 177 firms (204 - 27 firms) and 1,947 yearly data observations.

The analysis tested several specifications of a log-linear model, including models with the intercept and slope dummies for different industrial sectors and models with the intercept suppressed.[116] Slope dummies were used to test the influence of industry classification on the elasticity of capital expenditures with respect to an explanatory variable: e.g., using the product of an industry classification dummy variable and CAPPRC to test whether certain industries responded differently to change in price of capital equipment over time. Following review of the different models tested, EPA concluded that the estimated coefficients did not vary, significantly, by industry and thus selected the simple log-linear model, with the intercept and no slope dummies as the basis for the 316(b) manufacturers capital expenditures analysis. The results for this model are summarized below.

Cross-sectional, time-series datasets typically exhibit both autocorrelation and group-wise heteroscedasticity characteristics. Autocorrelation is frequently present in economic time series data as the data display a “memory” with the variation not being independent from one period to the next. Heteroscedasticity usually occurs in cross-sectional data where the scale of the dependent variable and the explanatory power of the model vary across observations. Not surprisingly, the dataset used in this analysis had both characteristics. Therefore, EPA estimated the specified model using the generalized least squares procedure. This procedure involves the following two steps:

- First, EPA estimated the model using simple OLS, ignoring autocorrelation for the purpose of obtaining a consistent estimator of the autocorrelation coefficient (ρ);
- Second, EPA used the generalized least squares procedure, where the analysis is applied to transformed data. The resulting autocorrelation adjustment is as follows:

$$Z_{i,t} = Z_{i,t} - \rho Z_{i,t-1} \quad \text{(Equation 4C-4)}$$

where Z_{it} is either dependent or independent variables.

EPA was unable to correct the estimated model for group-wise heteroscedasticity due to computational difficulties. The statistical software used in the analysis (LIMDEP) failed to correct the covariance matrix due to the very large number of groups (i.e., 177 firms) included in the dataset. Application of other techniques to correct for group-wise heteroscedasticity was not feasible due to time constraints. The estimated coefficients remain unbiased; however, they are not minimum variance estimators. Regression results reveal strong systematic elements influencing capital expenditures: the analysis finds both statistically significant and intuitive patterns that influence firm's investment behavior. We find a strong systematic element of capital expenditures variation that allows forecasting of capital expenditures based on firm and business environment characteristics.

116 While specifying the MP&M regression model, EPA also tested specifications that included the following structural modifications: (1) testing contemporary vs. lagged specification of certain explanatory variables: e.g., using prior, instead of current period revenue, REV, as an explanatory variable; (2) testing scale-normalized specification of the dependent variable: e.g., using CAPEX/REV as the dependent variable instead of simple CAPEX; (3) testing flexible functional forms that included quadratic terms; and (4) testing additional explanatory variables including the index of 10 leading economic indicators (ILI) and market-to-book ratio (MV/B). Because EPA found that these structural modifications either did not improve the fit of the MP&M regression model or resulted in the introduction of multicollinearity among variables, these structural modifications were not tested while specifying the Phase III regression model.

Table 4C-4 presents model results. The model has a fairly good fit, with adjusted R^2 of 0.81. All coefficients have the expected sign and all but one variable (cost of debt capital) are significantly different from zero at the 95th percentile.

Table 4C-4: Time Series, Cross-Sectional Model Results

Variable	Coefficient	t-Statistics
Constant	21.880	2.618
Ln(ROA)	0.526	3.964
Ln(REV)	1.129	58.450
Ln(CAPT)	0.687	11.085
Ln(CAPI)	1.078	18.491
Ln(DEBTCST)	-0.789	-1.605
Ln(CAPPRC)	-5.957	-4.369
Ln(CAPUTIL)	1.716	2.842
Autocorrelation Coefficient		
r	0.385	18.402

Source: U.S. EPA Analysis

The empirical results show that among the firm-specific variables, the output variable (REV) is a dominant determinant of firms' investment spending. A positive coefficient on this variable means that larger firms invest more, all else equal, which is clearly a simple expected result. In addition, as expected, firms with higher financial performance and better investment opportunities (ROA) invest more, all else equal: for each one percent increase in ROA, a firm is expected to increase its capital outlays by 0.53 percent. Other firm-specific characteristics were also found important and will aid in differentiating the expected capital outlay for 316(b) manufacturers facilities according to firm-specific characteristics. Firms that require more capital to produce a given level of business activity (i.e., firms that have high capital intensity, CAPI) tend to invest more: a one percent increase in capital intensity leads to a 1.08 percent increase in capital spending. Higher capital turnover/shorter capital life (CAPT) also has a positive effect on investment decisions: a one percent increase in capital turnover rate translates to a 0.69 percent increase in capital outlays.

The model also shows that current business environment conditions play an important role in firms' decision to invest. Negative signs on the capital price (CAPPRC) and debt cost (DEBTCST) variables match expectations, indicating that falling (either relatively or absolutely) capital equipment prices and less costly credit are likely to have a positive effect on firms' capital expenditures. The most influential factor is capital equipment prices for manufacturing facilities. A one percent increase in the capital price index (CAPPRC) leads to a 5.96 percent decrease in capital investment. Capacity utilization is also an influential factor: a one percent increase in the Federal Reserve Index of Capacity Utilization for the relevant industrial sector (CAPUTIL) leads to a 1.7 percent increase in capital investments. The fact that these systematic variables are significant in the regression analysis means that EPA will be able to control for economy- and industry-wide conditions in estimating capital outlays for 316(b) manufacturers facilities.

4C.5 Model Validation

To validate the results of the regression analysis, EPA used the estimated regression equation to calculate capital expenditures and then compared the resulting estimate of capital expenditures with actual data. EPA used two methods to validate its results:

- EPA used median values for explanatory variables from the Value Line data as inputs to estimate capital expenditures and then compared the estimated value to the median reported capital expenditures, and
- EPA used 316(b) manufacturers survey data to estimate capital expenditures and then compared the estimated values to depreciation reported in the survey.

First, EPA estimated capital expenditures for a hypothetical firm based on the median values of the four dependent variables from the Value Line data and the relevant values of the three economic indicators. The estimated capital expenditures for this hypothetical firm are $43 million. EPA then compared this estimate to the median value of capital expenditures from the Value Line data. The median capital expenditure value in the dataset is $36 million, which provides a close match to the estimated value. This is not surprising since the same dataset was used to estimate the regression model and to calculate the median values used in this analysis.

EPA also used 316(b) manufacturers survey data to confirm that the estimated capital expenditures seem reasonable. Because the 316(b) manufacturers survey does not provide information on capital expenditures, EPA compared the capital expenditure estimates to the depreciation values reported in the survey. Depreciation had been proposed as a possible surrogate for cash outlays for capital replacements and additions. However, depreciation does not capture important variations in capital outlays that result from differences in firms' financial performance.

For this analysis, EPA chose a representative facility from each of the 316(b) primary manufacturing sectors for model validation. The selected facility for each sector corresponds as closely as possible to the hypothetical median facility in the sector based on the distribution of facility revenues and facility return on assets. For each of the facilities, EPA estimated capital expenditures using the estimated regression equation and facility financial data. *Table 4C-5* shows the estimated regression coefficients, financial averages for the primary 316(b) Phase III sectors, estimated facility capital expenditures, reported facility depreciation, and the comparison of capital expenditures and depreciation.

As shown in *Table 4C-5*, the estimated model provides reasonable estimates of capital expenditures.

Table 4C-5: Estimation of Capital Outlays for 316(b) Manufacturers Sample Facilities: Median Facilities Selected by Revenue and ROA Percentiles

Sectors	Pre-Tax Return on Assets (ROA)	Revenue ($2004, millions)	Capital Turnover Rate	Capital Intensity	Cost of Debt	Price of Capital Goods	Capacity Utilization	Estimated Capital Expenditures ($2004, millions)	Depreciation ($2004, millions)	Difference between Depreciation and Capital Expenditures ($2004, millions)
Coefficient Intercept (21.88)	0.53	1.13	0.69	1.08	-0.79	-5.96	1.72			
Paper and allied products	0.16	252.00	0.09	0.89	7.71	137.60	86.24	$19.54	$16.73	($2.80)
Chemicals and allied products	0.27	244.59	0.06	1.14	7.71	137.60	79.36	$15.73	$14.69	($1.04)
Petroleum and coal products	0.22	1516.01	0.05	0.59	7.71	137.60	91.88	$47.03	$66.95	$19.93
Primary metals industries	0.09	458.46	0.04	0.93	7.71	137.60	88.77	$16.07	$19.21	$3.14
Food and kindred products	0.37	292.56	0.06	0.29	7.71	137.60	80.46	$4.82	$4.52	($0.30)

Source: U.S. EPA analysis, 2004.

One of the possible implications of the hypothesized relationships and estimated coefficient values from the prior analysis is that a facility's predicted capital expenditures might be expected to increase relative to the facility's actual depreciation as the facility's ROA increases. An extension of this hypothesis is that, at lower ROA values, predicted capital expenditures would be less than the depreciation but that at higher ROA values, predicted capital expenditures exceed depreciation. These hypotheses are consistent with the expectation that businesses with higher financial performance will have relatively more attractive investment opportunities and are more likely to attract the capital to undertake those investments. EPA examined whether these relationships occur in the 316(b) sample facilities. Specifically, EPA calculated the predicted capital expenditure for each facility and compared these values to the facilities' reported depreciation values. To remove the scale effect of revenue, EPA normalized both the predicted capital expenditure and reported depreciation values by dividing by the three-year average of revenue for each facility. EPA then estimated the simple linear relationship of the resulting revenue-normalized capital expenditure and deprecation values against facility ROA. The five graphs on the following pages present, for each of the five primary two-digit SIC code sectors, the normalized capital expenditure and deprecation values, and the estimated trend lines for each sector's depreciation and capital expenditures with respect to ROA.[117] The graphs indicate the following:

The Paper and Allied Products (SIC 26) graph shows depreciation exceeding predicted capital expenditure at low ROA values but this relationship reverses with predicted capital expenditure exceeding depreciation as ROA increases. Thus, the calculations for these facilities match the hypothesized relationship.

The Chemicals and Allied Products (SIC 28) graph also shows depreciation exceeding predicted capital expenditure at low ROA values, but again the relationship reverses with predicted capital expenditure exceeding depreciation as ROA increases. This predicted relationship is observed more strongly for facilities in the Chemicals and Allied Products industry than in the Paper and Allied Products industry.

The Petroleum and Coal Products (SIC 29) graph shows predicted capital expenditures exceeding depreciation over the ROA range analyzed. However, the extent of difference does not materially change as ROA increases.

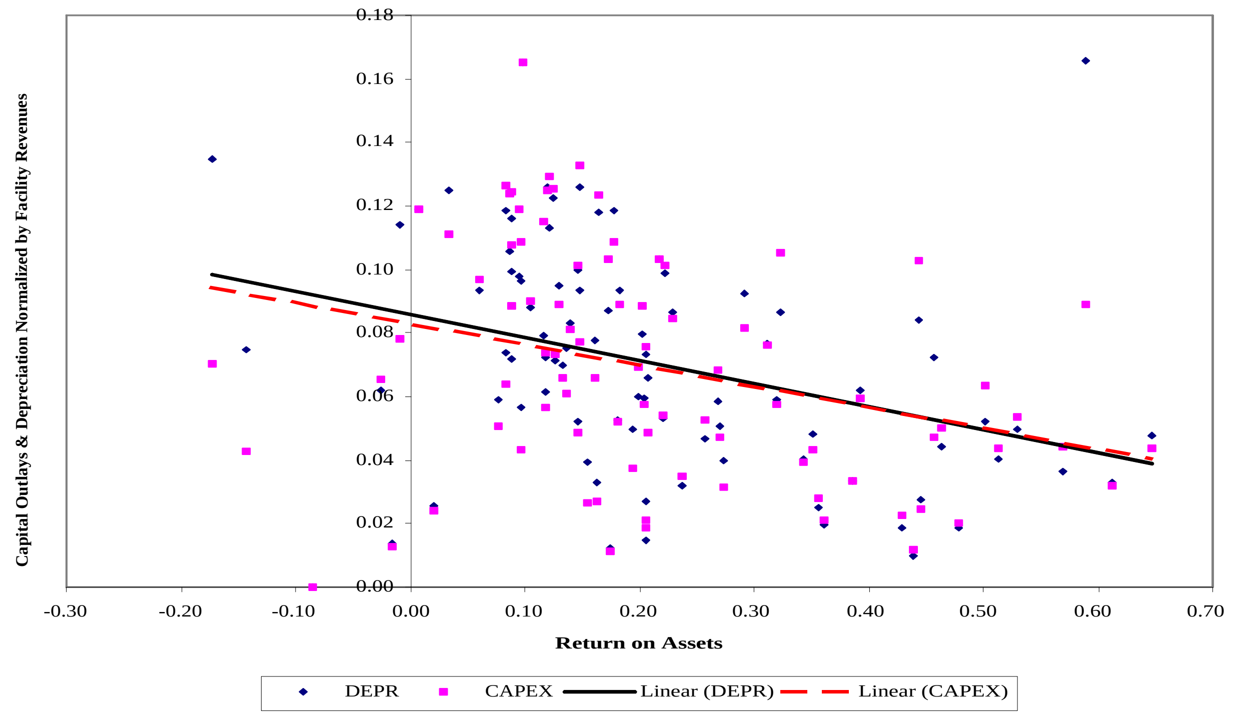
The Primary Metal Industries (SIC 33) graph also shows predicted capital expenditures exceeding depreciation over the ROA range analyzed. However, unlike for the Petroleum and Coal Products facilities, the amount by which predicted capital expenditures exceeds depreciation increases as ROA increases, thus matching the hypothesized relationship.

The Food and Kindred Products (SIC 20) graph also shows that calculations for these facilities match the hypothesized relationship, where predicted capital expenditures exceed depreciation over the ROA range analyzed. The consistency of this result, as well as the CAPEX estimation in Table 4C-5 above, is notable to the extent that it demonstrates the model's overall applicability across industries, as facility data from SIC 20 were not used for model specification.

In summary, with the exception of facilities in the Petroleum and Coal Products industry, the estimated model produces capital expenditure values that increase relative to reported depreciation with increasing ROA, which matches the hypothesized relationship.

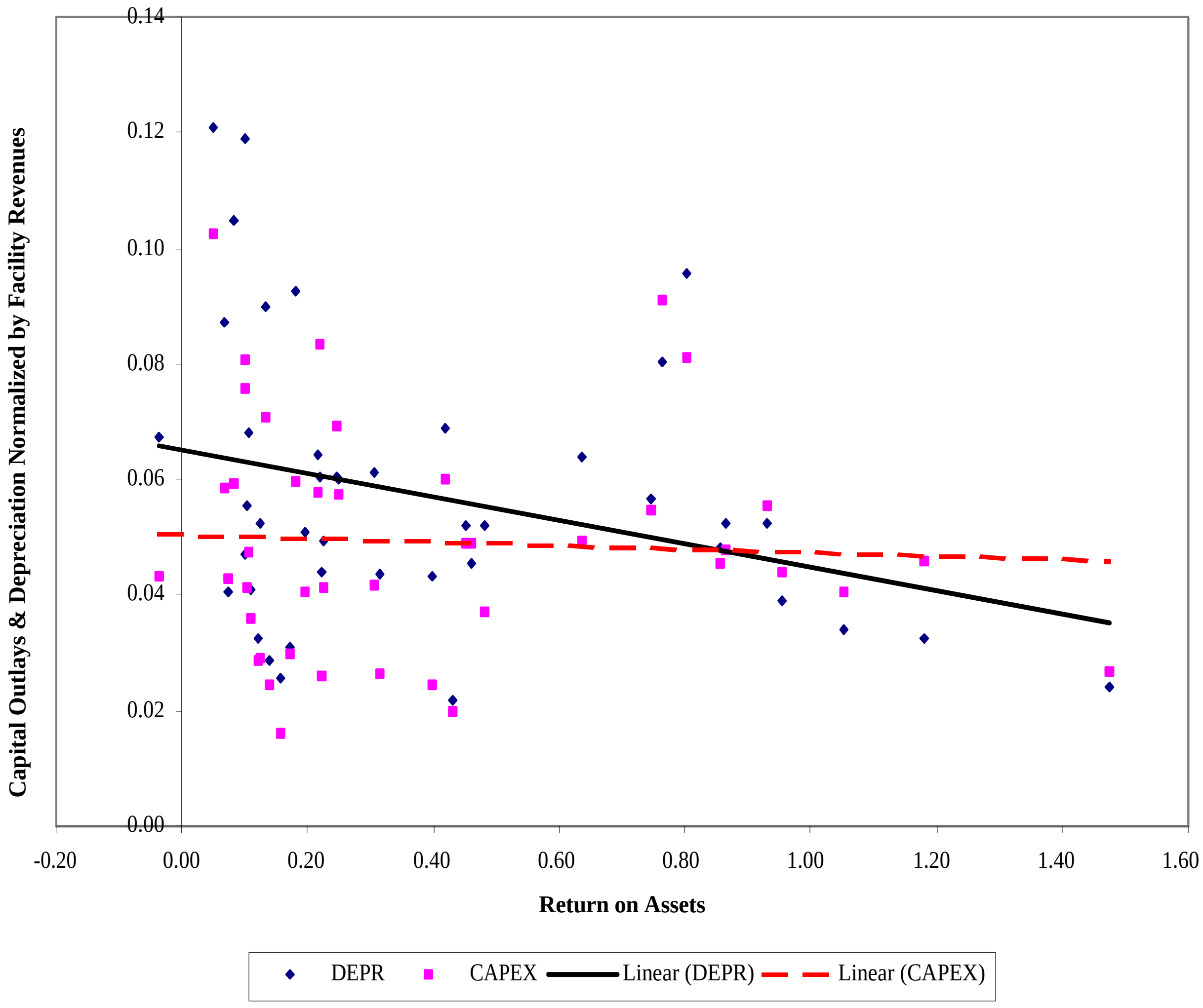
[117] For presentation purposes, two outlier facilities were excluded from the graph for SIC 28: Chemicals and allied products, and one outlier facility was excluded from the graph for SIC 26: Paper and allied products.

Figure 4C-1: Comparison of Estimated Capital Outlays to Reported Depreciation for 316(b) Manufacturers Survey Facilities in the Paper and Allied Products Sector



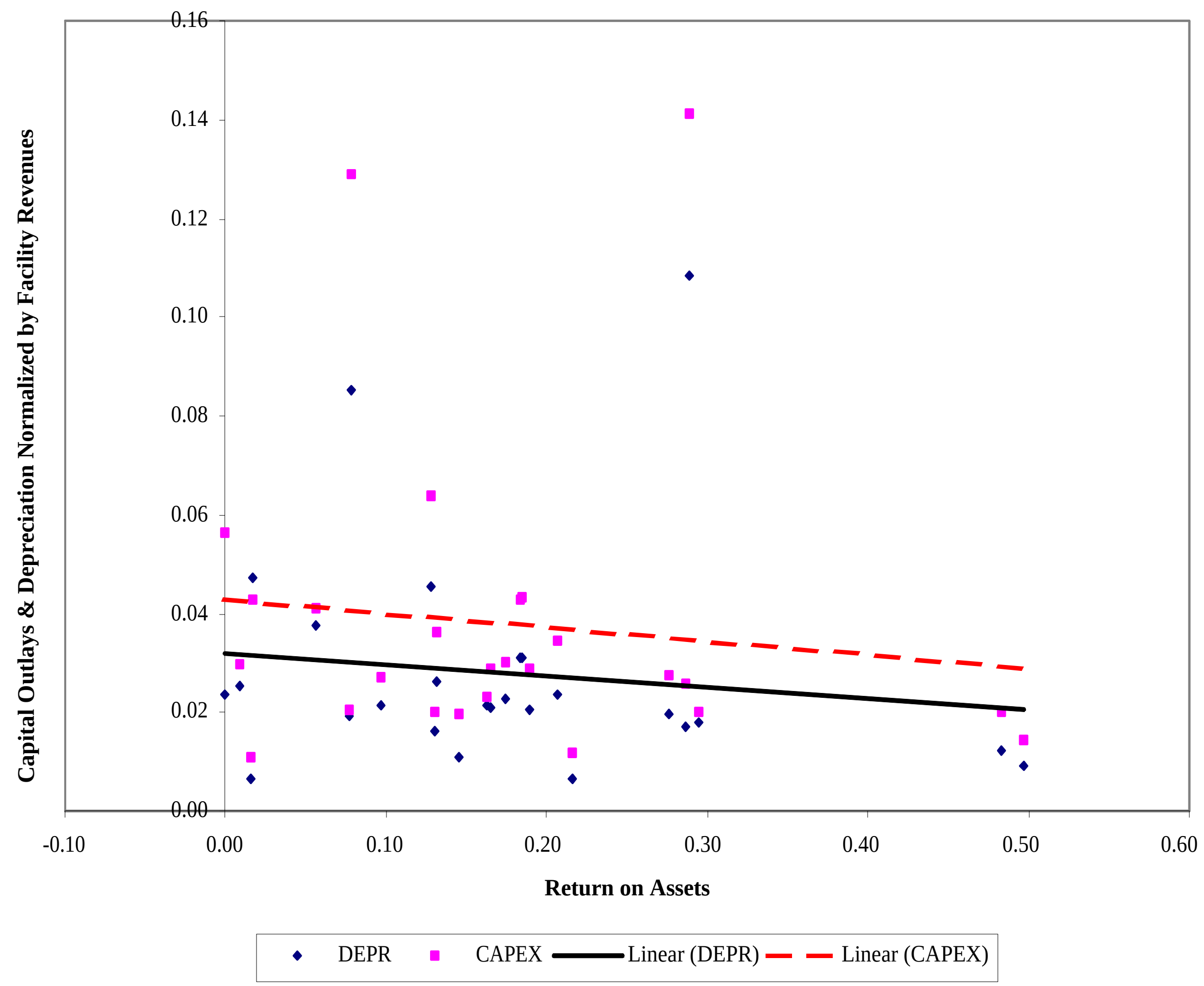
Source: U.S. EPA analysis, 2004.

Figure 4C-2: Comparison of Estimated Capital Outlays to Reported Depreciation for 316(b) Manufacturers Survey Facilities in the Chemicals and Allied Products Sector



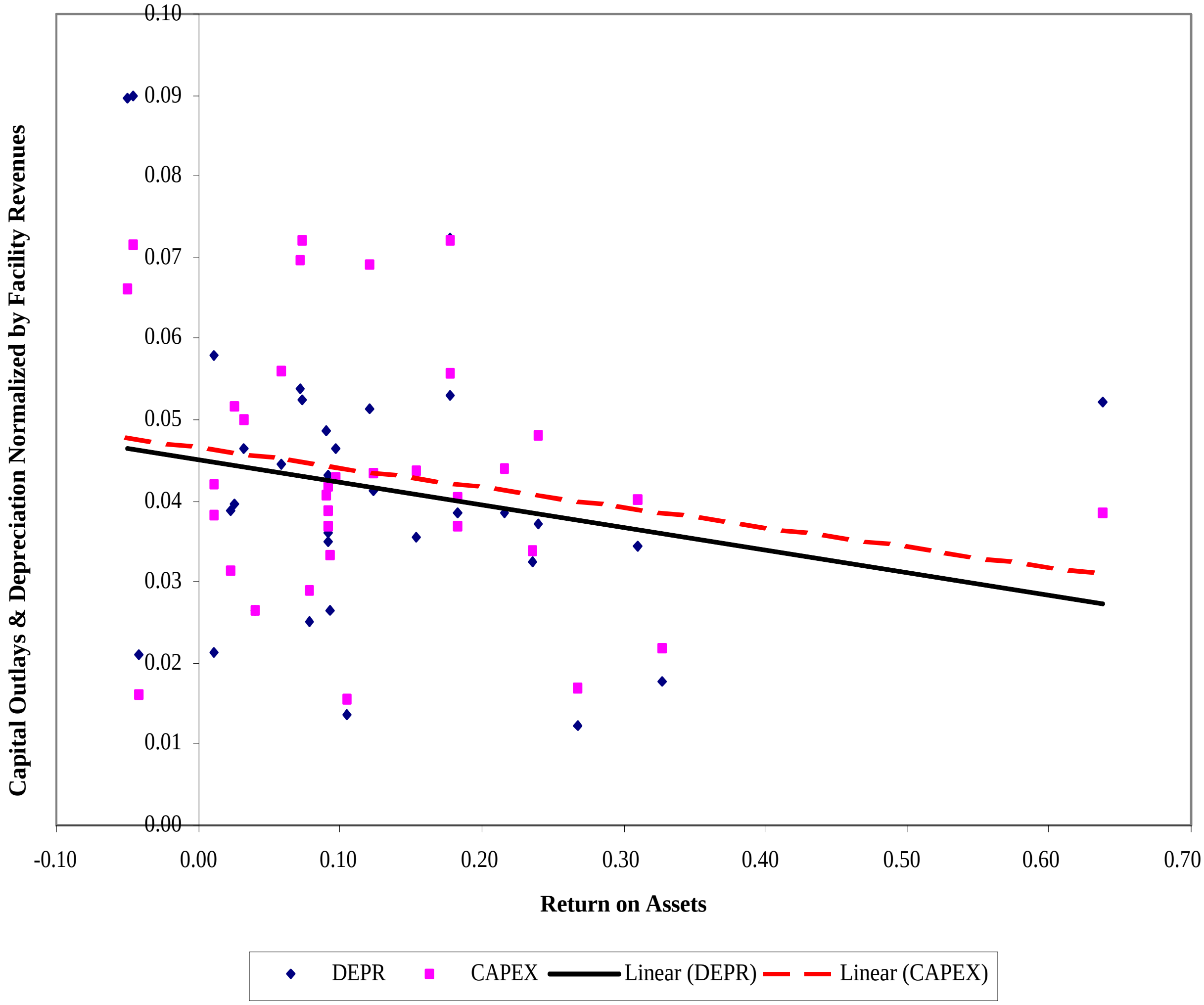
Source: U.S. EPA analysis, 2004.

Figure 4C-3: Comparison of Estimated Capital Outlays to Reported Depreciation for 316(b) Manufacturers Survey Facilities in the Petroleum and Coal Products Sector



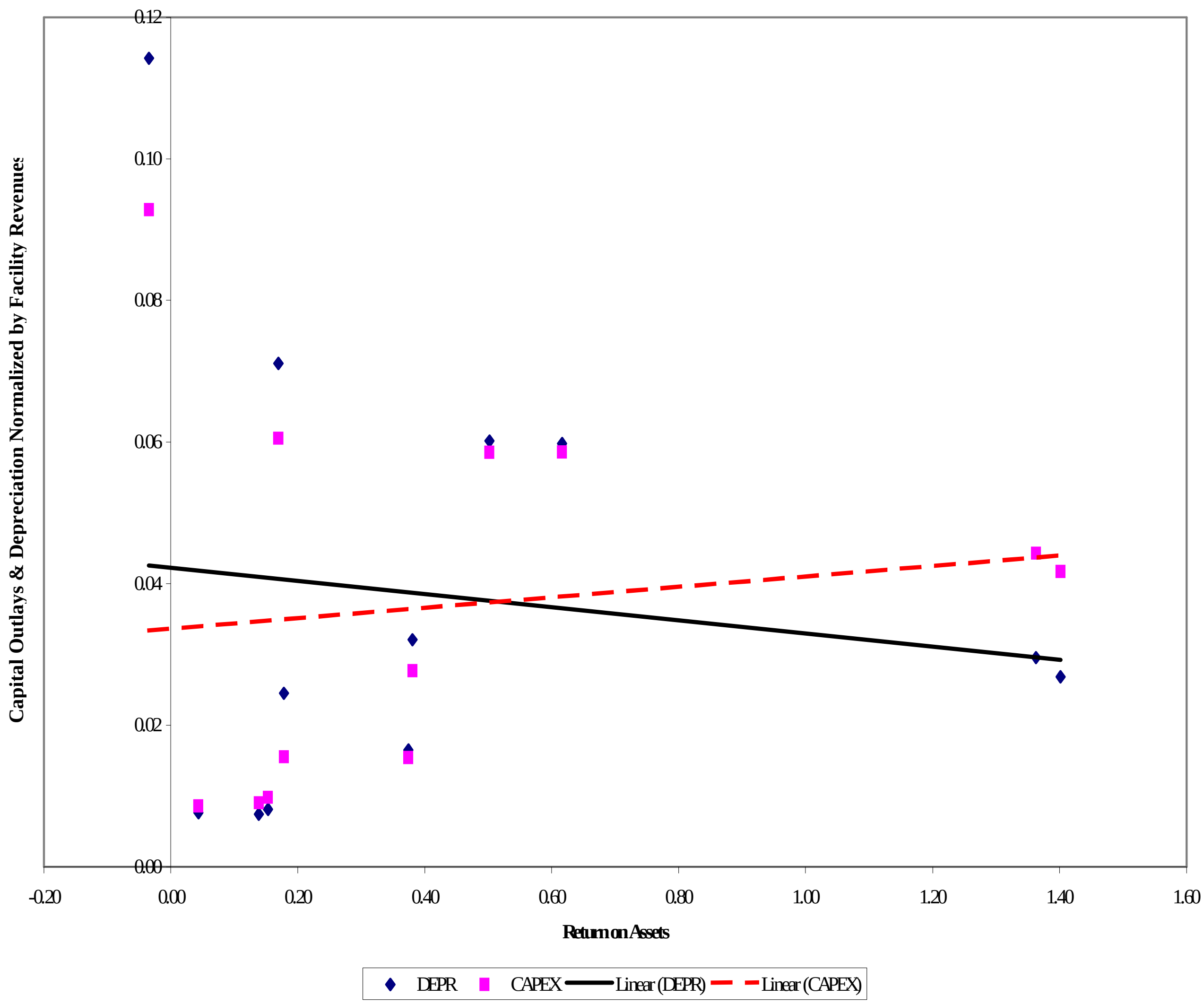
Source: U.S. EPA analysis, 2004.

Figure 4C-4: Comparison of Estimated Capital Outlays to Reported Depreciation for 316(b) Manufacturers Survey Facilities in the Primary Metal Industries Sector



Source: U.S. EPA analysis, 2004.

Figure 4C-5: Comparison of Estimated Capital Outlays to Reported Depreciation for 316(b) Manufacturers Survey Facilities in the Food and Kindred Products Sector



Source: U.S. EPA analysis, 2004.

4C.6 Updating Inputs to Estimate Capital Outlays for the Proposed Rule Analyses

For the analysis of the 2006 Phase III Final rule, EPA used the 316(b) Survey from 1996-1998, updated to 2004 dollars for the facility-specific explanatory variables. EPA followed the same concept for the current analyses, updating the facility-specific explanatory values to 2009, on the basis of the GDP deflator.

In the previous analyses, for the “General Business Environment” explanatory variables, EPA used averages of data from 1996-1998. For the current analysis, EPA updated these “General Business Environment” variables to the average of values over the period 1999-2008, the period between the end of the survey data and the time period of the proposed rule analyses. For DEBTCST, EPA took an average of the yield on 10-year BAA-rated bonds from 1999-2008 from the Federal Reserve; for CAPPRC, EPA averaged the PPI for capital goods from 1999-2008 from the Bureau of Labor Statistics; and for CAPUTIL, EPA averaged, by industry segment, annual average capacity utilization from the U.S. Census. Using this relatively long-term average for these three business environment variables is intended to account for changes in facilities’ operating environment over the past decade.

Attachment A Historical Variables Contained in the Value Line Investment Survey Dataset

All variables are provided for 10 years (except where a firm has been publicly listed for less than 10 years):

Price of Common Stock

- Revenues
- Operating Income
- Operating Margin
- Net Profit Margin
- Depreciation
- Working Capital
- Cash Flow per share
- Dividends Declared per share
- Capital Spending per share
- Revenues per share
- Average Annual Price-Earnings Ratio
- Relative Price-Earnings Ratio
- Average Annual Dividend
- Return Total Capital
- Return Shareholders Equity
- Retained To Common Equity
- All Dividends To Net Worth
- Employees
- Net Profit
- Income Tax Rate
- Earnings Before Extras
- Earnings per share
- Long Term Debt
- Total Loans
- Total Assets
- Preferred Dividends
- Common Dividends
- Book Value
- Book Value per share
- Shareholder Equity
- Preferred Equity
- Common Shares Outstanding
- Average Shares Outstanding
- Beta
- Alpha
- Standard Deviation

Appendix 4D Analysis of Other Regulations

4D.1 Regulations Potentially Affecting 316(b) Manufacturing Facilities

EPA also accounted for other environmental regulations that were recently or will soon be promulgated potentially imposing additional costs on 316(b) Manufacturing Industries beyond those reflected in facilities' baseline financial statements. The after-tax cash flow (ATCF) adjustment analysis, which EPA undertook to bring the estimates of cash flow forward from the time of the survey (1996-1998) to the time of the regulatory analysis (2008), accounts implicitly for additional regulatory costs incurred through the end of 2008. However, it does not capture the impact of new regulations that came into effect during this period and for which costs had not yet been incurred, or fully incurred, by the end of 2008.

To account for potential costs that had not been fully incurred by the end of 2008, EPA researched additional regulatory requirements that might apply to facilities in the 316(b) Manufacturing Industries, whose costs were not likely to have been captured in the ATCF adjustment analysis. This research included searching the Federal Register and the EPA website for final rules and regulations affecting the relevant NAICS groups and industry sectors within the timeframe of concern. These searches identified five regulations that apply to the 316(b) Manufacturing Industries *and* could result in additional costs to 316(b) manufacturing facilities after 2008.

Table 4D-1 below summarizes these regulations (referred to hereafter as *Other Regulations*). The following discussion uses both the regulation number presented in the first column and the abbreviated regulation name in bold in the second column.

Table 4D-1: Regulations Potentially Affecting 316(b) Manufacturers

No.	Regulation	Effective Date	Summary	316(b) Industries Affected	Compliance Date
1	National Air Emission Standards for Hazardous Air Pollutants: **Halogenated Solvent Cleaning**; Final Rule	05/07	Revises standards to limit emissions of methylene chloride (MC), trichloroethylene (TCE) and perchloroethylene (PCE) from facilities engaged in halogenated solvent cleaning	Metal manufacturers; machinery manufacturers;	Not later than 05/10
2	Revision of Source Category List for Standards Under Section 112(k) of the Clean Air Act; and National Emission Standards for Hazardous Air Pollutants for Area Sources: **Ferroalloys Production Facilities**	12/08	Revises the area source category list by changing the name of the ferroalloys production category to clarify that it includes all types of ferroalloys	Ferroalloy product manufacturers; chemical manufacturers	Not later than 06/09 for existing sources; 12/08 for new sources
3	National Emission Standards for Hazardous Air Pollutants: Area Source Standards for **Nine Metal Fabrication and Finishing Source Categories**; Final Rule	07/08	Issues national emission standards for control of hazardous air pollutants for nine metal fabrication and finishing area source categories	Metal products manufacturing	Not later than 07/11 for existing sources; 07/08 for new sources
4	National Emission Standards for Hazardous Air Pollutants: **Paint Stripping and Miscellaneous Surface Coating Operations** at Area Sources; Final Rule	01/08	Promulgates national emission standards for hazardous air pollutants (NESHAP) for area sources engaged in paint stripping, surface coating of motor vehicles and mobile equipment, and miscellaneous surface coating operations	Chemical manufacturers; metal and pipe foundries; alumina refineries; plastics material and resin manufacturers	Not later than 01/11
5	National Emission Standards for Hazardous Air Pollutants from **Petroleum Refineries**; Final Rule	10/09	Amends the national emission standards for petroleum refineries to add maximum achievable control technology standards for heat exchange systems	Petroleum refineries	Not later than 10/12 for existing sources; 10/09 for new sources

Source: Rule preambles and supporting materials. See reference section.

In addition to the five regulations listed in the *Table 4D-1*, EPA identified two regulations that apply to "new sources," i.e., new and existing but significantly reconstructed or modified facilities. The first of these regulations, Amendments to the Current Standards of Performance for Petroleum Refineries, applies to petroleum refineries that are new sources of air pollution.[118] EPA estimated the total annualized cost in the fifth year of the rule to be approximately $31 million ($2006) for new sources, comprised of 40% new processes or facilities, and 60% modified or reconstructed processes or facilities (U.S. EPA, 2008a). The second regulation, the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$ NSR), applies to petroleum refineries, chemical manufacturers, pulp and paper mills, and additional industries expected to be outside the scope of the Proposed 316(b) Existing Facilities Regulation.[119] EPA estimates that facilities within these industries may incur engineering and permitting costs as a result of the rule, but such costs would only apply to new sources of pollution. Because it is not possible to predict whether any of the existing 316(b) manufacturing facilities would undertake sufficient changes to become subject to these new source requirements, EPA judged that inclusion of the costs of these regulations in the Other Regulations analysis would be highly speculative. Further, as the potential costs of the $PM_{2.5}$ NSR are highly variable among facilities' geographical locations and

118 For details see "Standards of Performance for Petroleum Refineries; Final Rule," 73 Federal Register 122 (June 24, 2008), pp. 35838 – 35881.

119 For details see "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers (PM2.5): Final Rule." 73 Federal Register 96 (May 16, 2008). pp. 28321 – 28350.

operating capacities, it is not possible to assign these costs to in-scope Manufacturers. Consequently, EPA decided not to include these compliance costs in this analysis.

To account for the potential impact of the Other Regulations listed in *Table 4D-1* on in-scope Manufacturers, EPA determined which 316(b) industry sectors, based on the NAICS codes reported in the Federal Register notices for the regulations, that each regulation would be expected to apply to and extracted the reported per facility costs for facilities in the identified sectors. For each regulation, the per facility compliance costs were stated on an after-tax basis and subtracted from the estimated baseline free cash flow for each in-scope Manufacturer that EPA judged potentially affected by the regulation (see also *Chapter 4: Cost and Economic Impact Analysis - Manufacturers, Section 4.3*). EPA then determined if the potential costs associated with these regulations would affect either the baseline or the post-compliance determination of impact for each facility. The remainder of this appendix discusses the methodology used for this analysis and the findings.

4D.2 Methodology

4D.2.1 Determination of Applicability to 316(b) Manufacturing Facilities

EPA first identified which of the in-scope Manufacturers would potentially incur costs as a result of each of the five Other Regulations. This determination was based on the NAICS codes and/or industry description reported in either the Federal Register preamble or supporting documents of each regulation. All in-scope Manufacturers in each of the reported 6-digit NAICS sectors and/or industries are assumed to incur costs under that regulation.

EPA's assumption about the applicability of the five regulations – i.e., that an in-scope Manufacturer will incur costs under the regulation, if it belongs to a NAICS code that is subject to that regulation – is likely to overstate these regulations' additional cost burden on in-scope Manufacturers. Rules often only affect a specific part of an industry sector, depending, for example, on specific emission or discharge characteristics, or existing pollution control technology. It is therefore likely that not all in-scope Manufacturers in a given NAICS code subject to a rule would actually incur costs under that rule. However, little information is available on those technical characteristics of in-scope Manufacturers that would determine the applicability of the regulations to these facilities. To avoid potentially understating the additional cost burden of these regulations, EPA therefore assumed that all in-scope Manufacturer in the NAICS codes covered by the other regulations would incur costs under those rules.

4D.2.2 Extraction of Facility-Level Costs

As described in the earlier 316(b) Existing Facilities regulatory analysis documents, EPA considered several approaches for extracting and applying the costs of the five Other Regulations to 316(b) manufacturing facilities that might be affected by them. The cost application approach selected for each regulation depended on the level of detail that was available in the regulatory materials. Regardless of specific approach, EPA calculated the average annualized per facility cost, on an after-tax basis, for each of the regulations. Except for the Halogenated Solvent Cleaning rule, the reported implementation costs for each of the other regulations are fairly uniform across facilities; thus, average facility costs estimated for a given regulation as a whole (as opposed to for each affected NAICS or for specific facilities within a NAICS sector) should closely approximate the anticipated costs for all affected facilities. The economic analysis for the Halogenated Solvents Cleaning rule indicates that total per-facility capital costs are expected to vary between $15,000 and $800,000 ($2007), and that more than 60 percent of facilities would realize cost savings (U.S. EPA, 2008d). Due to data availability constraints, EPA used a generalized approach and subtracted the average cost savings, weighted by a 60 percent probability of a facility realizing savings, from the average annualized cost to all facilities. Actual costs incurred by a facility affected by this rule may deviate from this calculated average. *Table 4D-2* summarizes the resulting per facility costs of the five Other Regulations that were applied to 316(b) manufacturing facilities in the relevant sectors.

Table 4D-2: Per Facility Cost of Regulations that Affect 316(b) Industries[a]

No.	Regulation	Affected 316(b) NAICS Codes	Cost Application Method	Per Facility Cost (Pre-Tax; $2009)[a]
1	Halogenated Solvent Cleaning NESHAP	331, 332	➢ Average annualized cost per facility ➢ Cost recovery for 60% of facilities	$1,008
2	Ferroalloys Production Facilities NESHAP	331112, 325188	➢ Average annualized cost per facility	$2,843
3	Nine Metal Fabrication and Finishing Source Categories NESHAP	332618	➢ Average annualized cost per facility	$692
4	Paint Stripping and Miscellaneous Surface Coating Operations NESHAP	325110, 325210, 325131, 325188, 325192, 325193, 325199, 325998, 331111, 331221, 331942, 331311, 325211	➢ The cost analysis estimates a net savings for plastic parts and products, and miscellaneous parts and products manufacturers	$0
5	Petroleum Refineries NESHAP	324110	➢ Average annualized cost per facility ➢ Includes cost savings to facilities	$20,808

a. EPA used GDP Deflator published by the U.S. Bureau of Economic Analysis of the U. S. Department of Commerce to state average cost per facility in 2009 dollars.

Source: U.S. EPA Analysis, 2010

The per facility costs identified in *Table 4D-2* were then aggregated for each affected in-scope Manufacturer (based on NAICS code or individual facility identification), converted to a post-tax value, and subtracted from baseline adjusted after-tax cash flow (see discussion of the impact analysis method in *Chapter 4: Cost and Economic Impact Analysis - Manufacturers*). For all in-scope Manufacturers that were operational in the baseline under each primary analysis option, EPA determined if the additional cost of complying with the five Other Regulations would cause the facility to (1) fail the baseline test and become a "baseline closure" or (2) fail the post-compliance impact test and be considered a "severe impact" of the analysis option.

4D.3 Results

4D.3.1 Baseline Analysis

Of the 203 in-scope sample Manufacturers that are operational in the baseline and have a design intake flow of at least 2 MGD, EPA found that no additional facilities would become a baseline closure (i.e., before incurring compliance costs under the Proposed Existing Facilities Rule) due to application of the additional costs from the Other Regulations.[120]

4D.3.2 Post-Compliance Analysis

The post-compliance analysis sets aside facilities considered baseline closures. Because the adjusted baseline analysis found that no additional manufacturing facilities would be assessed as baseline closures due to application of the additional costs from Other Regulations, no additional facilities were removed from the post-compliance analysis. Of the 188 sample manufacturing facilities (i.e., those that are not considered a baseline closure *after* applying the costs of the Other Regulations), EPA found that no *additional* facilities would experience a severe impact as a result of incurring both the Proposed Existing Facilities Rule compliance costs *and* the costs of the Other Regulations.

120 This analysis excludes 15 facilities with insufficient survey-based economic data and 32 facilities determined to be baseline closures without taking into account the impact of these other regulations.

Based on this analysis, EPA concluded that consideration of the Other Regulations that might affect 316(b) Manufacturers would not alter the findings from EPA's facility impact analyses conducted in support of the Proposed 316(b) Existing Facilities Rule.

Appendix 4E Economic Impact Methodology – Manufacturers

EPA conducted an economic impact analysis of each regulatory option for the Manufacturers segment. Measures of economic impact for this segment include facility closures and associated losses in employment, financial stress short of closure, and firm-level impacts. For the 316(b) Existing Facilities proposed regulation, the potential impacts on the Manufacturers segment at the facility-level are defined in two ways:

- ***Severe impacts*** are facility closures and the associated losses in jobs at facilities that would close due to the regulation.
- ***Moderate impacts*** are adverse changes in a facility's financial position that are not threatening to its short-term viability.

In conducting these analyses, EPA closely followed the methodologies used to conduct analyses in support of the previous 316(b) rule analyses and, to the extent practicable, relied on similar data sources. This appendix details the calculations of the severe and moderate facility-level impact assessments (See *Chapter 4: Cost and Economic Impact Analysis – Manufacturers* for data inputs and analysis approach details).

4E.1 Facility-Level Impacts: Severe Impact Analysis

The assessment of severe impacts for facilities in the Manufacturers segment is based on the change in the facility's estimated business value, as determined from a discounted present value analysis of baseline cash flow and the change in cash flow resulting from regulatory compliance.

The cash flow concept used in calculating ongoing business value for the closure analysis is *free cash flow* available to all capital. Free cash flow is the cash available to the providers of capital – both equity owners and creditors – on an after-tax basis from business operations, and takes into account the cash required for ongoing replacement of the facility's capital equipment. Free cash flow is discounted at an estimated after-tax total *cost of capital* to yield the estimated business value of the facility. Details of the calculation of free cash flow and the discounting of free cash flow to yield the facility's estimated value are explained in the following sections.

4E.1.1 Calculation of Baseline Free Cash Flow and Performance of Baseline Closure Test

Calculation of baseline free cash flow and performance of the baseline closure test involved the following steps:

Average survey income statement data over response years and convert to mid-year 2004 dollars: EPA first adjusted facility income statement data for 1996, 1997, and 1998 to the year 1998, using the GDP Deflator. These data were then averaged over the months and/or years for which survey respondents reported data to develop an annual average income statement in 1998 constant dollars. For example, if a facility reported income statement data for 1996, 1997, and 1998, then a simple average was calculated for the three reported years. The annual average income statement in 1998 was then brought forward from 1998 to 2009, again using the GDP Deflator.

Calculate after-tax income excluding the effects of financial structure: The questionnaire responses include a calculation of after-tax income in accord with conventional accounting principles. However, this calculation reflects the financial structure of the business, which may include debt financing and thus interest charges against income. Because the cash flow concept to be discounted in the business value analysis is cash flow available to *all* capital, it is necessary to restate after-tax income to exclude the effects of debt financing, or on a *before-interest* basis. This restatement involves: (1) increasing after-tax income by the amount of interest charges and (2) increasing taxes (and thereby reducing after-tax income) by the amount of tax reduction provided by interest deductibility. This adjustment amounts to adding tax-adjusted interest expense to after-tax income and yields an estimate of after-tax income *independent of capital structure or financing effects*. In calculating the tax adjustment for interest, EPA used a combined federal/state corporate income tax rate. For this calculation, EPA used a tax rate that integrates the federal corporate income tax rate (35 percent) and state-specific state corporate income tax rates, based on facility location.

The combined federal/state corporate income tax rate was calculated as follows:

$$\tau = \tau_S + \tau_F - (\tau_S * \tau_F) \qquad (4E\text{-}10)$$

where:

τ	=	estimated combined federal-state tax rate;
τ_S	=	state tax rate; and
τ_F	=	federal tax rate (35 percent).

After-tax income, *before interest*, was calculated as follows:

$$ATI\text{-}BI = ATI + I - \tau I$$

or (4E-11)

$$ATI\text{-}BI = ATI + (1 - \tau)I$$

where:

ATI-*BI*	=	after-tax income *before interest*;
ATI	=	after-tax income from baseline financial statement;
I	=	interest charge from baseline financial statement; and
τ	=	estimated combined federal-state tax rate.

Calculate after-tax cash flow from operations, before interest, by adjusting income for non-cash charges: The calculation of after-tax income may include a non-cash charge for depreciation (and potentially amortization). To convert income to *after-tax cash flow (<u>ATCF</u>)* from operations, it is therefore necessary to add back any depreciation charge to the calculation of after-tax income, before interest. Cash flow, *before interest*, was calculated as follows:

$$ATCF\text{-}BI = ATI\text{-}BI + D \qquad (4E\text{-}3)$$

where:

ATCF-*BI*	=	after-tax cash flow *before interest*;
ATI-*BI*	=	after-tax income *before interest*; and
D	=	baseline depreciation.

As a final step in the calculation of after-tax cash flow before interest, EPA eliminated the implied cash flow benefit of any negative taxes, as reported in the facility's income statement and after adjustment for removal of interest. That is, in these calculations, negative taxes increase after-tax income and cash flow, and thus appear to improve the financial performance and value of the facility in terms of cash flow from operations. However, whether *and when* the implied cash flow benefit of negative taxes can be realized depends on the overall profitability and tax circumstances of the total enterprise, including any other facilities owned by the same firm, and the extent of profitability in periods before or after the survey data periods. To ensure this effect is not overstated, EPA therefore assumed that a facility would not receive the implied cash flow benefit from negative taxes – negative taxes, after adjustment for interest, were set to zero in the baseline analysis. This assumption is consistent with a later step in the post-compliance analysis in which EPA limited the cash flow benefit of tax deductions on compliance outlays not to exceed the amount of taxes paid as reported in the baseline income statement (and adjusted for interest). In theory, the application of this limit could cause some facilities that would otherwise pass the baseline closure analysis, instead to fail the analysis if the reported amount of negative tax, after adjustment for interest, would be sufficient to offset the negative cash flow from operations independent of taxes. In practice, though, this limitation did not affect the findings of the baseline closure analysis. This limit was applied as a check and did not cause a different outcome.

Adjust after-tax cash flow to reflect estimated real change in business performance from the time of survey data collection to the present: EPA adjusted facility baseline cash flow to reflect the estimated real change (i.e., independent of inflation) in business performance in the manufacturing industries from the time of the facility survey, 1996-1998, to the present.

To calculate the adjustment factor, EPA collected data on after-tax cash flow for public firms in the 316(b) manufacturing industry sectors over a 21-year period and developed adjustment factors by industry and/or key industry segment (details of this analysis are contained in *Appendix 4.B: Adjusting Baseline Facility Cash Flow*). Adjusted after-tax cash flow is calculated as follows:

$$\text{ATCF-}BI_{\text{ADJ}} = \text{ATCF-}BI * \text{Adj} \qquad (4E\text{-}4)$$

where:

$\text{ATCF-}BI_{\text{ADJ}}$	=	after-tax cash flow *before interest* adjusted to reflect the real change in business performance;
ATCF-*BI*	=	after-tax cash flow *before interest*; and
Adj	=	adjustment factor to reflect the real change in business performance.

Calculate free cash flow by adjusting after-tax cash flow from operations for ongoing capital equipment outlays: The measure of after-tax cash flow from the previous step, cash flow from operations, reflects the cash receipts and outlays from ordinary business operations, but includes no allowance for replacement of the facility's existing capital equipment. To sustain ongoing operations, however, a business must expend cash for capital replacement. Accordingly, to understand the true cash flow of a business, it is necessary to reduce cash flow from operations by an allowance for capital replacement. For the calculation of free cash flow, EPA estimated baseline capital outlays from a regression analysis of capital expenditures by public firms in the 316(b) industry sectors over an 11-year period (details of this analysis and estimation framework are contained in *Appendix 4.B: Adjusting Baseline Facility Cash Flow*). Free cash flow is calculated as follows:

$$\text{FCF} = \text{ATCF-}BI_{\text{ADJ}} - \text{CAPEX} - \text{OTHREGS} \qquad (4E\text{-}12)$$

where:

FCF	=	free cash flow
$\text{ATCF-}BI_{\text{ADJ}}$	=	after-tax cash flow *before interest* adjusted to reflect the real change in business performance; and
CAPEX	=	estimated baseline capital outlays; and
OTHREGS	=	annualized after-tax cost of compliance with Federal environmental regulations that were recently promulgated and whose costs are not likely to be reflected

fully in the ATCF adjustment analysis (Other Regulations). This variable and the associated analysis are not part of the primary case analysis but were dealt with on an alternative, sensitivity case basis.[121]

Or on a more detailed accounting statement basis:

$$FCF = REV - TC - T - \tau I - CAPEX \qquad (4E\text{-}6)$$

where:

FCF	=	free cash flow
REV	=	revenue
TC	=	total operating costs, *excluding interest, depreciation, and taxes*
T	=	baseline income tax
τ	=	estimated combined federal-state tax rate;
I	=	interest charge from baseline financial statement;
τI	=	the increase in tax liability resulting from calculating income on a pre-interest basis;
CAPEX	=	estimated annual baseline capital outlays; and
OTHREGS	=	annualized cost of other compliance with Federal environmental regulations that were recently promulgated and whose costs are not likely to be reflected fully in the ATCF adjustment analysis.

This calculation of free cash flow is based on a static representation of a facility's business. With the exception of bringing estimated cash flow forward from the time of the survey, 1996-1998, to approximately the present, 2009, the facility impact analysis assumes, in effect, that the facility's business will continue in the future – absent the effects of regulation – exactly as reflected in the baseline financial statements provided in the survey questionnaire

Calculate baseline facility value as the present value of free cash flow over a 30-year analysis horizon: To calculate baseline business value, EPA expressed free cash flow over a 30-year period in present value terms using an estimated real (i.e., excluding the effects of inflation), after-tax cost of capital of 7.0 percent. The use of 30 years as the time horizon reflects the facility-level analysis period for the 316(b) existing facilities rule. Facility baseline business value is calculated as follows:

$$VALUE = \sum_{t=0}^{29} \frac{FCF}{(1 + CoC)^t} \qquad (4E\text{-}7)$$

where:

VALUE	=	estimated baseline business value of the facility
FCF	=	free cash flow

[121] EPA also undertook an alternative case analysis in which it further adjusted baseline cash flow to reflect costs that facilities might incur from compliance with Federal environmental regulations that were recently promulgated and whose costs are not likely to be reflected fully in the ATCF adjustment analysis. This analysis, which is documented in *Appendix 4.D: Analysis of Other Regulations*, found no material effect on the facility impact analysis, as reported in this chapter. The alternative case analysis, which incorporated estimated compliance costs from the recent Federal environmental regulations, found one additional baseline closure and no change in post-compliance closures.

CoC	=	after-tax cost-of-capital (7.0 percent); and
t	=	year index, t = 0-29 (30-year discounting horizon).

In the present value calculation, yearly cash flows accrue at the beginning of the year. As a result, the first year of cash flows is already in present value terms – i.e., t = 0 for the first year of the analysis – and cash flows in the tenth and final year of the analysis period are discounted over a 29-year period – i.e., t = 29 in the final year of the analysis.

As explained above, EPA considered a facility to be a baseline closure if its estimated business value was negative before incurring regulatory compliance costs. Baseline closures were neither tested for adverse impact in the post-compliance impact analysis nor were their compliance costs included in the tally of total costs of 316(b) regulatory compliance.

4E.1.2 Calculation of Post-Compliance Free Cash Flow and Performance of Post-Compliance Closure Test

For the post-compliance closure analysis, EPA recalculated annual free cash flow, accounting for changes in revenue, annual expenses and taxes that are estimated to result from compliance-related outlays. EPA combined the post-compliance free cash flow value and the estimated compliance capital outlay in the present value framework to calculate business value on a post-compliance basis.

For the post-compliance analysis, EPA considered whether in-scope Manufacturers would be able to pass forward compliance costs to customers through increased prices. From the analyses presented in *Appendix 4A: Cost Pass-Through Analysis*, EPA concluded that an assumption of zero cost pass-through is appropriate for analyzing the impact of the regulatory analysis options on facilities in the six Primary Manufacturing Industries (this is the same assumption as applied in the previous analysis conducted in support of the 2006 Final Section 316(b) Phase III Existing Facilities Rule). Performance of the impact analysis under this assumption means that facilities must absorb all compliance-related costs and operating effects (e.g., income loss from facility shutdown during equipment installation) within their baseline cash flow and financial condition. To the extent that facilities would be able to pass on some of the compliance costs to customers through price increases, the analysis may overstate the potential impact on complying facilities.

Calculation of post-compliance free cash flow and performance of the post-compliance closure test involved the following steps:

Adjust baseline annual free cash flow to reflect compliance outlay effects: Compliance-related effects on annual free cash flow include: annual change in revenue; annually recurring operating and maintenance costs; the annual equivalent of permitting and re-permitting costs, which recur on other than an annual basis over the life of the analysis; the annual equivalent of the income loss from installation downtime; and related changes in taxes.[122] The change in taxes includes: (1) the tax effect of these annually recurring and annualized expenses and (2) the tax effect from depreciation of initial compliance outlays. For calculating the tax effect of depreciation, EPA assumed

[122] For the facility cash flow analysis, EPA treated the income loss from installation downtime on an annual equivalent basis even though this financial event occurs only once, and at the beginning of the assumed analysis period. EPA treated the installation downtime on an annualized basis for two reasons. First, the installation downtime is assumed to have a useful “financial life” of 30 years to reflect the total potential business life of the facility with the installed compliance technology (note that reinstallation of the basic capital equipment other than cooling towers, which is assumed to recur on a 10-, 20-, or 25-year interval depending on the specific technology, does not require a new round of downtime). Since compliance capital equipment is assumed to have a specific useful life and the discounted cash flow analysis is accordingly structured around this period, including the income loss from installation downtime (which is assumed to have a 30-year useful life) as a one-time up-front cost would overstate its impact in the discounted cash flow calculation. Second, calculation of the downtime cost on an annual basis allows the tax effect from the one-time income loss to be summed with other annual tax effects for applying the limit to tax offsets, as explained in the next step of the analysis.

that compliance capital outlays would be depreciated for tax purposes on a straight-line schedule equal to the assumed useful life of the technology. Post-compliance free cash flow was calculated as follows:

$$FCF_{PC} = FCF_{BL} + \Delta R - \Delta TC - \tau(- \Delta TC - \Delta D) \quad (4E\text{-}8)$$

where:

FCF_{PC}	=	post-compliance free cash flow;
FCF_{BL}	=	baseline free cash flow, as calculated above;
ΔR	=	change (increase) in revenue from pass through of compliance costs to customers[123]
ΔTC	=	change in total facility annual costs (excluding interest, depreciation and taxes), calculated as the cost of operating and maintaining compliance equipment plus the annual equivalent of certain non-annual costs, as described above;
T	=	marginal tax rate for calculating compliance-related tax effects (combined federal-state tax rate); and
ΔD	=	change in depreciation expense, calculated as compliance capital outlay (CC) divided by the useful life of the compliance technology.

Limit tax adjustment to not exceed taxes as reported in baseline financial statement: The tax effect of compliance outlays is to reduce tax liability. As a result, in the free cash flow calculation, the tax adjustment generally increases cash flow and business value and, all else equal, reduces the likelihood that a facility will fail the post-compliance closure test. However, the extent to which a facility would realize this contribution to cash flow depends on its tax circumstances. In particular, some businesses may not be paying sufficient taxes in the baseline to take full benefit of the implied tax reduction *at the facility level* – unless the unused tax loss can be transferred to other, profitable business units in the firm, these businesses would not be able to use fully the implied tax reduction on a current basis. Also, the marginal tax rate for businesses with relatively lower pre-tax income may be less than the combined Federal/State tax rate used in the analysis. While businesses may be able to carry forward tax losses to reduce taxes in later years, EPA recognizes that the implied cash flow benefit from tax reduction may not be fully realized, particularly in circumstances involving single-facility firms. To reduce the risk of over stating this tax offset benefit in its analysis and as a result potentially understating business impact, EPA therefore limited the amount of tax reduction from compliance outlays to be no greater than the amount of tax paid by facilities as reported in the baseline financial statement. The analysis effectively assumes that facilities will not be able to offset an implicit negative tax liability against positive tax liability elsewhere in the owning firm's operations or to carry forward (or back) the negative income and its implicit negative tax liability to other positive income/positive tax liability operating periods. Nevertheless, some businesses may be able to benefit from tax reductions that exceed facility baseline taxes, especially if the facility is owned by a multiple-site firm. Accordingly, EPA constrained the tax effect term in the free cash flow calculation, $[-\tau(- \Delta TC - \Delta D)]$ as specified above, to be no greater than baseline financial statement tax liability, T.

Calculate post-compliance facility value, including post-compliance free cash flow and the compliance capital outlay: As in the baseline analysis, EPA calculated post-compliance facility value as the present value of free cash flow and accounting for the compliance capital outlay as an undiscounted cash outlay in the first analysis period. Facility post-compliance business value was calculated as follows:

[123] As described above, EPA concluded that in-scope Manufacturers are likely to have little or no potential to pass through compliance costs to customers through price increases. Accordingly, this variable (ΔR) is assigned the value of *zero* in the Manufacturers impact analysis.

$$VALUE_{PC} = \sum_{t=0}^{29} \frac{FCF_{PC}}{(1+CoC)^t} - CC \qquad (4E\text{-}9)$$

where:

$VALUE_{PC}$	=	estimated post-compliance business value of the facility
FCF_{PC}	=	estimated post-compliance free cash flow
CoC	=	after-tax cost-of-capital (7.0 percent);
t	=	year index, t = 0-29 (30-year discounting horizon); and
CC	=	compliance capital outlay.

EPA considered a facility to be a post-compliance closure if its estimated business value was positive in the baseline but became negative after adjusting for compliance-related cost, revenue and tax effects. In addition to tallying closure impacts in terms of the number of estimated facility closures, EPA also measured the significance of closures in terms of losses in employment and output. Employment losses equal the number of employees reported by closure facilities in survey responses; output losses equal total revenue reported for regulatory closure facilities. EPA estimated national results by multiplying facility results by facility sample weights.[124]

4E.2 Facility-Level Impacts: Moderate Impact Analysis

The analysis of moderate impacts examined two financial measures:

<u>Pre-Tax Return on Assets (PTRA):</u> ratio of pre-tax operating income – earnings before interest and taxes (EBIT) – to assets. This ratio measures the operating performance and profitability of a business' assets independent of financial structure and tax circumstances. PTRA is a comprehensive measure of a firm's economic and financial performance. If a firm cannot sustain a competitive PTRA on a post-compliance basis, it will likely face difficulty financing its investments, including the outlay for compliance equipment.

<u>Interest Coverage Ratio (ICR):</u> ratio of pre-tax operating cash flow – earnings before interest, taxes, and depreciation (EBITDA) – to interest expense. This ratio measures the facility's ability to service its debt on the basis of current, ongoing financial performance and to borrow for capital investments. Investors and creditors will be concerned about a firm whose operating cash flow does not comfortably exceed its contractual obligations. As ICR increases, the firm's general ability to meet interest payments and carry credit also increases. ICR also provides a measure of the amount of cash flow available for equity after interest payments.

Creditors and equity investors review the above two measures as criteria to determine whether and under what terms they will finance a business. PTRA and ICR also provide insight into a firm's ability to generate funds for compliance investments from internally generated equity, i.e., from after-tax cash flow. The following sections detail the calculation and development of these threshold values.

4E.2.1 Calculation of Moderate Impact Metrics

EPA calculated a firm's PTRA and ICR measures using data collected from the 316(b) industry survey, adjusted for inflation to 2009. The two measures are defined as follows:

[124] For the analysis of options presented in this chapter, none of these impact measures (e.g., employment loss, output loss) were in fact relevant because none of the three regulatory analysis options resulted in regulatory closures.

Pre-Tax Return on Assets

$$PTRA = \frac{EBIT}{TA} \quad \text{(4E-10)}$$

where:

PTRA	=	pre-tax return on assets,
EBIT	=	pre-tax operating income, or *earnings before interest and taxes*, and
TA	=	total assets.

Or, stated in terms of income statement accounts,

$$PTRA = \frac{REV - (TC + D)}{TA} \quad \text{(4E-11)}$$

where:

PTRA	=	pre-tax return on assets;
REV	=	revenue;
TC	=	total operating costs (excluding interest, taxes, and depreciation/amortization);
D	=	depreciation; and
TA	=	total assets.

Interest Coverage Ratio

$$ICR = \frac{EBITDA}{I} \quad \text{(4E-113)}$$

where:

ICR	=	interest coverage ratio;
EBITDA	=	pre-tax operating cash flow, or *earnings before interest, taxes, and depreciation (and amortization)* and
I	=	interest expense.

Or, stated in terms of income statement accounts,

$$ICR = \frac{REV - TC}{I} \quad \text{(4E-13)}$$

where:

ICR	=	interest coverage ratio;
REV	=	revenue;
TC	=	total operating costs (excluding interest, taxes, and depreciation/amortization); and

I	=	interest expenses.

Including the effects of 316(b) compliance costs, post-compliance PTRA and ICR are:

$$PTRA_{pc} = \frac{[REV - (TC + \Delta TC + D + \Delta D)]}{(TA + CC)} \quad (4E\text{-}14)$$

$$ICR_{pc} = \frac{[REV - (TC + \Delta TC)]}{(I + \Delta I)} \quad (4E\text{-}15)$$

where:

PTRApc	=	pre-tax return on assets, post-compliance;
ICRpc	=	interest coverage ratio, post-compliance;
ΔTC	=	change in total facility operating costs (excluding interest, depreciation and taxes), calculated as operating and maintenance costs of compliance;
ΔD	=	change in depreciation expense, calculated as compliance capital outlay (CC) divided by 10;
CC	=	compliance capital outlay (assuming all of the outlay would be capitalized and reported as an addition to assets on the balance sheet); and
ΔI	=	incremental interest expense from financing of compliance capital outlay. As a simplifying, conservative assumption, incremental interest expense is calculated assuming that the compliance capital outlay is fully debt-financed at the overall real cost-of-capital of 7.0 percent. The annual incremental interest value is calculated as the annualized value of interest payments over 10 years, assuming a constant annual payment of principal and interest.

In calculating the baseline values of the PTRA and ICR measures, EPA applied the same cash flow adjustments as described above for the Manufacturers facility closure analysis, to the numerators of the PTRA and ICR measures. In the same way as described for the closure analysis, these adjustments are intended to capture the change in the financial performance of firms in the Primary Manufacturing Industries between the time of the 316(b) Phase III survey and 2008 (see *Appendix 4.B: Adjusting Baseline Facility Cash Flow*).

4E.2.2 Developing Threshold Values for Pre-Tax Return on Assets (PTRA)

Pre-tax return on total assets measures management's effectiveness in employing the capital resources of the business to produce income. A low ratio may indicate that a borrower would have difficulty financing treatment investments and continuing to attract investment.

The following data from Risk Management Association *Annual Statement Studies* were used to calculate PTRA:

- *% Profit Before Taxes / Total Assets*$_{25th}$ Ratio of profit before taxes divided by total assets and multiplied by 100 for the lowest quartile of values in each 6-digit NAICS code.
- *Operating Profit* Gross profit minus operating expenses.
- *Profit Before Taxes* Operating profit minus all other expenses (net).

RMA provides a measure of pre-tax return on assets that approximates the measure EPA defined for the moderate impact analysis. As defined by RMA, this measure is the ratio of pre-tax *income* to assets, designated ROA_{RMA}:

$$ROA_{RMA} = \text{Pre-Tax Income (EBT)} / ASSETS_{25th}$$

However, as defined by EPA for its analysis, the numerator of the PTRA measure requires the use of earnings before interest and taxes (EBIT) instead of pre-tax income (EBT). Defined as EBIT, the PTRA numerator will capture all return from assets, whether going to debt or equity. To derive a pre-tax, total return value, EPA adjusted RMA's measure of PTRA using the median percentage values of EBIT and EBT available from RMA. This adjustment yields the PTRA measure that EPA used in the moderate impact analysis, designated $ROA_{316(b)}$:

$$ROA_{316(b)} = ROA_{RMA} * EBIT / EBT$$

Negative values are included in the weighted-industry PTRA averages but a different method is used to adjust the ROA values reported in RMA to the value used in the moderate impact analysis. Specifically, using only those observations (i.e., 6-digit NAICS code and year combinations) with positive values for % Profit Before Taxes / Total Assets, Operating Profit, and Profit Before Taxes, EPA calculated an adjustment factor by subtracting the difference between $ROA_{316(b)}$ and ROA_{RMA} as follows:

$$ROA_{316(b)} - ROA_{RMA} = \text{adjustment factor.}$$

Those values were consolidated into industry-specific adjustment factors, weighted by 2007 value of shipments from the Economic Censuses (U.S. DOC, 2002). Each negative PTRA observation from RMA was adjusted by its industry specific adjustment factor to approximate the measure used in the moderate impact analysis:

$$ROA_{RMA} + \text{industry specific adjustment factor} = ROA_{316(b)}$$

The industry specific adjustment factors average 0.41 and range from 0.23 for the Chemicals and Other sectors to 0.61 for the Aluminum industry.

4E.2.3 Developing Threshold Values for Interest Coverage Ration (ICR)

Interest coverage ratio measures a business' ability to meet current interest payments and, on a pro-forma basis, to meet the additional interest payments for new debt. A high ratio may indicate that a borrower would have little difficulty in meeting the interest obligations of a loan. This ratio serves as an indicator of a firm's capacity to take on additional debt, as might be required to finance installation of compliance technology.

The following data from Risk Management Association *Annual Statement Studies* were used to calculate ICR:

- *EBIT/Interest*$_{25th}$ — Ratio of earnings (profit) before annual interest expense and taxes (EBIT) divided by annual interest expense for the lowest quartile of values in each 6-digit NAICS code.
- *% Depr., Dep., Amort./Sales*$_{med}$ — Median ratio of annual depreciation, amortization and depletion expenses divided by net sales and multiplied by 100.
- *Operating Profit* — Gross profit minus operating expenses.

RMA provides a measure of interest coverage that approximates the measure that EPA defined for the moderate impact analysis. As defined by RMA, this measure is the ratio of earnings before interest and taxes to interest, designated ICR_{RMA}:

$$ICR_{RMA} = EBIT / INTEREST_{25th}$$

However, as defined by EPA for its analysis, the numerator of the ICR measure requires the use of earnings before interest, taxes, depreciation, and amortization (EBITDA) instead of earnings before interest and taxes (EBIT). Defined this way, the ICR numerator will include all operating cash flow that could be used for interest payments. To derive the desired ICR value (designated $ICR_{316(b)}$), EPA adjusted the RMA value as outlined below:

$$ICR_{316(b)} = EBITDA / INTEREST$$

Therefore, $ICR_{316(b)} = ICR_{RMA} * (EBIT + DA) / EBIT$

or $ICR_{316(b)} = ICR_{RMA} * \{1+ [(DA / SALES) / (EBIT / SALES)]\}$

For consistency of calculation, EPA used the median values available from RMA for the adjusting both the numerator (DA / SALES) and denominator (EBIT / SALES) terms.[125]

EPA used the same method as described above to adjust the negative ICR values reported in RMA to the value used in the moderate impact analysis. Including only those observations with positive values for EBIT/Interest, % Depr., Dep., Amort./Sales, and Operating Profit, an adjustment factor was calculated by subtracting the difference between $ICR_{316(b)}$ and ICR_{RMA} as follows:

$$ICR_{316(b)}-ICR_{RMA} = \text{adjustment factor.}$$

An industry specific adjustment factor was calculated for ICR values similar to the PTRA. Each negative ICR observation from RMA was adjusted by its industry specific adjustment factor to approximate the measure used in the moderate impact analysis:

$$ICR_{RMA} + \text{industry specific adjustment factor} = ICR_{316(b)}$$

The industry specific adjustment factors average 0.66 and range from 0.51 for the Steel and Petroleum industries to 1.2 for the Food industry.

[125] Numerator (% Depr., Dep., Amort./Sales) is available for quartile values; denominator (Operating Profit) only for median values.

5 Cost and Economic Impact Analysis – Electric Generators

5.1 Analysis Overview

This chapter assesses the expected economic impact of the Proposed 316(b) Existing Facilities Rule options on the Electric Generators segment of in-scope facilities. EPA performed this assessment in two parts:

1. A cost and economic impact assessment reflecting baseline operating characteristics of in-scope facilities and with assignment of estimated compliance costs to those facilities. This analysis assumes no changes in those baseline operating characteristics – e.g., level of electricity generation and revenue – as a result of the requirements of the proposed regulatory options. This analysis, which is documented in this chapter, includes five specific analyses:

- A cost-to-revenue screening analysis to assess the impact of compliance outlays on individual in-scope facilities (*Section 5.2*)
- A cost-to-revenue screening analysis to assess the impact of compliance outlays on domestic parent-entities owning in-scope facilities (*Section5.3*)[126]
- An assessment of the potential electricity rate impact of compliance costs to the residential sector (*Section 5.4*)
- An assessment of the potential electricity rate impact of compliance costs, across sectors (*Section 5.5*).
- An assessment of reduction in availability of generating capacity due to downtime associated with the installation of compliance technology and the impact of that capacity reduction on the North American bulk power system (*Section 5.6*).

2. A broader electricity market-level analysis based on the Integrated Planning Model (IPM) is discussed in *Chapter 6: Electricity Market Model Analysis* (the Market Model Analysis). Unlike the preceding analysis, the Market Model Analysis accounts for expected changes in the operating characteristics of facilities from both:

- Estimated changes in electricity markets and operating characteristics of facilities *independent of the considered regulatory options* and
- Estimated changes in markets and operating characteristics of facilities *as a result of the considered regulatory options*.

In conducting these analyses, EPA closely followed the methodologies used to conduct analyses in support of the previous 316(b) regulatory analyses, and, to the extent possible, relied on the same data sources.

5.2 Cost-to-Revenue Analysis: Facility-Level Screening Analysis

The cost-to-revenue measure compares the cost of reducing adverse environmental impact from the operation of the facility's cooling water intake structure (CWIS) with its operating revenue, and provides a screening-level assessment of the impact of the regulatory options.[127]

[126] The purpose of the cost-to-revenue assessments is to provide an indication of the relative magnitude of the compliance costs controlling for the size or market share of the firm, and not to predict closures and/or other types of economic impact on facilities expected to be subject to the Proposed Existing Facilities Rule options.

5.2.1 Analysis Approach and Data Inputs

As described in *Chapter 3: Development of Costs for Regulatory Options*, EPA expects in-scope Electric Generators would comply during a 15-year window, from 2013 through 2027, depending on the regulatory option analyzed. However, for the facility-level cost-to-revenue analysis, EPA used a single assumed compliance year, 2015, as the basis for the analysis. Specifically, EPA compared annualized after-tax compliance costs, calculated under the assumption that all facilities would achieve compliance as of 2015 and stated on a present value basis as of 2015 (see *Chapter 3: Development of Costs for Regulatory Options*), with estimated 2015 facility revenue.[128] EPA selected 2015 as the assumed compliance year for this analysis based on the following considerations. First, 2015 is approximately mid-way through the period in which facilities assigned only IM technology are expected to achieve compliance (2013-2017) and therefore closely reflects the operating conditions of these in-scope facilities at the time of compliance (see *Chapter 3: Development of Costs for Regulatory Options*). Second, although facilities assigned cooling towers are expected to comply during windows of time that are farther into the future (2018-2022 for non-nuclear facilities and 2023-2027 for nuclear facilities), EPA was not confident in the reliability of projecting compliance cost and revenue values beyond 2015 and consequently, used 2015 as the impact analysis year for facilities assigned cooling towers as well. Thus, the estimated costs of technology installation and compliance, overall, are calculated as of 2015 for purposes of the cost-to-revenue analysis, regardless of the specific window of years in which facilities would be expected to achieve compliance and incur compliance costs.[129]

To be consistent with the compliance cost estimates, EPA used 2015 as the basis of the revenue estimate to be used in the facility-level cost-to-revenue comparison. For all Electric Generators modeled in the Integrated Planning Model (IPM), EPA used the average of facility-specific *baseline* (i.e. pre-regulation) projections from IPM analysis for the 2015, 2020, 2025, and 2028.[130,131] This revenue estimate captures expected changes in electricity markets and in the utilization of facilities subject to the regulatory options in the period following rule promulgation. To estimate facility-level revenue for facilities not modeled in IPM or for which IPM reported no revenue, EPA used revenue estimates developed from EIA data on electricity generation by prime mover and utility-level electricity prices.

For this analysis, EPA brought all cost and revenue values to the cost-to-revenue analysis year of 2015, and expressed them in 2009 dollars to provide cost and revenue comparisons on a consistent analysis-year and dollar-year basis as described in *Chapter 3: Development of Costs for Regulatory Options*. EPA performed the following adjustments:

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127 In conducting this analysis, EPA relied on the cost-to-revenue impact analysis concept as outlined in *Guidelines for Preparing Economic Analyses* available online at http://yosemite.epa.gov/ee/epa/eed.nsf/pages/Guidelines.html/$file/Guidelines.pdf (U.S. EPA, 2010c).

128 For private, tax-paying entities, *after-tax costs* are a more relevant measure of potential cost burden than *pre-tax costs*. For non tax-paying entities (e.g., State government and municipality owners of in-scope facilities), the estimated costs used in this calculation include no adjustment for taxes.

129 Because this analysis relies on a ratio of cost to revenue as opposed to absolute values, a cost to revenue ratio for a given facility will be the same in years beyond the selected analysis year as long as cost and revenue values are as of the same year and the basis for projecting cost and revenue values is the same, going forward from the selected analysis year. That is, beyond the selected analysis year, cost and revenue values are assumed to change at the same rate and thus the ratio of these values will be constant.

130 The Integrated Planning Model (IPM) is a comprehensive model of the electric power sector. As described above and in the following chapter, EPA used IPM to assess the market-level impact of the 316(b) Existing Facilities Rule options (See *Chapter 6: Market Model Analysis*).

131 To develop average values for each statistic – i.e., energy revenue and capacity revenue – over the data years, EPA set aside from the averaging calculation values for years that are anomalously low, i.e., more than 30 percent below the 4-year average values

- For facilities for which electricity revenue values were developed from EIA data (i.e., not obtained from IPM), EPA developed these values as the average of estimated revenue values over the period 2003 to 2007.[132] The EIA data are reported in nominal dollars of each year so, EPA's first step in this calculation was to restate these values in 2009 dollars using the GDP deflator index published by the U.S. Bureau of Economic Analysis (BEA). These individual yearly values were then averaged and brought forward to 2015 using electricity price projections from the Annual Energy Outlook publication for 2009 (*AEO2009*).[133] Because the *AEO2009* electricity price projections are in constant dollars, these adjustments yield revenue values at 2015 in dollars of the year 2009.
- For facilities where electricity revenue values were obtained from IPM, IPM provided revenue estimates as of 2015, 2020, 2025, and 2028 but denominated in 2006 dollars. The Agency assumed that these revenue values are, on average, equivalent to values in 2015. Thus, no adjustment was applied to bring the values to the 2015 analysis year. However, as described below, a further adjustment was needed to state the IPM revenue estimates, which are initially stated in 2006 dollars, in 2009 dollars.
- Compliance technology cost values, which were originally estimated as of 2009, were adjusted over time to the cost-to-revenue analysis year, 2015, using the Construction Cost Index (CCI) from McGraw Hill Construction. EPA used the average of the year-to-year changes in the CCI over the most recent ten-year reporting period to bring these values to 2015. Because the CCI is a nominal cost adjustment index, the resulting technology cost values are as of the assumed year of compliance, 2015, and in 2015 dollars.
- Administrative cost values were also brought forward to the cost-to-revenue analysis year, 2015, using the Employment Cost Index (ECI) published by the Bureau of Labor Statistics. This adjustment was performed using the average of the year-to-year changes in the ECI over the most recent ten-year reporting period. The resulting administrative cost values are as of the assumed year of compliance, 2015, and in 2015 dollars.
- The above adjustments yield revenue and cost values in dollars of varying years, depending on the underlying estimation approach and adjustment concept. Because EPA performed the cost and economic impact analysis in constant dollars of the year 2009, a further adjustment was needed to restate these projected cost and revenue values in 2009 dollars. To state IPM revenue values in 2009 dollars, EPA used the BEA GDP deflator. To state compliance cost values in 2009 dollars, the Agency used the average of the year-to-year changes in the GDP Deflator index over the most recent ten-year reporting period.
- The resulting facility-level compliance cost and revenue values are as of 2015 in 2009 dollars.

In the cost-to-revenue comparisons, EPA used cost-to-revenue thresholds of 1 and 3 percent as markers of potentially significant impact.[134] EPA compared facility-level costs and revenue *on a non-weighted basis* and determined the number of instances in which facilities incurred costs in ranges of "less than 1 percent of revenue," "between 1 and 3 percent of revenue," and "greater than 3 percent of revenue." EPA applied facility-level sample weights (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses* for a

[132] In using the year-by-year revenue values to develop an average over the data years, EPA set aside from the average calculation, revenue values that are anomalously low based on very low generating output from a generating unit in a given year. Such low generating output would likely result from a generating unit being out of service for maintenance.

[133] Annual Energy Outlook is published by the Energy Information Administration (EIA). AEO2009 contains projections and analysis of U.S. energy supply, demand, and prices through 2030; these projections are based on results from the Energy Information Administration's National Energy Modeling System.

[134] The cost and economic impact analysis for the suspended 2004 Phase II Final Rule also used 1 and 3 percent cost-to-revenue thresholds as markers of potentially significant impact.

discussion on weights development and application) to the individual facility counts within each impact category to estimate the number of facilities at the population-level incurring these cost burdens.[135]

5.2.2 Key Findings for Regulatory Options

Table 5-1 reports facility-level cost-to-revenue results by North American Reliability Corporation (NERC) region and regulatory option.[136] EPA estimates that the majority of Electric Generators subject to the Proposed Existing Facilities Rule will on average incur annualized costs of *less than* 1 percent of revenue under Option 1 (86 percent); this finding applies to all NERC regions. The Agency estimates that the majority of in-scope facilities under Options 2 (60 percent) and 3 (69 percent) will incur annualized costs exceeding 3 percent of revenue. Under Option 2, this finding applies to all but three NERC regions – MRO, SPP, and WECC – while under Option 3 this finding applies to all NERC regions except SPP and WECC. Under Options 2 and 3, all in-scope Electric Generators in HICC are expected to incur costs exceeding 3 percent of revenue.

135 The specific facility-level weights used in this analysis are the facility count-based weights (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).

136 NERC is responsible for the overall reliability, planning, and coordination of the power grids; it is organized into regional councils that are responsible for the overall coordination of bulk power policies that affect their regions' reliability and quality of service (see *Chapter 2.H: Profile of the Electric Power Industry*). As noted previously, NERC region definitions have recently changed.

Table 5-1: Facility-Level Cost-to-Revenue Analysis Results by NERC Region and Regulatory Option[a,b]

NERC Region	Total Number of Facilities[c]	No Revenue[d]	Number of Facilities with a Ratio of <1%	1-3%	>3%	Minimum Ratio	Maximum Ratio
Option 1: IM Everywhere							
ASCC	0	0	0	0	0	0.00%	0.00%
ERCOT	42	5	28	7	2	0.00%	3.28%
FRCC	25	0	18	4	4	0.00%	3.49%
HICC	3	0	2	2	0	0.34%	1.04%
MRO	46	0	43	4	0	0.00%	1.80%
NPCC	63	0	49	14	0	0.00%	2.64%
RFC	164	0	148	13	3	0.00%	3.58%
SERC	157	0	146	6	5	0.00%	3.61%
SPP	34	0	28	6	0	0.00%	2.38%
WECC	23	0	19	0	4	0.00%	3.38%
Total	**559**	**5**	**481**	**55**	**18**	**0.00%**	**3.61%**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD							
ASCC	0	0	0	0	0	0.00%	0.00%
ERCOT	42	5	5	1	31	0.00%	43.39%
FRCC	25	0	5	4	16	0.00%	35.37%
HICC	3	0	0	0	3	3.87%	8.48%
MRO	46	0	20	6	20	0.00%	10.96%
NPCC	63	0	15	10	38	0.00%	37.53%
RFC	164	0	47	15	102	0.00%	12.50%
SERC	157	0	44	14	100	0.00%	24.23%
SPP	34	0	11	6	17	0.00%	49.66%
WECC	23	0	19	0	4	0.00%	40.10%
Total	**559**	**5**	**166**	**55**	**333**	**0.00%**	**49.66%**
Option 3: I&E Mortality Everywhere							
ASCC	0	0	0	0	0	0.00%	0.00%
ERCOT	42	5	5	1	31	0.00%	43.39%
FRCC	25	0	5	4	16	0.00%	35.37%
HICC	3	0	0	0	3	3.87%	8.48%
MRO	46	0	6	7	33	0.00%	18.38%
NPCC	63	0	0	9	55	1.22%	37.53%
RFC	164	0	38	8	119	0.00%	51.38%
SERC	157	0	29	22	106	0.00%	28.47%
SPP	34	0	11	6	17	0.00%	49.66%
WECC	23	0	17	0	6	0.00%	40.10%
Total	**559**	**5**	**112**	**57**	**386**	**0.00%**	**51.38%**

a. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.
b. Facility counts may not add up due to rounding.
c. Facility counts exclude baseline closures.
d. IPM and EIA report no revenue for 2 facilities (5 on a weighted basis); consequently, the facility-level cost-to-revenue analysis is performed for 257 facilities (559 on a weighted basis).
Source: U.S. EPA Analysis, 2010

5.2.3 Uncertainties and Limitations

Given the large number of implicitly analyzed facilities, it is impossible to develop sample weights that accurately account for all economic and operating differences of these facilities. Specifically, the facility count-based weights used for this analysis account only for the number of facilities within each NERC region (*Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*). The actual compliance costs assigned to each of the explicitly analyzed facilities may differ from the costs that would be assigned to the implicitly analyzed facilities they represent. Consequently, the facility counts in each impact magnitude group may be over- or under-estimated.

5.3 Cost-to-Revenue Screening Analysis: Parent Entity-Level Analysis

EPA also assessed the economic impact of the proposed regulatory options at the parent entity (firm) level. The cost-to-revenue screening analysis at the entity level provides insight on the impact of compliance requirements on those firms that own multiple facilities.[137]

5.3.1 Analysis Approach and Data Inputs

To assess the entity-level economic/financial impact of compliance requirements, EPA aggregated compliance costs to the level of the parent entity identified as the owner of the explicitly analyzed in-scope facilities and compared these costs to parent entity revenue. As described for the facility-level analysis above, EPA used cost-to-revenue thresholds of 1 and 3 percent as markers of potentially significant impact for this analysis. This analysis involved the following steps.

Determining the Parent Entity and Parent Entity Revenue

EPA determined the highest level domestic parent entity for each in-scope Electric Generator (548 facilities).[138] EPA performed this determination both for the explicitly and implicitly analyzed Electric Generators (for a discussion on explicitly and implicitly analyzed facilities and on the use of sample weights, see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).[139] As described below, the determination for both categories of facilities was needed to support an estimate of entity level impact that reflects the number of parent entities for not only the explicitly analyzed Electric Generators and associated parent entities but also for the implicitly analyzed Electric Generators and associated parent entities. EPA determined ownership using the following data sources:

- EIA-861 databases for 2003 through 2007
- EIA-860 database for 2007
- finance.google.com/finance
- www.hoovers.com
- www.selectory.com
- Corporate websites

EPA developed parent entity-level revenue values using the following sources:

- For publicly owned utilities, for which revenue from corporate websites was not available, EPA used 2003-2007 average revenue (retail plus wholesale) from EIA-861 database
- For revenue of privately owned entities, the Agency used corporate websites, Google Finance, Hoovers, and Selectory.com (in that order)

For 10 identified parent entities, which are owned ultimately by non-U.S. firms, EPA could not obtain revenue for a domestic entity but did obtain revenue at the level of the *international* parent entity; for these 10 entities, the Agency used the international entity revenue in the cost-to-revenue analysis. EPA developed parent entity-level

[137] In conducting this analysis, EPA relied on cost-to-revenue impact analysis as outlined *in Guidelines for Preparing Economic Analyses* available online at http://yosemite.epa.gov/ee/epa/eed.nsf/pages/Guidelines.html/$file/Guidelines.pdf (U.S. EPA 2010),.but applied this analysis at the level of the parent entity.

[138] These are non-retired Electric Generators that responded to either the 2000 316(b) Detailed Questionnaire (DQ) or the 2000 316(b) Short Technical Questionnaire (STQ). EPA found that the remaining 108 facilities that responded to the DQ and the STQ have retired since the survey (see *Chapter 3: Development of Costs for Regulatory Options* for more details). This number is not a weighted estimate.

[139] The "explicitly analyzed" facilities are those for which costs were specifically estimated. The "implicitly analyzed" facilities are accounted for through application of sample weights to the "explicitly analyzed" facilities.

revenue values from 2006 - 2008 financial reports and converted revenue values to dollar year 2009 using the Electric PPI; therefore, all values are stated in 2009 dollars. Although the entity-level revenue values might reasonably be expected to change in the future in a way that differs from a general price index – e.g., according to the Electric PPI or GDP Deflator – EPA was less confident in the reliability of projecting values *at the entity level* using the PPI than in the facility-level projections outlined in the preceding section. As a result, for the entity-level analysis, EPA did not project or further adjust the 2009 entity-level revenue values but used these values *as is* for the cost-to-revenue analysis. This *non-adjustment* assumes in effect that the change over time in *entity-level* revenue will match the change in general inflation.

Estimating Compliance Costs at the Level of the Parent Entity

As described in the preceding section, compliance cost values were brought to the analysis year 2015 and restated, as necessary, in 2009 dollars.

EPA assessed the potential impact of the regulatory options on parent entities by comparing the estimated entity-level annualized compliance cost to entity-level revenue for each of the entities identified as owning explicitly and implicitly analyzed facilities. To calculate entity-level cost, EPA summed the after-tax annualized compliance cost for the explicitly analyzed facilities owned by these entities. EPA followed two approaches in aggregating compliance costs to the level of the owning entity:

1. EPA applied facility-level sample weights to the estimated costs for the explicitly analyzed facilities – these are the facilities for which EPA explicitly estimated costs (for a discussion on sample weights development and application see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).[140] In effect, this analysis assumes that a parent entity identified as owning one or more explicitly analyzed facilities is assumed to own and incur the compliance costs for those explicitly analyzed facilities *and* the implicitly analyzed facilities that are represented by the sample weights applied to the costs for the explicitly analyzed facilities. *This analysis will likely overstate impacts on the identified parent firms.*
2. EPA used only the estimated costs for the explicitly analyzed facilities without application of sample weights and aggregated costs to the level of the parent firm for only those explicitly analyzed in-scope facilities. *This analysis may understate impacts on the identified parent firms.*

To assess whether these parent entity-level costs could constitute a *significant impact*, EPA assessed whether the parent-level costs exceed 1 percent or 3 percent of entity-level revenue.

Estimating the Number of Parent Entities Incurring Potentially Significant Impacts

The preceding steps yield the number of parent entities identified as owning explicitly analyzed facilities that would incur total costs exceeding a given *impact* threshold: costs exceeding 1 percent of revenue or 3 percent of revenue. However, the number of parent entities identified as owning explicitly analyzed facilities – and for which this impact analysis is undertaken – is less than the number of parent entities in the total population of entities owning *both* explicitly and implicitly analyzed facilities. Thus, an analysis that does not account for the parent entities that own *only* implicitly analyzed facilities may understate the absolute number of parent entities incurring a given level of cost-to-revenue impact.

To account for those parent entities that own only implicitly analyzed facilities – and thus are not directly captured in the explicitly analyzed facility-based analysis – EPA developed *entity-level weights* to extrapolate the findings from the explicitly analyzed entity analysis to the total population of entities, including those that own at least one explicitly analyzed facility or own only implicitly analyzed facilities (for a discussion on entity-level

[140] The specific facility-level weights used in this analysis are the facility count-based weights (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).

weights development see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*). Applying these entity-level weights to the number of parent entities owning explicitly analyzed facilities assessed in the various cost impact categories yields an estimate of the number of parent entities including those that own implicitly analyzed facilities. However, as described in the following section, combining the *entity-level* weights with the *facility-level* weights is not straightforward in estimating the number of small parent entities incurring costs in the specified cost-to-revenue ranges.

Combining the Facility-Level and Entity-Level Weights in the Small Entity Impact Analysis

Estimating the number of parent entities that may incur costs in the specified cost-to-revenue ranges requires combining the facility-level and entity-level weights outlined above. As outlined above, two weighting approaches are applicable for each of the two analytic steps:

1. The number of facilities and costs at the level of the entity may be estimated:

- Without application of *facility* weights to the explicitly analyzed facilities assigned to a given parent entity
- With application of *facility* weights to the explicitly analyzed facilities assigned to a given parent entity.

2. The number of entities incurring costs in the specified cost-to-revenue ranges may be estimated:

- Without application of *entity* weights
- With application of *entity* weights.

Given that two weighting approaches are applicable at each of the two analytic steps, *four* combinations of facility-level and entity-level weights are possible. None of the four combinations provide a conceptually perfect estimate of the number of entities incurring costs – from the ownership of in-scope facilities – in the specified cost-to-revenue ranges. *Table 5-2* summarizes the possible combinations and the issues associated with each possibility.

Table 5-2: Issues in Combining Facility- and Entity-Level Weights in the Small Entity Impact Analysis

<table>
<tr><th colspan="2"></th><th colspan="2">Facility Weighting Approaches</th></tr>
<tr><th colspan="2"></th><th>Without Use of Facility Weights</th><th>With Use of Facility Weights</th></tr>
<tr><td rowspan="2">Entity Weighting Approaches</td><td>Without Use of Entity Weights</td><td>Combination 1
➢ Doesn’t account for all estimated facilities, their compliance costs, or the entities that own them
➢ May underestimate the number of facilities owned by a parent entity and the associated compliance costs incurred by the parent entity
➢ May underestimate the number of parent entities falling in a given cost-to-revenue impact range</td><td>Combination 2
➢ Accounts for all estimated facilities and their compliance costs
➢ Doesn’t account for all of the entities that own complying facilities
➢ May overestimate the number of facilities owned by a parent entity and the associated compliance costs incurred by the parent entity
➢ May underestimate the number of parent entities falling in a given cost-to-revenue impact range</td></tr>
<tr><td>With Use of Entity Weights</td><td>Combination 3
➢ Accounts for all the entities that own complying facilities
➢ Accounts for all estimated facilities and their compliance costs, but with less precision than through use of the facility weights
➢ May underestimate the number of facilities owned by a parent entity and the associated compliance costs incurred by the parent entity</td><td>Combination 4
➢ Accounts for all of the entities that own complying facilities
➢ Overestimates the number of in-scope estimated facilities and their compliance costs
➢ May overestimate the number of facilities owned by a parent entity and the associated compliance costs incurred by the parent entity</td></tr>
</table>

Of these four possible combinations, EPA chose not to present results for *Combination 1* and *Combination 4* for the following reasons:

- *Combination 1* – no *facility-level* weights or *entity-level* weights – likely underestimates on both factors of concern: number of entities and associated compliance costs that may be owned by a parent entity and the number of parent entities. Given these weaknesses, EPA chose not to present results for this combination.
- *Combination 4* – using *facility-level* weights and *entity-level* weights – in effect creates facilities, and their compliance cost and potential cost impact, that are known *not* to exist at the population level. This combination thus may overstate the number of facilities owned by a parent entity and will also overestimate the total cost expected to be incurred by any parent entity.

EPA chose to present results for *Combination 2* and *Combination 3* for the entity-level cost-to-revenue analysis as well as regulatory flexibility analysis (RFA). *Combination 2* and *Combination 3* each have error in the opposite directions:

- *Combination 2* – using *facility-level* weights and but not *entity-level* weights – likely overstates the cost to the individual parent entity but underestimates the number of parent entities owning in-scope facilities.
- *Combination 3* – using *entity-level* weights and but not *facility-level* weights – likely underestimates the number of facilities owned and costs incurred by, individual parent entities, but provides a more accurate estimate of the number of entities owning in-scope facilities.

Given that *Combination 2* and *Combination 3* do not systematically overestimate or underestimate on both factors of concern, EPA judges that both of these estimation options are superior to *Combination 1* and *Combination 4* and presents the findings from these analyses for the entity-level cost-to revenue analysis (and the RFA analysis, which is discussed in *Chapter 7: Regulatory Flexibility Act Analysis*).

EPA presents these estimates of parent entities with costs exceeding, respectively, 1 percent and 3 percent of entity-level revenue, as the numbers of parent entities that *may* experience a *significant impact* as a result of the Phase II Proposed regulatory options.

5.3.2 Key Findings for Regulatory Options

Using *facility weights*, EPA estimates that 97 unique parent entities own 559 facilities subject to the Proposed Existing Facilities Rule (*Table 4-5*). EPA estimates that the majority of parent entities will incur annualized costs of less than 1 percent of revenues under Option 1 (88 percent) and Option 2 (56 percent). This finding applies across all parent entity types under Option 1. Under Option 2, this finding holds true for all parent entity types except investor-owned utilities and municipalities; the majority of parent entities in these ownership type groups have revenue exceeding 1 percent of revenue. Under the more expensive Option 3, a nearly equal number of entities are expected to incur costs *above* and *below* 1 percent of revenue, i.e., 46 and 45 out of 91 parent entities, respectively, not taking into account 6 parent entities with unknown revenue. However, this finding does not hold for all entity types. EPA estimates that the majority of nonutilities (59 percent) will incur costs below 1 percent of revenue, while the only federal entity will incur costs exceeding 3 percent of revenue. The agency expects cooperatives, investor-owned utilities, and municipalities to incur costs exceeding 1 percent of revenue and the equal number of state-owned entities to incur costs above and below 1 percent of revenue.

EPA estimates that 2 out of 97 parent entities will incur costs exceeding 3 percent under Option 1, 15 parent entities under Option 2, and 20 parent entities under Option 3. As described above, *the analysis using only facility-level weights is likely to overstate the costs to individual parent entities but may undercount the number of parent entities in a given impact range*.

Table 5-3: Entity-Level Cost-to-Revenue Analysis Results, Using Facility-Level Weights

Entity Type	Total Number of Facilities[a]	Total Number of Entities	Number of Facilities with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[b]		
Option 1: IM Everywhere								
Cooperative	25	11	10	0	1	0	0.00%	4.09%
Federal	16	1	1	0	0	0	0.22%	0.22%
Investor-owned	306	38	38	0	0	0	0.00%	0.65%
Municipality	25	13	9	4	0	0	0.00%	2.55%
Nonutility	170	30	23	0	1	6	0.00%	47.84%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	17	4	4	0	0	0	0.00%	0.67%
Total	**559**	**97**	**85**	**4**	**2**	**6**	**0.00%**	**47.84%**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Cooperative	25	11	7	1	3	0	0.00%	22.16%
Federal	16	1	0	0	1	0	8.89%	8.89%
Investor-owned	306	38	20	14	4	0	0.00%	11.18%
Municipality	25	13	6	5	2	0	0.01%	17.41%
Nonutility	170	30	18	2	4	6	0.00%	519.67%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	17	4	3	0	1	0	0.00%	13.40%
Total	**559**	**97**	**54**	**22**	**15**	**6**	**0.00%**	**519.67%**
Option 3: I&E Mortality Everywhere								
Cooperative	25	11	4	3	4	0	0.00%	22.16%
Federal	16	1	0	0	1	0	8.89%	8.89%
Investor-owned	306	38	20	14	4	0	0.00%	11.18%
Municipality	25	13	2	5	6	0	0.57%	17.41%
Nonutility	170	30	18	2	4	6	0.00%	519.67%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	17	4	2	1	1	0	0.00%	13.40%
Total	**559**	**97**	**46**	**25**	**20**	**6**	**0.00%**	**519.67%**

a. Facility counts exclude baseline closures.
b. EPA was unable to determine revenues for 6 parent entities (8 weighted).
Source: U.S. EPA Analysis, 2010

Using *entity weights*, EPA estimates that 140 parent entities own 257 explicitly analyzed facilities subject to the Proposed Existing Facilities Rule (*Table 5-4*).[141] EPA estimates that the majority of these parent entities will incur annualized costs of less than 1 percent of revenues under all three options (92 percent of parent entities under Option 1, 72 percent of parent entities under Option 2, and 61 percent of parent entities under Option 3). Under Option 1, this finding applies to all ownership categories. Under Option 2, this finding applies to all parent entity types *except* federal: only one federal entity is present in this analysis and it is expected to incur costs exceeding 3 percent of revenues. Under Option 3, the finding applies to all parent entity types *except* cooperatives and federal. As for Option 2, the only federal entity present in this analysis is expected to incur costs exceeding 3 percent of revenues under Option 3. In addition, under Option 3, EPA estimates the majority of cooperatives (55 percent) to incur costs exceeding 1 percent of revenue. EPA estimates 1 entity to incur costs exceeding 3 percent of revenue under Option 1 (less than 1 percent of all entities), 9 entities under Option 2 (6 percent), and 17 entities under Option 3 (12 percent). As described above, *the analysis using only entity-level weights is likely to understate the costs to individual parent entities but provides a more comprehensive estimate of the number of parent entities incurring costs*.

141 There are a total of 143 small parent entities on an unweighted basis, 3 of which are *Other Political Subdivision* entities. These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed Other Political Subdivision parent entity to represent these implicitly analyzed Other Political Subdivision parent entities. As a result, the weighted entity counts do not include the 3 known Other Political Subdivision entities even though they are known to be part of the regulated facility and entity universe.

Table 5-4: Entity-Level Cost-to-Revenue Analysis Results, Using Entity-Level Weights

Entity Type	Total Number of Facilities[a]	Total Number of Entities[b]	Number of Facilities with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[c]		
Option 1: IM Everywhere								
Cooperative	13	20	18	2	0	0	0.00%	1.78%
Federal	7	1	1	0	0	0	0.09%	0.09%
Investor-owned	138	42	42	0	0	0	0.00%	0.16%
Municipality	13	35	35	0	0	0	0.00%	0.82%
Nonutility	78	38	29	0	1	8	0.00%	22.74%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	8	4	4	0	0	0	0.00%	0.29%
Total	**257**	**140**	**129**	**2**	**1**	**8**	**0.00%**	**22.74%**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Cooperative	13	20	13	5	2	0	0.00%	9.63%
Federal	7	1	0	0	1	0	3.83%	3.83%
Investor-owned	138	42	35	6	1	0	0.00%	5.28%
Municipality	13	35	24	8	3	0	0.00%	8.22%
Nonutility	78	38	25	4	1	8	0.00%	229.17%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	8	4	3	0	1	0	0.00%	5.86%
Total	**257**	**140**	**101**	**23**	**9**	**8**	**0.00%**	**229.17%**
Option 3: I&E Mortality Everywhere								
Cooperative	13	20	9	9	2	0	0.00%	9.63%
Federal	7	1	0	0	1	0	3.83%	3.83%
Investor-owned	138	42	35	6	1	0	0.00%	5.28%
Municipality	13	35	13	11	11	0	0.26%	8.22%
Nonutility	78	38	25	4	1	8	0.00%	229.17%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	8	4	3	0	1	0	0.00%	5.86%
Total	**257**	**140**	**86**	**29**	**17**	**8**	**0.00%**	**229.17%**

a. Facility counts exclude baseline closures.

c. EPA was unable to determine revenue for 6 parent entities (8 weighted).

b. There are a total of 143 parent entities on an unweighted basis, 3 of which are other political subdivision entities. These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed other political subdivision parent entity to represent these implicitly analyzed parent entities and total weighted entity counts do not include 3 other political subdivision entities.

Source: U.S. EPA Analysis, 2010

Overall, this analysis shows that the entity-level compliance costs are low in comparison to the entity-level revenues; consequently, parent entities that own more than one facility subject to the Proposed Existing Facilities Rule will not be additionally "penalized" as the result of this rule as a result of their ownership of multiple facilities.

5.3.3 Uncertainties and Limitations

- As described above, the estimates of entity-level impacts and the estimated numbers of entities incurring costs in given cost-to-revenue impact ranges are based on the application of facility-level and entity-level weights. The use of these sample weights in the analysis, generally, and the specific use of weights in the two entity-level estimation approaches outlined above, yield estimates of entity-level impacts that are subject to estimation error. In particular, each of the two entity-level impact estimation approaches embeds specific issues of potential over- and under-statement of impact.
  - Use of the facility-level weights alone likely overstates the cost-to-revenue impact on identified parent entities while potentially understating the number of parent entities in a given cost-to-revenue impact category.

- Use of entity-level weights alone may underestimate the number of facilities owned by a parent entity and the associated compliance costs incurred by the parent entity.

- As described in *Section 5.2.3* above, the facility count-based sample weights used for this analysis account only for the number of facilities within each NERC region (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*). The actual compliance costs assigned to each of the explicitly analyzed facilities may differ from the costs that would be assigned to the implicitly analyzed facilities that they represent. Consequently, the cost estimates generated through application of facility-level weights may be over- or under-stated at the level of a given parent-entity as well as the entity counts in each of the impact magnitude groups, even if the facility-weights account properly for facility ownership.

5.4 Impact of Compliance Costs on Household Electricity Costs

As part of its assessment of the cost and economic impact of the Proposed Existing Facilities Rule options, EPA assessed the burden of compliance cost from potential increases in the cost of electricity to residential consumers. While the facility-level and parent entity-level cost-to-revenue screening analyses described in *Sections 5.2* and *4.3* essentially reflect an assumption that in-scope facilities and their parent entities will absorb 100 percent of the compliance burden (zero cost pass-through), this household electricity cost analysis and the electricity price impact analysis described in *Section 5.5*, assume a simple 100 percent pass-through of compliance costs in electricity prices. *If this full cost pass-through condition were to occur, the screening analyses assessed in Sections 5.2 and 4.3 would not be relevant.*

As discussed in *Chapter 2.H: Profile of the Electric Power Industry*, the majority of in-scope electric power generating facilities in the United States operate in states in which electricity prices remain regulated under the traditional cost-of-service rate regulation framework. In these states, EPA anticipates that facilities will be able to recover compliance cost-based increases in their production costs through increased electricity rates – as opposed to states in which electric power generation has been deregulated, and where cost recovery is thus not guaranteed. While facilities operating within deregulated electricity markets may be able to recover some of their additional production costs in increased revenue, it is not possible to determine the extent of cost recovery ability for each facility. Moreover, even though individual complying facilities may not be able to recover all of their compliance costs through increased revenues, the market-level effect may still be that consumers will see higher overall electricity prices because of changes in the cost structure of electricity supply and resulting changes in market-clearing prices in deregulated generation markets. Based on these considerations, for the purpose of the household electricity cost and electricity price impact analyses, the Agency assumed that 100 percent of compliance costs would be passed through to consumers; this assumption will avoid understating the potential cost impact to consumers from 316(b) compliance costs. To the extent that all compliance-related costs are *not* passed forward to consumers but are absorbed, at least in part, by electric power generators, this analysis will overstate consumer impacts.

5.4.1 Analysis Approach and Data Inputs

For this analysis, EPA assumed that compliance costs would be 100 percent passed through as increased electricity prices and allocated among customer classes in proportion to the baseline quantity of electricity consumption by customer class. EPA specifically analyzed potential impact on annual electricity costs by household. The Agency performed this analysis at the level of the NERC region, which is appropriate given the structure and functioning of sub-national electricity markets, around which NERC regions are defined.[142] The steps in this calculation are as follows:

[142] As noted previously, NERC regions definitions have recently changed.

- To calculate an approximate total estimated annual cost in each NERC region, EPA aggregated weighted pre-tax, facility-level annualized compliance costs, in 2009 dollars as of a given compliance year, i.e., 2015, 2020, or 2025, and discounted to 2015 (the assumed *analysis* year) using a 7 percent discount[143] rate, by NERC region.[144] This analysis accounts for the different years in which facilities are expected to achieve compliance in order to reflect the effect of differences in timing of these rate impacts in terms of cost to household ratepayers and society. Costs and ratepayer effects occurring farther in the future (e.g., based on the expected compliance profile for nuclear generating facilities) have a lower present value of impact than those that occur sooner following rule promulgation. Estimating the cost and ratepayer effect as of the assumed compliance year (2015, 2020, 2025) and then discounting these effects to a single analysis year (2015) accounts for this consideration.
- To calculate an approximate average price impact per unit of electricity sales, EPA divided total compliance costs by the total MWh of sales reported for each NERC region. For all NERC regions except Alaska System Coordinating Council (ASCC) and Hawaii Coordinating Council (HICC), EPA used electricity sales (in MWh) for 2015 from *AEO2009*.[145] For ASCC and HICC EPA used the historical quantity of electricity sales (in MWh) for the year 2007 from the 2007 EIA-861 database; for these two NERC regions, the Agency assumed that total average electricity sales would remain unchanged through 2015.
- To calculate average annual electricity sales per household, EPA divided the total quantity of *residential* sales (in MWh) for 2007 in each NERC region by the number of households in that region; the Agency obtained both the quantity of residential sales and the number of households for all NERC regions from the 2007 EIA-861 database. For this analysis, EPA assumed that average electricity sales per household would remain the same in 2015 as in 2007.
- To assess the potential annual cost impact per household, EPA multiplied the estimated average price impact by the average quantity of electricity sales per household in 2007 by NERC region.

5.4.2 Key Findings for Regulatory Options

Table 5-5 reports the results of this analysis by NERC region for each option. These results show that for Option 1, the average annual cost per residential household is expected to range from $0.05 in WECC to $3.93 in SPP, for Option 2 from $0.09 in WECC to $27.11 in SERC, and for Option 3 from $0.11 in WECC to $27.88 in SERC. On average, for a typical U.S. household, Option 1 is expected to result in the lowest cost of $1.41 per household, while Option 3 is expected to result in the highest cost of $17.60 per household. Overall, Option 2 is estimated to result in costs of $17.09 per household.

143 The 7 percent discount rate is intended to reflect the opportunity cost of capital to society, on a real (i.e., without the effects of inflation) basis, per guidance from the Office of Management and Budget, and thus an approximate basis for estimating potential rate effects.

144 For this analysis, EPA brought technology and administrative costs forward to 2015 using the Construction Cost Index and Employment Cost Index, respectively and assumed that these costs were as of a given compliance year, i.e., 2015 for facilities installing IM technologies, 2020 for non-nuclear facilities installing cooling towers, and 2025 for nuclear facilities installing cooling towers. EPA was not confident in the reliability of projecting compliance cost values using the respective Indexes beyond 2015. *Not* using explicit index adjustments after 2015 assumes zero real growth (i.e., no difference from general inflation) after 2015. EPA's choice of the year for which cost and revenue values are used in a particular part of the cost analysis was driven by the concept of a given analysis and the availability of data for the analysis.

145 AEO does not provide information for HICC and ASSC.

Table 5-5: Average Annual Cost per Household in 2015 by NERC Region and Regulatory Option ($2009)[a]

NERC Region[b]	Total Annual Compliance Cost (at 2015; Million; $2009)	Total Electricity Sales (at 2015; MWh)	Compliance Cost per Unit of Sales ($2009/MWh)	Residential Electricity Sales (at 2015; MWh)	Number of Households (at 2015)	Residential Sales per Residential Consumer (MWh)	Compliance Cost per Household ($2009)
Option 1: IM Everywhere							
ASCC	$0	6,326,610	$0.00	2,114,456	265,449	7.97	$0.00
ECAR	$62,390,503	569,849,487	$0.11	190,477,670	16,899,104	11.27	$1.23
ERCOT	$40,029,111	313,395,966	$0.13	91,064,812	6,603,322	13.79	$1.76
FRCC	$41,259,203	242,320,908	$0.17	110,173,004	7,923,249	13.91	$2.37
HICC	$4,259,468	10,585,038	$0.40	3,200,675	407,140	7.86	$3.16
MAAC	$61,468,467	294,365,234	$0.21	104,073,139	10,285,013	10.12	$2.11
MAIN	$41,292,594	275,415,009	$0.15	86,988,500	8,939,201	9.73	$1.46
MAPP	$27,565,966	165,189,056	$0.17	55,172,815	5,146,199	10.72	$1.79
NPCC	$51,647,619	284,990,412	$0.18	95,584,731	12,557,410	7.61	$1.38
SERC	$99,360,633	887,073,303	$0.11	332,332,257	22,705,585	14.64	$1.64
SPP	$63,811,175	204,172,272	$0.31	68,368,566	5,439,270	12.57	$3.93
WECC	$4,015,273	701,826,043	$0.01	240,757,548	26,073,156	9.23	$0.05
U.S.	**$497,100,012**	**3,960,424,805**	**$0.13**	**1,380,308,173**	**123,244,098**	**11.20**	**$1.41**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD							
ASCC	$0	6,326,610	$0.00	2,114,456	265,449	7.97	$0.00
ECAR	$1,010,953,670	569,849,487	$1.77	190,477,670	16,899,104	11.27	$20.00
ERCOT	$602,721,709	313,395,966	$1.92	91,064,812	6,603,322	13.79	$26.52
FRCC	$311,699,736	242,320,908	$1.29	110,173,004	7,923,249	13.91	$17.89
HICC	$32,074,166	10,585,038	$3.03	3,200,675	407,140	7.86	$23.82
MAAC	$551,710,436	294,365,234	$1.87	104,073,139	10,285,013	10.12	$18.97
MAIN	$542,786,160	275,415,009	$1.97	86,988,500	8,939,201	9.73	$19.18
MAPP	$246,541,770	165,189,056	$1.49	55,172,815	5,146,199	10.72	$16.00
NPCC	$744,738,535	284,990,412	$2.61	95,584,731	12,557,410	7.61	$19.89
SERC	$1,643,059,866	887,073,303	$1.85	332,332,257	22,705,585	14.64	$27.11
SPP	$350,239,021	204,172,272	$1.72	68,368,566	5,439,270	12.57	$21.56
WECC	$6,930,361	701,826,043	$0.01	240,757,548	26,073,156	9.23	$0.09
U.S.	**$6,043,455,430**	**3,960,424,805**	**$1.53**	**1,380,308,173**	**123,244,098**	**11.20**	**$17.09**
Option 3: I&E Mortality Everywhere							
ASCC	$0	6,326,610	$0.00	2,114,456	265,449	7.97	$0.00
ECAR	$1,035,075,751	569,849,487	$1.82	190,477,670	16,899,104	11.27	$20.47
ERCOT	$602,721,709	313,395,966	$1.92	91,064,812	6,603,322	13.79	$26.52
FRCC	$317,419,881	242,320,908	$1.31	110,173,004	7,923,249	13.91	$18.21
HICC	$32,074,166	10,585,038	$3.03	3,200,675	407,140	7.86	$23.82
MAAC	$561,627,430	294,365,234	$1.91	104,073,139	10,285,013	10.12	$19.31
MAIN	$571,233,958	275,415,009	$2.07	86,988,500	8,939,201	9.73	$20.18
MAPP	$262,582,596	165,189,056	$1.59	55,172,815	5,146,199	10.72	$17.04
NPCC	$791,203,354	284,990,412	$2.78	95,584,731	12,557,410	7.61	$21.13
SERC	$1,689,520,164	887,073,303	$1.90	332,332,257	22,705,585	14.64	$27.88
SPP	$350,239,021	204,172,272	$1.72	68,368,566	5,439,270	12.57	$21.56
WECC	$8,641,891	701,826,043	$0.01	240,757,548	26,073,156	9.23	$0.11
U.S.	**$6,222,339,919**	**3,960,424,805**	**$1.57**	**1,380,308,173**	**123,244,098**	**11.20**	**$17.60**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.

b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*

Source: U.S. EPA Analysis, 2010; U.S. DOE, 2009b; U.S. DOE, 2007c

5.4.3 Uncertainties and Limitations

The assessment of electricity price impact is somewhat simple in its assumption that costs would be passed on in the form of a flat rate price increase per unit of power, to be distributed in proportion to the current electricity consumption profile. Within a rate regulation framework, fixed and variable costs would be allocated among customer classes based on the contribution of each class to consumption during specific electricity production periods. As a result, the allocation of costs to the residential class could be higher or lower than estimated by this approach. In addition, this analysis ignores heterogeneous impacts at the household level, which may be more important for utilities that use block-rate pricing or other price-discrimination rate structures, in which unit consumption prices vary by consumption level. The analysis also does not account for rate structures – e.g., lifeline rates – which could moderate the impact of otherwise increased rates on lower income households.

5.5 Impact of Compliance Costs on Electricity Prices

As an additional measure of the potential cost and economic impact of the Proposed Existing Facilities Rule beyond the level of the complying entity, EPA also assessed the potential increase in electricity prices to all consumer groups (residential, commercial, industrial, and transportation), again assuming a simple 100 percent pass-through of compliance costs in electricity prices.[146] As discussed in *Section 5.4*, above, EPA assumed that 100 percent of compliance costs would be passed through to consumers for the purpose of the electricity price impact analysis. EPA judges that this assumption is appropriate because the majority of electric power facilities in the United States operate in states in which electricity generation remains regulated under the cost-of-service framework, where facilities are able to recover increases in production costs through increased electricity rates. Although some facilities operate in states in which electric power generation has been deregulated, and, as a result, compliance costs may not be fully recovered in increased consumer electricity prices, EPA determined that it would not be possible to estimate this consumer price effect at the state level. Accordingly, EPA judges that the assumption of 100 percent cost pass-through for the purpose of electricity price impact analysis is appropriate for this analysis and will avoid understating the potential cost impact to consumers of 316(b) compliance costs. As stated above, this assumption may overstate the eventual consumer cost impact.

5.5.1 Analysis Approach and Data Inputs

For this analysis, EPA again assumed that compliance costs would be fully passed through as increased electricity prices and allocated among customer classes in proportion to the baseline quantity of electricity consumption by customer class. As in the preceding section, EPA performed this analysis at the level of the NERC region, as follows:[147]

- EPA summed weighted pre-tax facility-level annualized compliance costs, in 2009 dollars as of a given compliance year, i.e., 2015, 2020, or 2025, and discounted to 2015 at seven percent, by NERC region
- As done for the analysis of impact of compliance costs on household electricity costs, EPA estimated the approximate average price impact per unit of electricity consumption by dividing total compliance costs by the projected total MWh of sales in 2015 by NERC region, from *AEO2009*. EPA followed this approach for all NERC regions except ASCC and HICC, for which the Agency used the historical quantity of electricity sales – total and by consumer group – from the 2007 EIA-861 database.
- EPA compared the estimated average price effect to the projected electricity price by customer class and NERC region for 2015 from *AEO2009* for all NERC regions except, again, for ASCC and HICC. To estimate average electricity rate by consumer class for ASCC and HICC, EPA divided electricity revenue by electricity sales (MWh) reported by consumer class in the 2007 EIA-861 database.

146 These consumer groups are defined in *AEO2009*.

147 As noted previously, NERC region definitions have recently changed.

5.5.2 Key Findings for Regulatory Options

As reported in *Table 5-6*, annualized compliance costs (in cents per KWh sales) range from 0.001¢ in the WECC region to 0.040¢ in the HICC region for Option 1, and from 0.001¢ in the WECC region to 0.303¢ in the HICC region for Options 2 and 3. On average, across the United States, Option 1 results in the lowest cost of 0.013¢ per KWh, while Option 3 results in the highest cost of 0.157¢ per KWh. Option 2, results in national costs of 0.153¢ per KWh.

Table 5-6: Compliance Cost per KWh of Sales by NERC Region and Regulatory Option in 2015 ($2009) [a]

NERC Region [b]	Annualized Pre-Tax Compliance Costs (at 2015; $2009; million)	Total Electricity Sales (at 2015; KWh)	Costs per Unit of Sales (2009¢/KWh Sales)
Option 1: IM Everywhere			
ASCC	$0	6,326,610,000	0.000
ECAR	$62,390,503	569,849,487,305	0.011
ERCOT	$40,029,111	313,395,965,576	0.013
FRCC	$41,259,203	242,320,907,593	0.017
HICC	$4,259,468	10,585,038,000	0.040
MAAC	$61,468,467	294,365,234,375	0.021
MAIN	$41,292,594	275,415,008,545	0.015
MAPP	$27,565,966	165,189,056,396	0.017
NPCC	$51,647,619	284,990,412,176	0.018
SERC	$99,360,633	887,073,303,223	0.011
SPP	$63,811,175	204,172,271,729	0.031
WECC	$4,015,273	701,826,043,025	0.001
U.S. [c]	**$497,100,012**	**3,960,424,804,688**	**0.013**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD			
ASCC	$0	6,326,610,000	0.000
ECAR	$1,010,953,670	569,849,487,305	0.177
ERCOT	$602,721,709	313,395,965,576	0.192
FRCC	$311,699,736	242,320,907,593	0.129
HICC	$32,074,166	10,585,038,000	0.303
MAAC	$551,710,436	294,365,234,375	0.187
MAIN	$542,786,160	275,415,008,545	0.197
MAPP	$246,541,770	165,189,056,396	0.149
NPCC	$744,738,535	284,990,412,176	0.261
SERC	$1,643,059,866	887,073,303,223	0.185
SPP	$350,239,021	204,172,271,729	0.172
WECC	$6,930,361	701,826,043,025	0.001
U.S.	**$6,043,455,430**	**3,960,424,804,688**	**0.153**
Option 3: I&E Mortality Everywhere			
ASCC	$0	6,326,610,000	0.000
ECAR	$1,035,075,751	569,849,487,305	0.182
ERCOT	$602,721,709	313,395,965,576	0.192
FRCC	$317,419,881	242,320,907,593	0.131
HICC	$32,074,166	10,585,038,000	0.303
MAAC	$561,627,430	294,365,234,375	0.191
MAIN	$571,233,958	275,415,008,545	0.207
MAPP	$262,582,596	165,189,056,396	0.159
NPCC	$791,203,354	284,990,412,176	0.278
SERC	$1,689,520,164	887,073,303,223	0.190
SPP	$350,239,021	204,172,271,729	0.172
WECC	$8,641,891	701,826,043,025	0.001
U.S.	**$6,222,339,919**	**3,960,424,804,688**	**0.157**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.

b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.

Source: U.S. EPA Analysis, 2010; U.S. DOE 2009b; U.S. DOE 2007c

As discussed above, to determine the potential significance of these compliance costs on electricity prices, EPA compared the per KWh compliance cost to baseline electricity prices by consuming sector, and for the average of the sectors. As reported in *Table 5-7*, across the United States, Option 1 is expected to result in the lowest electricity price increase, 0.13 percent; Option 3 is expected to yield the highest increase, 1.68 percent; with Option 2 resulting in a 1.63 percent increase. Looking across the three consumer groups, industrial consumers are expected to experience the highest price increases: 0.19 percent under Option 1, 2.36 percent under Option 2, and 2.43 percent under Option 3. Residential consumers are expected to experience the lowest price increases: 0.11 percent under Option 1, 1.36 percent under Option 2, and 1.40 percent under Option 3.

Table 5-7: Projected 2015 Price (Cents per KWh of Sales) and Potential Price Increase Due to Compliance Costs by NERC Region and Regulatory Option ($2009) [a]

		Residential		Commercial		Industrial		Transportation		All Sector Average	
NERC Region [b]	**Compliance Cost (¢/KWh)**	**Baseline Price**	**% Change**	**Baseline Price**	**% Change**	**Baseline Price**	**% Change**	**Baseline Price**	**% Change**	**Baseline Price**	**% Change**
Option 1: IM Everywhere											
ASCC	0.000	15.69	0.00%	12.59	0.00%	13.06	0.00%	NA	NA	13.73	0.00%
ECAR	0.011	9.83	0.11%	8.97	0.12%	6.15	0.18%	7.90	0.14%	8.21	0.13%
ERCOT	0.013	13.28	0.10%	9.37	0.14%	7.47	0.17%	10.59	0.12%	10.39	0.12%
FRCC	0.017	13.38	0.13%	11.28	0.15%	9.16	0.19%	8.94	0.19%	12.19	0.14%
HICC	0.040	24.93	0.16%	22.64	0.18%	18.99	0.21%	NA	NA	22.00	0.18%
MAAC	0.021	13.09	0.16%	11.35	0.18%	8.14	0.26%	11.06	0.19%	11.32	0.18%
MAIN	0.015	10.15	0.15%	8.24	0.18%	5.64	0.27%	7.52	0.20%	7.99	0.19%
MAPP	0.017	8.02	0.21%	7.45	0.22%	5.68	0.29%	6.84	0.24%	7.04	0.24%
NPCC	0.018	18.23	0.10%	14.42	0.13%	9.69	0.19%	15.84	0.11%	14.92	0.12%
SERC	0.011	9.04	0.12%	7.67	0.15%	5.56	0.20%	5.97	0.19%	7.60	0.15%
SPP	0.031	9.71	0.32%	8.25	0.38%	6.15	0.51%	7.56	0.41%	8.23	0.38%
WECC	0.001	11.37	0.01%	9.63	0.01%	7.00	0.01%	8.87	0.01%	9.64	0.01%
U.S.	**0.013**	**11.20**	**0.11%**	**9.57**	**0.13%**	**6.46**	**0.19%**	**10.64**	**0.12%**	**9.35**	**0.13%**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD											
ASCC	0.000	15.69	0.00%	12.59	0.00%	13.06	0.00%	NA	NA	13.73	0.00%
ECAR	0.177	9.83	1.80%	8.97	1.98%	6.15	2.89%	7.90	2.25%	8.21	2.16%
ERCOT	0.192	13.28	1.45%	9.37	2.05%	7.47	2.57%	10.59	1.82%	10.39	1.85%
FRCC	0.129	13.38	0.96%	11.28	1.14%	9.16	1.40%	8.94	1.44%	12.19	1.06%
HICC	0.303	24.93	1.22%	22.64	1.34%	18.99	1.60%	NA	NA	22.00	1.38%
MAAC	0.187	13.09	1.43%	11.35	1.65%	8.14	2.30%	11.06	1.69%	11.32	1.66%
MAIN	0.197	10.15	1.94%	8.24	2.39%	5.64	3.49%	7.52	2.62%	7.99	2.47%
MAPP	0.149	8.02	1.86%	7.45	2.00%	5.68	2.63%	6.84	2.18%	7.04	2.12%
NPCC	0.261	18.23	1.43%	14.42	1.81%	9.69	2.70%	15.84	1.65%	14.92	1.75%
SERC	0.185	9.04	2.05%	7.67	2.41%	5.56	3.33%	5.97	3.10%	7.60	2.44%
SPP	0.172	9.71	1.77%	8.25	2.08%	6.15	2.79%	7.56	2.27%	8.23	2.08%
WECC	0.001	11.37	0.01%	9.63	0.01%	7.00	0.01%	8.87	0.01%	9.64	0.01%
U.S.	**0.153**	**11.20**	**1.36%**	**9.57**	**1.60%**	**6.46**	**2.36%**	**10.64**	**1.43%**	**9.35**	**1.63%**
Option 3: I&E Mortality Everywhere											
ASCC	0.000	15.69	0.00%	12.59	0.00%	13.06	0.00%	NA	NA	13.73	0.00%
ECAR	0.182	9.83	1.85%	8.97	2.03%	6.15	2.95%	7.90	2.30%	8.21	2.21%
ERCOT	0.192	13.28	1.45%	9.37	2.05%	7.47	2.57%	10.59	1.82%	10.39	1.85%
FRCC	0.131	13.38	0.98%	11.28	1.16%	9.16	1.43%	8.94	1.47%	12.19	1.07%
HICC	0.303	24.93	1.22%	22.64	1.34%	18.99	1.60%	NA	NA	22.00	1.38%
MAAC	0.191	13.09	1.46%	11.35	1.68%	8.14	2.34%	11.06	1.72%	11.32	1.69%
MAIN	0.207	10.15	2.04%	8.24	2.52%	5.64	3.67%	7.52	2.76%	7.99	2.60%
MAPP	0.159	8.02	1.98%	7.45	2.13%	5.68	2.80%	6.84	2.32%	7.04	2.26%
NPCC	0.278	18.23	1.52%	14.42	1.92%	9.69	2.87%	15.84	1.75%	14.92	1.86%
SERC	0.190	9.04	2.11%	7.67	2.48%	5.56	3.42%	5.97	3.19%	7.60	2.51%
SPP	0.172	9.71	1.77%	8.25	2.08%	6.15	2.79%	7.56	2.27%	8.23	2.08%
WECC	0.001	11.37	0.01%	9.63	0.01%	7.00	0.02%	8.87	0.01%	9.64	0.01%
U.S.	**0.157**	**11.20**	**1.40%**	**9.57**	**1.64%**	**6.46**	**2.43%**	**10.64**	**1.48%**	**9.35**	**1.68%**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.

b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.c

Source: U.S. EPA Analysis, 2010; U.S. DOE, 2009b; U.S. DOE, 2007c

5.5.3 Uncertainties and Limitations

As noted above, the assumptions regarding pass-through of compliance costs to electricity prices are relatively simple and may overstate or understate the potential impact of 316(b) compliance costs on electricity consumers.

5.6 Assessment of Short-Term Reduction in Capacity Availability Due to Installation Downtime

EPA assessed the reduction in generating capacity availability due to installation downtime for explicitly and implicitly analyzed Electric Generators that are estimated to incur downtime during installation of compliance technology as well as the impact of that capacity reduction on the North American bulk power system:

- For *Option 1: IM Everywhere*, 224 Electric Generators are estimated to incur net downtime, ranging from 0.3 to 9 weeks
- For *Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD*, 343 Electric Generators are estimated to incur net downtime, ranging from 0.3 to 24 weeks
- For *Option 3: I&E Mortality Everywhere*, 386 Electric Generators are estimated to incur net downtime, ranging from 0.3 to 24 weeks[148]

5.6.1 Analysis Approach and Data Inputs

For this assessment, EPA estimated the quantity of generating capacity that would be temporarily out of service by NERC region over the years in which facilities would be expected to come into compliance with the Proposed Existing Facilities Rule. This assessment aims to provide an insight into whether the quantity of capacity that might be out of service at a given time would be substantial in relation to total installed generating capacity by NERC region, and, as a result, might pose a short-term electricity supply reliability issue.

To perform this assessment, EPA distributed the occurrence of installation downtime by facility, and by NERC region, over the periods in which facilities are expected to achieve compliance with the regulatory options. Specifically, EPA distributed downtime occurrence in such way that the total capacity out of service, *by NERC region*, would be as uniform as possible over the periods in which facilities would be expected to achieve compliance and incur downtime.

In implementing this procedure, EPA recognized that the amount of capacity *at a facility* that would need to be removed from service at a given time for completion of technology installation, could not be "subdivided" – i.e., all of the generating capacity associated with a given intake structure would need to be taken out of service *at the same time* to complete compliance technology installation for that intake structure. However, the implementation of this procedure involved a key simplifying assumption that will tend to overstate the capacity availability impact during the several year period of technology installation. Compliance technologies and downtime duration for the installation of these technologies are assigned to individual intake structures. As a result, only generating capacity associated with a specific intake structure would be expected to be out of service as a result of technology installation at a given time. For this assessment, EPA was unable to identify the specific steam-generating units and quantity of generating capacity associated with the individual intake structures. Thus, this assessment assumes that *all* steam-generating capacity at a given facility will be out of service at the same time, even though

148 For the purpose of this analysis EPA analyzed DQ and STQ facilities explicitly as is done for the Market Model Analysis (see *Chapter 6: Electricity Market Model Analysis*) and used the Original 316(b) survey weights (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).

this may overstate the downtime impact on capacity. Therefore, to the extent that some in-scope facilities may operate several intake structures with different generating units assigned to different intake structures, this analysis will overstate the impact of downtime on short-term capacity availability.

As described previously in *Chapter 3: Development of Costs for Regulatory Options*, facilities assigned non-cooling tower technologies are expected to come into compliance with the Proposed Existing Facilities Rule during a 5-year time period of 2013 through 2017. Non-nuclear and nuclear facilities assigned cooling towers are estimated to come into compliance during 5-year windows of 2018 though 2022 and 2023 through 2027, respectively. For this analysis, EPA assumed that each facility expected to incur installation downtime will do so in the year of compliance. The Agency also assumed that facilities will incur downtime during the spring or fall seasons so as not to coincide with either the winter or summer higher demand periods. Consequently, facilities incurring installation downtime would have 10 time periods in which the downtime might occur (i.e., two time periods for each of the possible compliance years).

EPA distributed the occurrence of downtime capacity as evenly as possible over these potential downtime periods, recognizing the limitation described above that *all* of a facility's reported steam-generating capacity would need to be taken out of service *at once*. The resulting assignments of facility capacity to individual downtime periods were then summed over the facilities, by NERC region, to yield a potential reduction in capacity availability by downtime period. The resulting downtime capacity values were then sorted from highest to lowest for each NERC region. EPA intentionally did not assign these capacity estimates to particular years and/or seasons; the Agency assumed that each NERC region would work with facility owners to coordinate the occurrence of downtime within a given compliance window in such way as to minimize the potential for adverse reductions in supply reliability due to the occurrence of installation downtime.

This distribution of downtime occurrence is meant to illustrate how the incremental installation downtime and capacity availability effects *might* occur during the available compliance window – based on this specific approach for distributing the occurrence of downtime. *Table 3A-4* presents a summary of the resulting downtime capacity values by downtime period, for each NERC region and regulatory option. For Options 2 and 3, the downtime capacity values are presented separately for nuclear and fossil fuel facilities that are assigned cooling towers *and* non-cooling tower technologies and facilities that are assigned *only* non-cooling tower technologies, because the compliance windows for achieving compliance would not be the same.

To evaluate the reliability impact of technology installation downtime, EPA assessed whether the amount of generating capacity that would be unavailable could prevent a given NERC region from meeting Reliability Standards developed and enforced by NERC – i.e., whether a given NERC region will be able to meet its electricity demand and its reserve margin requirement.[149] Reserve margin is the amount of unused available capacity at peak load in an electric power system, as a percentage of total capacity. EPA made this assessment, by NERC region, by comparing the *Reference Reserve Margin* set by NERC with projected *actual* reserve margin adjusted for capacity loss as the result of 316(b) technology installation, referred to herein as *Compliance Adjusted Potential Reserve Margin*.[150]

EPA calculated *Compliance Adjusted Potential Reserve Margin* as follows:

$$CAPRM = (APC - 316bNDC - NID) / (APC - 316bNDC) \qquad (5\text{-}1)$$

Where:

[149] For more information see http://www.nerc.com/files/StandardsBackground.pdf and http://www.nerc.com/page.php?cid=2%7C97.

[150] EPA obtained all baseline reserve margin and other information from NERC's 2008 Long-Term Reliability Assessment (LTRA) report (NERC, 2008), available online at: http://www.nerc.com/files/LTRA2008.pdf.

CAPRM	=	*Compliance Adjusted Potential Reserve Margin*, or baseline NERC region reserve margin (*Reference Reserve Margin*) adjusted for the reduction in available capacity due to 316(b) installation downtime
APC	=	*Adjusted Potential Capacity* (MW), an available capacity value published by NERC and defined as the sum of net capacity resources, existing uncertain resources less all derates, total proposed resources reduced by a confidence factor and net non-firm transactions. This capacity value includes future capacity additions and adjusts for the possibility that some of this future capacity may not be available when estimated to be constructed.
316bNDC	=	*316(b) Net Downtime Capacity* (MW), or estimated capacity reductions due to 316(b) installation downtime, by NERC region and year; calculated as described above.
NID	=	*Net Internal Demand* (MW), a NERC-published region-level electricity demand value, defined as total internal demand reduced by dispatchable controllable (capacity) demand response.

The result of this calculation is the percentage of available capacity that would be available at peak demand after adjusting available capacity for capacity reductions due to 316(b) installation downtime.

In performing this calculation, EPA used NERC-reported data for *Adjusted Potential Capacity* and *Net Internal Demand* for the winter season. The LTRA report contains analysis of winter and summer bulk power system reliability but does not report information for the shoulder season demand periods – fall and spring – which are the periods when EPA expects that installation downtime would generally occur. EPA used information for the winter season because, for the United States, winter is generally a lower demand season than summer and therefore, would provide a better basis for assessing the impact of downtime-based capacity reductions *that would actually be expected to occur during the lower demand shoulder season operating periods.* To the extent that technology installation occurs during the shoulder months of spring and fall, when electricity demand is on average below that during winter, the reliability impact estimated using winter demand is likely to be over-stated.

In addition, EPA used NERC-reported data for the year 2017, which is the last year covered by the 2008 LTRA report. EPA judges that the 2017 value, which lies within the period (2013-2027) during which installation downtime under the Proposed Existing Facilities Rule is expected to occur, provides a reasonable basis for assessing the reliability impact of downtime.

To assess whether the reduction in available capacity due to 316(b) installation downtime could pose a bulk power reliability concern, EPA compared *Compliance Adjusted Potential Reserve Margin* with *Reference Reserve Margin*, as reported by NERC. *Reference Reserve Margin* (percent MW) represents either the target reserve margin provided by the region/subregion *or* the target reserve margin assigned by NERC based on capacity mix (i.e., thermal vs. hydro).

The results of these calculations are reported in *Table 3A-4*. *Table 3A-4* reports for eight NERC regions (ERCOT, FRCC, MRO, NPCC, RFC, SERC, SPP, WECC):[151]

- NERC Reference Reserve Margin (percentage) level
- *Net Internal Demand* (MW) for the 2017/2018 winter season
- *Adjusted Potential Capacity* (MW) for the 2017/2018 winter season
- EPA's estimate of *Downtime Capacity* (MW) for each of the analyzed downtime periods

[151] This analysis was undertaken for all NERC regions except ASCC (Alaska) and HICC (Hawaii). Energy concerns in the States of Alaska and Hawaii (and the Dominion of Puerto Rico, and the Territories of American Samoa, Guam, and the Virgin Islands, as well) are not under reliability oversight by NERC. As described below, because the 2008 LTRA report does not include information on ASCC and HICC, EPA undertook a more summary analysis for these regions

- *Compliance Adjusted Potential Reserve Margin* (percentage), as calculated above, by downtime period , based on the 2017/2018 winter *Net Internal Demand* and *Adjusted Potential Capacity*.

In any downtime period, the higher the percentage of total capacity that would potentially be out of service due to 316(b) regulatory compliance, the greater the potential for electricity supply reliability effects.

It is important to note that this assessment of downtime effects does not account for the duration of downtime. As noted above, the analysis assumes that all of the downtime across facilities in a region occurs at the same time within an analysis period. This assumption may lead to significant overstatement of the potential impact of downtime on electricity supply reliability.

Because energy reliability in Alaska and Hawaii is not under NERC's oversight, the 2008 LTRA report does not include any information on these states. To assess reliability impact for Alaska and Hawaii, EPA performed an additional analysis where the Agency looked at downtime capacity as a percentage of total regional capacity for Alaska and Hawaii (*Table 5-9*).

For non-cooling tower technologies, which is the minimum technology standard required nationally under Option 1, the required duration of net downtime is between 2 and 9 weeks; only 2 explicitly analyzed facilities are estimated to incur 9 weeks of downtime while for the majority of explicitly analyzed facilities, this duration is on average 0.3 weeks. For cooling towers, most fossil fuel facilities, which are the vast majority of 316(b) Electric Generators, are assigned 4 weeks of downtime, while some fossil facilities are assigned no net downtime; only 8 nuclear facilities are assigned 24 weeks of downtime, while the other 33 nuclear facilities are assigned no net downtime. Thus, incremental downtime is quite low for nearly all facilities under Option 1, and for the non-cooling tower facilities under Options 2 and 3. For the installation of cooling towers, which are required for all facilities under Option 3 and most facilities under Option 2, net downtime is estimated at 4 weeks for non-nuclear facilities; as stated above, while some nuclear facilities are expected to incur 24 weeks of net downtime, most are expected to incur none.

5.6.2 Key Findings for Regulatory Options

For the 8 NERC regions that were able to be analyzed under the downtime assignment concept outlined above, capacity loss due to 316(b) compliance technology installation is not expected to prevent any of these regions from meeting either the expected electricity demand or required reserve capacity margin under any of the three proposed regulatory options. *Table 3A-4*, which summarizes the results from this analysis, reports, for each NERC region, the *Reference Margin* (second column from left), the baseline *Demand* and *Capacity* values derived from the LTRA report, and the estimated *Downtime Capacity* and *Compliance Adjusted Potential Capacity Margin* for each of the 10 periods in which downtime might be taken within the 5-year compliance windows for each compliance technology. As shown in *Table 3A-4*, the Compliance Adjusted Potential Capacity Margin remains substantially greater than the target *Reference Margin* for all regulatory options and NERC regions in all of the potential downtime periods.

To assess reliability impact for ASCC and HICC, EPA performed an additional analysis where the Agency looked at downtime capacity as a percentage of total regional capacity in each of these two regions (*Table 5-9*). Only 1 in-scope Electric Generator is located in ASCC (a non-nuclear facility with relatively low capacity, 28 MW). This facility is expected to install IM technology under *Options 1 and 2* and a cooling tower under *Option 3*, which would require 0.3 weeks and 4 weeks of net downtime, respectively. Given the small facility size and relatively short net downtime duration that would be required to install 316(b) compliance technology, EPA does not expect significant reliability effects in the ASCC region as a result of this Rule.

The HICC region includes 3 in-scope Electric Generators, all of which are non-nuclear. These facilities are relatively large with 610 MW, 372 MW, and 104 MW of capacity. Under *Option 1*, only one facility (610 MW) is estimated to incur additional downtime (0.3 weeks); this facility represents approximately 23 percent of the region’s total electric generating capacity. Under *Options 2 and 3*, all three facilities are expected to incur net downtime of 4 weeks for cooling tower installation; these facilities represent 23 percent, 14 percent, and 4 percent of the total regional capacity. Given the relatively large size of these facilities, it is quite likely for them to operate multiple intake structures, in which case they would not need to be completely out of service to complete technology installation.

In conclusion, EPA does not expect the short-term loss of capacity as the result of compliance with the Proposed Existing Facilities Rule in any of the NERC regions to cause significant reliability effects in any of the NERC regions.

Table 5-8: Summary of Downtime Impact Analysis by NERC Region, Downtime Period, and Option

NERC Region	Reference Margin[a]	Demand[b]	Capacity[c]	Measure[d,e,f]	Downtime Periods 1	2	3	4	5	6	7	8	9	10
Option 1: IM Everywhere														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	2,460	2,250	1,094	936	1,335	818	1,150	0	0	0
				Compliance Adj Potential Cap Margin	37.5%	37.6%	38.4%	38.6%	38.3%	38.6%	38.4%	39.2%	39.2%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	3,140	1,441	1,252	924	1,025	960	779	0	0	0
				Compliance Adj Potential Cap Margin	20.2%	22.1%	22.3%	22.7%	22.6%	22.6%	22.8%	23.7%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	1,365	950	959	956	936	923	939	932	801	0
				Compliance Adj Potential Cap Margin	24.5%	25.1%	25.1%	25.1%	25.1%	25.1%	25.1%	25.1%	25.3%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	1,216	946	1,099	1,550	1,213	1,187	1,669	835	1,418	0
				Compliance Adj Potential Cap Margin	29.8%	30.1%	29.9%	29.5%	29.8%	29.9%	29.4%	30.2%	29.6%	31.0%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	5,526	5,537	5,521	5,531	5,516	5,539	5,537	5,529	5,525	598
				Compliance Adj Potential Cap Margin	30.3%	30.3%	30.3%	30.3%	30.3%	30.3%	30.3%	30.3%	30.3%	31.8%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	5,053	4,999	5,041	5,017	4,974	4,916	4,982	4,914	4,817	1,337
				Compliance Adj Potential Cap Margin	22.2%	22.2%	22.2%	22.2%	22.2%	22.2%	22.2%	22.2%	22.3%	23.3%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	1,623	1,584	1,547	1,406	1,331	1,311	1,241	1,282	825	0
				Compliance Adj Potential Cap Margin	39.4%	39.4%	39.5%	39.6%	39.7%	39.7%	39.8%	39.7%	40.2%	40.9%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	1,103	665	2,080	1,392	762	700	2,213	1,320	0	0
				Compliance Adj Potential Cap Margin	22.5%	22.7%	22.1%	22.4%	22.7%	22.7%	22.0%	22.4%	23.0%	23.0%
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD														
IM Technology														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	1,252	65	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.3%	23.6%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	670	135	122	133	120	49	0	0	0	0
				Compliance Adj Potential Cap Margin	25.5%	26.2%	26.2%	26.2%	26.2%	26.3%	26.4%	26.4%	26.4%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	388	39	28	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	30.6%	30.9%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	2,900	2,600	1,933	1,700	1,477	1,464	1,398	0	0	0
				Compliance Adj Potential Cap Margin	31.1%	31.2%	31.4%	31.4%	31.5%	31.5%	31.5%	31.9%	31.9%	31.9%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	880	852	878	859	1,635	757	1,678	515	0	0
				Compliance Adj Potential Cap Margin	23.4%	23.4%	23.4%	23.4%	23.2%	23.5%	23.2%	23.5%	23.7%	23.7%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	315	171	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	40.6%	40.8%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	359	2,080	1,392	700	2,213	1,320	0	0	0	0
				Compliance Adj Potential Cap Margin	22.9%	22.1%	22.4%	22.7%	22.0%	22.4%	23.0%	23.0%	23.0%	23.0%
Cooling Towers – Fossil Fuel Facilities														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	2,460	2,250	1,568	1,641	1,595	1,280	1,880	1,150	1,133	0
				Compliance Adj Potential Cap Margin	37.5%	37.6%	38.1%	38.1%	38.1%	38.3%	37.9%	38.4%	38.4%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	3,352	3,140	1,889	1,673	1,826	1,763	1,819	1,154	0	0

Table 5-8: Summary of Downtime Impact Analysis by NERC Region, Downtime Period, and Option

NERC Region	Reference Margin[a]	Demand[b]	Capacity[c]	Measure[d,e,f]	Downtime Periods 1	2	3	4	5	6	7	8	9	10
				Compliance Adj Potential Cap Margin	20.0%	20.2%	21.6%	21.9%	21.7%	21.8%	21.7%	22.4%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	1,618	1,365	1,299	1,305	1,315	1,332	1,290	1,323	1,307	0
				Compliance Adj Potential Cap Margin	24.1%	24.5%	24.6%	24.6%	24.6%	24.6%	24.6%	24.6%	24.6%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	1,849	2,360	1,818	1,691	1,726	1,796	1,650	1,669	835	1,418
				Compliance Adj Potential Cap Margin	29.2%	28.7%	29.2%	29.4%	29.3%	29.3%	29.4%	29.4%	30.2%	29.6%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	7,620	7,613	7,623	7,624	7,624	7,620	7,599	7,624	7,575	822
				Compliance Adj Potential Cap Margin	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%	31.7%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	8,345	8,349	8,336	8,290	8,390	8,320	8,253	8,237	7,891	2,230
				Compliance Adj Potential Cap Margin	21.2%	21.2%	21.2%	21.2%	21.2%	21.2%	21.2%	21.2%	21.4%	23.0%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	1,623	1,584	1,547	1,406	1,396	1,307	1,326	1,344	1,038	508
				Compliance Adj Potential Cap Margin	39.4%	39.4%	39.5%	39.6%	39.6%	39.7%	39.7%	39.7%	40.0%	40.5%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	1,025	199	184	762	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.6%	22.9%	22.9%	22.7%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Cooling Towers – Nuclear Facilities														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	572	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	25.6%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	620	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	30.4%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	1,734	1,734	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	31.4%	31.4%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	3,700	1,152	2,057	1,824	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.6%	23.3%	23.1%	23.2%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Option 3: I&E Mortality Everywhere														
IM Technology														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	1,252	65	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.3%	23.6%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	670	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	25.5%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%

Table 5-8: Summary of Downtime Impact Analysis by NERC Region, Downtime Period, and Option

NERC Region	Reference Margin[a]	Demand[b]	Capacity[c]	Measure[d,e,f]	Downtime Periods									
					1	2	3	4	5	6	7	8	9	10
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	39	28	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	30.9%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	2,900	2,600	1,933	1,700	1,388	1,387	1,306	0	0	0
				Compliance Adj Potential Cap Margin	31.1%	31.2%	31.4%	31.4%	31.5%	31.5%	31.5%	31.9%	31.9%	31.9%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	679	676	1,635	639	1,678	668	237	0	0	0
				Compliance Adj Potential Cap Margin	23.5%	23.5%	23.2%	23.5%	23.2%	23.5%	23.6%	23.7%	23.7%	23.7%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	315	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	40.6%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	281	1,392	700	2,213	1,320	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.9%	22.4%	22.7%	22.0%	22.4%	23.0%	23.0%	23.0%	23.0%	23.0%
Cooling Towers – Fossil Fuel Facilities														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	2,460	2,250	1,625	1,641	1,595	1,406	1,880	1,150	1,133	0
				Compliance Adj Potential Cap Margin	37.5%	37.6%	38.1%	38.1%	38.1%	38.2%	37.9%	38.4%	38.4%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	3,352	3,140	1,910	1,889	1,945	1,991	1,852	1,959	488	0
				Compliance Adj Potential Cap Margin	20.0%	20.2%	21.6%	21.6%	21.6%	21.5%	21.7%	21.5%	23.1%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	1,618	1,463	1,463	1,461	1,458	1,461	1,466	1,464	1,445	29
				Compliance Adj Potential Cap Margin	24.1%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	1,936	2,360	1,913	1,931	1,919	1,907	1,936	1,931	609	1,418
				Compliance Adj Potential Cap Margin	29.1%	28.7%	29.1%	29.1%	29.1%	29.1%	29.1%	29.1%	30.4%	29.6%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	8,042	8,038	8,039	8,039	8,041	8,042	8,037	8,039	8,026	772
				Compliance Adj Potential Cap Margin	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	29.5%	31.7%
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	9,276	9,274	9,258	9,273	9,174	9,174	9,270	9,140	8,305	2,230
				Compliance Adj Potential Cap Margin	20.9%	20.9%	20.9%	20.9%	21.0%	21.0%	20.9%	21.0%	21.2%	23.0%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	1,623	1,584	1,547	1,406	1,396	1,307	1,326	1,344	1,209	508
				Compliance Adj Potential Cap Margin	39.4%	39.4%	39.5%	39.6%	39.6%	39.7%	39.7%	39.7%	39.8%	40.5%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	1,025	320	184	2,080	762	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.6%	22.9%	22.9%	22.1%	22.7%	23.0%	23.0%	23.0%	23.0%	23.0%
Cooling Towers – Nuclear Facilities														
ERCOT	11.1%	54,085	88,965	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
FRCC	13.0%	55,516	72,725	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
MRO	13.0%	40,067	54,436	Downtime Capacity (MW)	572	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	25.6%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%
NPCC	13.0%	50,760	73,549	Downtime Capacity (MW)	620	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	30.4%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
RFC	12.8%	157,900	231,959	Downtime Capacity (MW)	1,734	1,734	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	31.4%	31.4%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%	31.9%

Table 5-8: Summary of Downtime Impact Analysis by NERC Region, Downtime Period, and Option

NERC Region	Reference Margin[a]	Demand[b]	Capacity[c]	Measure[d,e,f]	Downtime Periods 1	2	3	4	5	6	7	8	9	10
SERC	13.0%	23,698	266,885	Downtime Capacity (MW)	3,700	1,152	2,057	1,824	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	22.6%	23.3%	23.1%	23.2%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%
SPP	13.0%	37,592	63,650	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%
WECC	12.1%	131,752	171,152	Downtime Capacity (MW)	0	0	0	0	0	0	0	0	0	0
				Compliance Adj Potential Cap Margin	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%

Source: U.S. EPA Analysis, 2010; NERC 2008

Notes to *Table 5-8*

a. Reference reserve margin: either the target reserve margin provided by the region/subregion or NERC assigned based on capacity mix (i.e., thermal/hydro).

b. The expected 2017/2018 winter net internal demand. Net internal demand is a total internal demand reduced by dispatchable controllable (capacity) demand response.

c. The expected 2017/2018 winter adjusted potential capacity. Adjusted potential capacity is the sum of net capacity resources, existing uncertain resources less all derates, total proposed resources reduced by a confidence factor and net non-firm transactions

d. Compliance Adjusted Potential Capacity Margin is calculated as (Adjusted Potential Capacity – Downtime Capacity - Net Internal Demand) / (Adjusted Potential Capacity – Downtime Capacity)

e. 316(b) Facility-Level Downtime Capacity values for most facilities were developed using the average of baseline projections from IPM for 2015, 2020, 2025, and 2028. For the other facilities, capacity values are from the 2007 EIA-860 database. Facility-level capacity used for the downtime assessment includes steam capacity only.

f. In most instances when downtime capacity in a given time period exceeds 2 percent of the total capacity in the region, this downtime capacity belongs to an individual facility and, therefore, could not be subdivided to ensure a more uniform downtime capacity distribution across time periods. To the extent that the entire steam generating capacity of these individual facilities would not need to be out of service at the same time to complete technology installation, the assessment of capacity availability impact is likely overstated in these instances.

Table 5-9: Downtime Capacity for the ASCC and HICC NERC Regions, by Region, Compliance Year, and Option

NERC Region	Total Regional Capacity (MW)[a]	Measure[b,c]	1	2	3
Option 1: IM Everywhere					
ASCC	2,049	Downtime Capacity (MW)	28	0	0
		% of Region Total	1.37%	0.00%	0.00%
HICC	2,648	Downtime Capacity (MW)	610	0	0
		% of Region Total	23.02%	0.00%	0.00%
Option 2: IM Everywhere and EM for Facilities with DIF>125MGD					
IM Technology					
ASCC	2,049	Downtime Capacity (MW)	28	0	0
		% of Region Total	1.37%	0.00%	0.00%
HICC	2,648	Downtime Capacity (MW)	0	0	0
		% of Region Total	0.00%	0.00%	0.00%
Cooling Towers – Fossil Fuel Facilities					
ASCC	2,049	Downtime Capacity (MW)	0	0	0
		% of Region Total	0.00%	0.00%	0.00%
HICC	2,648	Downtime Capacity (MW)	610	372	104
		% of Region Total	23.02%	14.05%	3.94%
Option 3: I&E Mortality Everywhere					
Cooling Towers – Nuclear					
ASCC	2,049	Downtime Capacity (MW)	28	0	0
		% of Region Total	1.37%	0.00%	0.00%
HICC	2,648	Downtime Capacity (MW)	610	372	104
		% of Region Total	23.02%	14.05%	3.94%

a. Regional capacity values for HICC and ASCC are from the 2007 EIA-860 database. Regional capacity is a total of steam and non-steam capacity.

b. Facility-level downtime capacity values are from the 2007 EIA-860 database. Facility-level capacity used for the downtime assessment includes steam capacity only.

c. There is only 1 in-scope Electric Generator in the ASCC NERC region and 3 in-scope Electric Generators in the HICC NERC region.

d. When downtime capacity in a given time period exceeds 2 percent of the total capacity in the region, this downtime capacity belongs to an individual facility and, therefore, could not be subdivided to ensure a more uniform downtime capacity distribution across time periods. To the extent that the entire steam generating capacity of these individual facilities would not need to be out of service at the same time to complete technology installation, the assessment of capacity availability impact is likely overstated in these instances.

Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b

6 Assessing the Impact of the Existing Facilities Regulatory Options in the Context of National Electricity Markets

In the previous analyses for the 316(b) Phase II Regulations, EPA used ICF International's Integrated Planning Model (IPM®)[152], a comprehensive electricity market optimization model, to assess the economic impact of regulatory options within the context of regional and national electricity markets. For its market model analysis of the 316(b) existing facilities rule options, EPA used an updated version of this same analytic system, Integrated Planning Model Version 3.02 EISA (IPM V3.02), to assess facility and market-level effects.[153]

Use of a comprehensive, market model analysis system is important in assessing the potential impact of the options because of the interdependence of electricity generating units in supplying power to the electric transmission grid. Increases in electricity production costs and potential reductions in electricity output at directly affected facilities – whether due to the temporary shutdown of electric generating units during technology installation and/or the energy production penalties resulting from compliance system operation – can have a range of broader market impacts that extend beyond the effect on complying facilities. In addition, the impact of compliance requirements on directly affected facilities may be seen differently when the analysis considers the impact on those facilities in the context of the broader electricity market instead of looking at the impact on a standalone, single-facility basis.

This chapter is organized as follows:

- *Section 6.1* provides an overview of IPM V3.02, which is the basis of the Market Model Analysis for the proposed regulatory options.
  - Within *Section 6.1*, *Section 6.1.1* reviews changes in the model since the time of the suspended 2004 Phase II Rule analyses.
  - *Section 6.1.2* reviews specifications and changes to the standard IPM configuration to meet the requirements of the Proposed Existing Facilities Rule analyses.
- *Section 6.2* summarizes the key inputs to IPM for performing the Proposed Existing Facilities Rule analyses and the key outputs reviewed as indicators of the effect of the regulatory options.
- *Section 6.3* describes the specific regulatory options considered in the market model analysis and how these options map to the broader set of regulatory options that EPA considered in developing the Proposed Existing Facilities Rule options for presentation in this report.
- *Section* 6.4 provides the findings from the market model analysis.
- *Section 6.5* identifies key uncertainties and limitations in the market model analysis.

[152] Specifically, IPM Version 2.1.

[153] EPA reviewed a number of electricity market models for potential use in assessing the impact of the 316(b) Phase II regulation in its analyses for the suspended 2004 Phase II Rule. At that time, EPA concluded that IPM represented the best choice for 316(b) rule analyses considering a number of factors: ability to receive and account for as inputs, the cost and operating effect specifications of the 316(b) regulation; ability to assess the impact of 316(b) regulatory requirements on capacity dispatch and utilization, capacity planning and management (i.e., capacity expansion, modifications, and retirements), and electricity production costs and prices; level of documentation and acceptance of the models for use in assessing electricity market impacts of environmental regulations; ability to incorporate other environmental regulatory actions in the baseline analysis; ability to incorporate EPA preferences in terms of adjustments to the baseline electricity demand forecasts built into the model; and cost of model usage. On the basis of this prior model review and selection process, EPA decided to rely again on IPM for the analyses of the existing facilities rule.

6.1 Overview of the IPM Model and Its Use for the Market Model Analysis of the Existing Facilities Rule Options

IPM V3.02 is an engineering-economic optimization model of the electric power industry, which generates least-cost resource dispatch decisions based on user-specified constraints such as environmental, demand, and other operational constraints. The model can be used to analyze a wide range of electric power market questions at the plant, regional, and national levels. In the past, applications of IPM have included capacity planning, environmental policy analysis and compliance planning, wholesale price forecasting, and asset valuation.

IPM uses a long-term dynamic linear programming framework that simulates the dispatch of generating capacity to achieve a demand-supply equilibrium on a seasonal basis and by region. The model seeks the optimal solution to an "objective function," which is the summation of all the costs incurred by the electric power sector, i.e., capital costs, fixed and variable operation and maintenance (O&M) costs, and fuel costs, over the entire evaluated time horizon; the result is expressed as the net present value of all cost components. The objective function is minimized subject to a series of user-defined supply and demand, or system operating, constraints. Supply-side constraints include capacity constraints, availability of generation resources, plant minimum operating constraints, transmission constraints, and environmental constraints. Demand-side constraints include reserve margin constraints and minimum system-wide load requirements. The optimal solution to the objective function is the least-cost mix of resources required to satisfy system-wide electricity demand on a seasonal basis by region. In addition to existing capacity, the model also considers new resource investment options, including capacity expansion at existing facilities, as well as investment in new plants. The model selects new investments while considering interactions with fuel markets, capacity markets, power plant cost and performance characteristics, forecasts of electricity demand, system reliability considerations, and other constraints. The resulting system dispatch is optimized given the resource mix, unit operating characteristics, and fuel and other costs, to achieve the most efficient use of existing and new resources available to meet demand. The model is dynamic in that it is capable of using forecasts of future conditions to make decisions for the present. For a detailed discussion on adjustments made to the IPM framework to analyze the impact of the regulatory options on electricity generation market, see *Section 6.1.2* below.

6.1.1 Key Specifications of the IPM V3.02 Update

For the current analysis, EPA used IPM Version 3.02, which is an update from the version (Version 2.1) used for the suspended 2004 Phase II regulatory analysis. Key specifications of the updated Version 3.02 that are relevant to the existing facilities rule analyses are summarized in the following sections.

Power Plant Universe

IPM V3.02 is based on an inventory of all U.S. utility- and non-utility-owned boilers and generation facilities[154] that provide power to the integrated electric transmission grid, as recorded in the Department of Energy's EIA databases as of 2005.[155] The modeling system includes 533, or nearly all, of the 559 explicitly and implicitly analyzed electric generating facilities that EPA estimates will be within the scope of Proposed Existing Facilities Rule. The exclusions of facilities from the IPM analysis include 4 facilities that are located in Alaska or Hawaii (and thus not included in IPM), 4 "lower-48" facilities that are not connected to the integrated electric transmission grid, 7 facilities excluded from the IPM baseline as the result of custom adjustments made by ICF, and 11 facilities that are not *explicitly* present in the 316(b) facility dataset for this analysis.[156]

154 With the exception that IPM does not include units based in Hawaii or Alaska.

155 In some instances, facility information has been updated to reflect known material changes in a plant's generating capacity since 2005.

156 EPA's analysis of electricity market impacts is based on the total of "lower-48"/grid-connected facilities that responded to the Detailed Questionnaire (DQ) and Short Technical Questionnaire (STQ) to the 316(b) survey. A small number of facilities did not

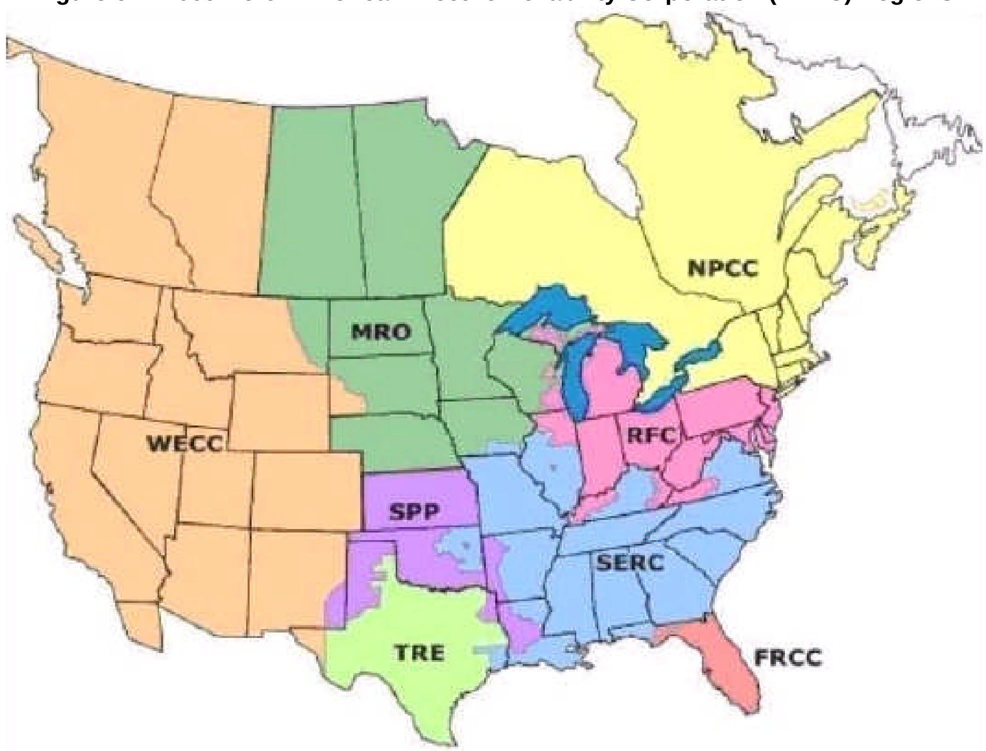
Electricity Demand Baseline

IPM Version 3.02 embeds a baseline energy demand forecast that is derived from the Department of Energy's *Annual Energy Outlook 2008* (AEO2008), with adjustments by EPA to account for the effect of certain voluntary energy efficiency programs. This electricity demand baseline is the same as that used by EPA in IPM-based analyses for air program regulations.

Regional Analysis Framework

IPM V3.02 divides the U.S. electric power market into 32 regions in the contiguous 48 states. It does not include generators located in Alaska or Hawaii. The 32 regions map to North American Reliability Corporation (NERC) regions and sub-regions. IPM models electricity demand, generation, transmission, and distribution within each region and across the transmission grid that connects regions. For the analyses presented in this chapter, IPM regions were aggregated back into NERC regions. *Figure 4C-5* provides a map of the 2009 NERC regions and *Table 6-1* lists the regions included in IPM V3.02 and a crosswalk between these NERC regions and the IPM regions.

Figure 6-1: 2009 North American Electric Reliability Corporation (NERC) Regions



a. The ASCC and HICC are not shown.
Source: U.S. DOE, 2009c

respond to either the DQ or STQ. In the analyses described elsewhere in this report, these non-respondents are accounted in the facility sample weights. However, use of sample weights would not be appropriate in the IPM framework, and thus these "sample weight-represented" facilities cannot be analyzed in the IPM-based electricity market analysis.

Table 6-1: Crosswalk between NERC Regions and IPM Regions[a]

NERC Region		Corresponding IPM Region(s)
ASCC	Alaska Systems Coordinating Council	Alaska plants are not included in IPM
TRE[b]	Texas Regional Entity	ERCT
FRCC	Florida Reliability Coordinating Council	FRCC
HI	Hawaii	Hawaii plants are not included in IPM
MRO	Midwest Reliability Organization	MRO, WUMS
NPCC	Northeast Power Coordination Council	DSNY, LILC, NENG, NYC, UPNY
RFC	ReliabilityFirst Council	COMD, MACE, MACS, MACW, MECS, RFCO, RFCP
SERC	Southeastern Electricity Reliability Council	ENTG, GWAY, SOU, TVA, TVAK, VACA, VAPW
SPP	Southwest Power Pool	SPPN, SPPS
WECC	Western Electricity Coordinating Council	AZNM, CA-N, CA-S, NWPE, PNW, RMPA, SNV

a. The definition and configurations of NERC regions have changed several times over the past few years. This report uses different NERC region configurations in different analyses, depending on the NERC region definition in which the data underlying a given analysis were reported. The NERC region framework used in the IPM Version 3.02 and underlying the Market Model Analysis is based on NERC region definitions as of 2009.

b. TRE replaced ERCOT (Electric Reliability Council of Texas). For the purpose of this analysis, to identify this geographic region EPA used ERCOT instead of TRE.

Source: U.S. EPA, 2010

Regulations Accounted for in the IPM Analysis Baseline

An important reason for using IPM for the 316(b) regulatory analyses is that EPA uses the model to support analysis of air regulations and the model thus incorporates in its analytic baseline, the expected compliance response for air regulations affecting the power sector: Title IV of the Clean Air Act (the Acid Raid Program); the NOx SIP Call; various New Source Review (NSR) settlements[157]; and several state rules[158] affecting emissions of SO_2 and NOx that were finalized through February 3, 2009. IPM also includes state rules that have been finalized and/or approved by a state's legislature or environmental agency, and in certain instances, facility-level compliance technology installations that have already been undertaken because of CAIR requirements.

Earlier versions of the IPM baseline included the Clean Air Visibility Act (CAVR) and the Clean Air Mercury Rule (CAMR); however, these regulations were removed from the Version 3.02 baseline. CAMR was vacated by the D.C. Circuit Court in February 2008 along with EPA's rule removing power plants from the Clean Air Act list of sources of hazardous air pollutants. The specific CAVR electric power sector assumptions formerly modeled in IPM have been removed because of uncertainties associated with the measures and requirements States will adopt to satisfy CAVR requirements.[159]

As described in the preceding paragraph, the D.C. Circuit vacated EPA's Clean Air Interstate Rule (CAIR) on July 11, 2008. However, on December 23, 2008, the U.S. Court of Appeals issued a new ruling that repealed the vacatur and instead, remanded CAIR, noting that: "allowing CAIR to remain in effect until it is replaced by a rule consistent with our opinion would at least temporarily preserve the environmental values."[160] At the time that EPA began analyzing the Proposed Existing Facilities Rule, the Agency was still in the process of developing the regulatory standards to replace CAIR requirements. The Transport Rule, which replaces CAIR, was proposed on July 6, 2010, i.e., after EPA began developing the baseline for the current analyses. Consequently, the IPM

157 Including agreements between EPA and Southern Indiana Gas and Electric Company (Vectren), Public Service Enterprise Group, Tampa Electric Company, We Energies (WEPCO), Virginia Electric & Power Company (Dominion), Santee Cooper, Minnkota Power Coop, American Electric Power (AEP), East Kentucky Power Cooperative (EKPC), Nevada Power Company, Illinois Power, Mirant, Ohio Edison, and Kentucky.

158 Include current and future state programs in Connecticut, Delaware, Georgia, Illinois, Maine, Maryland, Massachusetts, Minnesota, Missouri, New Hampshire, North Carolina, New Jersey, New York, Oregon, Texas, and Wisconsin.

159 Under CAVR, States determine which facilities must install controls and the type of controls facilities must use to satisfy Best Available Retrofit Technology (BART) requirement according to the guidelines finalized by EPA in June 2005.

160 United States Court of Appeals for the District of Columbia Circuit, No. 05-1244

baseline used for the analysis of the Proposed Existing Facilities Rule does not reflect requirements under the Transport Rule.[161] However, because EPA used the v3.02 EISA, i.e., the same IPM version used for the market model analysis of 316(b) regulatory options, to assess the impact of the proposed Transport Rule on the U.S. electric power sector, the 316(b) baseline includes other important *existing* regulations currently affecting this industry sector. Consequently, on balance, EPA judges that the performance of the market model analyses against the v3.02 EISA constitutes a reasonable cost and economic impact analysis for the Proposed Existing Facilities Rule – in particular, given the uncertainties regarding the *final* standards promulgated, and the specific requirements that States will adopt in implementing the Transport Rule.[162]

6.1.2 Key Specifications for Analysis of the Proposed Existing Facilities Regulatory Options

In the same way as in the analysis for the suspended 2004 Phase II rule, EPA specified certain adjustments to the IPM framework to meet the objectives of the electricity market analysis for the 316(b) Existing Facilities Rule.

Treatment of Individual Plants and Generating Units

IPM is supported by a database of boilers and electric generation units that includes all existing *utility-owned* generation units as well as those located at plants owned by *non-utility* power generators that contribute capacity to the electric transmission grid.[163] Individual generators are aggregated into model plants with similar O&M costs and specific operating characteristics including seasonal capacities, heat rates, maintenance schedules, outage rates, fuels, and transmission and distribution loss characteristics.

In the analyses for EPA air regulations, IPM aggregates individual boilers and generators with similar cost and operational characteristics into model plants. Since the IPM model plants were initially created to support air policy analyses, this configuration was not appropriate for the 316(b) analysis. As a result, the steam electric generators at facilities subject to the existing facilities rule were unbundled from the existing IPM model plants and analyzed as individual generating units along with the other existing model plants. Consequently, the IPM baseline for the existing facilities rule market analysis consists of 14,903 individually modeled generating units.

Model Run Years

For the Proposed Existing Facilities Rule analyses, IPM V3.02 modeled the electric power market over the 25-year period from 2012 to 2035. Due to the highly data- and calculation-intensive computational procedures required for the IPM dynamic optimization algorithm, IPM is run only for a limited number of years. Run years are selected based on analytical requirements and the necessity to maintain a balanced choice of run years throughout the modeled time horizon. Further, depending on the analytical needs, in the IPM analysis, these *individual* run years are assigned to represent other *adjacent* years in addition to the run year, itself. In the *standard* IPM baseline analysis (i.e., before any adjustments to accommodate the 316(b) analysis requirements), the IPM run years are set up on a simple interval: 2015, 2020, and 2025. IPM run years represent the 5-year period beginning two years before and ending two years after the run year – e.g., 2015 would represent the interval 2013-2017. In specifying the run years for the current 316(b) analyses, EPA used the standard 5-year interval-based run years (e.g., 2015, 2020, and 2025) and identified an additional run year to meet specific 316(b) regulatory analysis requirements.

In specifying the additional run years EPA accounted for two key analytic requirements:

- <u>The need to assess the effect of the Proposed Existing Facilities Rule on electricity markets during the years in which facilities would be expected to incur downtime to install compliance technology.</u> This

[161] For more information on the Transport Rule see http://www.epa.gov/airtransport/actions.html#jul10.

[162] For more information on IPM v3.02 EISA see http://www.epa.gov/airmarkets/progsregs/epa-ipm/transport.html.

[163] See Chapter 2 for a review of the operating structure of the national electric power sector.

compliance window is expected to occur over the period 2013-2027: for IM-only technology installations, the currently expected compliance window is from 2013 to 2017, and for cooling tower installations from 2018 to 2022 for fossil fuel facilities and 2023 to 2027 for nuclear facilities leading to a "total" compliance window of 2013 to 2027 for all facilities (see *Chapter 3: Development of Costs for Regulatory Options*). The incurrence of downtime may lead to increased cost of electricity generation as in-scope generating units are taken out of service to complete technology installation and other, presumably higher production cost generating units are dispatched to meet electricity demand. Because of the potential resulting increase in electricity production costs, it is important to examine market-level effects during the period in which downtime would occur.

- The need to assess the effect of the proposed existing facilities rule on electricity markets during the period after achievement of compliance by all 316(b) facilities, which, under the regulatory option specifications considered for this analysis, is expected to occur in 2028 and subsequent years. Effects that may occur during the post-compliance "steady state" include potential permanent losses in generating capacity from early retirement (closure) of generating units, increases in electricity production costs due to higher operating expenses and permanent reduction in electric generating capability and production efficiency at 316(b) facilities (in particular, from energy penalty effects), and, as described for the assessment of downtime effects, the need to dispatch other, potentially higher production cost, generating units to offset losses in electric generating capacity. The increase in electricity production costs observed during the *steady state* post-compliance period would be expected to be less than the increase in costs during the period of installation downtime: during the period of installation downtime, full generating units could be out of service for technology installation and for early retirement; during the post-compliance period, capacity losses and increased overall production costs would result only from the early retirements, energy penalty effects, and other increased expenses *and would not include the effect of the temporary unit closures for completing of technology installation*.

Based on these considerations, EPA designated the following run years and assigned *representation* years as follows:

- To capture the effect of 316(b)-related installation downtime, EPA designated the years:
  - 2015, which was assigned to the years 2013 through 2017
  - 2020, which was assigned to the years 2018 through 2022
  - 2025, which was assigned to the years 2023 through 2027
- To capture the effect of 316(b) increased electricity production costs *at the market level* resulting from capacity closures, and increased operating and maintenance expenses and energy penalty effects at 316(b) facilities, during the period following achievement of compliance by all facilities and completion of all installation downtime, EPA designated 2028, which was assigned only to one year - 2028.

In the analyses presented later in this chapter, EPA reports results for the 2028 model run year, which is the first year after promulgation in which all in-scope facilities would have achieved compliance, to provide insight on the effect of the proposed rule during the steady state period of post-compliance operations.

EPA also reports results for the 2015, 2020, and 2025 model run years. These results provide insight into potential market-level effects for the years during which facilities would be expected to shut down operations temporarily to complete technology installation (2015 for installation of IM-only technologies and 2020 and 2025 for installation of cooling towers for nuclear and fossil fuel facilities, respectively).

Selection of Compliance Responses

In the same way as was done in the earlier IPM-based analyses for the suspended 2004 Phase II Rule, EPA did not apply a feature available in the IPM framework in which modeled facilities select their compliance response to a regulation that is being analyzed. This capability is used regularly in analyses of air regulations and permits facilities to be analyzed assuming selection of a compliance response from a menu of options, based on the most advantageous economic outcome *to the facility*. For the analysis of the Proposed Existing Facilities Rule options, EPA determined the compliance response to regulatory options external to IPM, from an evaluation of baseline engineering factors for facilities (e.g., design flow of existing cooling water intake structures, presence of equipment for reducing impingement and entrainment of aquatic organisms, etc.) in relation to the requirements of a given regulatory option. As described below, the compliance specifications were input to IPM via several cost factors, adjustments to the energy production efficiency of affected generating units, and potential downtime of generating units for installation of compliance equipment.

6.2 Model Analysis Inputs and Outputs

In performing the analysis based on IPM V3.02, EPA first developed a baseline – i.e., without regulation – projection of electricity markets and facility operations over the period from the expected promulgation date, 2012, through 2028 (pre-regulation baseline case). EPA then overlaid this analysis with the estimated compliance costs and other operating effects – downtime for installation of compliance technology and energy penalty – for in-scope facilities under selected regulatory options (post-compliance cases).

6.2.1 Key Inputs to IPM V3.0 for the Proposed Phase II Rule Analyses

The inputs for the electricity market analysis include compliance costs, compliance installation downtime, and technology-based reductions in plant generating efficiency (energy penalty) *by affected generating unit*, and the assigned year of compliance. EPA developed the cost and compliance-related capacity reduction input values for each of the 533 facilities subject to the Proposed Existing Facilities Rule and modeled by IPM, based on the costing methodologies described in the Section 316(b) Technical Development Document (U.S. EPA, 2010).

These input categories are as follows:

- *Capital cost* inputs, which reflect the cost of compliance technology equipment, construction, and other upfront, non annually recurring outlays associated with compliance with the proposed regulatory options. Capital costs are specified in terms of the expected useful service life for the specific capital outlay. The categories of outlay and associated service life used in the Proposed Existing Facilities Rule analysis are as follows:
  - Cooling tower equipment: 30 years
  - All other compliance technology outlays: 20, 25, and 30 years

  In the IPM analysis, these outlays are converted into a constant annual charge using IPM's conventional frameworks for recognition of capital outlays over the useful life of the technology.
- *Fixed O&M cost* inputs are expressed in dollars per KW of capacity per year.
- *Variable O&M cost* inputs are expressed in dollars per megawatt hour (MWh) of generation. As discussed in Chapter 3: Development of Costs for Regulatory Options, variable O&M costs also include initial entrainment study over a three-year period and follow-up entrainment studies of one year duration every third year after completion of the initial entrainment study. For the purpose of Market Model Analysis, these entrainment study costs are expressed as follows: initial entrainment study is necessary for the on-going operation of the plant and costs associated with this initial study are therefore added to the capital costs for cooling towers and non-cooling tower technologies with useful life of 30 years; recurring entrainment study costs (annualized over 3 years) are added to fixed O&M costs.
- *Permitting costs* consist of initial permitting costs, annual monitoring costs, and repermitting costs (occurring every five years after issuance of the initial permit). For the purpose of Market Model Analysis, permitting cost inputs are expressed as follows: initial permitting activities are necessary for the

on-going operation of the plant and are therefore added to the capital costs for cooling towers and non-cooling tower technologies with useful life of 30 years; annual monitoring and repermitting costs (annualized over 5 years) are added to fixed O&M costs.

- *Energy penalty* consists of a reduction in the energy production capability and energy efficiency of an affected generating unit based on (1) reduced net saleable generating output from the affected unit due to energy required for operating compliance technology and (2) for cooling towers only, a reduction in energy conversion efficiency due to increased turbine back pressure. These values were combined into a single percentage reduction in the energy production efficiency of the affected generating unit following the methodology outlined in *Chapter 3*. In IPM, the percentage reduction is applied as a permanent decrease in the affected generating unit's energy conversion efficiency – i.e., a reduction in the saleable electricity derived from a given quantity of energy input to the generating unit. The energy penalty affects the electricity production cost of the affected unit in the same way as a change in variable O&M.
- *Installation downtime capacity reductions* enter the analysis as a designated time period in which affected generating units are taken out of service for installation of compliance technology. Installation downtime values are expressed in weeks, and are estimated and applied in the analysis, as the *additional* downtime beyond normally scheduled downtime for affected generating units (see *Chapter 3*). That is, plant operators are assumed to schedule downtime for 316(b) compliance in conjunction with ordinary scheduled downtime; the effect of 316(b) compliance downtime on electricity markets thus results only from the extension of downtime beyond the ordinary scheduled downtime. Installation downtime is assumed to occur in the year in which a facility complies with a regulatory option. For the electricity market analysis, downtime therefore occurs during the IPM analysis compliance windows of 2013-2017, 2018-2022, and 2023-2027, depending on assigned technology and facility fuel type. In the IPM analysis, the *total* downtime for each affected generating unit is spread uniformly over a given five-year period.[164] Thus, the analysis assumes that installation downtime occurs uniformly over the five-year compliance window both for individual generating units and for the aggregate of affected generating units. As discussed in Chapter 3, nuclear facilities are not expected to incur any additional downtime as the result of either IM technology or cooling tower installation.

Because the market model analysis is performed at the level of the individual boiler and/or generating unit, it was necessary to distribute facility-level costs across affected boilers/generating units in developing the above inputs. EPA followed a similar approach to that used in the previous 316(b) rule analyses. Specifically, EPA allocated facility-level costs across all affected steam generating units (boilers and generators) using allocation factors based either on steam generating capacity from IPM or on boiler-level water flow data from 2005 EIA-767.[165] For facilities with available design intake flow data, this distribution was based on each affected generating unit's proportion of total design intake flow; for facilities without available design intake flow, this distribution was based on each generating unit's proportion of total steam electric capacity. Generator-level compliance costs were aggregated to the boiler level (for use in IPM) based on the boiler-generator crosswalk contained in the IPM baseline datasets.

In addition to specifying these cost elements and the duration of installation downtime, it was necessary to assign compliance years for each facility. To develop this compliance schedule, the Agency closely followed the approach of the suspended Phase II Final Rule for fossil fuel facilities, and of the original 2002 Phase II Proposed Rule for nuclear facilities. For this analysis, EPA assumed that non-nuclear and nuclear Electric Generators

[164] This required treatment is an artifact of the way in which IPM performs analysis using single model run-years to represent the effect over a specified period of years. One-fifth of the downtime value is assigned to each of the two 5-year analysis periods of 2013-2017, for IM technologies, 2018-2022, for cooling towers at fossil fuel facilities, and 2023-2027 for cooling towers at nuclear facilities with each of the years receiving one-fifth of the relevant downtime value.

[165] The latest year for which EIA flow data are available is 2005.

assigned either only IM technology or no compliance technology[166] would comply in the year of their first post-promulgation permit and first post-promulgation In-Service Inspection (ISI), respectively, resulting in a compliance window of 2013 through 2017. Further, the Agency assumed that fossil fuel and nuclear Electric Generators assigned cooling towers regardless of whether they were also assigned IM technologies would comply in the year of their second post-promulgation permit and third post-promulgation ISI, respectively, resulting in a compliance window of 2018 through 2022 for fossil fuel facilities and 2023 through 2027 for nuclear facilities. For more information on compliance schedule see *Chapter 3: Development of Costs for Regulatory Options*.[167]

6.2.2 Key Outputs of the Market Model Analysis Used in Assessing the Effects of the Proposed Phase II Regulatory Options

IPM V3.02 provides outputs for the NERC regions that lie within the continental United States. As described above, IPM V3.02 does not analyze electric power operations in Alaska and Hawaii because these states' electric power operations are not interconnected to the continental U.S. power grid.

IPM V3.02 generates a series of outputs at different levels of aggregation (boiler, model plant, region, and nation). The economic analysis for the Proposed Existing Facilities Rule used a subset of the available IPM output. For each model run (baseline case and each analyzed regulatory option) and for the analysis years indicated above, the following model outputs were generated:

- *Capacity* – Capacity is a measure of the ability to generate electricity. This output measure reflects the summer net dependable capacity of all generating units at the plant. The model differentiates between existing capacity, new capacity additions, and existing capacity that has been repowered.
- *Early Retirements* – IPM models two types of plant closures: closures of nuclear plants as a result of license expiration and economic closures as a result of negative net present value of future operation. This analysis considers only economic closures in assessing the impacts of the Proposed Existing Facilities Rule. However, cases where a nuclear facility decides to renew its license in the baseline case but does not renew its license in the post-compliance case for a given policy option, are also considered economic closures and an impact of that policy option.
- *Energy Price* – The average annual price received for the sale of electricity.
- *Capacity Price* – The premium over energy prices received by facilities operating in peak hours during which system load approaches available capacity. The capacity price is the premium required to stimulate new market entrants to construct additional capacity, cover costs, and earn a return on their investment. This price manifests as short term price spikes during peak hours and, in long-run equilibrium, need be only so large as is required to justify investment in new capacity.
- *Generation* – The amount of electricity produced by each plant that is available for dispatch to the transmission grid ("net generation"). IPM provides summer, winter, and total annual generation.
- *Energy Revenue* – Revenue from the sale of electricity to the grid. IPM provides summer, winter, and total annual energy revenue.
- *Capacity Revenue* – Revenue received by facilities operating in hours where the price of energy exceeds the variable production cost of generation for the next unit to be dispatched at that price in order to maintain reliable energy supply in the short run. At these peak hours, the price of energy includes a

[166] These facilities still incur permitting costs.

[167] EPA obtained information on NPDES permit renewals from the Water Permit Compliance System (PCS) or the Integrated Container Information Systems – National Pollutant Discharge Elimination System (ICIS-NPDES) and information on ISI schedules for nuclear facilities from the 2007 EIA-860 database.

premium which reflects the cost of the required reserve margin and serves to stimulate investment in the additional capacity required to maintain a long run equilibrium in the supply and demand for capacity.

- *Fuel Costs* – The cost of fuel consumed in the generation of electricity. IPM provides summer, winter, and total annual fuel costs.
- *Variable Operation and Maintenance (VOM) Costs* – Non-fuel O&M costs that vary with the level of generation, e.g., cost of consumables, including water, lubricants, and electricity. IPM provides summer, winter, and total annual VOM costs.
- *Fixed Operation and Maintenance (FOM) Costs* – O&M costs that do not vary with the level of generation, e.g., labor costs and capital expenditures for maintenance. In the post-compliance cases, fixed O&M costs also include annualized capital costs of compliance and permitting costs.
- *Capital Costs* – The cost of construction, equipment, and capital. Capital costs are associated with investment in new equipment, e.g., the replacement of a boiler or condenser, installation of technologies to meet the requirements of air regulations, or the repowering of a plant.

Comparison of these outputs for the baseline and post-compliance cases provides insight into the effect of the Proposed Existing Facilities Rule options on affected facilities and broader electric power markets.[168]

6.3 Regulatory Options Analyzed

For this analysis, EPA analyzed three regulatory options that closely align with the three options discussed elsewhere in this EA report:[169]

1. Option 1: Impingement Mortality at All Existing Facilities and Entrainment Controls for All New Units at Existing Facilities; Determined Entrainment Controls for Facilities Greater than 2 MGD DIF On a Site-Specific Basis (IM Everywhere[170,171])
2. Option 2: Impingement Mortality Everywhere Plus Entrainment Mortality for Facilities with DIF >125 MGD (IM Everywhere, EM for Facilities with DIF>125 MGD)
3. Option 3: Impingement and Entrainment Mortality Everywhere (I&E Mortality Everywhere).

The fourth option – Option 4: Non-Cooling Tower-Based Impingement and Entrainment requirements at all In-Scope Facilities with DIF of 50 MGD or more – which is addressed in Chapter 13 of this report, was not analyzed in IPM due to time constraints. Since this option mimics the requirements of Option 1, but only applies them to a subset of in-scope facilities, the findings for this option in the IPM analysis would be lower than those estimated for Option 1.

168 IPM output also includes NOx, SO_2, CO_2 and Mercury emissions and total fuel usage – for the full year and by winter and summer season. These metrics are not a part of the analysis discussed in this Chapter.

169 As the case for the Regulatory Options presented in other chapters of this document, these options do not include new unit costs; new unit costs are not a part of IPM analysis.

170 The shorthand notation for this and the other option refers to the minimum direct requirements of the regulatory options. For example, for Option 1, in addition to this minimum requirement (e.g., IM technology for all in-scope facilities), additional requirements for EM technology may be determined on a case-by-case basis and all new units at existing facilities would be required to meet EM technology standards.

171 As analyzed in IPM, Option 1 differs slightly from the Regulatory Option presented in other chapters of this document. In particular, as analyzed in IPM, Option 1 assumes lower costs from the performance of pre-compliance entrainment studies. In the IPM analysis, the duration of these studies is shorter (and the costs lower) than as assessed in the rest of the EA report.

6.4 Findings from the Market Model Analysis

The impacts of the analysis options are assessed as the difference between key economic and operational impact metrics that compare the post-compliance cases to the pre-regulation baseline case.

The main analysis presented in this chapter uses output from the analysis run year 2028, which is the first year after promulgation in which all in-scope facilities would have achieved compliance under either of the three analyzed regulatory options.[172] These results provide insight on the effect of the Proposed Existing Facilities Rule during the steady state period of post-compliance operations.

EPA also presents a subset of results for model run years 2015, 2020, and 2025, which are years during which some in-scope facilities would experience installation downtime. This secondary analysis provides insight into potential market-level effects for a year during which facilities would be expected to shut down operations temporarily to complete technology installation.

6.4.1 Analysis Results for the Year 2028 – To Reflect Steady State, Post-Compliance Operations

In these results, all facilities are assumed to have reached compliance with the analyzed regulatory options and no facilities would be incurring downtime for installation of compliance technology. EPA considered impact metrics of interest at three levels of aggregation:

1. Impact on national and regional electricity markets
2. Impact on the group of in-scope power generating facilities (i.e., facilities that are expected to be within the scope of today's proposed regulation)
3. Impact on individual in-scope facilities.

Impact on National and Regional Electricity Markets

The market-level analysis assesses national and regional changes as a result of the regulatory options. Seven measures are analyzed:

1. *Changes in available capacity*: This measure analyzes changes in the capacity available to generate electricity. A long-term reduction in availability may result from partial or full closures of plants subject to the rule. For this impact measure, EPA distinguished between existing capacity and new capacity additions. Under this measure, EPA also analyzed capacity closures. Only capacity that is projected to remain operational in the baseline case but is closed in the post-compliance case is considered a closure as the result of the Rule. The Market Model Analysis may result in partial (i.e., unit) or full plant early retirements (closures) for a given regulatory option; it may also result in avoided closures if a facility's compliance costs are low relative to other affected facilities. An avoided closure is a unit or plant that would is estimate to close in the baseline, but estimated to continue operation in the post-compliance case.
2. *Changes in the price of electricity*: This measure considers changes in regional prices as a result of the regulatory options. In the long term, electricity prices may change as a result of increased production costs at the affected facilities. In the short-term, price increases may be higher if large power plants have to shut down temporarily to construct and/or install compliance technologies. For this analysis, EPA combined both components of the estimated electricity price – i.e., energy price and capacity price – into a single energy-unit equivalent price (i.e., $ per MWh of energy).

[172] The first year of full compliance is 2028 for Options 2 and 3, and 2018 for Option 1. To facilitate comparison of market-level impacts across options, this presentation focuses on 2028 as the steady state comparison year.

3. *Changes in generation*: This measure considers the amount of electricity generated. At a regional level, long-term changes in generation may result from plant closures or a change in the amount of electricity traded between regions. At the national level, the demand for electricity does not change between the baseline and the analyzed policy options (generation within the regions is allowed to vary). However, demand for electricity does vary across the modeling horizon according to the model's underlying electricity demand growth assumptions.
4. *Changes in revenue*: This measure considers the revenue realized by all facilities in the market and includes both energy revenue and capacity revenue (see definition in *Section 6.2.2* above). A change in revenue could be the result of a change in generation, the price of electricity, or both.
5. *Changes in costs*: This measure considers changes in the overall cost of generating electricity, including fuel costs, variable and fixed O&M costs, and capital costs. Fuel costs and variable O&M costs are production costs that vary with the level of generation. Fuel costs generally account for the single largest share of production costs. Fixed O&M costs and capital costs do not vary with generation. They are fixed in the short-term and therefore do not affect the dispatch decision of a unit (given sufficient demand, a unit will dispatch as long as the price of electricity is at least equal to its per MWh production costs). However, in the long-run, these costs need to be recovered for a unit to remain economically viable.
6. *Changes in pre-tax income*: Pre-tax income is defined as total revenues minus total costs and is an indicator of profitability. Pre-tax income may decrease as a result of reductions in revenue and/or increases in costs.
7. *Changes in variable production costs per MWh*: This measure considers the change in average variable production cost per MWh. Variable production costs include fuel costs and other variable O&M costs but exclude fixed O&M costs and capital costs. Production cost per MWh is a primary determinant of how often a power plant's units are dispatched. This measure presents similar information to total fuel and variable O&M costs, but normalized for changes in generation.

Table 6-2 reports results for regulatory options at the level of the national market and also for regional electricity markets defined on the basis of NERC regions (*Table 6-1*). All of the impact metrics described above are reported at both the national and NERC regional level except electricity prices, which are calculated in IPM only at the regional level.

Table 6-2: Impact of Regulatory Options on National and Regional Markets at the Year 2028

Economic Measures	Baseline	Option 1			Option 2			Option 3		
(all dollar values in $2009)	Value	Value	Diff	% Diff	Value	Diff	% Diff	Value	Diff	% Diff
National Totals										
Total Capacity (GW)	1,148	1,148	0	0.0%	1,148	0	0.0%	1,148	0	0.0%
Existing			-1	-0.1%		-24	-2.1%		-24	-2.1%
New Additions			1	0.1%		24	2.1%		24	2.1%
Early Retirements			1	0.1%		14	1.3%		15	1.3%
Electricity Prices ($/MWh)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Generation (TWh)	4,895	4,895	0	0.0%	4,894	-1	0.0%	4,894	-1	0.0%
Revenue ($Millions)	$315,010	$315,186	$177	0.1%	$315,437	$427	0.1%	$315,518	$508	0.2%
Costs ($Millions)	$187,914	$188,413	$499	0.3%	$197,971	$10,057	5.4%	$198,215	$10,301	5.5%
Fuel Cost	$90,903	$90,860	-$44	0.0%	$91,587	$684	0.8%	$91,587	$683	0.8%
Variable O&M	$14,623	$14,656	$33	0.2%	$14,939	$316	2.2%	$14,941	$318	2.2%
Fixed O&M	$48,578	$49,021	$443	0.9%	$54,474	$5,897	12.1%	$54,601	$6,023	12.4%
Capital Cost	$33,810	$33,877	$67	0.2%	$36,970	$3,160	9.3%	$37,087	$3,276	9.7%
Pre-Tax Income ($Millions)	$127,096	$126,773	-$323	-0.3%	$117,466	-$9,630	-7.6%	$117,303	-$9,793	-7.7%
Variable Production Cost ($/MWh)	$21.56	$21.56	$0.00	0.0%	$21.77	$0.21	1.0%	$21.77	$0.21	1.0%

Table 6-2: Impact of Regulatory Options on National and Regional Markets at the Year 2028

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1 Value	Option 1 Diff	Option 1 % Diff	Option 2 Value	Option 2 Diff	Option 2 % Diff	Option 3 Value	Option 3 Diff	Option 3 % Diff
Electric Reliability Council of Texas (ERCOT)										
Total Capacity (GW)	99	99	0	0.0%	99	0	0.0%	99	0	0.0%
Existing			0	-0.2%		-5	-5.3%		-5	-5.3%
New Additions			0	0.2%		5	5.3%		5	5.3%
Early Retirements			0	0.2%		4	4.5%		4	4.6%
Electricity Prices ($/MWh)	$59.65	$59.64	-$0.01	0.0%	$59.75	$0.10	0.2%	$59.75	$0.10	0.2%
Generation (TWh)	392	392	0	0.0%	392	0	0.0%	392	0	0.0%
Revenue ($Millions)	$26,284	$26,282	-$2	0.0%	$26,307	$23	0.1%	$26,307	$23	0.1%
Costs ($Millions)	$17,476	$17,513	$37	0.2%	$18,335	$858	4.9%	$18,337	$861	4.9%
Fuel Cost	$8,739	$8,725	-$14	-0.2%	$8,554	-$186	-2.1%	$8,538	-$201	-2.3%
Variable O&M	$1,361	$1,363	$2	0.2%	$1,434	$73	5.4%	$1,436	$76	5.6%
Fixed O&M	$3,207	$3,237	$30	0.9%	$3,593	$386	12.0%	$3,596	$389	12.1%
Capital Cost	$4,169	$4,187	$18	0.4%	$4,754	$585	14.0%	$4,767	$598	14.3%
Pre-Tax Income ($Millions)	$8,808	$8,769	-$39	-0.4%	$7,972	-$836	-9.5%	$7,970	-$838	-9.5%
Variable Production Cost ($/MWh)	$25.74	$25.71	-$0.03	-0.1%	$25.45	-$0.29	-1.1%	$25.42	-$0.32	-1.2%
Florida Reliability Coordinating Council (FRCC)										
Total Capacity (GW)	79	79	0	0.0%	79	0	0.0%	79	0	0.0%
Existing			0	-0.1%		-1	-0.7%		-1	-0.8%
New Additions			0	0.1%		1	0.7%		1	0.8%
Early Retirements			0	0.1%		0	0.0%		0	0.0%
Electricity Prices ($/MWh)	$63.56	$63.56	-$0.01	0.0%	$63.62	$0.06	0.1%	$63.62	$0.06	0.1%
Generation (TWh)	310	311	0	0.0%	311	0	0.1%	311	0	0.0%
Revenue ($Millions)	$22,432	$22,438	$6	0.0%	$22,526	$95	0.4%	$22,518	$86	0.4%
Costs ($Millions)	$16,745	$16,775	$31	0.2%	$17,105	$360	2.2%	$17,101	$357	2.1%
Fuel Cost	$9,236	$9,276	$40	0.4%	$9,387	$151	1.6%	$9,395	$159	1.7%
Variable O&M	$1,111	$1,107	-$5	-0.4%	$1,099	-$12	-1.1%	$1,095	-$17	-1.5%
Fixed O&M	$2,311	$2,324	$13	0.6%	$2,522	$211	9.1%	$2,522	$211	9.1%
Capital Cost	$4,087	$4,069	-$18	-0.4%	$4,098	$11	0.3%	$4,090	$3	0.1%
Pre-Tax Income ($Millions)	$5,687	$5,662	-$25	-0.4%	$5,422	-$266	-4.7%	$5,417	-$271	-4.8%
Variable Production Cost ($/MWh)	$33.33	$33.43	$0.10	0.3%	$33.75	$0.41	1.2%	$33.78	$0.45	1.3%
Midwest Reliability Organization (MRO)										
Total Capacity (GW)	71	71	0	0.2%	71	0	0.0%	71	0	0.0%
Existing			0	0.0%		-1	-2.0%		-1	-2.0%
New Additions			0	0.3%		1	2.0%		1	2.1%
Early Retirements			0	0.0%		1	1.1%		1	1.1%
Electricity Prices ($/MWh)	$52.16	$52.16	$0.00	0.0%	$52.22	$0.06	0.1%	$52.20	$0.04	0.1%
Generation (TWh)	292	292	0	0.0%	290	-2	-0.7%	290	-2	-0.5%
Revenue ($Millions)	$17,779	$17,783	$5	0.0%	$17,705	-$73	-0.4%	$17,712	-$66	-0.4%
Costs ($Millions)	$9,392	$9,479	$87	0.9%	$10,024	$632	6.7%	$10,090	$699	7.4%
Fuel Cost	$4,158	$4,143	-$15	-0.4%	$4,171	$14	0.3%	$4,174	$16	0.4%
Variable O&M	$743	$743	-$1	-0.1%	$770	$26	3.6%	$772	$29	3.9%
Fixed O&M	$2,797	$2,850	$53	1.9%	$3,103	$306	10.9%	$3,143	$347	12.4%
Capital Cost	$1,694	$1,743	$49	2.9%	$1,980	$286	16.9%	$2,001	$307	18.1%
Pre-Tax Income ($Millions)	$8,387	$8,305	-$82	-1.0%	$7,682	-$705	-8.4%	$7,622	-$765	-9.1%
Variable Production Cost ($/MWh)	$16.81	$16.75	-$0.06	-0.4%	$17.06	$0.25	1.5%	$17.05	$0.25	1.5%

Table 6-2: Impact of Regulatory Options on National and Regional Markets at the Year 2028

Economic Measures	Baseline	Option 1			Option 2			Option 3		
(all dollar values in $2009)	Value	Value	Diff	% Diff	Value	Diff	% Diff	Value	Diff	% Diff
Northeast Power Coordinating Council (NPCC)										
Total Capacity (GW)	80	79	-1	-0.7%	78	-2	-2.3%	78	-2	-2.3%
Existing			-1	-0.9%		-5	-6.1%		-5	-6.1%
New Additions			0	0.2%		3	3.8%		3	3.8%
Early Retirements			1	0.9%		4	4.8%		4	4.8%
Electricity Prices ($/MWh)	$74.51	$74.60	$0.09	0.1%	$73.29	-$1.22	-1.6%	$73.27	-$1.25	-1.7%
Generation (TWh)	317	317	0	0.0%	317	-1	-0.2%	317	-1	-0.2%
Revenue ($Millions)	$26,624	$26,686	$62	0.2%	$26,446	-$178	-0.7%	$26,413	-$211	-0.8%
Costs ($Millions)	$15,829	$15,861	$32	0.2%	$16,771	$941	5.9%	$16,801	$971	6.1%
Fuel Cost	$7,941	$7,900	-$41	-0.5%	$7,684	-$256	-3.2%	$7,680	-$261	-3.3%
Variable O&M	$1,064	$1,071	$7	0.6%	$1,068	$3	0.3%	$1,066	$2	0.2%
Fixed O&M	$4,117	$4,150	$33	0.8%	$4,703	$586	14.2%	$4,725	$608	14.8%
Capital Cost	$2,708	$2,741	$33	1.2%	$3,316	$608	22.5%	$3,330	$622	23.0%
Pre-Tax Income ($Millions)	$10,795	$10,825	$30	0.3%	$9,676	-$1,119	-10.4%	$9,613	-$1,182	-11.0%
Variable Production Cost ($/MWh)	$28.36	$28.26	-$0.10	-0.4%	$27.62	-$0.75	-2.6%	$27.60	-$0.77	-2.7%
ReliabilityFirst Corporation (RFC)										
Total Capacity (GW)	245	245	0	0.1%	246	1	0.6%	246	1	0.6%
Existing			0	0.1%		-6	-2.4%		-6	-2.4%
New Additions			0	0.0%		7	3.0%		7	3.0%
Early Retirements			0	-0.1%		3	1.3%		3	1.3%
Electricity Prices ($/MWh)	$53.23	$53.26	$0.03	0.1%	$53.42	$0.19	0.3%	$53.50	$0.27	0.5%
Generation (TWh)	1,144	1,144	0	0.0%	1,143	-1	-0.1%	1,143	-1	-0.1%
Revenue ($Millions)	$69,701	$69,833	$132	0.2%	$70,051	$350	0.5%	$70,130	$429	0.6%
Costs ($Millions)	$41,944	$42,099	$155	0.4%	$45,155	$3,211	7.7%	$45,213	$3,269	7.8%
Fuel Cost	$19,555	$19,581	$26	0.1%	$20,065	$510	2.6%	$20,082	$527	2.7%
Variable O&M	$2,723	$2,737	$14	0.5%	$2,788	$65	2.4%	$2,787	$64	2.3%
Fixed O&M	$13,818	$13,964	$146	1.1%	$15,641	$1,823	13.2%	$15,669	$1,851	13.4%
Capital Cost	$5,848	$5,817	-$31	-0.5%	$6,661	$813	13.9%	$6,675	$827	14.1%
Pre-Tax Income ($Millions)	$27,757	$27,734	-$23	-0.1%	$24,896	-$2,861	-10.3%	$24,918	-$2,839	-10.2%
Variable Production Cost ($/MWh)	$19.48	$19.52	$0.03	0.2%	$20.00	$0.52	2.7%	$20.01	$0.53	2.7%
Southeast Electric Reliability Council (SERC)										
Total Capacity (GW)	286	287	0	0.0%	287	0	0.1%	287	0	0.1%
Existing			0	0.0%		-4	-1.4%		-4	-1.5%
New Additions			0	0.0%		4	1.6%		5	1.6%
Early Retirements			0	0.0%		1	0.3%		1	0.3%
Electricity Prices ($/MWh)	$54.82	$54.82	-$0.01	0.0%	$54.79	-$0.04	-0.1%	$54.82	$0.00	0.0%
Generation (TWh)	1,263	1,263	0	0.0%	1,266	3	0.2%	1,266	3	0.2%
Revenue ($Millions)	$79,803	$79,792	-$11	0.0%	$80,145	$341	0.4%	$80,202	$398	0.5%
Costs ($Millions)	$43,976	$44,101	$126	0.3%	$47,488	$3,512	8.0%	$47,565	$3,589	8.2%
Fuel Cost	$22,087	$22,056	-$31	-0.1%	$22,504	$417	1.9%	$22,506	$419	1.9%
Variable O&M	$3,319	$3,331	$12	0.4%	$3,457	$138	4.2%	$3,460	$141	4.2%
Fixed O&M	$13,555	$13,688	$134	1.0%	$15,806	$2,251	16.6%	$15,831	$2,276	16.8%
Capital Cost	$5,015	$5,026	$11	0.2%	$5,721	$706	14.1%	$5,768	$754	15.0%
Pre-Tax Income ($Millions)	$35,828	$35,691	-$137	-0.4%	$32,657	-$3,171	-8.9%	$32,637	-$3,191	-8.9%
Variable Production Cost ($/MWh)	$20.11	$20.10	-$0.01	-0.1%	$20.50	$0.39	2.0%	$20.51	$0.40	2.0%

Table 6-2: Impact of Regulatory Options on National and Regional Markets at the Year 2028

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1 Value	Option 1 Diff	Option 1 % Diff	Option 2 Value	Option 2 Diff	Option 2 % Diff	Option 3 Value	Option 3 Diff	Option 3 % Diff
Southwest Power Pool (SPP)										
Total Capacity (GW)	68	68	0	0.0%	68	0	0.0%	68	0	0.0%
Existing			0	0.0%		-1	-2.1%		-1	-2.2%
New Additions			0	0.0%		1	2.1%		1	2.2%
Early Retirements			0	0.0%		1	1.4%		1	1.5%
Electricity Prices ($/MWh)	$49.81	$49.80	-$0.01	0.0%	$49.77	-$0.04	-0.1%	$49.80	-$0.01	0.0%
Generation (TWh)	282	282	0	0.0%	281	-1	-0.3%	281	-1	-0.3%
Revenue ($Millions)	$15,589	$15,588	-$1	0.0%	$15,580	-$9	-0.1%	$15,577	-$12	-0.1%
Costs ($Millions)	$9,916	$9,945	$29	0.3%	$10,395	$480	4.8%	$10,400	$484	4.9%
Fuel Cost	$4,238	$4,236	-$2	-0.1%	$4,253	$15	0.3%	$4,251	$13	0.3%
Variable O&M	$922	$924	$2	0.3%	$939	$18	1.9%	$940	$18	1.9%
Fixed O&M	$1,916	$1,943	$28	1.5%	$2,228	$312	16.3%	$2,230	$314	16.4%
Capital Cost	$2,840	$2,842	$2	0.1%	$2,975	$135	4.8%	$2,979	$139	4.9%
Pre-Tax Income ($Millions)	$5,673	$5,643	-$31	-0.5%	$5,185	-$489	-8.6%	$5,177	-$496	-8.7%
Variable Production Cost ($/MWh)	$18.33	$18.33	$0.00	0.0%	$18.49	$0.16	0.9%	$18.49	$0.16	0.9%
Western Electricity Coordinating Council (WECC)										
Total Capacity (GW)	220	220	0	0.0%	220	0	0.0%	220	0	0.0%
Existing			0	0.0%		0	-0.1%		0	-0.1%
New Additions			0	0.0%		0	0.1%		0	0.1%
Early Retirements			0	0.0%		0	0.1%		0	0.1%
Electricity Prices ($/MWh)	$56.08	$56.06	-$0.01	0.0%	$55.92	-$0.16	-0.3%	$55.92	-$0.16	-0.3%
Generation (TWh)	894	894	0	0.0%	895	0	0.0%	894	0	0.0%
Revenue ($Millions)	$56,798	$56,785	-$13	0.0%	$56,677	-$121	-0.2%	$56,658	-$139	-0.2%
Costs ($Millions)	$32,637	$32,639	$3	0.0%	$32,700	$63	0.2%	$32,708	$72	0.2%
Fuel Cost	$14,950	$14,943	-$7	0.0%	$14,970	$21	0.1%	$14,961	$11	0.1%
Variable O&M	$3,379	$3,380	$1	0.0%	$3,384	$5	0.2%	$3,385	$6	0.2%
Fixed O&M	$6,858	$6,864	$6	0.1%	$6,879	$21	0.3%	$6,886	$28	0.4%
Capital Cost	$7,450	$7,453	$3	0.0%	$7,466	$16	0.2%	$7,477	$27	0.4%
Pre-Tax Income ($Millions)	$24,161	$24,145	-$16	-0.1%	$23,978	-$184	-0.8%	$23,950	-$211	-0.9%
Variable Production Cost ($/MWh)	$20.49	$20.49	-$0.01	0.0%	$20.52	$0.02	0.1%	$20.52	$0.02	0.1%

Findings for Option 1 (IM Everywhere)

As reported in *Table 6-2*, the market model analysis indicates that Option 1, the preferred Option, would have very small effects in overall electricity markets, on both a national and regional sub-market basis, in the year 2028.

Overall at the national level, the net change in total capacity, including reductions in capacity (which includes early retirements) and capacity additions in new plants/units, is essentially zero. Consequently, Option 1 (IM Everywhere) would not be expected to have a material ongoing effect on capacity availability and supply reliability at the national level. At the NERC region level, 5 of the 8 analyzed NERC regions record nearly no change in capacity, 2 record modest capacity increases of no more than 0.2 percent of baseline, and only 1 region records a non-consequential loss in capacity of 0.7 percent of baseline.

At the national level, the analysis indicates a total reduction in capacity from closures of approximately 1 GW, or less than 0.1 percent of the total capacity baseline in 2028 (capacity closures are discussed in greater detail in the next section (*Impact on In-Scope Facilities as a Group*)). At the regional level, the greatest capacity reduction of approximately 1 GW occurs in the NPCC region; this reduction would be less than 1 percent of total baseline capacity in that region. Two NERC regions – RFC and SERC – are estimated to experience *avoided* capacity closures – i.e., one or more generating units that are otherwise projected to cease operations in the baseline become more economically attractive sources of electricity in the post-compliance case, because of relative changes in the economics of electricity production across the full market, and thus *avoid* closure.

Overall, Option 1 has a slight impact on electricity prices. For 5 out of 8 NERC regions, electricity prices are projected to decline very slightly – by no more than $0.01 per MWh resulting in nearly zero percent change – in the post-compliance case. For the remaining three NERC regions, electricity price does not increase by more than $0.09 per MWh or 0.1 percent (NPCC). These very small estimated changes in electricity prices are essentially within the analytic "noise" of the market model analysis system.

At the national level, in a similar way as described for net changes in capacity, the net change in generation is essentially zero, as electricity demand is assumed not to change as a result of the regulation. No region records a consequential change in total generation.

Total revenue in the electric power sector increases by a very small amount (less than 0.1 percent), potentially reflecting modest increases in prices to customers. No region records a material change, with the largest change – an increase of $132 million or 0.2 percent – occurring in the RFC region.

At the national level, total costs increase by less than 0.3 percent of the baseline value – again, a very modest amount. None of the cost components changes in a material way. Across regions, no NERC region records an increase in power sector total costs exceeding 1 percent.

As a specific measure of the effect of Option 1 on the short-term cost of electricity production, the change in variable production cost of electricity from the pre-regulation baseline value is nearly zero. Again, this effect varies by region, with the greatest increase occurring in the FRCC region (0.3 percent) and the most significant drop occurring in the NPCC region (-0.4 percent).

With the additional costs from compliance and resulting increases in overall electricity production costs, national sector-level pre-tax income is projected to decline very slightly, by approximately 0.3 percent. All regions except NPCC experience a decrease in pre-tax income; the greatest drop, approximately 1 percent, occurs in the MRO region.

Findings for Regulatory Option 2 (IM Everywhere and EM for Facilities with DIF>125MGD)

Option 2 (IM Everywhere and EM for Facilities with DIF>125MGD) blends the requirements of regulatory Options 1 and 3, with some facilities being required to meet non-cooling tower-based impingement mortality requirements (i.e., Regulatory Option 1 specifications) and others required to install cooling towers (i.e., Regulatory Option 3 specifications). As a result, the findings for Option 2 *overall* lie *within* the range of results found from the analysis of Options 1 and 3, although very close to Option 3 analysis results.

Similarly to Option 1, under Option 2, the net change in total capacity is essentially zero, indicating that this option would not be expected to have a material ongoing effect on capacity availability and supply reliability, at the national level. This is also the case for 5 of the 8 NERC regions. Of the remaining 3 NERC regions, one – NPCC – records a decrease in total capacity of 2.3 percent, while the other two – RFC and SERC – record a modest increase of no more than 0.6 percent of the projected baseline capacity in 2028.

The change in existing capacity at the national level, a reduction of approximately 24 GW, represents approximately 2.1 percent of total baseline generating capacity. Of this reduction, approximately 14 GW occurs as early retirements, or approximately 1.3 percent of total baseline capacity; the residual results from energy penalty reductions in capacity. At the regional level, the largest drop in existing capacity and the largest increase in retired capacity of approximately 5 GW (6.1 percent) and 4 GW (4.8 percent), respectively, occur in the NPCC region. No NERC region records a reduction in capacity retirements.

At the national level, the offsetting increase in capacity at new plants/units of approximately 24 GW is approximately 2 percent of total baseline generating capacity. At the regional level, the largest increase in new capacity of 5.3 percent occurs in the ERCOT region.

Option 2 also has a slight impact on electricity prices across all NERC regions. In 4 out of 8 NERC regions electricity prices increase slightly by no more than 0.3 percent. The other four NERC regions record a slight drop in electricity prices of no more than 0.3 percent.

As is the case for Option 1, for Option 2, the net change in generation at the national level is essentially zero. At the regional level, the change in net generation is also non-consequential. The largest decline of approximately 2 TWh (0.7 percent) occurs in the MRO region.

Total revenue in the electric power sector increases by a very small amount (0.1 percent), reflecting very modest overall increases in prices to customers. At the regional level, 4 of the 8 NERC regions record a slight increase in revenue of no more than 0.5 percent; the remaining 4 NERC regions record a slight drop in revenue of no more than 0.7 percent.

As expected for Option 2, which is more expensive than Option 1, the increase in total annual costs for the electric power sector is greater than under Option 1. At the national level, total annual costs increase by $10.1 billion, which is approximately a 5.4 percent increase from baseline power sector costs. The larger parts of this increase occur in fixed O&M ($5.9 billion or 12.1 percent) and annual recognition of capital costs ($3.2 billion or 9.3 percent), reflecting the cost requirements of cooling tower installation. Fuel costs increase by a much smaller amount ($0.7 billion) reflecting the improved energy efficiency and lower fuel cost of new capacity. All NERC regions show an increase in total costs, ranging from 0.2 percent in the WECC region to 8.0 percent in the SERC region; this increase in total costs is largely due to an increase in fixed O&M and capital costs.

At the national level, variable production costs, which is a measure of the short-run production cost of electricity – fuel and variable O&M – increase by a comparatively small amount ($0.21 per MWh) or less than 1 percent of the baseline value. The impact on production costs varies across NERC regions, however, increasing in some and decreasing in others; the largest increase of 2.7 percent occurs in the RFC region and the largest drop of 2.6 percent occurs in the NPCC region.

As would be expected with higher compliance outlays, and increase in capacity reduction as the result of more facilities incurring energy penalty under Option 2, total sector pre-tax income is more materially affected than under Option 1. At the national level, pre-tax income declines by $9.6 billion or 7.6 percent. All NERC regions incur a reduction in pre-tax income, with the largest reduction of 10.4 percent occurring in the NPCC region.

Findings for Regulatory Option 3 (I&E Mortality Everywhere)

The market model analysis projects that the most expensive Option 3 (I&E Mortality Everywhere) would have a slightly greater impact on national and regional electricity markets than Option 2, as more in-scope facilities install cooling towers (nearly all) to meet compliance requirements.

As observed for Options 1 and 2, the net change in total capacity under the Option 3 is essentially zero, indicating that this option would not be expected to have a material ongoing effect on capacity availability and supply reliability, at the national level. This is also the case of 5 of the 8 NERC regions. The 2 of the remaining 3 NERC regions record a slight increase in total capacity of no more than 0.6 percent; for the remaining NERC region – NPCC – records a 2.3 percent in total capacity loss.

At the national level, the change in existing capacity, a reduction of approximately 24 GW (approximately the same as under Option 2), represents approximately 2.1 percent of total baseline generating capacity in 2028. Of this reduction, approximately 14 GW occurs as early retirements, or approximately 1.3 percent of total baseline capacity. The residual results from energy penalty reductions in capacity. As is the case under Option 2, at the regional level, the largest drop in existing capacity and the largest increase in retired capacity of approximately 5 GW (6.1 percent) and 4 GW (4.8 percent), respectively, occur in the NPCC region. No NERC region records a reduction in capacity retirements.

At the national level, the offsetting increase in capacity at new plants/units of approximately 24 GW is approximately 2 percent of total baseline generating capacity. At the regional level, the largest increase in new capacity of 5.3 percent occurs in the ERCOT region.

Overall, Option 3 has a slightly larger impact on electricity prices than Option 2. Of the 8 NERC regions, 5 record a slight price increase of no more than 0.5 percent, occurring in RFC; the remaining 3 NERC regions record a slight price drop of no more than 1.7 percent, occurring in ERCOT.

At the national level, as is the case under Options 1 and 2, the net change in generation is essentially zero. No NERC region records a consequential change in total generation – the largest decline is 0.5 percent, which occurs in the MRO region.

Total revenue in the national electric power sector increases by a very small amount (0.2 percent), again reflecting overall very modest increases in prices to customers. Of the 8 NERC regions, 4 record a modest increase in revenue of no more than 0.6 percent, with the largest increase occurring in RFC; in the remaining 4 NERC regions, revenue drops slightly by no more than 0.8 percent, with the largest decline occurring in NPCC.

The overall increase in total annual costs under Option 3 is slightly higher than under Option 2. At the market level, total costs increase by approximately $10 billion or 5.5 percent. As for Option 2, the larger parts of this increase occur in fixed O&M ($6.0 billion) and annual recognition of capital costs ($3.3 billion), reflecting the cost requirements of cooling tower installations. Fuel costs increase by a much smaller amount ($0.7 billion) reflecting again the improved energy efficiency and lower fuel cost of new capacity. All NERC regions show an increase in total costs for electric power sector, ranging from 0.2 percent in the WECC region to 8.2 percent in the SERC region; this increase in total costs is largely due to an increase in fixed O&M and capital costs.

For Option 3, variable production costs increase by the same amount as that under Option 2 ($0.21 per MWh), or less than 1 percent of the baseline 2028 value. For all but 2 NERC regions, variable production costs increase by no more than 2.7 percent, which occurs in RFC; in ERCOT and NPCC variable production costs decrease by 1.2 percent and 2.7 percent, respectively.

Consistent with the policy impacts observed for annual costs and revenue, the impact on pre-tax income is slightly more material under Option 3 than under Option 2. At the national level, pre-tax income declines by $9.9 billion or 7.7 percent. All regions experience a loss in pre-tax income, with the largest loss occurring in the NPCC region, at 11.0 percent.

Impact on In-Scope Facilities as a Group

For the analysis of impact on in-scope facilities as a group, EPA used the same IPM V3.02 results for 2028 that were used to analyze the impact on national and regional electricity markets described above; however, this analysis considers the effect of the market impact analysis options on only the subset of electric generating facilities that are estimated to be within the scope of this proposed regulation's compliance requirements. The purpose of the market-level analysis is to assess the impact of the Proposed Rule on the entire electric power sector, i.e., including facilities that would not be directly affected by this Rule. The purpose of the analysis for in-scope facilities as a group is to assess the impact of Proposed Existing Facilities Rule on only those facilities that are directly in the scope of this regulation. The analysis results for the group of in-scope facilities (*Table 6-3*) overall show a greater degree of impact than that observed over all generating units (i.e., market-level analysis discussed in the preceding section (Impact on National and Regional Electricity Markets)): at the national level, more substantial impacts at the level of the directly affected in-scope units are offset by changes in capacity and energy production in the non in-scope units. This difference in impact magnitude is most prominent under Option 3.

The metrics of interest are largely the same as those presented above in assessing the effect of the regulatory options for the aggregate of electric generating facilities. However, in this assessment, the impact measures reflect only the economic activities of the 533 in-scope facilities analyzed in IPM. In addition, a few measures differ: (1) new capacity additions and prices are not relevant at the facility level, and (2) the number of in-scope facilities that experience closure of all their steam electric capacity is presented.

The following six measures are reported in the analysis of in-scope facilities as a group. In all instances, the measures are tabulated only for the 533 in-scope facilities that are analyzed in the Market Model Analysis:

1. *Changes in available capacity*: As defined in the preceding section (Impact on National and Regional Electricity Markets).
2. *Changes in generation*: Long-term changes in generation may result from a reduction in available capacity (see discussion above) or less frequent dispatch of a plant due to higher production cost resulting from compliance response. At the same time, for some in-scope facilities, the Proposed Existing Facilities Rule options may lead to an increase in generation if their compliance costs are low relative to other affected facilities.
3. *Changes in revenue*: This measure includes both energy revenue and capacity revenue (see definitions in the beginning of *Section 6.2.2*). A change in revenue could result from a change in generation, a change in the price of electricity, or both. For some modeled facilities, a regulatory option may lead to an increase in revenue, particularly for facilities that are more competitive in a post-regulation world.
4. *Changes in costs*: As defined in the preceding section (Impact on National and Regional Electricity Markets).
5. *Changes in pre-tax income*: As defined in the preceding section (Impact on National and Regional Electricity Markets).
6. *Changes in variable production costs per MWh*: As defined in the preceding section (Impact on National and Regional Electricity Markets).

Table 6-3 reports results for the Market Impact Analysis Options for in-scope facilities, as a group.

The impacts of the regulatory options on in-scope facilities differ from the total market impacts as these facilities become less competitive compared to facilities that do not incur compliance costs as a result of the regulatory options. As a result, capacity and generation impacts are greater in this set of facilities than for the entire electricity market, as summarized above. However, in the same way as described above, the impacts of Option 1 are considerably smaller than for Options 2 and 3.

Table 6-3: Impact of Market Impact Analysis Options on In-Scope Facilities, as a Group, at the Year 2028

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1			Option 2			Option 3		
		Value	Dif	% Diff	Value	Dif	% Diff	Value	Dif	% Diff
National Totals										
Total Capacity (GW)	479	478	-1	-0.2%	453	-26	-5.4%	452	-27	-5.6%
Early Retirements – Number of Facilities	39	45	6	15.4%	54	15	38.5%	58	19	48.7%
Full and Partial Retirements – Capacity (GW)	33	34	1	3.2%	50	17	51.3%	50	17	52.3%
Generation (TWh)	2,750	2,747	-4	-0.1%	2,667	-84	-3.0%	2,662	-88	-3.2%
Revenue ($Millions)	$159,029	$158,868	-$161	-0.1%	$153,216	-$5,813	-3.7%	$153,036	-$5,993	-3.8%
Costs ($Millions)	$86,130	$86,403	$273	0.3%	$90,244	$4,114	4.8%	$90,224	$4,094	4.8%
Fuel Cost	$45,734	$45,582	-$152	-0.3%	$44,426	-$1,308	-2.9%	$44,321	-$1,414	-3.1%
Variable O&M	$5,123	$5,153	$30	0.6%	$5,115	-$8	-0.2%	$5,104	-$19	-0.4%
Fixed O&M	$34,500	$34,905	$406	1.2%	$39,996	$5,496	15.9%	$40,092	$5,592	16.2%
Capital Cost	$773	$763	-$10	-1.3%	$707	-$66	-8.5%	$708	-$64	-8.3%
Pre-Tax Income ($Millions)	$72,899	$72,465	-$434	-0.6%	$62,972	-$9,927	-13.6%	$62,812	-$10,087	-13.8%
Variable Production Cost ($/MWh)	$18.49	$18.47	-$0.02	-0.1%	$18.58	$0.09	0.5%	$18.57	$0.08	0.4%

Table 6-3: Impact of Market Impact Analysis Options on In-Scope Facilities, as a Group, at the Year 2028

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1 Value	Option 1 Dif	Option 1 % Diff	Option 2 Value	Option 2 Dif	Option 2 % Diff	Option 3 Value	Option 3 Dif	Option 3 % Diff
Electric Reliability Council of Texas (ERCOT)										
Total Capacity (GW)	36	36	0	0.3%	30	-6	-17.4%	30	-6	-17.5%
Early Retirements – Number of Facilities	6	6	0	0.0%	11	5	83.3%	11	5	83.3%
Full and Partial Retirements – Capacity (GW)	8	8	0	-1.2%	14	5	68.2%	14	6	68.7%
Generation (TWh)	158	158	0	-0.1%	147	-11	-6.9%	147	-12	-7.4%
Revenue ($Millions)	$10,126	$10,118	-$8	-0.1%	$9,114	-$1,012	-10.0%	$9,078	-$1,047	-10.3%
Costs ($Millions)	$5,374	$5,399	$25	0.5%	$5,262	-$112	-2.1%	$5,230	-$144	-2.7%
Fuel Cost	$3,162	$3,150	-$12	-0.4%	$2,791	-$371	-11.7%	$2,761	-$401	-12.7%
Variable O&M	$267	$269	$2	0.7%	$264	-$3	-1.1%	$261	-$6	-2.2%
Fixed O&M	$1,935	$1,970	$35	1.8%	$2,196	$261	13.5%	$2,197	$262	13.5%
Capital Cost	$11	$11	$0	-0.6%	$11	$0	3.4%	$11	$0	3.4%
Pre-Tax Income ($Millions)	$4,751	$4,719	-$33	-0.7%	$3,852	-$899	-18.9%	$3,848	-$903	-19.0%
Variable Production Cost ($/MWh)	$21.66	$21.62	-$0.04	-0.2%	$20.73	-$0.93	-4.3%	$20.61	-$1.05	-4.9%
Florida Reliability Coordinating Council (FRCC)										
Total Capacity (GW)	27	27	0	0.0%	27	0	-0.7%	27	0	-0.9%
Early Retirements – Number of Facilities	2	4	2	100.0%	3	1	50.0%	3	1	50.0%
Full and Partial Retirements – Capacity (GW)	4	4	0	-0.3%	3	0	-9.3%	3	0	-9.3%
Generation (TWh)	93	93	0	-0.1%	89	-3	-3.6%	89	-3	-3.6%
Revenue ($Millions)	$6,832	$6,827	-$5	-0.1%	$6,665	-$167	-2.4%	$6,658	-$174	-2.5%
Costs ($Millions)	$3,714	$3,729	$15	0.4%	$3,849	$135	3.6%	$3,848	$134	3.6%
Fuel Cost	$2,247	$2,241	-$6	-0.3%	$2,164	-$82	-3.7%	$2,162	-$85	-3.8%
Variable O&M	$267	$269	$2	0.9%	$261	-$6	-2.1%	$261	-$6	-2.2%
Fixed O&M	$1,201	$1,219	$18	1.5%	$1,424	$223	18.6%	$1,425	$224	18.7%
Capital Cost	$0	$0	$0	NA	$0	$0	NA	$0	$0	NA
Pre-Tax Income ($Millions)	$3,118	$3,098	-$20	-0.6%	$2,816	-$302	-9.7%	$2,811	-$307	-9.9%
Variable Production Cost ($/MWh)	$27.13	$27.12	-$0.01	0.0%	$27.15	$0.02	0.1%	$27.13	$0.00	0.0%
Midwest Reliability Organization (MRO)										
Total Capacity (GW)	29	29	0	-1.0%	28	-2	-5.4%	27	-2	-5.7%
Early Retirements – Number of Facilities	4	4	0	0.0%	8	4	100.0%	9	5	125.0%
Full and Partial Retirements – Capacity (GW)	3	3	0	10.5%	4	1	34.2%	4	1	35.8%
Generation (TWh)	188	186	-1	-0.8%	178	-9	-4.9%	178	-10	-5.3%
Revenue ($Millions)	$10,098	$10,024	-$73	-0.7%	$9,604	-$493	-4.9%	$9,572	-$525	-5.2%
Costs ($Millions)	$5,190	$5,170	-$20	-0.4%	$5,357	$167	3.2%	$5,372	$182	3.5%
Fuel Cost	$2,868	$2,837	-$31	-1.1%	$2,797	-$71	-2.5%	$2,787	-$81	-2.8%
Variable O&M	$387	$386	-$1	-0.4%	$380	-$7	-1.9%	$379	-$8	-2.0%
Fixed O&M	$1,883	$1,905	$23	1.2%	$2,139	$256	13.6%	$2,164	$282	15.0%
Capital Cost	$52	$42	-$10	-19.2%	$42	-$11	-20.6%	$42	-$11	-20.1%
Pre-Tax Income ($Millions)	$4,907	$4,854	-$53	-1.1%	$4,247	-$660	-13.5%	$4,200	-$707	-14.4%
Variable Production Cost ($/MWh)	$17.36	$17.31	-$0.04	-0.3%	$17.82	$0.46	2.6%	$17.82	$0.47	2.7%

Table 6-3: Impact of Market Impact Analysis Options on In-Scope Facilities, as a Group, at the Year 2028										
Economic Measures	**Baseline**	**Option 1**			**Option 2**			**Option 3**		
(all dollar values in $2009)	**Value**	**Value**	**Dif**	**% Diff**	**Value**	**Dif**	**% Diff**	**Value**	**Dif**	**% Diff**
Northeast Power Coordinating Council (NPCC)										
Total Capacity (GW)	34	33	-1	-2.6%	28	-5	-15.9%	28	-5	-16.0%
Early Retirements – Number of Facilities	3	3	0	0.0%	4	1	33.3%	4	1	33.3%
Full and Partial Retirements – Capacity (GW)	2	3	1	38.3%	7	4	197.0%	7	4	197.0%
Generation (TWh)	143	142	-1	-0.9%	127	-16	-11.1%	127	-16	-11.3%
Revenue ($Millions)	$11,749	$11,663	-$87	-0.7%	$10,335	-$1,414	-12.0%	$10,296	-$1,453	-12.4%
Costs ($Millions)	$6,651	$6,606	-$45	-0.7%	$6,482	-$169	-2.5%	$6,488	-$163	-2.5%
Fuel Cost	$3,203	$3,130	-$73	-2.3%	$2,564	-$639	-20.0%	$2,551	-$652	-20.4%
Variable O&M	$281	$283	$2	0.7%	$263	-$18	-6.3%	$261	-$19	-6.8%
Fixed O&M	$3,121	$3,148	$26	0.8%	$3,612	$491	15.7%	$3,632	$511	16.4%
Capital Cost	$46	$46	$0	-0.2%	$43	-$3	-6.7%	$43	-$3	-6.7%
Pre-Tax Income ($Millions)	$5,098	$5,056	-$42	-0.8%	$3,853	-$1,246	-24.4%	$3,809	-$1,290	-25.3%
Variable Production Cost ($/MWh)	$24.36	$24.08	-$0.29	-1.2%	$22.23	-$2.13	-8.8%	$22.18	-$2.19	-9.0%
ReliabilityFirst Corporation (RFC)										
Total Capacity (GW)	139	139	0	0.1%	133	-6	-4.3%	132	-6	-4.4%
Early Retirements – Number of Facilities	3	3	0	0.0%	4	1	33.3%	4	1	33.3%
Full and Partial Retirements – Capacity (GW)	1	1	0	-6.9%	5	3	239.4%	5	3	239.4%
Generation (TWh)	907	907	0	0.0%	885	-22	-2.4%	884	-23	-2.5%
Revenue ($Millions)	$49,318	$49,371	$53	0.1%	$48,007	-$1,311	-2.7%	$48,042	-$1,276	-2.6%
Costs ($Millions)	$27,370	$27,528	$157	0.6%	$28,989	$1,619	5.9%	$29,015	$1,645	6.0%
Fuel Cost	$13,747	$13,748	$1	0.0%	$13,663	-$84	-0.6%	$13,662	-$85	-0.6%
Variable O&M	$1,568	$1,580	$12	0.8%	$1,570	$2	0.1%	$1,568	$1	0.1%
Fixed O&M	$11,736	$11,880	$144	1.2%	$13,456	$1,720	14.7%	$13,483	$1,747	14.9%
Capital Cost	$319	$319	$0	0.0%	$300	-$19	-6.0%	$301	-$18	-5.7%
Pre-Tax Income ($Millions)	$21,947	$21,843	-$104	-0.5%	$19,018	-$2,930	-13.3%	$19,027	-$2,921	-13.3%
Variable Production Cost ($/MWh)	$16.88	$16.90	$0.01	0.1%	$17.21	$0.33	1.9%	$17.23	$0.34	2.0%
Southeast Electric Reliability Council (SERC)										
Total Capacity (GW)	152	152	0	-0.1%	148	-4	-2.4%	148	-4	-2.7%
Early Retirements – Number of Facilities	8	12	4	50.0%	10	2	25.0%	13	5	62.5%
Full and Partial Retirements – Capacity (GW)	8	8	0	2.4%	9	0	5.3%	9	1	8.6%
Generation (TWh)	960	959	0	0.0%	943	-17	-1.8%	941	-18	-1.9%
Revenue ($Millions)	$53,851	$53,820	-$31	-0.1%	$52,880	-$971	-1.8%	$52,833	-$1,017	-1.9%
Costs ($Millions)	$28,970	$29,086	$116	0.4%	$31,257	$2,287	7.9%	$31,251	$2,281	7.9%
Fuel Cost	$15,662	$15,645	-$17	-0.1%	$15,690	$28	0.2%	$15,675	$12	0.1%
Variable O&M	$1,759	$1,770	$11	0.6%	$1,784	$24	1.4%	$1,780	$21	1.2%
Fixed O&M	$11,208	$11,330	$122	1.1%	$13,475	$2,268	20.2%	$13,489	$2,281	20.4%
Capital Cost	$341	$341	$0	0.0%	$308	-$33	-9.7%	$308	-$33	-9.7%
Pre-Tax Income ($Millions)	$24,881	$24,733	-$147	-0.6%	$21,623	-$3,258	-13.1%	$21,582	-$3,298	-13.3%
Variable Production Cost ($/MWh)	$18.16	$18.16	$0.00	0.0%	$18.54	$0.38	2.1%	$18.54	$0.39	2.1%

Table 6-3: Impact of Market Impact Analysis Options on In-Scope Facilities, as a Group, at the Year 2028

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1 Value	Option 1 Dif	Option 1 % Diff	Option 2 Value	Option 2 Dif	Option 2 % Diff	Option 3 Value	Option 3 Dif	Option 3 % Diff
Southwest Power Pool (SPP)										
Total Capacity (GW)	24	24	0	0.4%	21	-3	-11.4%	21	-3	-11.4%
Early Retirements – Number of Facilities	10	10	0	0.0%	9	-1	-10.0%	9	-1	-10.0%
Full and Partial Retirements – Capacity (GW)	4	4	0	-2.4%	7	2	54.0%	6	2	53.3%
Generation (TWh)	122	122	0	-0.1%	118	-4	-3.4%	117	-5	-3.7%
Revenue ($Millions)	$5,765	$5,763	-$2	0.0%	$5,409	-$356	-6.2%	$5,378	-$387	-6.7%
Costs ($Millions)	$2,939	$2,963	$24	0.8%	$3,105	$167	5.7%	$3,082	$143	4.9%
Fuel Cost	$1,795	$1,787	-$8	-0.5%	$1,704	-$91	-5.1%	$1,677	-$117	-6.5%
Variable O&M	$216	$217	$1	0.7%	$216	$0	-0.2%	$215	-$1	-0.4%
Fixed O&M	$924	$955	$31	3.4%	$1,183	$258	27.9%	$1,186	$261	28.3%
Capital Cost	$3	$3	$0	0.0%	$3	$0	0.0%	$3	$0	0.0%
Pre-Tax Income ($Millions)	$2,826	$2,800	-$26	-0.9%	$2,303	-$523	-18.5%	$2,297	-$530	-18.7%
Variable Production Cost ($/MWh)	$16.50	$16.47	-$0.03	-0.2%	$16.30	-$0.20	-1.2%	$16.13	-$0.37	-2.3%
Western Electricity Coordinating Council (WECC)										
Total Capacity (GW)	39	39	0	0.0%	39	0	-0.7%	39	0	-0.8%
Early Retirements – Number of Facilities	3	3	0	0.0%	5	2	66.7%	5	2	66.7%
Full and Partial Retirements – Capacity (GW)	2	2	0	0.4%	2	0	10.4%	2	0	10.4%
Generation (TWh)	180	180	0	0.0%	179	-1	-0.7%	179	-2	-1.0%
Revenue ($Millions)	$11,291	$11,283	-$8	-0.1%	$11,202	-$89	-0.8%	$11,178	-$113	-1.0%
Costs ($Millions)	$5,921	$5,922	$1	0.0%	$5,942	$20	0.3%	$5,939	$17	0.3%
Fuel Cost	$3,050	$3,044	-$6	-0.2%	$3,052	$2	0.1%	$3,045	-$5	-0.2%
Variable O&M	$379	$380	$0	0.1%	$379	$0	-0.1%	$378	-$1	-0.3%
Fixed O&M	$2,492	$2,498	$6	0.3%	$2,511	$19	0.7%	$2,516	$24	1.0%
Capital Cost	$0	$0	$0	NA	$0	$0	NA	$0	$0	NA
Pre-Tax Income ($Millions)	$5,369	$5,361	-$9	-0.2%	$5,260	-$109	-2.0%	$5,239	-$131	-2.4%
Variable Production Cost ($/MWh)	$19.00	$18.98	-$0.02	-0.1%	$19.14	$0.14	0.7%	$19.15	$0.15	0.8%

Findings for Regulatory Option 1 (IM Everywhere)

For Option 1, the degree of policy impact in terms of capacity and electricity generation on the group of in-scope facilities is greater than on the electric power sector as a whole; however, the magnitude of this difference is small (see *Table 6-2* and *Table 6-3*). For instance, at the market level, there is essentially no change in either total available capacity or electricity generation, while for the group of in-scope facilities at the national level total available capacity and electricity generation fall by only 0.2 percent and 0.1 percent, respectively.

Looking over all in-scope facilities, under Option 1, the total capacity loss from early retirements (closures) is approximately 1 GW at the national level, or 0.2 percent of total baseline capacity in the in-scope units. Out of 8 NERC regions, 3 – MRO, NPCC, and SERC – record a total capacity loss. The largest percentage loss (2.6 percent) and absolute loss (approximately 1 GW) occur in the NPCC region.

The 1 GW of capacity losses in in-scope facilities reflect a combination of *closures* and *avoided closures* in the universe of in-scope facilities. Some closures (or avoided closures) are full facility closures (i.e., all generating units at the facility close or avoid closure), while others are partial closures (i.e., at least one generating unit at the facility is assessed as closing, or avoiding closure, in the post-compliance case). Overall, 39 generating units close (approximately 9.8 GW) and 30 generating units avoid closure (approximately 8.8 GW) in the post-compliance case, resulting in net closure of 9 generating units (approximately 1 GW). The 39 generating unit closures reflect full closure of 20 units in 13 facilities (5.6 MW) and partial closure of 19 units in 16 facilities (4.2 GW).

Other assessed effects of Option 1 for the group of in-scope facilities are of less consequence. At the national level, total generation in in-scope facilities declines by less than 4 TWh, which represents approximately 0.1

percent of baseline generation in these facilities. At the regional level, MRO and NPCC record the largest decline in generation of approximately 1 TWh each or 0.8 percent and 0.9 percent of the baseline generation, respectively, with all other regions experiencing slight decreases not exceeding 0.1 percent.

Over all in-scope facilities, total costs increase by less than 0.3 percent of the baseline value – again, a modest amount. None of the cost components changes in a material way. Most regions record slight increases within the in-scope facility group with the SPP region recording the largest increase, at 0.8 percent. Variable production costs decline over all in-scope facilities by approximately 0.1 percent, with slight decreases recorded for most NERC regions. MRO records the largest decrease of approximately 0.3 percent. These findings of very small national and regional effects in these impact metrics confirm EPA's assessment, stated in the preceding paragraph, that the assessed capacity closures among in-scope facilities are of little economic consequence.

Finally, the losses in pre-tax income are greater among in-scope facilities than among the aggregate of generating facilities. Nationally, the group of in-scope facilities records a 0.6 percent reduction in pre-tax income, with the largest impact occurring in the MRO region (reduction of approximately 1.1%).

Findings for Regulatory Option 2 (IM Everywhere and EM for Facilities with DIF>125MGD)

As is the case for Option 1, for Option 2, the results for the group of in-scope facilities also show a greater degree of impact on capacity and electricity generation compared to the degree of impact observed at the market level. While there is almost no change in either total generating capacity or electricity generation for the electric power sector, for the group of in-scope facilities generating capacity and electricity generation fall by 5.4 percent and 3.0 percent, respectively (*Table 6-2* and *Table 6-3*).

As expected, the findings for the group of in-scope facilities for Option 2 are of greater consequence than those observed for Option 1 as some facilities are now required to install cooling towers. The total loss in capacity at in-scope facilities at the national level is approximately 26 GW. The percentage loss in certain regions – the ERCOT (17.4 percent), NPCC (16.0 percent), and SPP (11.4 percent) – would be substantial in relation to the baseline capacity of the total of in-scope units in these regions.

This capacity reduction includes early retirement and avoided retirement of generating units with net capacity losses of 17 GW; the residual capacity loss results from energy penalty. Under this option, 149 generating units close (36 GW) and 86 generating units avoid closure (19 GW), leading to an estimated net closure of 63 generating units (17 GW). Out of the 149 closed units, 72 units (23 GW) are in 35 fully closed facilities and 77 units (13 GW) are in 46 partially closed facilities.

Findings for the change in total costs, variable production costs, and generation under this Option also significantly exceed those under Option 1. As stated above, at the national level, generation falls by 3.0 percent, with the largest decline of 11.1 percent occurring in NPCC. Further, there is a 4.8 percent increase in total costs at the national level, with SERC recording the largest increase of 7.9 percent. For 2 of the 8 NERC regions – ERCOT and NPCC – total costs decline by 2.1 percent and 2.5 percent, respectively. At the national level, the increase in total costs occurs only in fixed O&M ($5.5 billion or approximately 16 percent); all other cost components decrease, reflecting the lower generation from these units. For some NERC regions, fixed O&M is not the only cost increasing; however, across all NERC regions fixed O&M increases by the largest amount.

At the national level, variable production costs increase by 0.5 percent, with MRO recording the highest increase of 2.7 percent. For 3 out of 8 NERC regions – ERCOT, NPCC, and SPP – variable production costs decline by 4.3 percent, 8.8 percent, and 1.2 percent, respectively.

Findings for Regulatory Option 3 (I&E Mortality Everywhere)

As is the case for Options 1 and 2, for Option 3, the results for the group of in-scope facilities also show a greater degree of impact on capacity and electricity generation compared to the degree of impact observed at the market level. At the national market level, there is almost no change in either generating capacity or electricity generation; however, for the group of in-scope facilities, generating capacity and electricity generation fall by 5.6 percent and 3.2 percent, respectively, at the national level (*Table 6-2* and *Table 6-3*).

In-scope facility impacts in the steady state year for Option 3 are slightly higher than those observed for Option 2, as additional facilities install cooling towers to meet compliance requirements. The total loss in capacity in 2028 is assessed at 27 GW compared to 26 GW under Option 2. The percentage loss in certain regions – ERCOT (17.5 percent), NPCC (16.0 percent). and SPP (11.4 percent) – would be substantial in relation to the baseline capacity of the total of in-scope units in these regions.

As is the case under Option 2, this reduction includes early retirement and avoided retirement of generating units with net capacity losses of approximately 17 GW; the residual capacity loss results from energy penalty. Under this option, 162 generating units close (37 GW) and 88 generating units avoid closure (20 GW), leading to an estimated net closure of 74 generating units (17 GW). Out of the 162 closed units, 79 units (23 GW) are in 39 fully closed facilities and 83 units (14 GW) are in 50 partially closed facilities.

For Option 3, the changes in total cost, variable production cost, and generation for in-scope facilities at the national level are nearly the same as those estimated for Option 2 – 4.8 percent increase in total cost, 0.4 percent increase in variable production cost, and 3.2 percent fall in generation. While for some NERC regions the changes in these metrics are on average more prominent under Option 3 than under Option 2, the general pattern of changes is very similar. The largest fall in generation occurs in NPCC (11.3 percent), while the largest increase in total costs and variable production costs occurs in SERC (7.9 percent) and MRO (2.7 percent), respectively.

Impact on Individual In-Scope Facilities

Results for the group of in-scope facilities as a whole may mask shifts in economic performance among individual facilities subject to the Proposed Existing Facilities Regulatory options. To assess potential facility-level effects, EPA analyzed the distribution of facility-specific changes between the baseline and the post-compliance cases for the following five metrics:

1. *Capacity Utilization*, defined as generation divided by capacity times 8,760 hours
2. *Electricity Generation*, as defined above
3. *Revenue*, as defined above
4. *Variable Production Costs per MWh*, defined as variable O&M cost plus fuel cost divided by net generation
5. *Pre-Tax Income*, defined as total revenues minus the sum of fixed and variable O&M costs, fuel costs, and capital costs.

Table 6-4 presents the estimated number of in-scope facilities with specific degrees of change in operations and financial performance as a result of regulatory options. This table excludes in-scope facilities with estimated significant status changes in 2028 that render these metrics of change not meaningful – i.e., under the analyzed Option, a facility is assessed as either a full closure between the base case and the post-compliance case. On this basis, 118, 159, and 165 facilities are excluded from assessment under Options 1, 2, and 3, respectively. As a result, the measures presented in *Table 6-3*, such as *change in revenue*, are not meaningful for these facilities. For example, for a facility that is projected to close in the post-compliance case, the change in revenue is 100 percent.

In addition, the change in variable production cost per MWh of generation could not be developed for 28, 21, and 18 facilities with zero generation in either baseline or post-compliance cases under Options 1, 2, and 3, respectively. For these facilities, variable production cost per MWh cannot be calculated for one or other of the two cases (because the divisor, MWh, is zero), and therefore the change in variable production cost per MWh cannot be meaningfully determined. For *change in variable production cost per MWh*, these facilities are recorded in the "N/A" column.

Table 6-4: Impact of Market Impact Analysis Options on Individual In-Scope Facilities at the Year 2028 (number of in-scope facilities with indicated effect)

Economic Measures	Reduction			No Change	Increase			N/A[b]
	> 3%	1-3%	</=1%		</=1%	1-3%	> 3%	
Option 1: IM Everywhere								
Change in Capacity Utilization[c]	0	1	23	398	41	5	3	118
Change in Generation	6	7	39	391	26	0	2	118
Change in Revenue	5	3	164	4	282	13	0	118
Change in Variable Production Costs/MWh	0	2	91	22	319	6	3	146
Change in Pre-Tax Income	40	126	243	0	55	4	3	118
Option 2: IM Everywhere and EM for Facilities with DIF>125MGD								
Change in Capacity Utilization[c]	13	18	102	147	104	24	22	159
Change in Generation	154	89	6	146	8	12	15	159
Change in Revenue	139	103	51	0	73	54	10	159
Change in Variable Production Costs/MWh	3	5	24	14	107	55	201	180
Change in Pre-Tax Income	267	33	55	0	28	23	24	159
Option 3: I&E Mortality Everywhere								
Change in Capacity Utilization[c]	10	16	132	96	118	25	27	165
Change in Generation	184	110	6	95	9	10	10	165
Change in Revenue	158	127	44	0	49	38	8	165
Change in Variable Production Costs/MWh	4	8	15	9	74	63	233	183
Change in Pre-Tax Income	315	12	41	0	24	11	21	165

a. The change in capacity utilization is the difference between the capacity utilization percentages in the base case and post-compliance cases. For all other measures, the change is expressed as the percentage change between the base case and post-compliance values.
b. Facilities with status changes in either base case or post-compliance scenario have been excluded from these calculations. In addition, the change in variable production cost per MWh could not be developed for 28, 21, and 18 facilities with zero generation in either base case or Options 1, 2, or 3 post-compliance scenarios, respectively.
Source: U.S. EPA analysis, 2010

For Option 1, which corresponds to EPA's proposed option, the analysis of changes in individual facilities indicates that most facilities experience very slight effects – no change, or less than a 1 percent reduction or 1 percent increase – in all of the impact metrics except *Change in Pre-Tax Income*. Only 1 facility is estimated to incur a reduction in capacity utilization exceeding 1 percent; 13 facilities incur a reduction in generation exceeding 1 percent; and 8 facilities incur a reduction in revenue exceeding 1 percent. Only 9 facilities incur an *increase* in variable production costs exceeding 1 percent. The estimated change in pre-tax income is more consequential as 126 facilities are projected to incur reductions in pre-tax income of 1-3 percent and 40 facilities are projected to incur reductions in pre-tax income exceeding 3 percent of the baseline value.

The findings for Option 2 are significantly more consequential compared to those estimated for Option 1. For 243 facilities, the *reduction* in generation is estimated to exceed 1 percent; for 242 facilities, the *reduction* in revenue is estimated to exceed 1 percent; for 256 facilities, the *increase* in variable production costs is estimated to exceed 1 percent. Again, the change in pre-tax income is more substantial, with 33 facilities expected to incur reductions in pre-tax income of 1-3 percent and 267 facilities, greater than 3 percent.

As in the preceding discussions, the findings for Option 3 are slightly more consequential than those estimated for Option 2. For 294 facilities, the *reduction* in generation is estimated to exceed 1 percent; for 285 facilities, the *reduction* in revenue is estimated to exceed 1 percent; for 296 facilities, the *increase* in variable production costs is estimated to exceed 1 percent. The change in pre-tax income is more substantial, with 12 facilities expected to incur reductions in pre-tax income of 1-3 percent and 315 facilities, greater than 3 percent.

6.4.2 Analysis Results for the Years 2015, 2020, and 2025 – To Capture the Effect of Installation Downtime

This section presents market-level results for the Proposed Existing Facilities Rule options for model run years 2015, 2020, and 2025. As discussed above, run year 2015 captures the period when in-scope facilities install IM technologies, while run years 2020 and 2025 capture the period when fossil fuel and nuclear facilities install cooling towers, respectively, and may incur installation downtime. Of particular importance as a potential impact, the additional unit downtime from installation of compliance technology would manifest as increased electricity production costs resulting from the dispatch of higher production cost generating units during the periods when units are taken offline to install compliance technologies. Because these effects are of most concern in terms of potential impact on national and regional electricity markets, this section presents results only for the total set of facilities analyzed in IPM and does not present results for the subset of only in-scope facilities.

Table 6-5 presents the following national market-level impacts for 2015, 2020, and 2025, respectively (for regional impacts see *Appendix 6.A*):

1. Electricity price changes, including changes in energy prices and capacity prices
2. Generation changes
3. Revenue changes
4. Cost changes, including changes in fuel costs, variable O&M costs, fixed O&M costs, and capital costs
5. Changes in pre-tax income
6. Changes in variable production costs per MWh.

For each measure, *Table 6-5* presents the results for the base case and the existing facilities rule options for each downtime year, i.e., 2015, 2020, and 2025, the absolute difference between the two cases, and the percentage difference. The following discussion of the impact findings for the three regulatory options focuses on these differences.

Table 6-5: Impact of Regulatory Options on National Electricity Market During Periods of Technology Installation Downtime

Economic Measures (all dollar values in $2009)	Baseline Value	Option 1			Option 2			Option 3		
		Value	Diff	% Change	Value	Diff	% Change	Value	Diff	% Change
2015 (2013-2017)										
Generation (TWh)	4,320	4,320	0	0.0%	4,320	0	0.0%	4,320	0	0.0%
Revenue ($Millions)	$212,857	$212,883	$26	0.0%	$214,124	$1,267	0.6%	$214,201	$1,343	0.6%
Costs ($Millions)	$144,212	$144,764	$552	0.4%	$144,251	$39	0.0%	$144,244	$33	0.0%
Fuel Cost	$81,076	$81,080	$5	0.0%	$80,896	-$180	-0.2%	$80,895	-$181	-0.2%
Variable O&M	$12,034	$12,080	$46	0.4%	$12,056	$22	0.2%	$12,054	$20	0.2%
Fixed O&M	$43,697	$44,140	$443	1.0%	$43,683	-$14	0.0%	$43,680	-$17	0.0%
Capital Cost	$7,405	$7,463	$59	0.8%	$7,616	$211	2.8%	$7,614	$209	2.8%
Pre-Tax Income ($Millions)	$68,646	$68,119	-$527	-0.8%	$69,873	$1,228	1.8%	$69,957	$1,311	1.9%
Variable Production Cost ($/MWh)	$21.55	$21.57	$0.01	0.1%	$21.52	-$0.04	-0.2%	$21.52	-$0.04	-0.2%
2020 (2018-2022)										
Generation (TWh)	4,530				4,530	0	0.0%	4,530	0	0.0%
Revenue ($Millions)	$261,531				$270,507	$8,976	3.4%	$270,709	$9,179	3.5%
Costs ($Millions)	$160,340				$167,450	$7,110	4.4%	$167,719	$7,380	4.6%
Fuel Cost	$83,418				$82,295	-$1,122	-1.3%	$82,295	-$1,123	-1.3%
Variable O&M	$13,349				$13,661	$312	2.3%	$13,673	$324	2.4%
Fixed O&M	$46,160				$50,888	$4,728	10.2%	$51,016	$4,856	10.5%
Capital Cost	$17,413				$20,605	$3,192	18.3%	$20,736	$3,323	19.1%
Pre-Tax Income ($Millions)	$101,191				$103,057	$1,866	1.8%	$102,990	$1,799	1.8%
Variable Production Cost ($/MWh)	$21.36				$21.18	-$0.18	-0.8%	$21.18	-$0.18	-0.8%
2025 (2023-2027)										
Generation (TWh)	4,746				4,746	0	0.0%	4,746	0	0.0%
Revenue ($Millions)	$280,613				$282,363	$1,750	0.6%	$282,381	$1,768	0.6%
Costs ($Millions)	$174,856				$184,900	$10,044	5.7%	$185,148	$10,291	5.9%
Fuel Cost	$86,633				$86,812	$179	0.2%	$86,834	$201	0.2%
Variable O&M	$13,907				$14,295	$388	2.8%	$14,299	$392	2.8%
Fixed O&M	$47,561				$53,500	$5,938	12.5%	$53,625	$6,064	12.7%
Capital Cost	$26,755				$30,294	$3,538	13.2%	$30,390	$3,635	13.6%
Pre-Tax Income ($Millions)	$105,757				$97,463	-$8,294	-7.8%	$97,233	-$8,523	-8.1%
Variable Production Cost ($/MWh)	$21.18				$21.30	$0.12	0.6%	$21.31	$0.13	0.6%

Findings for Regulatory Option 1 (IM Everywhere)

Because in-scope facilities would be required to meet compliance requirements no later than 5 years following rule promulgation, Option 1, the preferred Option, has downtime effects during only the five year period of 2013-2017. Results for the year 2015 are indicative of annual effects during each of these years.

With few facilities having an increase in net downtime under Option 1, the estimated effects of downtime are relatively minor. Variable production costs increase by less than 0.1 percent. While the effect on energy production costs varies at the regional level (see *Appendix 6.A*), this effect is overall very small. Of the 8 NERC regions, 2 – ERCOT and MRO – record a slight reduction in variable production costs of $0.03 per MWh and

$0.01 per MWh, respectively. For the remaining 5 NERC regions, the increase in variable production cost is no more than $0.03 per MWh or 0.2 percent, occurring in RFC.

Another potential market level impact due to the incurrence of downtime is the possible increase in electricity prices and, consequently, revenue. At the market level, the change in total revenue is nearly zero, indicating very small overall effects on consumer prices. The largest increase in revenue of $35 million or 0.2 percent occurs in ERCOT. The changes in electricity prices are not consequential either – no more than 0.1 percent - across all NERC regions.

Findings for Regulatory Option 2 (IM Everywhere and EM for Facilities with DIF>125MGD)

Option 2 would be expected to have downtime effects during each of the three five-year periods, as IM-only facilities comply during the first five years (2012-2017) following rule promulgation, fossil fuel facilities installing cooling tower technology comply during the second five years (2018-2022), and nuclear facilities installing cooling tower technology comply during the third five years (2023-2027).

2015

During the first five-year period (2012-2017), downtime effects under Option 2, although more significant than those under Option 1, remain small. Variable production costs decline by a very minor amount, 0.2 percent, as the market begins to adjust overall in anticipation of the larger effects on capacity availability as the result of cooling tower installation in later years. The effect on energy production costs varies at the regional level (see *Appendix 6.A*). Of the 8 NERC regions, 5 record a slight reduction in variable production costs of up to $0.49 per MWh or 1.8 percent. For the remaining 3 NERC regions, variable production costs increase by no more than $0.12 per MWh or 0.3 percent (FRCC).

Total market-level revenue increases by $1.2 billion, or 0.6 percent, indicating small effects on consumer prices. The largest increase in revenue of $524 million or 2.7 percent occurs in NPCC. Of the 8 NERC regions, 2 – FRCC and MRO – record a slight reduction in revenue of $14 million (0.1 percent) and 21 million (0.2 percent), respectively. The largest increase in electricity prices of $0.86 per MWh or 1.3 percent occurs in NPCC with the second largest increase of $0.29 per MWh or 0.6 percent occurring in SERC.

2020

During the second five-year period (2018-2022), downtime effects are more pronounced. At the market level, variable production costs decline again, by 0.8 percent, but revenue increases by nearly $9.0 billion, or 3.4 percent. Thus, the impact on consumer prices is greater during this period than during the preceding five years.

Again, of the 8 NERC regions, 5 record a reduction in variable production costs of up to $2.41 per MWh or 9.3 percent (see *Appendix 6.A*). For the remaining 3 NERC regions, variable production costs increase by no more than $0.22 per MWh or 1.2 percent (RFC).

The largest increases in revenue of $3.1 billion (5.2 percent) and in electricity prices of $2.33 per MWh (4.7 percent) occur in RFC. Of the 8 NERC regions, only 1 – WECC – records a slight reduction in revenue of $49 million (0.7 percent). All but two NERC regions – FRCC and WECC – record an electricity price decrease of $1.32 per MWh (2.0 percent) and $0.53 per MWh (0.9 percent). Again, the reduction in variable production costs and revenue reflect replacement of generation from older, less efficient and higher fuel cost capacity, with generation from more energy efficient, lower production cost capacity.

2025

The greatest impact on variable production cost under this option occurs during the third five-year period (2023-2027), when nuclear facilities incur downtime during technology installation. Net downtime for cooling tower installation at nuclear facilities is estimated at 24 weeks compared to 0.3 - 4 weeks for installations at fossil fuel facilities. During this period, variable production costs increase by $0.12 per MWh or approximately 0.6 percent.

Although variable production cost increases during this period (while declining during the preceding two five-year periods), annual revenue increases by a smaller amount, $1.8 billion, or a 0.6 percent increase above baseline. The smaller increase in revenue, and by inference in consumer prices, results from the ongoing market adjustment with replacement of less efficient, higher fuel cost generation with more efficient, lower fuel cost capacity.

Again, the impact of downtime varies across NERC regions (see *Appendix 6.A*). Out of 8 NERC regions, 2 – ERCOT and NPCC – record a reduction in variable production costs of $0.60 per MWh (2.4 percent) and $0.69 per MWh (2.5 percent), respectively. The same two NERC regions and WECC also record a slight reduction in electricity prices – no more than $0.54 per MWh (0.8 percent). The largest increases in variable production cost of $0.46 per MWh (2.5 percent), revenue of $1.2 billion, and electricity prices of $0.77 per MWh (2.0 percent) occur in the RFC region. ERCOT, FRCC, and WECC record a modest reduction in revenue – no more than $205 million (0.9 percent).

Findings for Regulatory Option 3 (I&E Mortality– Everywhere)

Like Option 2, Option 3 would be expected to have downtime effects during each of the three five-year periods.

2015

During the first five-year period (2012-2017), impacts are nearly identical to those of Option 2 at the national and regional level. At the national level, variable production costs decline by 0.2 percent, and total revenue increases by $1.2 billion, or 0.6 percent, indicating small effects on consumer prices.

At the regional level (see *Appendix 6.A*), the only NERC region with slightly different impacts is MRO. While under Option 2, revenue declines by 0.2 percent, under Option 3 it increases by 0.5 percent. Further, under Option 3, the decline in variable production costs as well as the drop in electricity prices are slightly more significant.

2020

During the second five-year period (2018-2022), downtime effects are again very similar to, but slightly higher than, those of Option 2. At the national level, variable production costs decline by 0.8 percent, while revenue increases by $9.2 billion, or 3.4 percent. Again, the impact on consumer prices is greater during this period than during the preceding five years.

At the regional level (see *Appendix 6.A*), the direction of the change in variable production costs, revenue, and electricity prices under Option 3 is the same as that under Option 2 for all NERC regions; the difference in the magnitude of change is not very pronounced either.

2025

As with Option 2, the greatest impact on variable production cost occurs during the third five-year period (2023-2027). During this period, market-level variable production costs increase by $0.13 per MWh or approximately 0.6 percent. Although variable production cost increases during this period (while declining during the preceding two five-year periods), annual revenue increases by a smaller amount, $1.8 billion, or a 0.6 percent increase above baseline.

At the regional level (see *Appendix 6.A*), as is the case in the preceding two five-year periods, the direction of the change in variable production costs, revenue, and electricity prices under Option 3 is the same as that under Option 2 for all NERC regions; the difference in the magnitude of change is not very pronounced either.

6.5 Uncertainties and Limitations

EPA's analysis of the electric power market and the economic impacts of the final rule involves several uncertainties:

- *Demand for electricity*: IPM assumes that electricity demand at the national level would not change between the base case and the analyzed post-compliance options (generation within the regions is allowed to vary). IPM Version 3.02 embeds a baseline energy demand forecast that is derived from the Department of Energy's *Annual Energy Outlook 2008* (AEO 2008), with certain adjustments by EPA to account for the effect of certain voluntary energy efficiency programs. As specified for this analysis, IPM does not capture changes in demand that may result from electricity price increases associated with the rule. While this constraint may overestimate total demand in policy options that have high compliance cost and that may therefore lead to significant price increases, EPA believes that it does not affect the results analyzed in support of the final rule. As described in *Section 0* above, the price increases associated with the proposed option rule in most NERC regions are small. EPA therefore concludes that the assumption of inelastic demand-responses to changes in prices is reasonable.
- *International imports*: IPM also assumes that imports from Canada and Mexico would not change between the base case and the analyzed policy options. Holding international imports fixed would potentially overstate production costs and electricity prices, because imports are not subject to the rule and may therefore become more competitive relative to domestic capacity, displacing some of the more expensive domestic generating units. On the other hand, holding imports fixed may understate effects on marginal domestic units, which may be displaced by increased imports. However, EPA concludes that fixed imports do not materially affect the results of the analyses. In 2020, only three of the eight NERC regions are projected to import electricity (MRO, NPCC, and WECC), and the level of imports compared to domestic generation in each of these regions is very small (1.6 percent in MRO, 5.5 percent in NPCC, and 0.1 percent in WECC).
- *Repowering*: For this analysis, EPA did not use the IPM function that allows the model to pick among a set of compliance responses. As a result, there is no iterative process that would adjust the compliance response (and as a result the cost of compliance) if a facility chooses to repower. Repowering in the IPM typically consists of the conversion of existing oil/gas or coal capacity to new combined-cycle capacity. The repowering analysis also increases the electric generating capacity of the repowered unit. This change in plant type and size might lead to a change in intake flow and potentially to different compliance requirements and costs. Since combined-cycle facilities require substantially less cooling water than other oil/gas or coal facilities of equivalent capacity, the effect of repowering is likely to be a reduction in cooling water requirements (even considering the increase in the plant's capacity). As a result, not allowing the model to adjust the compliance response or cost is likely to overstate compliance costs and potential economic impacts from the analyzed regulatory options.
- *Downtime associated with installation of compliance technologies*: EPA estimates that the installation of several compliance technologies would require the steam electric generators of facilities that are projected to install such technologies to be off-line. Downtime is estimated to range between two and 28 weeks, depending on the technology and type of generating unit. Generator downtime is estimated to occur during the year when a facility complies with the final rule. Since the years that are mapped to a run year are assumed to have the same characteristics as the run year itself, generator downtimes were applied as an average over the years that are mapped into each model run year. A potential drawback of this approach of averaging downtimes over the mapped years is that the snapshot of the effect of downtimes during the model run year is the average effect; this approach does not model potential more adverse effects of above-average amounts of capacity being down in any one NERC region during any one year.

Appendix 6A Market Model Analysis Results for the Years 2015, 2020, and 2025 – To Capture the Effect of Installation Downtime by NERC Region

This Appendix presents electricity market-level results for the Proposed Existing Facilities Rule options for model run years 2015 (*Table 6A-1*), 2020 (*Table 6A-2*), and 2025 (*Table 6A-3*) at the national and regional level. As discussed in Chapter 6, run year 2015 captures the period when in-scope facilities install IM technologies, while run years 2020 and 2025 capture the period when fossil fuel and nuclear facilities install cooling towers, respectively, and may incur installation downtime. *Table 6A-1*, *Table 6A-2*, and *Table 6A-3* present the following national and regional impacts for 2015, 2020, and 2025, respectively:

1. Electricity price changes, including changes in energy prices and capacity prices
2. Generation changes
3. Revenue changes
4. Cost changes, including changes in fuel costs, variable O&M costs, fixed O&M costs, and capital costs
5. Changes in pre-tax income
6. Changes in variable production costs per MWh.

For each measure, *Table 6A-1*, *Table 6A-2*, and *Table 6A-3* present the results for the base case and the existing facilities rule options for each downtime year, i.e., 2015, 2020, and 2025, respectively, the absolute difference between the two cases, and the percentage difference.

Table 6A-1: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2015

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 –				MMA Option 2 –				MMA Option 3 –			
				% Change				% Change				% Change	
		Value	Diff	2015	2028	Value	Diff	2015	2028	Value	Diff	2015	2028
National Totals													
Electricity Prices ($/MWh)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Generation (TWh)	4,320	4,320	0	0.0%	0.0%	4,320	0	0.0%	0.0%	4,320	0	0.0%	0.0%
Revenue ($Millions)	$212,857	$212,883	$26	0.0%	0.1%	$214,124	$1,267	0.6%	0.1%	$214,201	$1,343	0.6%	0.2%
Costs ($Millions)	$144,212	$144,764	$552	0.4%	0.3%	$144,251	$39	0.0%	5.4%	$144,244	$33	0.0%	5.5%
Fuel Cost	$81,076	$81,080	$5	0.0%	0.0%	$80,896	-$180	-0.2%	0.8%	$80,895	-$181	-0.2%	0.8%
Variable O&M	$12,034	$12,080	$46	0.4%	0.2%	$12,056	$22	0.2%	2.2%	$12,054	$20	0.2%	2.2%
Fixed O&M	$43,697	$44,140	$443	1.0%	0.9%	$43,683	-$14	0.0%	12.1%	$43,680	-$17	0.0%	12.4%
Capital Cost	$7,405	$7,463	$59	0.8%	0.2%	$7,616	$211	2.8%	9.3%	$7,614	$209	2.8%	9.7%
Pre-Tax Income ($Millions)	$68,646	$68,119	-$527	-0.8%	-0.3%	$69,873	$1,228	1.8%	-7.6%	$69,957	$1,311	1.9%	-7.7%
Variable Production Cost ($/MWh)	$21.55	$21.57	$0.01	0.1%	0.0%	$21.52	-$0.04	-0.2%	1.0%	$21.52	-$0.04	-0.2%	1.0%
Electric Reliability Council of Texas (ERCOT)													
Electricity Prices ($/MWh)	$58.43	$58.39	-$0.04	-0.1%	0.0%	$58.66	$0.23	0.4%	0.2%	$58.63	$0.20	0.3%	0.2%
Generation (TWh)	338	338	0	0.0%	0.0%	338	0	0.0%	0.0%	338	0	0.0%	0.0%
Revenue ($Millions)	$20,299	$20,334	$35	0.2%	0.0%	$20,523	$224	1.1%	0.1%	$20,526	$227	1.1%	0.1%
Costs ($Millions)	$13,216	$13,258	$42	0.3%	0.2%	$13,242	$26	0.2%	4.9%	$13,243	$27	0.2%	4.9%
Fuel Cost	$8,298	$8,284	-$14	-0.2%	-0.2%	$8,114	-$184	-2.2%	-2.1%	$8,113	-$184	-2.2%	-2.3%
Variable O&M	$1,065	$1,069	$4	0.4%	0.2%	$1,081	$16	1.5%	5.4%	$1,081	$16	1.5%	5.6%
Fixed O&M	$2,625	$2,655	$30	1.1%	0.9%	$2,644	$19	0.7%	12.0%	$2,645	$20	0.8%	12.1%
Capital Cost	$1,228	$1,249	$21	1.7%	0.4%	$1,403	$175	14.3%	14.0%	$1,403	$175	14.3%	14.3%
Pre-Tax Income ($Millions)	$7,083	$7,076	-$7	-0.1%	-0.4%	$7,281	$198	2.8%	-9.5%	$7,283	$201	2.8%	-9.5%
Variable Production Cost ($/MWh)	$27.71	$27.68	-$0.03	-0.1%	-0.1%	$27.22	-$0.49	-1.8%	-1.1%	$27.22	-$0.49	-1.8%	-1.2%
Florida Reliability Coordinating Council (FRCC)													
Electricity Prices ($/MWh)	$66.75	$66.83	$0.08	0.1%	0.0%	$66.93	$0.18	0.3%	0.1%	$66.93	$0.18	0.3%	0.1%
Generation (TWh)	236	236	0	0.0%	0.0%	236	0	0.0%	0.1%	236	0	0.0%	0.0%
Revenue ($Millions)	$16,115	$16,107	-$8	0.0%	0.0%	$16,101	-$14	-0.1%	0.4%	$16,102	-$14	-0.1%	0.4%
Costs ($Millions)	$11,625	$11,663	$37	0.3%	0.2%	$11,646	$21	0.2%	2.2%	$11,646	$21	0.2%	2.1%
Fuel Cost	$8,131	$8,130	-$1	0.0%	0.4%	$8,154	$24	0.3%	1.6%	$8,155	$24	0.3%	1.7%
Variable O&M	$868	$873	$5	0.6%	-0.4%	$873	$5	0.6%	-1.1%	$873	$5	0.6%	-1.5%
Fixed O&M	$1,893	$1,911	$18	0.9%	0.6%	$1,897	$4	0.2%	9.1%	$1,896	$3	0.2%	9.1%
Capital Cost	$733	$749	$16	2.1%	-0.4%	$721	-$12	-1.6%	0.3%	$721	-$12	-1.6%	0.1%
Pre-Tax Income ($Millions)	$4,490	$4,445	-$45	-1.0%	-0.4%	$4,456	-$34	-0.8%	-4.7%	$4,456	-$34	-0.8%	-4.8%
Variable Production Cost ($/MWh)	$38.16	$38.17	$0.02	0.0%	0.3%	$38.28	$0.12	0.3%	1.2%	$38.28	$0.12	0.3%	1.3%

Table 6A-1: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2015

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 –				MMA Option 2 –				MMA Option 3 –			
				% Change				% Change				% Change	
		Value	Diff	2015	2028	Value	Diff	2015	2028	Value	Diff	2015	2028
Midwest Reliability Organization (MRO)													
Electricity Prices ($/MWh)	$37.68	$37.70	$0.02	0.1%	0.0%	$37.49	-$0.19	-0.5%	0.1%	$37.40	-$0.27	-0.7%	0.1%
Generation (TWh)	256	255	0	-0.2%	0.0%	255	-1	-0.4%	-0.7%	255	-1	-0.4%	-0.5%
Revenue ($Millions)	$9,554	$9,544	-$9	-0.1%	0.0%	$9,533	-$21	-0.2%	-0.4%	$9,606	$52	0.5%	-0.4%
Costs ($Millions)	$6,751	$6,783	$33	0.5%	0.9%	$6,717	-$33	-0.5%	6.7%	$6,720	-$30	-0.5%	7.4%
Fuel Cost	$3,496	$3,487	-$10	-0.3%	-0.4%	$3,478	-$18	-0.5%	0.3%	$3,475	-$22	-0.6%	0.4%
Variable O&M	$618	$619	$1	0.2%	-0.1%	$615	-$4	-0.6%	3.6%	$614	-$4	-0.7%	3.9%
Fixed O&M	$2,563	$2,609	$46	1.8%	1.9%	$2,561	-$2	-0.1%	10.9%	$2,568	$5	0.2%	12.4%
Capital Cost	$73	$68	-$5	-7.1%	2.9%	$63	-$10	-13.3%	16.9%	$64	-$9	-13.0%	18.1%
Pre-Tax Income ($Millions)	$2,803	$2,761	-$42	-1.5%	-1.0%	$2,816	$13	0.5%	-8.4%	$2,886	$83	3.0%	-9.1%
Variable Production Cost ($/MWh)	$16.08	$16.08	-$0.01	0.0%	-0.4%	$16.07	-$0.02	-0.1%	1.5%	$16.04	-$0.04	-0.3%	1.5%
Northeast Power Coordinating Council (NPCC)													
Electricity Prices ($/MWh)	$64.91	$64.90	-$0.01	0.0%	0.1%	$65.78	$0.86	1.3%	-1.6%	$65.78	$0.87	1.3%	-1.7%
Generation (TWh)	296	296	0	0.0%	0.0%	296	0	0.0%	-0.2%	296	0	0.0%	-0.2%
Revenue ($Millions)	$19,195	$19,188	-$7	0.0%	0.2%	$19,719	$524	2.7%	-0.7%	$19,723	$528	2.8%	-0.8%
Costs ($Millions)	$13,554	$13,583	$29	0.2%	0.2%	$13,470	-$84	-0.6%	5.9%	$13,468	-$86	-0.6%	6.1%
Fuel Cost	$8,364	$8,356	-$8	-0.1%	-0.5%	$8,347	-$16	-0.2%	-3.2%	$8,347	-$17	-0.2%	-3.3%
Variable O&M	$947	$953	$5	0.6%	0.6%	$949	$2	0.2%	0.3%	$949	$2	0.2%	0.2%
Fixed O&M	$3,690	$3,720	$30	0.8%	0.8%	$3,615	-$75	-2.0%	14.2%	$3,613	-$77	-2.1%	14.8%
Capital Cost	$553	$554	$1	0.2%	1.2%	$559	$5	1.0%	22.5%	$559	$5	1.0%	23.0%
Pre-Tax Income ($Millions)	$5,641	$5,605	-$36	-0.6%	0.3%	$6,248	$608	10.8%	-10.4%	$6,255	$614	10.9%	-11.0%
Variable Production Cost ($/MWh)	$31.48	$31.48	$0.00	0.0%	-0.4%	$31.42	-$0.06	-0.2%	-2.6%	$31.42	-$0.06	-0.2%	-2.7%
ReliabilityFirst Corporation (RFC)													
Electricity Prices ($/MWh)	$39.22	$39.22	$0.00	0.0%	0.1%	$39.24	$0.03	0.1%	0.3%	$39.25	$0.03	0.1%	0.5%
Generation (TWh)	1,042	1,042	0	0.0%	0.0%	1,039	-3	-0.3%	-0.1%	1,039	-3	-0.3%	-0.1%
Revenue ($Millions)	$41,259	$41,248	-$11	0.0%	0.2%	$41,223	-$36	-0.1%	0.5%	$41,230	-$29	-0.1%	0.6%
Costs ($Millions)	$32,794	$32,964	$170	0.5%	0.4%	$32,678	-$116	-0.4%	7.7%	$32,682	-$111	-0.3%	7.8%
Fuel Cost	$16,181	$16,202	$20	0.1%	0.1%	$16,114	-$67	-0.4%	2.6%	$16,118	-$63	-0.4%	2.7%
Variable O&M	$2,196	$2,204	$8	0.4%	0.5%	$2,185	-$12	-0.5%	2.4%	$2,185	-$11	-0.5%	2.3%
Fixed O&M	$12,782	$12,931	$149	1.2%	1.1%	$12,740	-$42	-0.3%	13.2%	$12,738	-$44	-0.3%	13.4%
Capital Cost	$1,634	$1,626	-$7	-0.5%	-0.5%	$1,638	$5	0.3%	13.9%	$1,641	$7	0.4%	14.1%
Pre-Tax Income ($Millions)	$8,465	$8,284	-$181	-2.1%	-0.1%	$8,545	$80	0.9%	-10.3%	$8,548	$82	1.0%	-10.2%
Variable Production Cost ($/MWh)	$17.64	$17.66	$0.03	0.2%	0.2%	$17.61	-$0.02	-0.1%	2.7%	$17.62	-$0.02	-0.1%	2.7%

Table 6A-1: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2015													
Economic Measures (all dollar values in $2009)	**Baseline Value**	**MMA Option 1 –**				**MMA Option 2 –**				**MMA Option 3 –**			
				% Change				**% Change**				**% Change**	
		Value	**Diff**	**2015**	**2028**	**Value**	**Diff**	**2015**	**2028**	**Value**	**Diff**	**2015**	**2028**
Southeast Electric Reliability Council (SERC)													
Electricity Prices ($/MWh)	$45.62	$45.66	$0.04	0.1%	0.0%	$45.91	$0.29	0.6%	-0.1%	$45.91	$0.29	0.6%	0.0%
Generation (TWh)	1,121	1,121	0	0.0%	0.0%	1,125	4	0.4%	0.2%	1,125	4	0.3%	0.2%
Revenue ($Millions)	$53,084	$53,099	$15	0.0%	0.0%	$53,485	$401	0.8%	0.4%	$53,478	$393	0.7%	0.5%
Costs ($Millions)	$34,454	$34,635	$181	0.5%	0.3%	$34,645	$191	0.6%	8.0%	$34,635	$181	0.5%	8.2%
Fuel Cost	$18,813	$18,831	$18	0.1%	-0.1%	$18,908	$95	0.5%	1.9%	$18,909	$96	0.5%	1.9%
Variable O&M	$2,636	$2,653	$17	0.6%	0.4%	$2,647	$10	0.4%	4.2%	$2,646	$9	0.4%	4.2%
Fixed O&M	$12,566	$12,699	$133	1.1%	1.0%	$12,642	$76	0.6%	16.6%	$12,637	$71	0.6%	16.8%
Capital Cost	$438	$452	$14	3.1%	0.2%	$448	$9	2.1%	14.1%	$443	$5	1.1%	15.0%
Pre-Tax Income ($Millions)	$18,630	$18,464	-$166	-0.9%	-0.4%	$18,840	$210	1.1%	-8.9%	$18,842	$212	1.1%	-8.9%
Variable Production Cost ($/MWh)	$19.14	$19.16	$0.02	0.1%	-0.1%	$19.16	$0.02	0.1%	2.0%	$19.17	$0.03	0.1%	2.0%
Southwest Power Pool (SPP)													
Electricity Prices ($/MWh)	$46.14	$46.17	$0.03	0.1%	0.0%	$46.36	$0.22	0.5%	-0.1%	$46.34	$0.19	0.4%	0.0%
Generation (TWh)	249	249	0	0.0%	0.0%	249	0	0.0%	-0.3%	249	0	0.0%	-0.3%
Revenue ($Millions)	$11,775	$11,800	$25	0.2%	0.0%	$11,907	$132	1.1%	-0.1%	$11,907	$132	1.1%	-0.1%
Costs ($Millions)	$7,946	$7,995	$50	0.6%	0.3%	$7,956	$10	0.1%	4.8%	$7,954	$9	0.1%	4.9%
Fuel Cost	$4,239	$4,237	-$2	-0.1%	-0.1%	$4,224	-$15	-0.4%	0.3%	$4,224	-$15	-0.4%	0.3%
Variable O&M	$724	$729	$5	0.7%	0.3%	$726	$2	0.2%	1.9%	$726	$2	0.2%	1.9%
Fixed O&M	$1,698	$1,728	$30	1.8%	1.5%	$1,702	$4	0.2%	16.3%	$1,701	$2	0.1%	16.4%
Capital Cost	$1,284	$1,302	$18	1.4%	0.1%	$1,304	$20	1.6%	4.8%	$1,304	$20	1.6%	4.9%
Pre-Tax Income ($Millions)	$3,829	$3,805	-$25	-0.6%	-0.5%	$3,951	$122	3.2%	-8.6%	$3,953	$123	3.2%	-8.7%
Variable Production Cost ($/MWh)	$19.96	$19.98	$0.01	0.1%	0.0%	$19.91	-$0.05	-0.3%	0.9%	$19.91	-$0.05	-0.3%	0.9%
Western Electricity Coordinating Council (WECC)													
Electricity Prices ($/MWh)	$52.60	$52.60	$0.00	0.0%	0.0%	$52.65	$0.05	0.1%	-0.3%	$52.65	$0.05	0.1%	-0.3%
Generation (TWh)	783	783	0	0.0%	0.0%	783	0	0.0%	0.0%	783	0	0.0%	0.0%
Revenue ($Millions)	$41,577	$41,564	-$13	0.0%	0.0%	$41,634	$57	0.1%	-0.2%	$41,629	$52	0.1%	-0.2%
Costs ($Millions)	$23,872	$23,883	$11	0.0%	0.0%	$23,898	$25	0.1%	0.2%	$23,895	$23	0.1%	0.2%
Fuel Cost	$13,553	$13,554	$1	0.0%	0.0%	$13,555	$2	0.0%	0.1%	$13,554	$1	0.0%	0.1%
Variable O&M	$2,979	$2,980	$1	0.0%	0.0%	$2,981	$2	0.1%	0.2%	$2,981	$2	0.1%	0.2%
Fixed O&M	$5,880	$5,886	$7	0.1%	0.1%	$5,882	$2	0.0%	0.3%	$5,881	$1	0.0%	0.4%
Capital Cost	$1,461	$1,463	$2	0.1%	0.0%	$1,479	$18	1.3%	0.2%	$1,479	$18	1.3%	0.4%
Pre-Tax Income ($Millions)	$17,705	$17,680	-$24	-0.1%	-0.1%	$17,736	$31	0.2%	-0.8%	$17,734	$29	0.2%	-0.9%
Variable Production Cost ($/MWh)	$21.12	$21.12	$0.00	0.0%	0.0%	$21.12	$0.00	0.0%	0.1%	$21.12	$0.00	0.0%	0.1%

Table 6A-2: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2020

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 –				MMA Option 2 –				MMA Option 3 –			
		Value	Diff	% Change 2020	% Change 2028	Value	Diff	% Change 2020	% Change 2028	Value	Diff	% Change 2020	% Change 2028
National Totals													
Electricity Prices ($/MWh)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Generation (TWh)	4,530	4,530	0	0.0%	0.0%	4,530	0	0.0%	0.0%	4,530	0	0.0%	0.0%
Revenue ($Millions)	$261,531	$261,648	$118	0.0%	0.1%	$270,507	$8,976	3.4%	0.1%	$270,709	$9,179	3.5%	0.2%
Costs ($Millions)	$160,340	$160,668	$328	0.2%	0.3%	$167,450	$7,110	4.4%	5.4%	$167,719	$7,380	4.6%	5.5%
Fuel Cost	$83,418	$83,155	-$263	-0.3%	0.0%	$82,295	-$1,122	-1.3%	0.8%	$82,295	-$1,123	-1.3%	0.8%
Variable O&M	$13,349	$13,394	$45	0.3%	0.2%	$13,661	$312	2.3%	2.2%	$13,673	$324	2.4%	2.2%
Fixed O&M	$46,160	$46,608	$449	1.0%	0.9%	$50,888	$4,728	10.2%	12.1%	$51,016	$4,856	10.5%	12.4%
Capital Cost	$17,413	$17,511	$98	0.6%	0.2%	$20,605	$3,192	18.3%	9.3%	$20,736	$3,323	19.1%	9.7%
Pre-Tax Income ($Millions)	$101,191	$100,981	-$210	-0.2%	-0.3%	$103,057	$1,866	1.8%	-7.6%	$102,990	$1,799	1.8%	-7.7%
Variable Production Cost ($/MWh)	$21.36	$21.31	-$0.05	-0.2%	0.0%	$21.18	-$0.18	-0.8%	1.0%	$21.18	-$0.18	-0.8%	1.0%
Electric Reliability Council of Texas (ERCOT)													
Electricity Prices ($/MWh)	$59.05	$59.00	-$0.05	-0.1%	0.0%	$59.63	$0.58	1.0%	0.2%	$59.65	$0.60	1.0%	0.2%
Generation (TWh)	358	358	0	0.0%	0.0%	359	1	0.2%	0.0%	359	1	0.2%	0.0%
Revenue ($Millions)	$21,938	$21,981	$44	0.2%	0.0%	$22,902	$965	4.4%	0.1%	$22,914	$977	4.5%	0.1%
Costs ($Millions)	$14,681	$14,686	$5	0.0%	0.2%	$15,250	$569	3.9%	4.9%	$15,254	$573	3.9%	4.9%
Fuel Cost	$8,097	$8,062	-$35	-0.4%	-0.2%	$7,169	-$929	-11.5%	-2.1%	$7,151	-$947	-11.7%	-2.3%
Variable O&M	$1,221	$1,224	$3	0.2%	0.2%	$1,306	$85	6.9%	5.4%	$1,307	$86	7.0%	5.6%
Fixed O&M	$2,937	$2,965	$29	1.0%	0.9%	$3,264	$328	11.2%	12.0%	$3,267	$331	11.3%	12.1%
Capital Cost	$2,426	$2,435	$8	0.3%	0.4%	$3,512	$1,085	44.7%	14.0%	$3,530	$1,103	45.5%	14.3%
Pre-Tax Income ($Millions)	$7,256	$7,295	$39	0.5%	-0.4%	$7,652	$396	5.5%	-9.5%	$7,660	$403	5.6%	-9.5%
Variable Production Cost ($/MWh)	$26.01	$25.93	-$0.08	-0.3%	-0.1%	$23.60	-$2.41	-9.3%	-1.1%	$23.56	-$2.45	-9.4%	-1.2%
Florida Reliability Coordinating Council (FRCC)													
Electricity Prices ($/MWh)	$66.56	$66.31	-$0.24	-0.4%	0.0%	$65.24	-$1.32	-2.0%	0.1%	$65.18	-$1.38	-2.1%	0.1%
Generation (TWh)	266	266	0	0.1%	0.0%	272	6	2.3%	0.1%	272	6	2.3%	0.0%
Revenue ($Millions)	$18,349	$18,322	-$27	-0.1%	0.0%	$18,988	$639	3.5%	0.4%	$18,971	$622	3.4%	0.4%
Costs ($Millions)	$13,861	$13,871	$10	0.1%	0.2%	$14,512	$651	4.7%	2.2%	$14,511	$649	4.7%	2.1%
Fuel Cost	$8,412	$8,399	-$13	-0.2%	0.4%	$8,574	$162	1.9%	1.6%	$8,566	$154	1.8%	1.7%
Variable O&M	$1,027	$1,030	$3	0.3%	-0.4%	$1,031	$3	0.3%	-1.1%	$1,030	$3	0.3%	-1.5%
Fixed O&M	$2,092	$2,108	$16	0.8%	0.6%	$2,294	$203	9.7%	9.1%	$2,296	$204	9.8%	9.1%
Capital Cost	$2,330	$2,333	$3	0.1%	-0.4%	$2,613	$283	12.1%	0.3%	$2,618	$288	12.3%	0.1%
Pre-Tax Income ($Millions)	$4,488	$4,451	-$37	-0.8%	-0.4%	$4,476	-$12	-0.3%	-4.7%	$4,460	-$27	-0.6%	-4.8%
Variable Production Cost ($/MWh)	$35.49	$35.42	-$0.06	-0.2%	0.3%	$35.28	-$0.20	-0.6%	1.2%	$35.26	-$0.23	-0.6%	1.3%

Table 6A-2: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2020

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 –				MMA Option 2 –				MMA Option 3 –			
				% Change				% Change				% Change	
		Value	Diff	2020	2028	Value	Diff	2020	2028	Value	Diff	2020	2028
Midwest Reliability Organization (MRO)													
Electricity Prices ($/MWh)	$47.25	$47.42	$0.17	0.4%	0.0%	$48.64	$1.39	2.9%	0.1%	$48.68	$1.43	3.0%	0.1%
Generation (TWh)	269	269	-1	-0.2%	0.0%	268	-1	-0.4%	-0.7%	268	-1	-0.5%	-0.5%
Revenue ($Millions)	$14,264	$14,288	$24	0.2%	0.0%	$14,596	$332	2.3%	-0.4%	$14,602	$338	2.4%	-0.4%
Costs ($Millions)	$7,595	$7,611	$16	0.2%	0.9%	$8,126	$530	7.0%	6.7%	$8,170	$575	7.6%	7.4%
Fuel Cost	$3,861	$3,852	-$9	-0.2%	-0.4%	$3,874	$13	0.3%	0.3%	$3,874	$13	0.3%	0.4%
Variable O&M	$680	$680	$0	0.0%	-0.1%	$704	$23	3.4%	3.6%	$704	$24	3.5%	3.9%
Fixed O&M	$2,622	$2,667	$45	1.7%	1.9%	$2,977	$355	13.5%	10.9%	$3,016	$394	15.0%	12.4%
Capital Cost	$432	$412	-$20	-4.6%	2.9%	$571	$139	32.2%	16.9%	$576	$145	33.5%	18.1%
Pre-Tax Income ($Millions)	$6,668	$6,677	$8	0.1%	-1.0%	$6,471	-$198	-3.0%	-8.4%	$6,432	-$237	-3.5%	-9.1%
Variable Production Cost ($/MWh)	$16.86	$16.86	$0.00	0.0%	-0.4%	$17.06	$0.20	1.2%	1.5%	$17.08	$0.22	1.3%	1.5%
Northeast Power Coordinating Council (NPCC)													
Electricity Prices ($/MWh)	$70.55	$70.38	-$0.17	-0.2%	0.1%	$70.81	$0.26	0.4%	-1.6%	$70.77	$0.22	0.3%	-1.7%
Generation (TWh)	303	303	0	-0.1%	0.0%	303	0	-0.1%	-0.2%	303	0	-0.1%	-0.2%
Revenue ($Millions)	$22,653	$22,657	$4	0.0%	0.2%	$23,119	$466	2.1%	-0.7%	$23,111	$458	2.0%	-0.8%
Costs ($Millions)	$14,671	$14,667	-$4	0.0%	0.2%	$15,128	$457	3.1%	5.9%	$15,158	$487	3.3%	6.1%
Fuel Cost	$8,255	$8,136	-$119	-1.4%	-0.5%	$7,943	-$313	-3.8%	-3.2%	$7,956	-$299	-3.6%	-3.3%
Variable O&M	$1,063	$1,074	$11	1.0%	0.6%	$1,101	$38	3.5%	0.3%	$1,100	$36	3.4%	0.2%
Fixed O&M	$3,880	$3,917	$37	1.0%	0.8%	$4,275	$394	10.2%	14.2%	$4,294	$414	10.7%	14.8%
Capital Cost	$1,472	$1,539	$67	4.6%	1.2%	$1,809	$337	22.9%	22.5%	$1,808	$336	22.8%	23.0%
Pre-Tax Income ($Millions)	$7,982	$7,990	$8	0.1%	0.3%	$7,991	$9	0.1%	-10.4%	$7,954	-$29	-0.4%	-11.0%
Variable Production Cost ($/MWh)	$30.74	$30.40	-$0.34	-1.1%	-0.4%	$29.86	-$0.88	-2.9%	-2.6%	$29.90	-$0.84	-2.7%	-2.7%
ReliabilityFirst Corporation (RFC)													
Electricity Prices ($/MWh)	$50.00	$49.97	-$0.03	-0.1%	0.1%	$52.32	$2.33	4.7%	0.3%	$52.37	$2.37	4.7%	0.5%
Generation (TWh)	1,076	1,076	1	0.1%	0.0%	1,078	2	0.2%	-0.1%	1,079	3	0.3%	-0.1%
Revenue ($Millions)	$60,046	$60,191	$145	0.2%	0.2%	$63,143	$3,097	5.2%	0.5%	$63,233	$3,187	5.3%	0.6%
Costs ($Millions)	$36,048	$36,245	$197	0.5%	0.4%	$38,582	$2,534	7.0%	7.7%	$38,666	$2,618	7.3%	7.8%
Fuel Cost	$17,126	$17,140	$14	0.1%	0.1%	$17,329	$203	1.2%	2.6%	$17,342	$215	1.3%	2.7%
Variable O&M	$2,440	$2,452	$12	0.5%	0.5%	$2,521	$81	3.3%	2.4%	$2,529	$90	3.7%	2.3%
Fixed O&M	$13,400	$13,552	$153	1.1%	1.1%	$14,889	$1,489	11.1%	13.2%	$14,919	$1,519	11.3%	13.4%
Capital Cost	$3,082	$3,101	$19	0.6%	-0.5%	$3,843	$761	24.7%	13.9%	$3,877	$794	25.8%	14.1%
Pre-Tax Income ($Millions)	$23,998	$23,946	-$52	-0.2%	-0.1%	$24,561	$563	2.3%	-10.3%	$24,567	$569	2.4%	-10.2%
Variable Production Cost ($/MWh)	$18.19	$18.21	$0.01	0.1%	0.2%	$18.42	$0.22	1.2%	2.7%	$18.42	$0.22	1.2%	2.7%

Table 6A-2: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2020

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 – Value	Diff	% Change 2020	% Change 2028	MMA Option 2 – Value	Diff	% Change 2020	% Change 2028	MMA Option 3 – Value	Diff	% Change 2020	% Change 2028
Southeast Electric Reliability Council (SERC)													
Electricity Prices ($/MWh)	$50.83	$50.77	-$0.06	-0.1%	0.0%	$52.49	$1.66	3.3%	-0.1%	$52.62	$1.78	3.5%	0.0%
Generation (TWh)	1,170	1,170	0	0.0%	0.0%	1,162	-8	-0.7%	0.2%	1,162	-9	-0.7%	0.2%
Revenue ($Millions)	$63,737	$63,720	-$17	0.0%	0.0%	$66,615	$2,879	4.5%	0.4%	$66,726	$2,989	4.7%	0.5%
Costs ($Millions)	$37,454	$37,564	$110	0.3%	0.3%	$39,379	$1,925	5.1%	8.0%	$39,453	$1,999	5.3%	8.2%
Fuel Cost	$20,128	$20,098	-$30	-0.1%	-0.1%	$20,172	$44	0.2%	1.9%	$20,194	$66	0.3%	1.9%
Variable O&M	$2,871	$2,882	$11	0.4%	0.4%	$2,917	$46	1.6%	4.2%	$2,918	$47	1.6%	4.2%
Fixed O&M	$13,000	$13,133	$133	1.0%	1.0%	$14,577	$1,576	12.1%	16.6%	$14,599	$1,599	12.3%	16.8%
Capital Cost	$1,454	$1,451	-$3	-0.2%	0.2%	$1,713	$259	17.8%	14.1%	$1,741	$286	19.7%	15.0%
Pre-Tax Income ($Millions)	$26,283	$26,156	-$127	-0.5%	-0.4%	$27,237	$954	3.6%	-8.9%	$27,273	$990	3.8%	-8.9%
Variable Production Cost ($/MWh)	$19.65	$19.64	-$0.01	-0.1%	-0.1%	$19.86	$0.21	1.1%	2.0%	$19.90	$0.24	1.2%	2.0%
Southwest Power Pool (SPP)													
Electricity Prices ($/MWh)	$47.14	$47.08	-$0.06	-0.1%	0.0%	$48.12	$0.98	2.1%	-0.1%	$48.11	$0.97	2.1%	0.0%
Generation (TWh)	262	262	0	0.0%	0.0%	262	0	0.1%	-0.3%	262	0	0.1%	-0.3%
Revenue ($Millions)	$12,752	$12,777	$25	0.2%	0.0%	$13,399	$647	5.1%	-0.1%	$13,399	$647	5.1%	-0.1%
Costs ($Millions)	$8,618	$8,648	$30	0.3%	0.3%	$9,123	$505	5.9%	4.8%	$9,127	$509	5.9%	4.9%
Fuel Cost	$3,994	$3,964	-$29	-0.7%	-0.1%	$3,814	-$179	-4.5%	0.3%	$3,812	-$181	-4.5%	0.3%
Variable O&M	$814	$818	$4	0.5%	0.3%	$850	$36	4.5%	1.9%	$850	$37	4.5%	1.9%
Fixed O&M	$1,808	$1,839	$31	1.7%	1.5%	$2,137	$329	18.2%	16.3%	$2,139	$331	18.3%	16.4%
Capital Cost	$2,003	$2,027	$24	1.2%	0.1%	$2,322	$319	15.9%	4.8%	$2,326	$323	16.1%	4.9%
Pre-Tax Income ($Millions)	$4,134	$4,129	-$4	-0.1%	-0.5%	$4,276	$142	3.4%	-8.6%	$4,272	$138	3.3%	-8.7%
Variable Production Cost ($/MWh)	$18.37	$18.27	-$0.10	-0.5%	0.0%	$17.80	-$0.57	-3.1%	0.9%	$17.79	-$0.57	-3.1%	0.9%
Western Electricity Coordinating Council (WECC)													
Electricity Prices ($/MWh)	$55.59	$55.45	-$0.14	-0.3%	0.0%	$55.06	-$0.53	-0.9%	-0.3%	$55.06	-$0.53	-1.0%	-0.3%
Generation (TWh)	826	826	0	0.0%	0.0%	826	0	0.0%	0.0%	826	0	0.0%	0.0%
Revenue ($Millions)	$47,793	$47,712	-$81	-0.2%	0.0%	$47,744	-$49	-0.1%	-0.2%	$47,754	-$39	-0.1%	-0.2%
Costs ($Millions)	$27,411	$27,376	-$35	-0.1%	0.0%	$27,350	-$61	-0.2%	0.2%	$27,381	-$30	-0.1%	0.2%
Fuel Cost	$13,544	$13,502	-$42	-0.3%	0.0%	$13,421	-$124	-0.9%	0.1%	$13,399	-$145	-1.1%	0.1%
Variable O&M	$3,233	$3,233	$1	0.0%	0.0%	$3,233	$0	0.0%	0.2%	$3,235	$3	0.1%	0.2%
Fixed O&M	$6,421	$6,427	$6	0.1%	0.1%	$6,475	$54	0.8%	0.3%	$6,485	$64	1.0%	0.4%
Capital Cost	$4,213	$4,213	$0	0.0%	0.0%	$4,222	$9	0.2%	0.2%	$4,261	$48	1.1%	0.4%
Pre-Tax Income ($Millions)	$20,382	$20,336	-$45	-0.2%	-0.1%	$20,394	$12	0.1%	-0.8%	$20,372	-$9	0.0%	-0.9%
Variable Production Cost ($/MWh)	$20.31	$20.26	-$0.05	-0.2%	0.0%	$20.17	-$0.14	-0.7%	0.1%	$20.15	-$0.17	-0.8%	0.1%

Table 6A-3: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2025

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 – Value	MMA Option 1 – Diff	MMA Option 1 – % Change 2025	MMA Option 1 – % Change 2028	MMA Option 2 – Value	MMA Option 2 – Diff	MMA Option 2 – % Change 2025	MMA Option 2 – % Change 2028	MMA Option 3 – Value	MMA Option 3 – Diff	MMA Option 3 – % Change 2025	MMA Option 3 – % Change 2028
National Totals													
Electricity Prices ($/MWh)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Generation (TWh)	4,746	4,746	0	0.0%	0.0%	4,746	0	0.0%	0.0%	4,746	0	0.0%	0.0%
Revenue ($Millions)	$280,613	$280,598	-$15	0.0%	0.1%	$282,363	$1,750	0.6%	0.1%	$282,381	$1,768	0.6%	0.2%
Costs ($Millions)	$174,856	$175,248	$391	0.2%	0.3%	$184,900	$10,044	5.7%	5.4%	$185,148	$10,291	5.9%	5.5%
Fuel Cost	$86,633	$86,519	-$114	-0.1%	0.0%	$86,812	$179	0.2%	0.8%	$86,834	$201	0.2%	0.8%
Variable O&M	$13,907	$13,942	$35	0.2%	0.2%	$14,295	$388	2.8%	2.2%	$14,299	$392	2.8%	2.2%
Fixed O&M	$47,561	$48,002	$441	0.9%	0.9%	$53,500	$5,938	12.5%	12.1%	$53,625	$6,064	12.7%	12.4%
Capital Cost	$26,755	$26,786	$30	0.1%	0.2%	$30,294	$3,538	13.2%	9.3%	$30,390	$3,635	13.6%	9.7%
Pre-Tax Income ($Millions)	$105,757	$105,350	-$406	-0.4%	-0.3%	$97,463	-$8,294	-7.8%	-7.6%	$97,233	-$8,523	-8.1%	-7.7%
Variable Production Cost ($/MWh)	$21.18	$21.17	-$0.02	-0.1%	0.0%	$21.30	$0.12	0.6%	1.0%	$21.31	$0.13	0.6%	1.0%
Electric Reliability Council of Texas (ERCOT)													
Electricity Prices ($/MWh)	$56.69	$56.53	-$0.16	-0.3%	0.0%	$56.21	-$0.47	-0.8%	0.2%	$56.22	-$0.47	-0.8%	0.2%
Generation (TWh)	379	379	0	0.1%	0.0%	380	1	0.3%	0.0%	380	1	0.3%	0.0%
Revenue ($Millions)	$23,707	$23,706	-$1	0.0%	0.0%	$23,502	-$205	-0.9%	0.1%	$23,493	-$214	-0.9%	0.1%
Costs ($Millions)	$16,051	$16,083	$32	0.2%	0.2%	$16,940	$889	5.5%	4.9%	$16,945	$894	5.6%	4.9%
Fuel Cost	$8,193	$8,201	$8	0.1%	-0.2%	$7,907	-$286	-3.5%	-2.1%	$7,894	-$299	-3.7%	-2.3%
Variable O&M	$1,268	$1,270	$2	0.1%	0.2%	$1,353	$85	6.7%	5.4%	$1,355	$87	6.9%	5.6%
Fixed O&M	$3,103	$3,131	$28	0.9%	0.9%	$3,499	$396	12.8%	12.0%	$3,502	$399	12.9%	12.1%
Capital Cost	$3,487	$3,481	-$6	-0.2%	0.4%	$4,181	$694	19.9%	14.0%	$4,194	$707	20.3%	14.3%
Pre-Tax Income ($Millions)	$7,656	$7,623	-$33	-0.4%	-0.4%	$6,562	-$1,094	-14.3%	-9.5%	$6,548	-$1,108	-14.5%	-9.5%
Variable Production Cost ($/MWh)	$24.96	$24.96	$0.00	0.0%	-0.1%	$24.36	-$0.60	-2.4%	-1.1%	$24.33	-$0.63	-2.5%	-1.2%
Florida Reliability Coordinating Council (FRCC)													
Electricity Prices ($/MWh)	$60.15	$60.18	$0.04	0.1%	0.0%	$60.19	$0.05	0.1%	0.1%	$60.19	$0.05	0.1%	0.1%
Generation (TWh)	298	298	0	0.0%	0.0%	299	0	0.1%	0.1%	299	0	0.1%	0.0%
Revenue ($Millions)	$19,657	$19,679	$22	0.1%	0.0%	$19,634	-$23	-0.1%	0.4%	$19,634	-$23	-0.1%	0.4%
Costs ($Millions)	$15,470	$15,470	$0	0.0%	0.2%	$15,794	$324	2.1%	2.2%	$15,800	$330	2.1%	2.1%
Fuel Cost	$9,017	$8,992	-$25	-0.3%	0.4%	$9,028	$11	0.1%	1.6%	$9,027	$10	0.1%	1.7%
Variable O&M	$1,014	$1,015	$1	0.1%	-0.4%	$1,019	$5	0.5%	-1.1%	$1,018	$4	0.4%	-1.5%
Fixed O&M	$2,202	$2,218	$17	0.8%	0.6%	$2,424	$222	10.1%	9.1%	$2,425	$224	10.2%	9.1%
Capital Cost	$3,237	$3,244	$7	0.2%	-0.4%	$3,324	$87	2.7%	0.3%	$3,329	$92	2.8%	0.1%
Pre-Tax Income ($Millions)	$4,187	$4,210	$22	0.5%	-0.4%	$3,840	-$347	-8.3%	-4.7%	$3,834	-$353	-8.4%	-4.8%
Variable Production Cost ($/MWh)	$33.61	$33.53	-$0.08	-0.2%	0.3%	$33.64	$0.03	0.1%	1.2%	$33.63	$0.03	0.1%	1.3%

Table 6A-3: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2025

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 – Value	MMA Option 1 – Diff	MMA Option 1 – % Change 2025	MMA Option 1 – % Change 2028	MMA Option 2 – Value	MMA Option 2 – Diff	MMA Option 2 – % Change 2025	MMA Option 2 – % Change 2028	MMA Option 3 – Value	MMA Option 3 – Diff	MMA Option 3 – % Change 2025	MMA Option 3 – % Change 2028
Midwest Reliability Organization (MRO)													
Electricity Prices ($/MWh)	$48.67	$48.64	-$0.03	-0.1%	0.0%	$49.43	$0.76	1.6%	0.1%	$49.43	$0.76	1.6%	0.1%
Generation (TWh)	282	282	0	0.1%	0.0%	282	-1	-0.2%	-0.7%	282	-1	-0.2%	-0.5%
Revenue ($Millions)	$15,702	$15,700	-$2	0.0%	0.0%	$15,976	$274	1.7%	-0.4%	$15,974	$272	1.7%	-0.4%
Costs ($Millions)	$8,686	$8,771	$85	1.0%	0.9%	$9,374	$688	7.9%	6.7%	$9,426	$740	8.5%	7.4%
Fuel Cost	$4,051	$4,036	-$14	-0.4%	-0.4%	$4,085	$35	0.9%	0.3%	$4,088	$38	0.9%	0.4%
Variable O&M	$711	$710	-$1	-0.1%	-0.1%	$749	$38	5.4%	3.6%	$750	$39	5.5%	3.9%
Fixed O&M	$2,726	$2,778	$53	1.9%	1.9%	$3,033	$308	11.3%	10.9%	$3,072	$347	12.7%	12.4%
Capital Cost	$1,199	$1,247	$47	4.0%	2.9%	$1,506	$307	25.6%	16.9%	$1,515	$316	26.4%	18.1%
Pre-Tax Income ($Millions)	$7,016	$6,929	-$87	-1.2%	-1.0%	$6,602	-$413	-5.9%	-8.4%	$6,548	-$467	-6.7%	-9.1%
Variable Production Cost ($/MWh)	$16.88	$16.81	-$0.06	-0.4%	-0.4%	$17.17	$0.29	1.7%	1.5%	$17.18	$0.31	1.8%	1.5%
Northeast Power Coordinating Council (NPCC)													
Electricity Prices ($/MWh)	$68.16	$68.15	-$0.01	0.0%	0.1%	$67.62	-$0.54	-0.8%	-1.6%	$67.62	-$0.54	-0.8%	-1.7%
Generation (TWh)	313	313	0	0.0%	0.0%	313	-1	-0.3%	-0.2%	313	-1	-0.3%	-0.2%
Revenue ($Millions)	$23,229	$23,309	$79	0.3%	0.2%	$23,342	$112	0.5%	-0.7%	$23,342	$113	0.5%	-0.8%
Costs ($Millions)	$15,295	$15,314	$19	0.1%	0.2%	$16,215	$920	6.0%	5.9%	$16,246	$952	6.2%	6.1%
Fuel Cost	$7,516	$7,448	-$69	-0.9%	-0.5%	$7,274	-$242	-3.2%	-3.2%	$7,271	-$246	-3.3%	-3.3%
Variable O&M	$1,075	$1,081	$7	0.6%	0.6%	$1,080	$5	0.5%	0.3%	$1,079	$5	0.4%	0.2%
Fixed O&M	$4,106	$4,140	$35	0.8%	0.8%	$4,689	$583	14.2%	14.2%	$4,711	$606	14.7%	14.8%
Capital Cost	$2,598	$2,644	$46	1.8%	1.2%	$3,172	$574	22.1%	22.5%	$3,185	$587	22.6%	23.0%
Pre-Tax Income ($Millions)	$7,935	$7,995	$60	0.8%	0.3%	$7,126	-$808	-10.2%	-10.4%	$7,096	-$839	-10.6%	-11.0%
Variable Production Cost ($/MWh)	$27.41	$27.22	-$0.19	-0.7%	-0.4%	$26.73	-$0.69	-2.5%	-2.6%	$26.71	-$0.70	-2.6%	-2.7%
ReliabilityFirst Corporation (RFC)													
Electricity Prices ($/MWh)	$49.82	$49.73	-$0.08	-0.2%	0.1%	$50.59	$0.77	1.5%	0.3%	$50.59	$0.77	1.5%	0.5%
Generation (TWh)	1,113	1,113	0	0.0%	0.0%	1,112	-1	-0.1%	-0.1%	1,112	-1	-0.1%	-0.1%
Revenue ($Millions)	$62,045	$62,057	$11	0.0%	0.2%	$63,278	$1,233	2.0%	0.5%	$63,288	$1,243	2.0%	0.6%
Costs ($Millions)	$39,380	$39,506	$126	0.3%	0.4%	$42,537	$3,157	8.0%	7.7%	$42,603	$3,224	8.2%	7.8%
Fuel Cost	$18,387	$18,402	$15	0.1%	0.1%	$18,806	$419	2.3%	2.6%	$18,828	$442	2.4%	2.7%
Variable O&M	$2,609	$2,621	$12	0.5%	0.5%	$2,687	$78	3.0%	2.4%	$2,688	$79	3.0%	2.3%
Fixed O&M	$13,669	$13,813	$145	1.1%	1.1%	$15,493	$1,824	13.3%	13.2%	$15,520	$1,852	13.5%	13.4%
Capital Cost	$4,714	$4,669	-$45	-1.0%	-0.5%	$5,551	$837	17.8%	13.9%	$5,566	$852	18.1%	14.1%
Pre-Tax Income ($Millions)	$22,666	$22,551	-$115	-0.5%	-0.1%	$20,741	-$1,924	-8.5%	-10.3%	$20,685	-$1,981	-8.7%	-10.2%
Variable Production Cost ($/MWh)	$18.87	$18.90	$0.03	0.2%	0.2%	$19.33	$0.46	2.5%	2.7%	$19.35	$0.48	2.5%	2.7%

Table 6A-3: Impact of Market Impact Analysis Options on National and Regional Markets at the Year 2025

Economic Measures (all dollar values in $2009)	Baseline Value	MMA Option 1 –				MMA Option 2 –				MMA Option 3 –			
		Value	Diff	% Change 2025	% Change 2028	Value	Diff	% Change 2025	% Change 2028	Value	Diff	% Change 2025	% Change 2028
Southeast Electric Reliability Council (SERC)													
Electricity Prices ($/MWh)	$51.95	$51.91	-$0.04	-0.1%	0.0%	$51.96	$0.01	0.0%	-0.1%	$51.96	$0.02	0.0%	0.0%
Generation (TWh)	1,221	1,221	0	0.0%	0.0%	1,223	1	0.1%	0.2%	1,222	1	0.1%	0.2%
Revenue ($Millions)	$71,631	$71,565	-$65	-0.1%	0.0%	$71,868	$238	0.3%	0.4%	$71,886	$255	0.4%	0.5%
Costs ($Millions)	$40,723	$40,850	$127	0.3%	0.3%	$44,254	$3,531	8.7%	8.0%	$44,317	$3,593	8.8%	8.2%
Fuel Cost	$21,126	$21,120	-$7	0.0%	-0.1%	$21,373	$247	1.2%	1.9%	$21,387	$261	1.2%	1.9%
Variable O&M	$3,091	$3,103	$12	0.4%	0.4%	$3,243	$152	4.9%	4.2%	$3,244	$153	4.9%	4.2%
Fixed O&M	$13,274	$13,405	$131	1.0%	1.0%	$15,543	$2,270	17.1%	16.6%	$15,566	$2,292	17.3%	16.8%
Capital Cost	$3,232	$3,222	-$10	-0.3%	0.2%	$4,094	$862	26.7%	14.1%	$4,120	$888	27.5%	15.0%
Pre-Tax Income ($Millions)	$30,907	$30,715	-$192	-0.6%	-0.4%	$27,614	-$3,293	-10.7%	-8.9%	$27,569	-$3,338	-10.8%	-8.9%
Variable Production Cost ($/MWh)	$19.83	$19.84	$0.01	0.0%	-0.1%	$20.13	$0.30	1.5%	2.0%	$20.15	$0.32	1.6%	2.0%
Southwest Power Pool (SPP)													
Electricity Prices ($/MWh)	$46.67	$46.52	-$0.15	-0.3%	0.0%	$47.31	$0.64	1.4%	-0.1%	$47.36	$0.69	1.5%	0.0%
Generation (TWh)	273	273	0	0.0%	0.0%	272	0	-0.2%	-0.3%	272	0	-0.2%	-0.3%
Revenue ($Millions)	$13,904	$13,907	$3	0.0%	0.0%	$14,149	$245	1.8%	-0.1%	$14,153	$249	1.8%	-0.1%
Costs ($Millions)	$9,291	$9,316	$25	0.3%	0.3%	$9,777	$486	5.2%	4.8%	$9,783	$492	5.3%	4.9%
Fuel Cost	$4,098	$4,091	-$7	-0.2%	-0.1%	$4,099	$1	0.0%	0.3%	$4,096	-$2	0.0%	0.3%
Variable O&M	$870	$873	$3	0.3%	0.3%	$889	$19	2.2%	1.9%	$890	$20	2.3%	1.9%
Fixed O&M	$1,869	$1,897	$28	1.5%	1.5%	$2,183	$314	16.8%	16.3%	$2,185	$316	16.9%	16.4%
Capital Cost	$2,454	$2,456	$2	0.1%	0.1%	$2,606	$152	6.2%	4.8%	$2,613	$159	6.5%	4.9%
Pre-Tax Income ($Millions)	$4,613	$4,591	-$22	-0.5%	-0.5%	$4,372	-$241	-5.2%	-8.6%	$4,369	-$244	-5.3%	-8.7%
Variable Production Cost ($/MWh)	$18.23	$18.21	-$0.02	-0.1%	0.0%	$18.33	$0.11	0.6%	0.9%	$18.32	$0.10	0.5%	0.9%
Western Electricity Coordinating Council (WECC)													
Electricity Prices ($/MWh)	$52.97	$52.88	-$0.09	-0.2%	0.0%	$52.81	-$0.15	-0.3%	-0.3%	$52.81	-$0.16	-0.3%	-0.3%
Generation (TWh)	866	867	0	0.0%	0.0%	866	0	0.0%	0.0%	866	0	0.0%	0.0%
Revenue ($Millions)	$50,738	$50,674	-$63	-0.1%	0.0%	$50,613	-$125	-0.2%	-0.2%	$50,611	-$127	-0.2%	-0.2%
Costs ($Millions)	$29,961	$29,938	-$23	-0.1%	0.0%	$30,008	$48	0.2%	0.2%	$30,027	$66	0.2%	0.2%
Fuel Cost	$14,245	$14,230	-$15	-0.1%	0.0%	$14,240	-$5	0.0%	0.1%	$14,243	-$2	0.0%	0.1%
Variable O&M	$3,269	$3,268	-$1	0.0%	0.0%	$3,273	$5	0.1%	0.2%	$3,274	$5	0.2%	0.2%
Fixed O&M	$6,614	$6,618	$5	0.1%	0.1%	$6,636	$22	0.3%	0.3%	$6,642	$29	0.4%	0.4%
Capital Cost	$5,834	$5,822	-$12	-0.2%	0.0%	$5,859	$26	0.4%	0.2%	$5,868	$34	0.6%	0.4%
Pre-Tax Income ($Millions)	$20,777	$20,736	-$40	-0.2%	-0.1%	$20,604	-$172	-0.8%	-0.8%	$20,584	-$193	-0.9%	-0.9%
Variable Production Cost ($/MWh)	$20.21	$20.19	-$0.02	-0.1%	0.0%	$20.21	$0.00	0.0%	0.1%	$20.22	$0.01	0.0%	0.1%

7 Assessing the Potential Impact of the Proposed Existing Facilities Rule on Small Entities – Regulatory Flexibility Act (RFA) Analysis

In accordance with requirements of the Regulatory Flexibility Act (RFA), EPA assessed whether the Proposed Rule regulatory options would have "a significant impact on a substantial number of small entities" (SISNOSE). Small entities include small businesses, small organizations, and small governmental jurisdictions. This assessment followed the same concepts and methods as applied for the previous 316(b) rule analyses, and involved the following steps:

- Determining the domestic parent entities of in-scope facilities
- Determining which of those domestic parent entities are small entities, based on Small Business Administration (SBA) entity size criteria
- Assessing the potential impact of the regulatory options on those small entities by comparing the estimated entity-level annualized compliance cost to entity-level revenue. Small entities with compliance costs estimated to exceed 1 percent or 3 percent of entity-level revenue were assessed as potentially incurring *significant impacts*.
- Assessing whether those small entities incurring potentially significant impacts represent a *substantial number of small entities* based on (1) the estimated *absolute numbers* of small entities incurring potentially significant impacts according to the two cost impact criteria, and (2) the *percentage of small in-scope entities* in the relevant entity categories that are estimated to incur these impacts.

EPA undertook the assessment of small entity impacts separately, and using somewhat different population-level estimation methods, for Manufacturers and Electric Generators. The separate analyses reflect the different levels of information available for Manufacturers and Electric Generators from the 316(b) facility surveys. In particular, the 316(b) surveys provide facility-level information for essentially the universe of Electric Generators that rely on cooling water in their operations. In contrast, the sample of Manufacturers facilities for which the survey provides information is much smaller than the universe of manufacturing facilities potentially affected by the proposed rule. As a result, a more precise analysis of potential entity-level impacts is possible for Electric Generators than for Manufacturers, and the different analytic methods reflect this difference.

The following sections of this chapter describe the analytic approach and findings first for Manufacturers and then for Electric Generators. The final section of the chapter reviews uncertainties and limitations in the analysis.

The discussion immediately below presents a consolidated summary of findings of small entity impact for Manufacturers and Electric Generators.

For Electric Generators, the *number* of small entities potentially incurring a significant impact are small for all three regulatory options: no more than 21 small parent entities are expected to incur costs exceeding 1 percent of revenue and no more than 14 small entities are expected to incur costs exceeding 3 percent of revenue. For Options 1 and 2, the percentages of small in-scope entities incurring an impact at either the 1 or 3 percent of revenue threshold are no higher than 18 percent, and therefore remain below a key threshold of concern for determining – 20 percent of small in-scope entities – as specified in EPA's *Final Guidance for EPA Rulewriters: Regulatory Flexibility Act*.[173] Accordingly, on the basis of both the small *number* of small entities potentially incurring a significant impact and *percentage* that those small entities represent in the total of small in-scope entities in the Electric Generators regulated industry segment, EPA concluded that Options 1 and 2 would not

[173] U.S. EPA, *Final Guidance for EPA Rulewriters: Regulatory Flexibility Act*, November 2006, see pages 23-26.

have “a significant impact on a substantial number of small entities” (SISNOSE) for the Electric Generators regulated industry segment. EPA did not reach a SISNOSE finding for Option 3 for the Electric Generators segment, since, at the time of completing the RFA analysis, the Agency did not anticipate selecting Option 3 as the proposed option for the 316(b) existing facilities rule.

The comparable findings for Manufacturers point to an even lower expected impact on small entities: across the three regulatory options, EPA estimated that no only one small entity would incur costs exceeding either the 1 or 3 percent of revenue threshold. EPA estimated that this single small entity would represent no more than 5 percent of the estimated number of small in-scope entities in the Manufacturers regulated industry segment. Accordingly, on the basis of both the small *number* of small entities potentially incurring a significant impact and *percentage* of small in-scope entities in the Manufacturers regulated industry segment, EPA concluded that none of the regulatory options would have “a significant impact on a substantial number of small entities” (SISNOSE) for the Manufacturers regulated industry segment.

Table 7-1, below, presents the overall findings from the small entity impact analysis on a combined regulated industry segment basis. Given (1) the small absolute number of small parent entities estimated to incur a potentially significant cost impact in both regulated industry segments *and* (2) the small percentage of total small in-scope parent entities that these entities represent, EPA concluded that regulatory Options 1 and 2 would not have “a significant impact on a substantial number of small entities” (no SISNOSE). As stated above, EPA did not reach an overall finding for Option 3.

Table 7-1: Summary of Small Entity Impact Analysis Findings for 316(b) Existing Facilities Rule Regulatory Options

	Cost Impact Category			
	Cost >1% of Revenue		Cost >3% of Revenue	
Regulatory Option	Number of Small Entities	% of Small In-Scope Entities[a]	Number of Small Entities[b]	% of Small In-Scope Entities
Option 1: IM Everywhere	5 - 7	5% - 13%	3[c]	3% - 5%
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD	5 - 7	5% - 13%	3 - 7	3% - 13%
Option 3: I&E Mortality Everywhere	10 - 22	10% - 39%	7 - 15	7% - 27%

a. Percentage of small in-scope entities incurring a cost-to-revenue impact involves range estimates in both the numerator (number of affected entities) and

b. The number of entities with cost-to-revenue ratios exceeding 3 percent is a subset of the number of entities with such ratios exceeding 1 percent.

c. The estimated number of small entities exceeding the impact threshold is the same under both estimation approaches.

Source: EPA analyses

7.1 Analysis of Manufacturers

7.1.1 Analysis Approach and Data Inputs

The small entity determination for Manufacturers facilities was conducted in two steps:

1. For each analysis option, identify the domestic parent entity of the sample Manufacturers facilities.
2. For each analysis option, determine the size of the entities owning the sample Manufacturers facilities.

Identification of Domestic Parent Entities

The RFA analysis is conducted at the highest level of domestic ownership, referred to as the "domestic parent entity" or "domestic parent firm." EPA gathered information on the domestic parent firm in the *Detailed Industry Questionnaire.* In instances where a response was not provided, EPA used several other data sources to determine the domestic parent firm including the *Screener Questionnaire*, corporate websites, and Dun & Bradstreet data (D&B, 2009). For the current analysis, EPA verified and updated the ownership determination made for the previous Phase III rule analyses using the current Dun & Bradstreet database and updated domestic parent entity data, where appropriate. This update included information on parent entity NAICS code, revenues, and employment, when available. If either parent revenue or employment were not available in the D&B database, EPA summed the revenue and/or employment information for all facilities owned by the firm as a lower-bound estimate of these metrics. This has the potential to understate the size of the parent entity and thus overstate the impact on small entities.

Size Determination of Domestic Parent Entities

EPA identified the size of each entity owning a potentially regulated Manufacturers facility using the most recent Small Business Administration (SBA) size threshold guidelines at the time of the analysis.[174] These thresholds define the minimum firm-level employment or revenue size, by industry (by 6-digit NAICS code), below which a business qualifies as a small business under SBA guidelines. To determine the entity size, EPA used data from the *2000 Detailed Industry Questionnaire*, as well as the *1999 Industry Screener Questionnaire*, and Dun & Bradstreet data (D&B, 2009).

EPA started with the unique firm-level, 6-digit NAICS codes for firms that own existing facilities potentially subject to the proposed regulation under the regulatory analysis options. *Table 7-2*, following page, presents the unique firm-level 6-digit NAICS codes and corresponding SBA size standards used to determine the size of entities that own Manufacturers facilities determined to be potentially subject to proposed regulation.

174 Since the time of the analysis, SBA issued a more recent set of small business size guidelines available online at http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf.

Table 7-2: Unique 6-Digit Firm-Level NAICS Codes and SBA Size Standards for Manufacturers

Firm NAICS	NAICS Description	SBA Size Threshold
111930	Sugarcane Farming	$750,000 in Revenue
113110	Timber Tract Operations	$7,000,000 in Revenue
211111	Crude Petroleum and Natural Gas Extraction	500 Employees
212210	Iron Ore Mining	500 Employees
212391	Potash, Soda, and Borate Mineral Mining	500 Employees
221119	Other Electric Power Generation	4,000,000 MWh of Electric Generation
311221	Wet Corn Milling	750 Employees
311311	Sugarcane Mills	500 Employees
311312	Cane Sugar Refining	750 Employees
311313	Beet Sugar Manufacturing	750 Employees
311942	Spice and Extract Manufacturing	500 Employees
313210	Broadwoven Fabric Mills	1,000 Employees
321113	Sawmills	500 Employees
322121	Paper (except Newsprint) Mills	750 Employees
322122	Newsprint Mills	750 Employees
322130	Paperboard Mills	750 Employees
322211	Corrugated and Solid Fiber Box Manufacturing	500 Employees
322222	Coated and Laminated Paper Manufacturing	500 Employees
322291	Sanitary Paper Product Manufacturing	500 Employees
324110	Petroleum Refineries	1,500 Employees
324191	Petroleum Lubricating Oil and Grease Manufacturing	500 Employees
325120	Industrial Gas Manufacturing	1,000 Employees
325181	Alkalis and Chlorine Manufacturing	1,000 Employees
325188	All Other Basic Inorganic Chemical Manufacturing	1,000 Employees
325199	All Other Basic Organic Chemical Manufacturing	1,000 Employees
325211	Plastics Material and Resin Manufacturing	750 Employees
325311	Nitrogenous Fertilizer Manufacturing	1,000 Employees
325320	Pesticide and Other Agricultural Chemical Manufacturing	500 Employees
325412	Pharmaceutical Preparation Manufacturing	750 Employees
325510	Paint and Coating Manufacturing	500 Employees
325992	Photographic Film, Paper, Plate and Chemical Manufacturing	500 Employees
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	500 Employees
331111	Iron and Steel Mills	1,000 Employees
331112	Electrometallurgical Ferroalloy Product Manufacturing	750 Employees
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	1,000 Employees
331221	Rolled Steel Shape Manufacturing	1,000 Employees
331222	Steel Wire Drawing	1,000 Employees
331312	Primary Aluminum Production	1,000 Employees
331315	Aluminum Sheet, Plate and Foil Manufacturing	750 Employees
332312	Fabricated Structural Metal Manufacturing	500 Employees
337910	Mattress Manufacturing	500 Employees
339999	All Other Miscellaneous Manufacturing	500 Employees
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers	100 Employees
423930	Recyclable Material Merchant Wholesalers	100 Employees
424510	Grain and Field Bean Merchant Wholesalers	100 Employees
424690	Other Chemical and Allied Products Merchant Wholesalers	100 Employees
424710	Petroleum Bulk Stations and Terminals	100 Employees
447190	Other Gasoline Stations	$9,000,000 in Revenue
522220	Sales Financing	$7,000,000 in Revenue
523910	Miscellaneous Intermediation	$7,000,000 in Revenue
523930	Investment Advice	$7,000,000 in Revenue
524126	Direct Property and Casualty Insurance Carriers	1,500 Employees
525990	Other Financial Vehicles	$7,000,000 in Revenue
531110	Lessors of Residential Buildings and Dwellings	$7,000,000 in Revenue
551112	Offices of Other Holding Companies	$7,000,000 in Revenue
561110	Office Administrative Services	$7,000,000 in Revenue

Source: SBA, 2008

As discussed in *Chapter 4*, EPA estimated the number of small entities owning facilities in the manufacturing industries as a range, based on alternative assumptions about the possible ownership of potentially regulated manufacturing facilities by small entities. EPA considered two cases based on the sample weights developed from the facility survey. These cases provide a range of estimates for (1) the number of firms incurring compliance costs and (2) the costs incurred by any firm owning a regulated facility. *Chapter 4: Cost Impact Analysis - Manufacturers* provides a more detailed description of these cases.

> *Case 1: Lower bound estimate of number of firms owning facilities that face requirements under each primary analysis option; upper bound estimate of total compliance costs that a firm may incur.*
>
> For this case, EPA assumed that any firm owning a regulated sample facility(ies) owns the known sample facility(ies) and all of the sample weight associated with the sample facility(ies). This case minimizes the count of affected firms, while tending to maximize the potential cost burden to any single firm.
>
> *Case 2: Upper bound estimate of number of firms owning facilities that face requirements under each primary analysis option; lower bound estimate of total compliance costs that a firm may incur.*
>
> For this case, EPA assumed (1) that a firm owns only the regulated sample facility(ies) that it is known to own from the sample analysis and (2) that this pattern of ownership, observed for sampled facilities and their owning firms, extends over the facility population represented by the sample facilities. This case minimizes the possibility of multi-facility ownership by a single firm and thus maximizes the count of affected firms, but also minimizes the potential cost burden to any single firm.

Data in the rest of this section are presented by the industry sector of the firm. EPA determined a firm's sector based on the sample facilities owned by the firm, and their industry sector(s). If all of the sampled facilities owned by the firm are in the same industry sector, then that industry sector was assigned to the firm. If sample facilities owned by the firm are in more than one industry sector, then the firm was assigned to the "multiple industries" firm sector. One known facility in the Other Industries group was found to be owned by a firm that owns facilities in the Primary Manufacturing Industries. This firm is included in the data reported for multiple industries. The remaining entities that were found to own facilities in Other Industries are presented separately.

The number of Manufacturers entities that would be required to install recirculating systems varies by option based on the DIF applicability threshold specified in the option, while all other facilities will be required to meet impingement reduction requirements. *Table 7-3* on the following page, presents the total number of firms with facilities potentially subject to the Existing Facilities rule as well as the number and percentage of those firms determined to be small. The data are shown for the three regulatory options under the two ownership cases described above.

Table 7-3: Number of Firms by Sector and Size (assuming two different ownership cases)

Firm Sector	Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulatory analysis			Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulatory analysis		
	Total Number of Firms	Number of Small Firms	Percentage of Firms that are Small	Total Number of Firms	Number of Small Firms	Percentage of Firms that are Small
Paper	42	9	21.4%	126	29	23.0%
Chemicals	26	4	15.4%	116	18	15.5%
Petroleum	17	4	23.5%	24	4	16.7%
Steel	16	3	18.8%	43	8	18.6%
Aluminum	5	2	40.0%	14	5	35.7%
Food	8	1	12.5%	24	1	0.0%
Multiple Industries	3	0	0.0%	13	0	0.0%
Firms that own facilities in Primary Manufacturing Industries[a,b]	**117**	**23**	**19.7%**	**359**	**64**	**17.5%**
Additional firms that own known facilities in Other Industries[a]	9	4	44.4%	9	4	44.4%

a. Excludes firms whose only sample facilities close in the baseline.

b. Individual numbers may not sum to reported totals due to independent rounding.

Source: U.S. EPA Analysis, 2010.

7.1.2 Key Findings for Regulatory Options

Number and Percentage of Small Manufacturers Entities Under the Regulatory Analysis Options

As part of its assessment of the small entity impact of the regulatory analysis options on Manufacturers, EPA estimated the percentage of all small entities in the Primary Manufacturing Industries that would be expected to be subject to the national requirements for the proposed options and additionally those small entities owning facilities required to install recirculating systems. Because the analysis of facilities in Other Industries is not based on a statistically valid sample, EPA could not estimate the number of entities in Other Industries that would be subject to the regulatory requirements of the regulatory analysis options, or the percentage that are small entities. From its prior analysis of the use of cooling water in industries other than the electric power industry, EPA judges the overall effect and coverage of the 316(b) existing facilities rule in the Other Industries to be minor in relation to the effect and coverage in the six Primary Manufacturing Industries.

EPA used the Statistics of U.S. Businesses (SUSB) published by the Small Business Administration, to estimate the total number of manufacturing establishments owned by small firms in each of the six Primary Manufacturing Industries. EPA included all of the NAICS industry groups with a sample facility in the six Primary Manufacturing Industries. Based on the SUSB reporting framework, EPA considered all establishments owned by a firm with 500 or fewer employees to be a small entity-owned establishment. This assumption will tend to underestimate the number of small entity-owned establishments in these industry groups because the SBA small entity size criterion is greater than 500 employees for some NAICS codes. Underestimating the total number of small entities would result in an overestimate of the percentage of small entities in these industries that are potentially subject to the proposed regulation under each option.

As shown in *Table 7-4* EPA estimated that 27,834 entities within the six Primary Manufacturing Industries are small. The proposed rule is estimated to affect 23-64 small entities in these industries, or 0.1-0.2 percent.

Table 7-4: Number and Percentage of Small Manufacturers Firms Subject to the Proposed Regulation, by Industry Sector

		Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulatory analysis		Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulatory analysis	
Firm Sector	**Total Sector Small Firms[a]**	**In-Scope Small Firms**	**Percent of Small Firms Subject to Regulation**	**In-Scope Small Firms**	**Percent of Small Firms Subject to Regulation**
Paper	218	9	4.1%	29	13.2%
Chemicals	2,506	4	0.2%	18	0.7%
Petroleum	188	4	2.1%	4	2.2%
Steel	1,149	3	0.3%	8	0.7%
Aluminum	227	2	0.9%	5	2.0%
Food	23,546	1	0.0%	1	0.0%
Firms that own facilities in Primary Manufacturing Industries	**27,834**	**23**	**0.1%**	**64**	**0.2%**

Individual values may not sum to reported totals due to rounding.

[a.] Includes all firms with less than 500 employees from 2006 Statistics of U.S. Businesses (SUSB) of the U.S. Department of Commerce (U.S. DOC). The Small Business Administration defines firms in nearly all profiled NAICS codes according to the firm's number of employees; however, for some in-scope manufacturing NAICS codes this threshold is 500 employees while for others this threshold is 750, 1,100, or 1,500 employees. Because the SUSB employment size categories do not correspond to the SBA entity size classifications EPA used the 500 employee threshold for all in-scope NAICS.

Sources: U.S. EPA Analysis, 2010; D&B, 2009; U.S. EPA, 2000; U.S. DOC, 2006; SBA, 2009

Sales Test for Small Entities

In addition to considering the fraction of small entities in each of the affected Manufacturers industries that would be potentially subject to the proposed existing facilities rule, EPA also assessed the extent of economic/financial impact on small entities by comparing estimated compliance costs to estimated entity revenue (also referred to as the "sales test"). The analysis is based on the ratio of estimated annualized after-tax compliance costs to annual revenue of the entity. For this analysis, EPA judges that entities for which annualized compliance costs exceed 1 percent or 3 percent of revenue, might experience a significant economic/financial impact as a result of the regulatory requirements under the three regulatory analysis options.

EPA included the following compliance cost categories in this analysis: one-time technology costs of complying with the regulatory requirements; one-time costs of installation downtime; annual operating and maintenance costs; annual energy penalty for operating a recirculating system (where applicable) and permitting costs (initial permit costs, annual monitoring costs, and permit re-issuance costs). A detailed summary of how these costs were developed is presented in *Chapter 3: Development of Costs for Regulatory Options* and *Chapter 4: Cost Impact Analysis - Manufacturers*. EPA collected revenue data for the small entities in EPA's *Detailed Industry Questionnaire*.

As reported in *Table 7-5*, EPA's findings for the numbers of small entities incurring costs exceeding 1 or 3 percent of revenue were the same under both of the Weighting Cases, and, as well, are the same across all three regulatory options. Specifically, EPA estimated that one small entity within the Primary Manufacturing Industries, in the Petroleum Refining Sector, would incur costs exceeding 1 and 3 percent of revenue. EPA estimated that no entities owning facilities in the Other Industries would incur costs exceeding 1 or 3 percent of revenue.

Table 7-5: Estimated Cost-To-Revenue Impact on Small Manufacturers Entities, by Industry

Firm Sector	Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulatory analysis				Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulatory analysis			
	Total In-Scope Firms	Small In-Scope Firms	Small Firms with Costs Exceeding 1% of Revenue	Small Firms with Costs Exceeding 3% of Revenue	Total In-Scope Firms	Small In-Scope Firms	Small Firms with Costs Exceeding 1% of Revenue	Small Firms with Costs Exceeding 3% of Revenue
Option 1: IM Everywhere								
Paper	42	9	0	0	126	29	0	0
Chemicals	26	4	0	0	116	18	0	0
Petroleum	17	4	1	1	24	4	1	1
Steel	16	3	0	0	43	8	0	0
Aluminum	5	2	0	0	14	5	0	0
Food	8	1	0	0	24	1	0	0
Multiple	3	0	0	0	13	0	0	0
Firms that own facilities in Primary Manufacturing Industries	**117**	**23**	**1**	**1**	**359**	**64**	**1**	**1**
Additional firms that own known facilities in Other Industries	9	4	0	0	9	4	0	0
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD								
Paper	42	9	0	0	126	29	0	0
Chemicals	26	4	0	0	116	18	0	0
Petroleum	17	4	1	1	24	4	1	1
Steel	16	3	0	0	43	8	0	0
Aluminum	5	2	0	0	14	5	0	0
Food	8	1	0	0	24	1	0	0
Multiple	3	0	0	0	13	0	0	0
Firms that own facilities in Primary Manufacturing Industries	**117**	**23**	**1**	**1**	**359**	**64**	**1**	**1**
Additional firms that own known facilities in Other Industries	9	4	0	0	9	4	0	0
Option 3: I&E Mortality Everywhere								
Paper	42	9	0	0	126	29	0	0
Chemicals	26	4	0	0	116	18	1	0
Petroleum	17	4	1	1	24	4	1	1
Steel	16	3	0	0	43	8	0	0
Aluminum	5	2	0	0	14	5	0	0
Food	8	1	0	0	24	1	0	0
Multiple	3	0	0	0	13	0	0	0
Firms that own facilities in Primary Manufacturing Industries	**117**	**23**	**1**	**1**	**359**	**64**	**1**	**1**
Additional firms that own known facilities in Other Industries	9	4	0	0	9	4	0	0

a. Includes all firms with less than 500 employees from 2006 Statistics of U.S. Businesses (SUSB) of the U.S. Department of Commerce (U.S. DOC). The Small Business Administration defines firms in nearly all profiled NAICS codes according to the firm's number of employees; however, for some in-scope manufacturing NAICS codes this threshold is 500 employees while for others this threshold is 750, 1,100, or 1,500 employees. Because the SUSB employment size categories do not correspond to the SBA entity size classifications, EPA used the 500 employee threshold for all in-scope NAICS sectors.

Sources: U.S. EPA Analysis, 2010; D&B, 2009; U.S. EPA, 2000; U.S. DOC, 2006; SBA, 2009

For the Primary Manufacturing Industries, the single small entity estimated to incur a significant impact under either of the impact thresholds represents 4.3 percent of the estimated 23 small in-scope entities under the Case 1 weighting approach and 1.6 percent of the estimated 64 small in-scope entities under the Case 2 weighting approach.

7.2 Analysis of Electric Generators

7.2.1 Analysis Approach and Data Inputs

EPA used the following methodology and assumptions in performing the RFA analysis for Electric Generators.

Determining Parent Entity of In-Scope Facilities

EPA determined the highest level domestic parent entity for each in-scope facility (565 facilities) using the approach outlined in *Chapter 3: Development of Regulation Costs*. [175] EPA performed this determination both for the explicitly and implicitly analyzed facilities (for a discussion on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).[176] As described below, the determination for both categories of facilities was needed to support an estimate of entity level impact that reflects the number of small parent entities for not only the explicitly analyzed facilities and associated parent entities but also for the implicitly analyzed facilities and associated parent entities.

Determining Whether Parent Entities Are Small Entities

For each of these identified parent entities, EPA assessed entity size based on the appropriate Small Business Administration (SBA) entity size criterion. The criteria for entity size determination vary by the organization/ operation category of the parent entity, as follows:

- Private entities
  - Include investor-owned utilities, non-utility entities, and entities with a primary business other than electric power generation.
  - For entities with electric power generation as a primary business, small entities are those with total annual electric output less than 4 million MWh.
  - For entities with a primary business other than electric power generation, the relevant size criteria are based on revenue or number of employees by NAICS sector (see *Table 7-6*): [177,178]

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[175] These are non-retired Electric Generators that responded to either the 2000 316(b) Detailed Questionnaire (DQ) or the 2000 316(b) Short Technical Questionnaire (STQ). EPA found that the remaining 91 of the total of 284 and 372 facilities responded to the DQ and the STQ, respectively (see *Chapter 3: Development of Costs for Regulatory Options* for more details). This number is not a weighted estimate.

[176] The "explicitly analyzed" facilities are those for which costs were specifically estimated. The "implicitly analyzed" facilities are accounted for through application of sample weights to the "explicitly analyzed" facilities.

[177] Certain in-scope facilities are owned by entities whose primary business is not electric power generation.

[178] For 9 identified parent entities, which are owned ultimately by non-U.S. firms, EPA could not obtain revenue for a domestic entity but did obtain revenue at the level of the *international* parent entity; for these 9 entities, EPA used this international entity revenue in the cost-to-revenue analysis.

Table 7-6: NAICS Codes and SBA Size Standards for Entities Owning Electric Generators, With a Primary Business Other Than Electric Power Generation

NAICS Code	NAICS Description	SBA Size Standard
221112	Fossil Fuel Electric Power Generation	4,000,000 MWh
221113	Nuclear Electric Power Generation	4,000,000 MWh
221119	Other Electric Power Generation	4,000,000 MWh
221122	Electric Power Distribution	4,000,000 MWh
221210	Natural Gas Distribution	500 Employees
238210	Electrical Contractors	$14,000,000 Revenue
331111	Iron and Steel Mills	1,000 Employees
331315	Aluminum Sheet, Plate, and Foil Manufacturing	750 Employees
523910	Miscellaneous Intermediation	$7,000,000 Revenue
486210	Pipeline Transportation of Natural Gas	$7,000,000 Revenue
523920	Portfolio Management	$7,000,000 Revenue
523930	Investment Advice	$7,000,000 Revenue
524126	Direct Property and Casualty Insurance Carriers	1,500 Employees
525990	Other Financial Vehicles	$7,000,000 Revenue
525910	Open-End Investment Funds	$7,000,000 Revenue
541990	All Other Professional, Scientific, and Technical Services	$7,000,000 Revenue
551112	Offices of Other Holding Companies	$7,000,000 Revenue
561499	All Other Business Support Services	$7,000,000 Revenue
562212	Solid Waste Landfill	$12,500,000 Revenue
562219	Other Nonhazardous Waste Treatment and Disposal	$12,500,000 Revenue
562920	Materials Recovery Facilities	$12,500,000 Revenue
611310	Colleges, Universities, and Professional Schools	$7,000,000 Revenue

Source: SBA, 2008

- Public entities
  - Include federal, state, municipal, and political subdivision entities
  - Facilities owned by Federal and State governments were considered to be large; facilities owned by municipalities and other political units with population less than 50,000 were considered to be small
- Not-for-profit enterprises
  - Include rural electric cooperatives
  - Small entities are those with total annual electric output less than 4 million MWh.

To determine whether a parent entity is a small entity according to these criteria, EPA compared the relevant measure for the identified parent entities to the appropriate SBA size criterion. EPA obtained these values for each parent entity from the following sources:

- For size determination based on electricity output, EPA used average utility-level electricity sales over the period 2003-2007 as reported in the EIA-861 database. For facilities not listed in the EIA-861 database, the Agency used 2003-2007 average facility-level generation values from the EIA-906/920/923 database.
- For size determination based on revenue and employment, EPA obtained revenue and employment values from SEC filings, Google Finance, Dun & Bradstreet (D&B), Hoovers, and/or corporate websites for 2006 through 2009. Values were brought forward to 2009 using the Producer Price Index for industrial electric power (Electric PPI) obtained from BLS (http://data.bls.gov/cgi-bin/srgate).
- Population data for municipalities and other non-state political subdivisions were obtained from the U.S. Census Bureau (estimated population for 2008).

Parent entities for which the relevant measure is less than the SBA size criterion were identified as small entities and carried forward in the RFA analysis.

As reported in *Table 7-7* when looking only at explicitly analyzed facilities, EPA identified 97 entities owning only explicitly analyzed facilities – i.e., 261 facilities. Using this approach, a typical parent entity on average is estimated to own three 316(b) Electric Generators. Only 12 percent of these entities are small; these small entities own 5 percent of 316(b) Electric Generators. When looking at the combination of explicitly and implicitly analyzed facilities, the Agency identified 143 entities owning 548 implicitly and explicitly analyzed facilities. Using this approach, a typical parent entity is estimated on average to own four 316(b) Electric Generators. Of these 143 parent entities, 23 percent are small; these entities own 7 percent of 316(b) Electric Generators.

Table 7-7: Unique Parent Entities and Facilities for Electric Generators (by Entity Type and Size)

Parent Entity Type	Small Entity Size Standard	Number of Parent Entities[a,b]			Number of Facilities		
		Large	Small	Total	Large	Small	Total
Parent Entities Owning at Least One Explicitly Analyzed Facility							
Rural Electric Cooperative	4,000 MWh output	9	2	11	11	2	13
Federal	assumed large	1	0	1	7	0	7
Investor-Owned Utilities	4,000 MWh output	37	1	38	137	1	138
Municipality	50,000 population served	7	6	13	7	6	13
Nonutility	4,000 MWh output	27	3	30	73	5	82
Other Political Subdivision	50,000 population served	0	0	0	0	0	0
State	assumed large	4	0	4	8	0	8
Total		**85**	**12**	**97**	**243**	**14**	**261**
Parent Entities Owning Only Implicitly Analyzed Facilities or Owning at Least One Explicitly Analyzed Facility[c,d]							
Rural Electric Cooperative	4,000 MWh output	12	8	20	23	8	31
Federal	assumed large	1	0	1	14	0	14
Investor-Owned Utilities	4,000 MWh output	40	2	42	280	3	283
Municipality	50,000 population served	18	17	35	26	17	43
Nonutility	4,000 MWh output	33	5	38	153	8	161
Other Political Subdivision	50,000 population served	2	1	3	6	1	7
State	assumed large	4	0	4	9	0	9
Total		**110**	**33**	**143**	**511**	**37**	**548**

a. For 8 entities EPA was unable to find entity revenue necessary to determine the size of these entities; consequently, EPA used the total revenue for all facilities owned by these entities to determine entity size.
b. In three instances, a facility is owned by a joint venture of two entities.
c. 548 facilities include (1) explicitly analyzed facilities and (2) implicitly analyzed facilities that responded to the 316(b) 2000 Surveys. For a discussion of explicitly and implicitly analyzed facilities refer to *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.
d. These counts are unweighted and reflect the known universe of facilities and their parent entities expected to be in scope of Proposed Existing Facilities Rule.
Source: U.S. EPA Analysis, 2010

Assessing Parent Entity Impact for Electric Generators

EPA assessed the potential impact of the Proposed Existing Facilities Rule options on these small entities by comparing the estimated entity-level annualized compliance cost to entity-level revenue for each small entity identified as owning an explicitly analyzed facility. To calculate entity-level cost, EPA summed the after-tax annualized compliance cost for the explicitly analyzed facilities owned by these entities. In the same way as described in *Chapter 5: Cost and Economic Impact Analyses-Electric Generators* for the general firm-level impact assessment, EPA followed two approaches in aggregating compliance costs to the level of the owning entity:

1. EPA applied facility-level sample weights to the estimated costs for the explicitly analyzed electric power generating facilities – these are the facilities for which EPA explicitly estimated costs (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).[179] In effect, this analysis assumes that a parent entity identified as owning one or more

179 The specific facility-level weights used in this analysis are the facility count-based weights (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).

explicitly analyzed facilities is assumed to own and incur the compliance costs for those explicitly analyzed facilities *and* the implicitly analyzed facilities that are represented by the sample weights applied to the costs for the explicitly analyzed facilities. *This analysis will likely overstate impacts on the identified parent firms.*

2. EPA used only the estimated costs for the explicitly analyzed facilities without application of sample weights and aggregated costs to the level of the parent firm for only those explicitly analyzed in-scope facilities. *This analysis may understate impacts on the identified parent firms.*

To assess whether these parent entity-level costs could constitute a *significant impact*, EPA assessed whether the parent-level costs exceed one percent or three percent of entity-level revenue.

Estimating the Number of Electric Generators Parent Entities Incurring Potentially Significant Impacts

The preceding steps yield the number of small entities identified as owning explicitly analyzed facilities that would incur total costs exceeding a given significant impact threshold: costs exceeding one percent of revenue or three percent of revenue. However, the number of small parent entities identified as owning explicitly analyzed facilities – and for which this impact analysis is undertaken – is less than the number of small parent entities in the total population of entities owning *both* explicitly and implicitly analyzed facilities, as shown in *Table 7-7*. However, the small entity analysis may rely on a finding of the *absolute* number of small entities incurring a potentially significant impact. As a result, accounting for only the entities identified through their ownership of at least one explicitly analyzed facility could understate the absolute number of small entities incurring this impact *if small entities owning only implicitly analyzed facilities would also incur a significant impact*.

To account for those small entities that own only implicitly analyzed facilities – and thus are not directly captured in the explicitly analyzed facility-based analysis – EPA developed *entity-level weights* to extrapolate the findings from the analysis of small entities owning only explicitly analyzed facilities, to the total population of entities, including those that own only implicitly analyzed facilities (for a discussion on entity-level weights development see to *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*).[180] Applying these entity-level weights to the numbers of small parent entities owning only explicitly analyzed facilities assessed in the various cost impact categories yields an estimate of the number of small parent entities including both entities owning at least one explicitly analyzed facilities and entities owning only implicitly analyzed facilities.

Combining the Facility-Level and Entity-Level Weights in the Small Entity Impact Analysis

As described in *Chapter 5: Cost and Economic Impact Analyses – Electric Generators* for the general entity-level impact assessment, EPA defined two cases which utilize entity-level sample weights *and* facility-level weights to yield approximate estimates of the numbers of parent entities incurring costs in specific cost-to-revenue ranges:

- *Using facility-level weights*: For this case, facility-level weights were applied to the estimated compliance costs for Electric Generators identified as being owned by a given parent entity.[181] *This calculation may overstate the number of facilities and compliance costs at the level of any given parent entity, but will also likely underestimates the number of affected parent entities*. This analysis indicates that 12 small unique domestic parent entities own 26 facilities subject to the Proposed Existing Facilities Rule.

[180] The development of entity-level weights was possible for Electric Generators because of the near universal coverage of potential in-scope Electric Generators by the 316(b) survey, including both *DQ* facilities and *STQ* facilities. The development of entity-level weights was not possible for the Manufacturers entity impact analysis because the Manufacturers survey does not provide the needed level of understanding of *all* entities potentially subject to the Proposed Existing Facilities Rule.

[181] Parent entity weights were not used in this calculation because the combination of facility weights and entity weights would overstate, perhaps substantially, the estimate of in-scope facilities and compliance costs assigned to parent entities.

- *Using entity-level weights*: For this case, entity-level weights were applied to the calculated number of parent entities estimated to incur costs in each cost-to-revenue range.[182] *This calculation may understate the number of facilities and compliance costs at the level of any given parent entity, but accounts more comprehensively for the number of parent entities owning in-scope facilities.* This analysis found that 32 small unique domestic parent entities own 14 in-scope Electric Generators.[183]

EPA presents these estimates of small entities with costs exceeding one and three percent of entity-level revenue as the numbers of small entities that may experience a *significant impact* as a result of the regulatory options. These estimates of the numbers of small entities incurring a potentially *significant impact* represent one of the key factors EPA considered in determining that the Proposed Existing Facilities Rule would qualify for a no-SISNOSE finding.

Estimating the Total Number of Electric Generators Small Entities by Entity Type and the Fraction of Those Entities Incurring Potentially Significant Impacts

As outlined in the introduction to this chapter, two criteria are assessed in determining whether the Proposed 316(b) Existing Facilities Rule would qualify for a no-SISNOSE finding:

1. Is the *absolute number* of small entities estimated to incur a potentially significant impact, as described above, *substantial*?

and

2. Do these *significant impact* entities represent a *substantial* fraction of small entities in the electric power industry that could potentially be within the scope of a regulation?

Insight on the second factor requires information on the total number of small entities in the electric power sector and by entity type. The fraction of small entity totals represented by the significant impact entities is an important measure of the potential small entity impact of the proposed regulation. For example, if a high percentage of potentially in-scope small entities incur significant impacts *even though the absolute number of significant impact entities is low*, then the regulation could constitute a substantial burden on small entities.

In the same way as found in the analysis for the suspended 2004 Phase II Final Regulation, EPA determined that data are not readily available to support a *parent entity-level determination* of the number of small entities in the affected electric power generating segments. The best data found by EPA to support this analysis are from the 2007 EIA-861 database, which reports total electric power generation for *regulated utilities* at the level of the *electric power utility*, 2007 EIA-860, which reports facility regulatory status and lists operator, and 2007 EIA-906/920/923, which reports net generation for all facilities regardless of regulatory status.[184] These data thus provide a basis for estimating the total number of *regulated utilities at the level of the utility and non-regulated facilities at the operator level* that would qualify as small based on the 4,000 MWh production quantity threshold of electric power generation. The EIA-861 data indicate that a total of 3,098 utilities and 1,737 non-utilities

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182 In the same way as stated above, facility weights were not used in conjunction with entity weights because the combination of facility weights and entity weights would overstate, perhaps, the estimate of in-scope facilities and compliance costs assigned to parent entities.

183 As shown in *Table 7-7* and *Table 7-8*, there are a total of 33 small parent entities on an unweighted basis, 1 of which is an Other Political Subdivision entity. This entity owns only implicitly analyzed facilities; consequently, there is no explicitly analyzed other political Subdivision parent entity to represent this implicitly analyzed parent entity. As a result, the weighted entity counts do not include 1 small Other Political Subdivision entity even though this entity is known to exist in the regulated facility and entity universe.

184 For the analysis in support of the suspended 2004 Final Section 316(b) Phase II Existing Facilities Rule, EPA used only the EIA-861 database for the analysis, and the total industry number of small nonutilities was not estimated.

operated industry-wide in the United States in 2007 and that 2,900 of these utilities and 1,547 of non-utilities would qualify as small according to the 4,000 MWh SBA size criterion.[185,186]

However, this estimate will diverge from an appropriate estimate of *small entities* for two reasons (*error factors*):

1. The *desired* count of small entities for the small entity analysis is not at the level of the utility/operator but at the level of the highest domestic parent, which in the electric power industry is often a holding company that may own several utilities operating in different state jurisdictions. In addition, these holding companies may also own *non-regulated* electric power generating businesses. As a result, the count of utilities *that appear to be small entities on the basis of their utility-level and/or operator-level electric power generation as reported in EIA-861* and *EIA-906/920/923*, respectively, is likely to *overstate* the count of parent-level entities that would qualify as small entities if the determination were made on the basis of electric power generation aggregated over regulated utilities and non-regulated businesses at the parent level. *This factor will cause the EIA-861-based and EIA-906/920/923-based determination to overstate the number of small entities in the affected electric power generating segments.*
2. According to the SBA entity-size criteria, the determination of small entities for electric power facilities owned by municipalities and other political subdivisions should be based on population served instead of electric power generated.[187] There is no *a priori* basis for knowing how a determination based on electric power generated would differ from a determination based on population served.

Again, in the same way as done previously for the suspended 2004 Phase II Final Regulation analysis, to the extent possible, EPA adjusted the estimates based on electric power generated from the EIA-861 database to account for these error factors and to provide a more appropriate estimate of small entities.[188] The adjustments vary by entity type, as follows:

- *Investor-Owned Utilities*: Based on the observed relationship between utility-based and entity-based determinations of “small entity” for privately owned facilities and entities in the 316(b) database, EPA reduced the utility-based count of “small entities” for private entities by 80 percent[189] to yield a more appropriate estimate of small entities at the true entity level. This adjustment addresses the first error factor described above.
- *Municipalities*: Based on the observed relationship between electric power generated- and population served-based determinations of small entity for municipality-owned facilities in the 316(b) database, EPA reduced the electric power generated-based count by 47 percent to yield a more appropriate estimate of small entities at the true entity level. This adjustment addresses the second error factor described above.

[185] These are industry-wide counts of utilities and non-utility electric power facility operators. These numbers are larger than the number of in-scope utilities and non-utility operators because they include, for instance, businesses that may not have steam generating operations or may have DIF below the 2 MGD threshold.

[186] Number of utilities is the sum of State, federal, investor-owned, municipal, other political subdivision, and cooperative operators from the 2007 EIA-861 database. Number of nonutilities is the number of non-regulated operators from the 2007 EIA-860 database.

[187] Except the federal and State government owners of electric power generating facilities, which were all assumed to be large entities.

[188] For all entity types except nonutilities, EPA used the same adjustment factors used for the RFA analysis in support of the suspended 2004 Phase II Final Rule.

[189] This adjustment value and those applied for municipalities and nonutilities are based on analyses undertaken for the previous 316(b) Phase II regulations.

- *Other Political Subdivisions*: EPA found no difference in the numbers of small political subdivision entities estimated using power generation-based and population-based SBA criteria. Consequently, no adjustment was needed for this entity-type category.
- *Rural Electric Cooperatives*: Because power generation is an appropriate basis for size determination for this entity type and because cooperatives are not owned by a holding company, EPA determined that no adjustment was needed for this entity-type category.
- *Nonutilities*: Based on the observed relationship between electric power generated-, revenue-, and employment-based determinations of small entity for nonutility-owned facilities in the 316(b) database, EPA reduced the electric power generated-based count by 98 percent to yield a more appropriate estimate of small entities at the true entity level. [190] This adjustment addresses the second error factor described above.

As a result, the adjusted estimates of total small entities in the affected electric power generation segments may understate the true value to the extent that some non-regulated private entities would qualify as a small entity. EPA's adjustments assume that the profile of entities and facilities and the determinations of whether they qualify as "small entities" as observed in the 316(b) facility dataset are also applicable to the total universe of electric power generating facilities.

Table 7-8 summarizes the estimated numbers of small entities by parent entity type, based on the EIA-861 data and adjustments, as described above. *Table 7-8* also reports the estimated number of small entities owning in-scope facilities, from *Table 7-7* and as a percentage of total small entities.

Table 7-8: Number of Small Electric Generators Parent Entities (Industry Total and Entities with In-Scope Facilities)

Parent Entity Type	Total Small Entities[a]	Small Entities Owning In-Scope Facilities	
		Number[b]	Percentage of Total Small Entities
Rural Electric Cooperative	848	8	0.94%
Federal	0	0	0.00%
Investor-Owned Utilities	18	2	10.87%
Municipality	968	17	1.76%
Nonutility	130	5	3.84%
Other Political Subdivision	113	1	0.88%
State	0	0	0.00%
All Entity Types	**2,078**	**33**	**1.59%**

a. Form EIA-861 does not provide data on nonutilities. The reported number of *total* small nonutilities is the total of non-regulated operators from the 2007 EIA-860 database; the number of small parent entities owning 316(b) facilities for non-regulated operators was determined using the 2007 EIA-906/920/923 database. State and federal entities are considered large.
b. Entity counts include entities owning explicitly and implicitly analyzed facilities and are not weighted estimates. For a discussion on explicitly and implicitly owned facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.
c. Industry non-regulated operators with no electricity sales/generation data were excluded from this analysis.
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2007b; U.S. DOE, 2007c; U.S. DOE, 2007d

As shown in *Table 7-8*, very small percentages of total small entities, by entity type, are estimated to own in-scope facilities and thus be directly affected by the Proposed Existing Facilities Rule.

In assessing the small entity impact of the Proposed Rule, EPA calculated the fraction of estimated small in-scope entities, in aggregate and by parent entity type, that are estimated to incur potentially significant impacts, as described in the preceding sections.

[190] Electricity generation, revenue, and employment are SBA criteria used to determine parent entity size for in-scope nonutilities. Industry non-regulated operators with no electricity sales/generation data were excluded from this analysis.

7.2.2 Key Findings for Regulatory Options

Table 7-9 and *Table 7-10* summarize the findings from the analyses outlined above in terms of numbers of small Electric Generators entities incurring costs exceeding the significant cost impact thresholds of one percent and three percent.

As described above, EPA developed estimates of the number of small Electric Generators entities incurring costs in the specified cost-to-revenue impact ranges using two weighting concepts:

- Usin*g Facility-Level Weights*, EPA estimates that 12 small unique domestic parent entities own 26 facilities subject the existing facilities rule options (*Table 7-9*). As described above , *this assessment may overstate the number of facilities and compliance costs at the level of the small parent entity, but may also understate the number of small parent entities.*
- Using *Entity-Level Weights*, EPA estimates that 32 small unique domestic parent entities own 14 facilities subject the existing facilities rule options (*Table 7-10*). [191] As described above, *this assessment may understate the number of facilities and compliance costs at the level of any given small parent entity, but accounts more comprehensively for the number of small parent entities owning 316(b) electric power generating facilities.*

Using Facility-Level Weights

Under the *facility-level sample-weighting approach*, EPA estimates that between 4 and 9 small entities owning Electric Generators will incur costs exceeding 1 percent of revenue, and that between 2 and 6 small entities will incur costs exceeding 3 percent of revenue, depending on the regulatory option. (see *Table 7-9*).

Options 1 and 2 yield the same results. Under these options, EPA estimates that 4 small entities, or 12.1 percent of the estimated 33 small in-scope entities, will incur costs exceeding 1 percent of revenue, and 2 small entities, or 6.1 percent of small in-scope entities, will incur costs exceeding 3 percent of revenue. Under Option 3, the most costly option, EPA estimates that 9 small entities, or 27.3 percent of small in-scope entities, would incur costs exceeding 1 percent of revenue and 6 small entities, or 18.2 percent of small in-scope entities, would incur costs exceeding 3 percent of revenue.

The impact findings in terms of numbers of affected entities are consistently low across ownership categories, with the largest *numbers* of small entities incurring costs exceeding an impact threshold in the Municipality category, at 6 entities exceeding the 1 percent threshold, and 4 exceeding the 3 percent threshold under Option 3.

On the basis of *percentage* of small in-scope entities by ownership category, the largest percentage under Options 1 and 2 occurs among nonutilities, at 20 percent. For Option 3, the largest percentages occur among municipalities at 35 percent for the 1 percent of revenue threshold and 24 percent for the 3 percent of revenue threshold; rural electric cooperatives.

[191] As shown in *Table 7-7*, above, there are a total of 33 small parent entities on an unweighted basis, 1 of which is another political subdivision entity. This entity owns only implicitly analyzed facilities; consequently, there is no explicitly analyzed other political subdivision parent entity to represent this implicitly analyzed parent entity and weighted entity counts do not include 1 small other political subdivision entity.

Table 7-9: Estimated Cost-to-Revenue Impact on Small Electric Generators Entities, by Entity Type – Using Facility-Level Weights[a]

	Cost Impact Category			
	Cost > 1% of Revenue		Cost > 3% of Revenue	
Parent Entity Type[b]	Number of Small Entities	% of Small In-scope Entities	Number of Small Entities	% of Small In-scope Entities
Option 1: IM Everywhere				
Rural Electric Cooperative	1	12.5%	1	12.5%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	2	11.8%	0	0.0%
Nonutility	1	20.0%	1	20.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**4**	**12.1%**	**2**	**6.1%**
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD				
Rural Electric Cooperative	1	12.5%	1	12.5%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	2	11.8%	0	0.0%
Nonutility	1	20.0%	1	20.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**4**	**12.1%**	**2**	**6.1%**
Option 3: I&E Mortality Everywhere				
Rural Electric Cooperative	2	25.0%	1	12.5%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	6	35.3%	4	23.5%
Nonutility	1	20.0%	1	20.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**9**	**27.3%**	**6**	**18.2%**

a. The number of entities with cost-to-revenue impact exceeding 3 percent is a subset of the number of entities with such ratios exceeding 1 percent.

Source: U.S. EPA Analysis, 2010

Using Entity-Level Weights

Under the *entity-level sample-weighting approach*, EPA's findings of potential small entity impacts differ from those under the *facility-level sample-weighting approach*, with more entities generally estimated to incur costs exceeding an impact threshold under all of the regulatory options. However, the profile of difference varies across options and by ownership category.

Overall, EPA estimates that between 6 and 21 small entities will incur costs exceeding 1 percent of revenue, and that between 2 and 14 small entities will incur costs exceeding 3 percent of revenue, depending on the regulatory option (see *Table 7-10*).

Under Option 1, and Option 2, EPA estimates that 6 small entities, or 18.2 percent of the 33 small in-scope Electric Generators entities, will incur costs exceeding 1 percent of revenue. Under Option 1, 2 small parent entities, or 6.1 percent of small in-scope entities, are expected to incur costs exceeding 3 percent of revenue, while under Option 2, this number is 6, or 18.2 percent. Under Option 3, the most costly option, EPA estimates that 21 small entities, or approximately 63.6 percent of small in-scope entities, would incur costs exceeding 1 percent of revenue, and that 14 small entities, or 42.4 percent of all small entities, would incur costs exceeding 3 percent of revenue.

Only two ownership categories record small entities exceeding either of the impact thresholds – rural electric cooperatives and nonutilities – under Options 1 and 2. Under Option 1, 4 rural electric cooperatives entities incur costs in excess of the 1 percent of revenue threshold, representing 50 percent of estimated small in-scope entities in this category; 2 nonutility entities incur an impact, representing 40 percent of this category. At the 3 percent of revenue threshold, only the 2 nonutility entities incur an impact, representing 40 percent of this category. For Option 2, the impact profile is the same at the 1 percent and 3 percent of revenue thresholds (and also the same as for Option 1): 4 rural electric cooperatives entities incur costs in excess of the 1 percent of revenue threshold, representing 50 percent of estimated small in-scope entities in this category; 2 nonutility entities incur an impact, representing 40 percent of this category. For Option 3, the largest number of entities incurring impacts occurs among municipalities, with 11 entities (65 percent of small in-scope entities in this category) incurring costs in excess of the 1 percent of revenue threshold and 9 entities (53 percent of small in-scope entities in this category) incurring costs in excess of the 3 percent of revenue threshold. In the rural electric cooperative category, 8 entities (or all of small in-scope entities) incur costs in excess of the 1 percent of revenue threshold, and 4 rural electric cooperatives entities (50 percent of small in-scope entities) incur costs in excess of the 3 percent of revenue threshold. Finally, 2 nonutility entities incur an impact at both the 1 and 3 percent of revenue thresholds, representing 40 percent of this category.

Table 7-10: Estimated Cost-to-Revenue Impact on Small Electric Generators Entities, by Entity Type – Using Entity-Level Weights[a]

	Cost Impact Category			
	Cost > 1% of Revenue		Cost > 3% of Revenue	
Parent Entity Type[b]	Number of Small Entities	% of Small In-scope Entities	Number of Small Entities	% of Small In-scope Entities
Option 1: IM Everywhere				
Rural Electric Cooperative	4	50.0%	0	0.0%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	0	0.0%	0	0.0%
Nonutility	2	40.0%	2	40.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**6**	**18.2%**	**2**	**6.1%**
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD				
Rural Electric Cooperative	4	50.0%	4	50.0%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	0	0.0%	0	0.0%
Nonutility	2	40.0%	2	40.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**6**	**18.2%**	**6**	**18.2%**
Option 3: I&E Mortality Everywhere				
Rural Electric Cooperative	8	100.0%	4	50.0%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	11	64.7%	9	52.9%
Nonutility	2	40.0%	2	40.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**21**	**63.6%**	**14**	**42.4%**

a. The number of entities with cost-to-revenue impact exceeding 3 percent is a subset of the number of entities with such ratios exceeding 1 percent.

Source: U.S. EPA Analysis, 2010

Comparing the Findings from the Facility-Level Weights and Entity-Level Weights Approaches

In comparison to the *facility-level sample-weighting approach*, under the *entity-level sample-weighting approach*, EPA finds that a larger number of small entities will incur costs *exceeding 1 percent of revenue* for all three regulatory options. For both Options 1 and 2, 6 small entities are estimated to incur costs exceeding 1 percent of revenue using the *entity-level weights*, compared to 4 small entities for each Options 1 and 2 using *facility-level weights* (see *Table 7-11*). For Option 3, 21 small entities are estimated to incur costs exceeding the 1 percent of revenue threshold using the *facility-level weights*, compared to 9 small entities using *entity-level weights*.

However, at the 3 percent cost-to-revenue threshold, the difference in findings between the *facility-level sample-weighting approach* and the *entity-level sample-weighting approach* varies by regulatory option, with the same number of small entities estimated to incur costs exceeding the 3 percent of revenue threshold under Option 1 (2 entities). However, for Option 2, more entities (6 entities) are estimated to incur costs exceeding the 3 percent of revenue threshold under the *entity-level weights* than under the *facility-level weights* (2 entities). A similar pattern occurs for Option 3 with 6 small entities exceeding the 3 percent of revenue threshold under the *facility-level weights* and 14 entities under the *entity-level weights*.

The observed profile of difference between the two weighting approaches – greater number of affected entities at the 1 percent of revenue threshold for all regulatory options, but a mixed finding at the 3 percent of revenue threshold over the regulatory options – is reasonable given the known potential biases in each of the two approaches:

- The facility-level sample-weighting approach, discussed in the previous section, is likely to overstate impact *in terms of number of in-scope facilities owned and associated costs* for any given parent entity, but may understate the number of parent entities in a given impact category.
- The entity-level sample-weighting approach, discussed in this section, may understate the impact *in terms of number of in-scope facilities owned and associated costs* for any given parent entity, but will tend to account more accurately for the number of parent entities, overall, in the analysis.

Table 7-11: Estimated Cost-to-Revenue Impact on Small Entities – Comparing Findings from the Facility-Level Weights and Entity-Level Weights Analyses[a]

	Cost Impact Category			
	Cost > 1% of Revenue		Cost > 3% of Revenue	
Parent Entity Type	Number of Small Entities	% of Small In-scope Entities	Number of Small Entities	% of Small In-scope Entities
Using Facility-Level Weights				
Option 1: IM Everywhere	4	12.1%	2	6.1%
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD	4	12.1%	2	6.1%
Option 3: I&E Mortality Everywhere	9	27.3%	6	18.2%
Using Entity-Level Weights				
Option 1: IM Everywhere	6	18.2%	2	6.1%
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD	6	18.2%	6	18.2%
Option 3: I&E Mortality Everywhere	21	63.6%	14	42.4%

a. The number of entities with cost-to-revenue impact exceeding 3 percent is a subset of the number of entities with such ratios exceeding 1 percent.

Source: U.S. EPA analysis, 2010

Summary of Findings for Electric Generators

Regardless of the weighting approach applied, the estimated numbers of small entities incurring potentially significant cost impacts are small and, in particular, for Option 1, represent small percentages of the total of small in-scope entities.

As shown in *Table 7-11* the estimated numbers of small entities incurring a potentially significant impact at the 1 percent of revenue threshold are small: 4 - 6 entities under the least costly Option 1 and the mid-cost Option 2; and 9 - 21 entities under the most costly Option 3.[192] At the 3 percent of revenue threshold, the findings of potentially significant impact are smaller: 2 entities under the least costly Option 1; 2 - 6 entities under the mid-cost Option 2; and 6 - 14 entities under the most costly Option 3. For Options 1 and 2, the percentages of small in-scope entities incurring an impact at either the 1 or 3 percent of revenue threshold, remain below a key threshold

[192] The number ranges result from use of the two estimation methods: (1) using *facility-level weights* and (2) using *entity-level weights*.

of concern – 20 percent of small in-scope entities – as specified in EPA's *Final Guidance for EPA Rulewriters: Regulatory Flexibility Act*.[193]

Given (1) the small absolute number of small entities estimated to incur a potentially significant cost impact *and* (2) the low percentage of total in-scope small entities in the Electric Generators regulated industry segment, EPA concluded that Options 1 and 2 would not have "a significant impact on a substantial number of small entities." EPA did not reach a finding for Option 3 since, at the time of completing the RFA analysis, the Agency did not anticipate selecting Option 3 as the proposed option for the 316(b) existing facilities rule.

7.3 Uncertainties and Limitations

- None of the sample-weighting approaches used for this analysis accounts precisely for the number of parent-entities *and* compliance costs assigned to those entities simultaneously for either Manufacturers or Electric Generators. EPA assesses the values presented in this chapter as reasonable estimates of the numbers of small entities that could incur a significant impact according to the impact concepts.
- To the extent that EPA used the 2004 Phase II Final adjustment factors to estimate the total number of small Electric Generators entities, the uncertainties associated with those factors still apply to the analysis in support of this proposed regulation. In particular, these adjustments are based on the assumption that the originally analyzed Phase II utilities are representative of the EIA universe of electric utilities (for private entities in terms of their respective sizes at the utility level and the holding company level; for municipalities and political subdivisions in terms of their respective sizes based on electric output and population). If this is not the case, the industry-wide numbers of small entities may be over- or under-estimated. Further, these adjustment factors may not be representative of the current electric power generating industry.
- To the extent that information reported in the 316(b) Surveys for Manufacturers and used in this analysis is not reflective of the present conditions, the number of small parent entities of manufacturing in-scope facilities may be over- or under-stated.
- To estimate the total industry-wide number of small entities for each Manufacturing sector subject to the Proposed Existing Facilities Rule, EPA used counts of 2006 SUSB firms with less than 500 employees. SBA defines firms in nearly all profiled NAICS codes according to the firm's number of employees. For some in-scope NAICS codes this threshold is 500 employees while for others it is 750, 1,100, or 1,500 employees. Because the SUSB employment size categories do not correspond to the SBA size EPA has to use the 500 employee threshold for all in-scope NAICS codes. Consequently, total industry-wide counts of small entities for Manufacturing sectors are likely understated, thereby potentially overstating the percent of small in-scope entities and percent of small in-scope entities with compliance costs exceeding one and three percent impact thresholds.

[193] U.S. EPA, *Final Guidance for EPA Rulewriters: Regulatory Flexibility Act*, November 2006, see pages 23-26.

8 Unfunded Mandates Reform Act (UMRA) Analysis

Title II of the Unfunded Mandates Reform Act of 1995, Pub. L. 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under UMRA section 202, 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. Before promulgating a regulation for which a written statement is needed, UMRA section 205 generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that might significantly or uniquely affect small governments, including Tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant intergovernmental mandates, and informing, educating, and advising small governments on compliance with regulatory requirements.

For the Electric Generators segment of the Proposed Existing Facilities Regulation, EPA estimates that the *maximum* cost *in any one year* for compliance with, and administration of, the regulatory options to governments (excluding federal government) is $23 million under Option 1, $336 million under Option 2, and $390 million under Option 3.[194] The *maximum* cost *in any given year* to the private sector for the Electric Generators segment (compliance cost only) is $756 million, $10,749 million, and $11,124 million, respectively, for Options 1, 2, and 3. For the Manufacturers segment of the Proposed Rule, EPA estimates that the *maximum* cost *in any one year* to governments (administrative cost only, as no Manufacturers facilities are government-owned) of the regulatory options in any given year is $1.6 million, $1.4 million, and $1.0 million under Options 1, 2, and 3, respectively. The *maximum* cost *in any one year* to the private sector for the Manufacturers segment (compliance cost only) is $373 million, $833 million, and $1,439 million, respectively, for Options 1, 2, and 3. Thus, EPA has determined that the Proposed Existing Facilities Rule contains a Federal mandate that may result in expenditures of $100 million or more for State, local, and Tribal governments, in the aggregate, or the private sector in any one year. Accordingly, under §202 of the UMRA, EPA has prepared a written statement, presented in the preamble to the proposed rule, that includes (1) a cost-benefit analysis; (2) a summary of State, local, and Tribal input; (3) a discussion related to the least burdensome option requirement; and (3) an analysis of small government burden. This chapter contains additional information to support that statement, including information on compliance and administrative costs, and on impacts to small governments.

In performing this analysis, EPA closely followed the methodology and assumptions used for the analysis in support of previous CWA 316(b) regulatory analyses, with the following modifications:[195]

- Costs to private facilities reflect pre-tax cost values.

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[194] Maximum costs are undiscounted costs incurred by the entire universe of in-scope facilities in a given year of occurrence under a given regulatory option.

[195] For more details on these analyses, see *Chapter B1: Summary of Compliance Costs* in the suspended 2004 *Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule* report (U.S. EPA, 2004a) and *Chapter C1: Summary of Cost Categories and Key Analysis Elements for Existing Facilities* in the 2006 *Economic and Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule* report (U.S. EPA, 2006a).

- Annualized costs presented in this UMRA analysis are calculated using the social cost framework presented in *Chapter 11: Social Cost Analysis*, being assigned on a year-explicit basis and discounted from each year of occurrence to the promulgation year (2012) using a 7 percent discount rate and a 3 percent discount rate, then annualized over a period of 50 years. For more details, see *Section 1* of *Chapter11.* All costs reflect weighted values unless otherwise noted.
- Unlike the total cost of compliance presented in *Chapter 11*, the costs to the private sector include the private concept of net downtime, being the difference between forgone revenue and reduced operating costs, rather than the social cost of downtime which is calculated as the total increase in variable costs of electricity generation for the entire industry while units are down.
- All costs are in 2009 dollars. Annualized values are derived from present values that were discounted to the promulgation year (expected to be 2012 for the Proposed Existing Facilities Rule).

The Agency analyzed the impact of the regulatory options on government entities, small government entities, and the private sector, the details of which are presented in the three sections below, followed by a summary.

8.1 UMRA: Analysis of Impact on Government Entities

This part of the UMRA analysis assesses the burden of the existing facilities regulatory options on State, local, and Tribal governments. The use of the phrase "government entities" in this section does *not* include the federal government, which owns 16 of the 559 (weighted) in-scope Electric Generators and is expected to incur both compliance and administrative costs under the regulatory options. In evaluating the magnitude of the impact of the options on government entities, EPA considered two burden concepts:

- Compliance costs incurred by government entities owning facilities required to meet the standards of the regulation. Because no Manufacturer facilities are government owned, EPA conducted this assessment for Electric Generators only.
- Administrative costs incurred to implement the rule option. This assessment applies to both Electric Generators and Manufacturers.
- Administrative costs to government entities were estimated based on the administrative costs for facilities that require State review, which are detailed in *Section 8.1.2* below.

The determination of owning entities, their type, and their size is detailed in *Chapter 7: Regulatory Flexibility Act Analysis*.

8.1.1 Compliance Costs

Table 8-1 summarizes the number of State and local government entities and the number of in-scope Electric Generators they own.

Table 8-1: Government-Owned Electric Generators and Their Parent Entities

Entity Type	Parent Entities[a]	Electric Generators[b]
Municipality	35	43
State	4	9
Other Political Subdivision	3	7
Total	**42**	**59**

a. Counts of entities owning explicitly and implicitly analyzed Electric Generators; these are not weighted entity counts.

b. Counts of explicitly and implicitly analyzed Electric Generators; these are not weighted estimates.

Source: U.S. EPA analysis, 2010

Out of 548 in-scope Electric Generators (known universe; unweighted counts), 59 are owned by 42 government entities.[196] The majority (73 percent) of these government-owned Electric Generators are owned by municipalities, followed by State governments (15 percent). The remaining 12 percent are owned by other political subdivisions.

EPA identified government entities that are expected to incur compliance, and calculated their compliance costs as part of the analyses described in *Chapter 3: Development of Costs for Regulatory Options*. These costs were assigned and discounted on a year-explicit basis as described in *Chapter 11: Assessment of Total Social Costs*.

Under Option 1: IM Everywhere, compliance costs for government-owned Electric Generators are approximately $10.8 million in the aggregate (total weighted compliance cost annualized at 7 %), an average of about $0.3 million per facility. Municipally-owned Electric Generators account for approximately $4.7 million of this cost, and State-owned Electric Generators account for the remaining $6.1 million. The average cost to a State-owned Electric Generator is $0.4 million, compared to about $0.2 million for the average municipal Electric Generator. The maximum annualized compliance costs expected to be incurred by any single government-owned Electric Generator is $1.0 million for a State-owned Electric Generator and $0.5 million for a municipal Electric Generator.[197]

Under Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD, government-owned Electric Generators incur annualized total cost of just over $102.3 million to comply with regulatory requirements, with $29.9 million in compliance costs borne by municipally-owned entities and $72.4 million by State-owned entities. Overall, government-owned Electric Generators incur average costs of $2.5 million per facility, with municipal Electric Generators incurring costs of $1.2 million per facility, and State-owned Electric Generator incurring costs of $4.3 million per facility. The largest annualized compliance cost to any government-owned Electric Generator is $17.8 million, incurred by a State-owned Electric Generator.

Under Option 3: I&E Mortality Everywhere, total annualized compliance costs for government-owned Electric Generators are expected to be about $120.1 million, an average of just over $2.9 million per facility. The highest annualized cost is $17.8 million, which is incurred by a State-owned Electric Generator. The maximum cost to a municipally-owned Electric Generator is $5.6 million.

[196] Excluding federal government-owned facilities.

[197] Maximum per facility values are reported on an unweighted basis.

Table 8-2: Compliance Costs to Government-Owned Electric Generators (Millions; $2009)

Ownership Type	Number of In-scope Facilities (weighted) [a]	Total Weighted, Annualized Pre-tax Compliance Cost	Average Annual Compliance Cost (per facility)	Maximum Annualized Facility Compliance Cost [b]
Option 1: IM Everywhere				
Municipality	25	$4.7	$0.2	$0.5
State	17	$6.1	$0.4	$1.0
Other Political Subdivision [c]	0	$0.0	$0.0	$0.0
Total	**42**	**$10.8**	**$0.3**	**$1.0**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD				
Municipality	25	$29.9	$1.2	$5.6
State	17	$72.4	$4.3	$17.8
Other Political Subdivision [c]	0	$0.0	$0.0	$0.0
Total	**42**	**$102.3**	**$2.5**	**$17.8**
Option 3: I&E Mortality Everywhere				
Municipality	25	$42.5	$1.7	$5.6
State	17	$77.6	$4.6	$17.8
Other Political Subdivision [c]	0	$0.0	$0.0	$0.0
Total	**42**	**$120.1**	**$2.9**	**$17.8**

a. Facility counts are weighted estimates and differ from the values reported in *Table 8-1* and *Table 8-4*, which are un-weighted values. This table presents sample weighted facility counts because costs were developed only for the explicitly analyzed Electric Generators facilities. See Appendix *A.3: Used of Sample Weights in the Proposed Existing Facilities Rule Analysis* for discussion on explicitly and implicitly analyzed facilities and facility sample weights.

b. Reflects maximum of un-weighted costs to explicitly analyzed facilities only.

c. EPA's analysis indicates there are 3 *Other Political Subdivision* entities (*Table 8-1*). These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed Other Political Subdivision parent entity to represent these implicitly analyzed Other Political Subdivision parent entities. As a result, the weighted entity counts do not include the 3 known Other Political Subdivision entities even though they are known to be part of the regulated facility and entity universe.

Source: U.S. EPA analysis, 2010

8.1.2 Administrative Costs

Forty-five States and 1 territory with NPDES permitting authority are expected to incur costs to administer the Proposed Existing Facilities Rule in their jurisdictions.[198] The Federal government is also expected to incur costs to oversee the initial post-promulgation permitting process. Details of the development of costs to NPDES authorities and the Federal government can be found in *Section 2* of *Chapter 3: Development of Costs for Regulatory Options*. These costs were assigned and discounted on a year-explicit basis as described in *Chapter 11: Assessment of Total Social Costs*.

As shown in *Table 8-3*, government entities are expected to incur annualized costs of $5.31 million to administer Option 1, $2.19 million to administer Option 2, and $1.28 million to administer Option 3. Administrative costs are lower for Options 2 and 3 than for Option 1 because they require cooling tower technology to be installed at some or all facilities, and facilities with cooling towers incur no monitoring costs and no entrainment study costs, reducing the administrative burden on the permitting authority. As described above, this tabulation includes government administrative costs associated with Electric Generators and Manufacturers facilities.

Annual *monitoring* activities are expected to account for the largest portion of administrative costs under Option 1 – $2.29 of the $5.31 million in annualized administrative costs incurred for this option. Under Option 2, EPA expects governments to spend about $2.19 million to administer the rule, of which the largest share is again annual monitoring activities, at $1.37 million. Under Option 3, in-scope facilities are expected to incur $ 0.72 million in monitoring costs, with other administrative costs of approximately $0.04 for start-up activities and $0.52 for permit issuance and reissuance.

198 Since the time of this analysis, Alaska was also granted NPDES permitting authority. Only one in-scope generator is located in Alaska.

Table 8-3: Annualized Government Administrative Costs (Millions; $2009)

Activity	Annualized Cost, Electric Generators	Annualized Cost, Manufacturers	Total Annualized Cost
Option 1: IM Everywhere			
Start-Up Activities	$0.02	$0.02	$0.04
First Permit Issuance Activities	$0.23	$0.24	$0.45
Annual Monitoring Activities	$1.17	$1.12	$2.29
Entrainment Study	$1.19	$0.97	$2.16
Permit Reissuance Activities	$0.18	$0.18	$0.36
Total	**$2.79**	**$2.52**	**$5.31**
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD			
Start-Up Activities	$0.02	$0.02	$0.04
First Permit Issuance Activities	$0.17	$0.23	$0.35
Annual Monitoring Activities	$0.36	$1.07	$1.37
Entrainment Study	$0.00	$0.00	$0.00
Permit Reissuance Activities	$0.14	$0.17	$0.31
Total	**$0.69**	**$1.48**	**$2.19**
Option 3: IM&EM Everywhere			
Start-Up Activities	$0.02	$0.02	$0.04
First Permit Issuance Activities	$0.16	$0.13	$0.29
Annual Monitoring Activities	$0.20	$0.52	$0.72
Entrainment Study	$0.00	$0.00	$0.00
Permit Reissuance Activities	$0.13	$0.10	$0.23
Total	**$0.51**	**$0.77**	**$1.28**

a. These costs reflect the assumption that all facilities will comply in one year, and were discounted accordingly because individual components of costs were not distributed over the 5-year compliance window, as described in *Chapter 11, Section 1*.

Source: U.S. EPA analysis, 2010

8.2 UMRA: Analysis of Impact on Small Governments

As part of the UMRA analysis, EPA also assessed whether the regulatory options would significantly and uniquely affect small governments. To assess whether the proposed regulatory options would affect small governments in a way that is disproportionately burdensome in comparison to the effect on large governments, EPA compared total costs and costs per facility as estimated to be incurred by small governments with those values as estimated to be incurred by large governments. EPA also compared the per facility costs incurred for small government-owned facilities with those incurred by non-government-owned facilities. The Agency evaluated costs per facility on the basis of both average and maximum annualized cost per facility. Because no Manufacturers facilities are government-owned, EPA conducted this analysis for Electric Generators only.

Costs to government-owned facilities were determined as part of EPA's analysis of the impact on facilities, as described in *Chapter 3: Development of Costs for Regulatory Options*. Facility ownership type and size were determined for the RFA analysis described in *Chapter 7: Regulatory Flexibility Act Analysis*.

Out of 59 government-owned in-scope Electric Generator facilities, EPA identified 18 facilities that are owned by 18 small government entities. These 18 facilities constitute approximately 31 percent of the total number of government-owned Electric Generators. [199]

[199] Excluding federal government-owned facilities.

Table 8-4: Government-Owned Electric Generators and Their Parent Entities, by Size

Entity Type	Entities[a]			Electric Generators[b]		
	Large	Small	Total	Large	Small	Total
Municipality	18	17	35	26	17	**43**
State	4	0	4	9	0	**9**
Other Political Subdivision	2	1	3	6	1	**7**
Total	**24**	**18**	**42**	**41**	**18**	**59**

a. Counts of entities owning explicitly and implicitly analyzed Electric Generators; these are not weighted entity counts.
b. Counts of explicitly and implicitly analyzed Electric Generators; these are not weighted estimates.
Source: U.S. EPA analysis, 2010

As presented in *Table 8-5*, costs are lower for small governments in comparison to large governments in the aggregate, and approximately the same on a per facility basis. Under Option 1, the 10 facilities owned by small government entities, all of which are municipalities, incur total annualized costs of $1.5 million, which is substantially less than the total of $9.2 million in costs incurred by the 31 facilities owned by large governments. Small and large governments incur costs of approximately $0.1 million and $0.3 million per facility, respectively.[200] Small government-owned facilities are also expected to incur lower cost per facility than the 16 small privately owned facilities, for which compliance costs are estimated to be $7.7 million in the aggregate, or about $0.5 million per facility. Moreover, the largest annualized cost to any individual facility owned by a small government is about $0.2 million, significantly lower than the maximum facility costs of around $1.0 million for large government-owned facilities and $2.5 million for small privately-owned facilities.

Under Option 2, impacts to facilities owned by small governments remain lower than those to other categories of facilities. Total annualized compliance costs are $1.5 million for facilities owned by small governments, which represents an average of $0.1 million per facility, with a maximum of $0.2 million for a single facility. This is substantially less than the total cost of $100.7 million, with an average cost of $3.2 million per facility, and maximum cost of $17.8 million to a single facility for facilities owned by large governments. Facilities owned by small private entities are expected to incur an average annualized compliance cost of $2.0 million and a maximum of $10.9 million for a single facility. These values are again substantially higher than the comparable values for small government-owned facilities.

Under Option 3, impacts to facilities owned by small governments are also less substantial than those to other categories of facilities. Total annualized compliance costs are $12.5 million for facilities owned by small governments compared to $107.6 million for facilities owned by large governments and $34.0 millions for facilities owned by small private entities. EPA estimates that a small government-owned facility would on average incur $1.2 million (maximum of $2.1 million to a single facility) in compliance costs compared to $3.4 million per facility (maximum of $17.8 million to a single facility) and $2.2 million per facility (maximum of $10.9 million to a single facility) for facilities owned by large governments and small private entities.

As described in the preceding paragraphs, under all of the regulatory options, EPA expects costs to facilities owned by small governments to be lower than costs to facilities owned by large-governments or by small private entities, and that this finding applies for both the average cost to facilities and the maximum cost to any one facility. Consequently, EPA assesses that small government will not be significantly or uniquely affected by the Proposed Existing Facilities Regulation.

200 Excluding federal government-owned facilities.

Table 8-5: Compliance Costs for Electric Generators by Ownership Type and Size (Millions; $2009)

Ownership Type	Entity Size	Number of Facilities (weighted)[a]	Total Annualized Pre-Tax Compliance Costs	Average Annualized Pre-tax Compliance Cost per Facility	Maximum Facility Annualized Pre-tax Compliance Cost[c]
Option 1: IM Everywhere					
Government (excluding Federal)	Small	10	$1.5	$0.1	$0.2
	Large	31	$9.2	$0.3	$1.0
Private	Small	16	$7.7	$0.5	$2.5
	Large	485	$354.4	$0.7	$7.2
All Facilities[b]		**559**	**$394.2**	**$0.7**	**$7.2**
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD					
Government (excluding Federal)	Small	10	$1.5	$0.1	$0.2
	Large	31	$100.7	$3.2	$17.8
Private	Small	16	$32.3	$2.0	$10.9
	Large	485	$4,171.7	$8.6	$59.9
All Facilities[b]		**559**	**$4,811.3**	**$8.6**	**$59.9**
Option 3: I&E Mortality Everywhere					
Government (excluding Federal)	Small	10	$12.5	$1.2	$2.1
	Large	31	$107.6	$3.4	$17.8
Private	Small	16	$34.0	$2.2	$10.9
	Large	485	$4,300.3	$8.9	$59.9
All Facilities[b]		**559**	**$4,959.4**	**$8.9**	**$59.9**

a. Facility counts are weighted estimates and differ from the values reported in *Table 8-1* and *Table 8-4*, which are un-weighted values. This table presents sample weighted facility counts because costs were developed only for the explicitly analyzed Electric Generators facilities. See Appendix *A.3: Used of Sample Weights in the Proposed Existing Facilities Rule Analysis* for discussion on explicitly and implicitly analyzed facilities and facility sample weights.

b. Facility counts and cost estimates reported for All Facilities include 15 federal government-owned facilities and costs estimated for these facilities.

c. Reflects maximum of un-weighted costs to explicitly analyzed facilities only.

Source: U.S. EPA analysis, 2010

8.3 UMRA: Analysis of Impact on the Private Sector

As a final part of the UMRA analysis, EPA reports the compliance costs expected to be incurred by private entities according to the methods described in *Chapter 3: Development of Costs for Regulatory Options* and annualized based on the year-explicit framework presented in *Chapter 11: Assessment of Total Social Costs*.

EPA estimates total annualized pre-tax compliance costs for 1,003 privately owned in-scope facilities – Electric Generators and Manufacturers – to be $0.4 billion under Option 1, $4.3 billion under Option 2, and $4.5 billion under Option 3. The highest undiscounted pre-tax compliance cost for privately owned in-scope facilities in any single year is expected to be $0.8 billion in 2016 for Electric Generators and $0.4 billion in 2015 for Manufacturers under Option 1, $10.8 billion in 2021 for Electric Generators and $0.8 billion in 2025 for Manufacturers under Option 2, and $11.0 billion in 2021 for Electric Generators and $1.4 billion in 2025 for Manufacturers under Option 3.

8.4 UMRA: Analysis Summary

EPA estimates that the Proposed 316(b) Existing Facilities regulatory options will result in expenditures of at least $100 million for State and local government entities, in the aggregate, or for the private sector in any one year. *Table 8-6* presents a summary of compliance costs for publicly- and privately-owned facilities, along with government administrative costs, for each regulatory option.

For Option 1, EPA estimates total annual compliance costs for government-owned Electric Generators to be about $10.8 million. NPDES permitting authorities are expected to incur another $3.7 million per year to implement this option for both Electric Generators and Manufacturers, resulting in a total annualized cost of approximately $14.5 million for State and local governments. The maximum compliance cost for government-owned Electric Generators in any one year under Option 1 is $18.9 million in 2036. The maximum administrative cost to NPDES authorities for administering this option is $4.1 million in 2018 and $1.6 million in 2015 for the Electric Generators and Manufacturers rule segments, respectively. Privately owned Electric Generators and Manufacturers are expected to incur annualized compliance costs of $427.4 million under this option, with a maximum of $0.8 billion in 2015 for Electric Generators and $0.4 billion in 2015 for Manufacturers.

Under Option 2, EPA estimates total annualized costs to State and local governments of $104 million, of which $102.3 million is the compliance cost to government-owned Electric Generators and $1.7 million is the cost of implementation of this option for Electric Generators and Manufacturers. The maximum compliance cost for government-owned Electric Generators in any one year is $334.9 million in 2021 and the maximum costs of administration to governments of this option for the Electric Generators and Manufacturers segments are $0.8 million in 2022 and $1.4 million in 2025, respectively. EPA estimates total annualized compliance costs of $4.3 billion to the private sector, with maximum compliance costs in any one year of $10.7 billion in 2021 for Electric Generators, and $0.8 billion in 2025 for Manufacturers.

Option 3 is expected to result in a total of $120.9 million in annualized costs to State and local governments, of which $120.1 million is the compliance cost to government-owned Electric Generators and $0.8 million is the cost of implementation of this option for Electric Generators and Manufacturers. The maximum compliance cost for government-owned Electric Generators in any one year is $389.0 million in 2021, and the maximum costs of administration of this option for the Electric Generators and Manufacturers segments are $0.7 million in 2022 and $1.0 million in 2025, respectively. The private sector is expected to incur total annualized compliance costs of $4.5 billion under Option 3, with a maximum one-year cost of $11.1 billion in 2021 for Electric Generators, and $1.4 billion in 2025 for Manufacturers.

Table 8-6: Summary of UMRA Costs (Millions; $2009)

Sector Incurring Costs	Total Annualized Cost			Maximum One-Year Cost		
	Facility Compliance Costs[a]	Government Administrative Costs[b]	Total	Facility Compliance Costs	Government Administrative Costs	Total
Option 1: IM Everywhere						
Electric Generators						
Government (excluding Federal)	$10.8	$2.5	$13.3	$18.9	$4.1	$23.0
Private	$362.1	N/A	$362.1	$756.4	N/A	$756.4
Manufacturers						
Government (excluding Federal)	$0.0	$1.2	$1.2	$0.0	$1.6	$1.6
Private	$65.3	N/A	$65.3	$371.3	N/A	$371.3
Option 2: IM Everywhere and EM for Facilities with DIF>125 MGD						
Electric Generators						
Government (excluding Federal)	$102.3	$0.6	$102.9	$334.9	$0.8	$335.7
Private	$4,204.1	N/A	$4,204.1	$10,748.8	N/A	$10,748.8
Manufacturers						
Government (excluding Federal)	$0.0	$1.1	$1.1	$0.0	$1.4	$1.4
Private	$139.3	N/A	$139.3	$832.5	N/A	$832.5
Option 3: I&E Mortality Everywhere						
Electric Generators						
Government (excluding Federal)	$120.1	$0.4	$120.5	$389.0	$0.7	$389.7
Private	$4,334.3	N/A	$4,334.3	$11,124.4	N/A	$11,124.4
Manufacturers						
Government (excluding Federal)	$0.0	$0.4	$0.4	$0.0	$1.0	$1.0
Private	$164.8	N/A	$164.8	$1,438.8	N/A	$1,438.8

a. Cost values for Electric Generators are lower than those presented in *Table 8-5* because they reflect a distribution over the compliance window, as described in Chapter 11: Assessment of Total Social Costs, thus changing the amount discounted in each year.

b. These values are slightly lower than those presented in *Table 8-3* because they reflect a distribution over the compliance window, as described in *Chapter 11: Assessment of Total Social Costs*, thus changing the amount discounted in each year.

Source: U.S. EPA analysis, 2010

9 Other Administrative Requirements

This chapter presents several other analyses in support of the Proposed Section 316(b) Existing Facilities Rule. These analyses address the requirements of Executive Orders and Acts applicable to this rule.

9.1 Executive Order 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The order defines a "significant regulatory action" as one that is likely to result in a rule that may:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or Tribal governments or communities; or
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; or
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, EPA determined that proposed 316(b) Existing Facilities Rule is an "economically significant regulatory action" because it is likely to have an annual effect on the economy of $100 million or more. As such, this action was submitted to the Office of Management and Budget (OMB) for review. Changes made in response to OMB suggestions or recommendations are documented in the docket for this action.

In addition, EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis is also described in *Chapter 12: Comparison of Social Cost and Monetized Benefits*.

9.2 Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 (59 FR 7629, February 11, 1994) requires that, to the greatest extent practicable and permitted by law, each Federal agency must make the achievement of environmental justice part of its mission. E.O. 12898 provides that each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures such programs, policies, and activities do not have the effect of (1) excluding persons (including populations) from participation in, or (2) denying persons (including populations) the benefits of, or (3) subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin.

The Proposed Existing Facilities Rule options require that the location, design, construction, and capacity of cooling water intake structures (CWIS) at 316(b) existing facilities reflect the best technology available for minimizing adverse environmental impact. For several reasons, EPA does not expect that this proposed rule will have an exclusionary effect, deny persons the benefits of the participation in a program, or subject persons to discrimination because of their race, color, or national origin. In fact, because EPA expects that this proposed rule will help to preserve the health of aquatic ecosystems located in reasonable proximity to 316(b) existing facilities, it believes that all populations, including minority and low-income populations, will benefit from improved environmental conditions as a result of this rule.

To meet the objectives of Executive Order 12898, EPA assessed whether the Proposed Existing Facilities Rule could distribute benefits among population sub-groups in a way that is significantly unfavorable to low income and minority populations. For this analysis, EPA reviewed the profile of populations that would be expected to benefit (the "benefit populations") from reduced impingement mortality and entrainment mortality of aquatic organisms as a result of the Proposed Existing Facilities Rule options. The analysis considered the benefit populations associated with all 700 facilities – 509 Electric Generators and 191 Manufacturers – that could potentially implement technology improvements as a result of the Proposed Existing Facilities Rule options.[201] The majority of these facilities are located inland, and in the eastern half of the United States. For this analysis, EPA defined the benefit population as (1) all individuals who live within a 50-mile radius of the facilities and (2) any additional anglers who live outside of the 50-mile facility buffer and within a 50-mile radius of the reaches nearest to the facilities. Individuals who live within a 50-mile radius of a facility may receive both use (e.g., recreational fishing or wildlife viewing) and non-use benefits from the improved aquatic ecosystem health of the area (e.g., satisfaction from knowing that the overall ecosystem health has improved). Anglers who live within the 50-mile buffer zone are likely to fish the affected water bodies and thus benefit from improved catch rates as a result of the proposed rule.[202]

For the assessment of the distribution of benefits among population sub-groups, EPA compared on a state-by-state basis, key demographic characteristics of the sub-state populations that are expected to benefit from the Proposed Rule with those demographic characteristics at the level of the state. If the demographic profile of the sub-state benefit population was found to be statistically similar to the demographic profile of the state and not exclusionary of minority and low income populations specifically, then the Proposed Rule would be assessed as *not* yielding an unfavorable distribution of benefits, from the perspective of the public policy principles of Executive Order 12898.

EPA completed the analysis of the socio-economic characteristics of the populations affected by the 316(b) Existing Facilities using the Fish Consumption Pathway (FCP) Module, which reports population estimates by socio-economic characteristics (U.S. EPA, 2004c).[203] The two demographic variables of interest for this EJ analysis are those within the FCP Module that best capture the low-income and minority aspects of the populations affected, which are:

- Annual household income: less than $20,000 (low-income) and at least $20,000 (*not* low-income);[204] and
- Race: white, black or African American, Asian or Native Hawaiian or Other Pacific Islander, American Indian and Alaska Native, and some other race.

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201 These are un-weighted explicitly and implicitly analyzed Electricity Generators and un-weighted explicitly analyzed Manufacturers with a compliance technology – Cooling Tower and/or IM technology – assigned under either of the three proposed options; these facility counts exclude baseline closures.

202 According to the US Fish and Wildlife Service, over 65% of anglers travel less than 50 miles one-way on a typical fishing trip (U.S. DOI, 2006).

203 The FCP Module is part of the Risk-Screening Environmental Indicators (RSEI) Model (U.S. EPA, 2004c).

204 Household data in the FCP Module are available for the following household income categories: less than $10,000; $10,000 to $19,999; $20,000 to $24,999; $25,000 to $29,999; $30,000 to $34,999; $35,000 to $39,999; $40,000 to $49,999; $50,000 to $74,999; $75,000 to $99,999; and more than $100,000. For this analysis as well as previous 316(b) rule analyses, these categories were combined into low- and *not* low-income groups based on the U.S. Department of Health and Human Services' poverty guidelines for a family of four living in the contiguous United States or D.C. The current (2009) poverty guideline is $22,050, which falls within the $20,000 to $24,999 income range (U.S. HHS, 2009). For the current analysis, EPA used $20,000 as the threshold for separating populations into low- and *not* low-income groups.

As described above, EPA assumed that the primary groups that benefit from the Proposed Rule are (1) all individuals who live within a 50-mile radius of the facilities and (2) any additional anglers who live outside of the 50-mile facility buffer and within a 50-mile radius of the reaches nearest to in-scope facilities.[205] To assess whether a lower income or minority group would experience a disproportionately low share of this Rule's use and non-use benefits in relation to the general population, the income and ethnicity of the affected populations were calculated in the FCP Module and analyzed statistically, using the following procedures:

1. The coordinate locations of each of the 316(b) sample facilities – Existing Generators and Manufacturers – were imported into the FCP Module.
2. The FCP module estimated the number of individuals residing within 50 miles of each facility.
3. The FCP module calculated the number of additional anglers that fish in the affected reaches but do not live within a 50-mile radius of the facility on the affected reach by estimating the number of anglers within a 50-mile radius of the affected reach and then subtracting the number of anglers within 50 miles of the facility that overlap with the 50-mile radius surrounding the affected reach.
4. Areas affected by the 316(b) Existing Facilities were spatially defined. They were then superimposed on the FCP Module's grid, and cell-level population data were used to define a demographic profile for the affected populations.
5. Once these population estimates were made, the data were exported and examined on a state-by-state basis.
6. To assess the presence of Environmental Justice concerns for the regulatory options, EPA compared the composition of the affected populations' income and race with the demographic composition of the state population as follows:

- Calculating a ratio of low- to *not* low-income individuals in the vicinity of in-scope facilities and comparing it to the averages within each affected state.
- Calculating a ratio of minority to white individuals in the vicinity of in-scope facilities and comparing it to the averages within each affected state.
- Testing the statistical significance of any *adverse* differences in these observed state-by-state relationships. That is, the differences are only of concern ("adverse") in the context of the Environmental Justice analysis when a calculated ratio for the benefit population is lower than the ratio for the general population. In effect, the analysis uses the observed relationships in individual states as a set of observations for testing the statistical significance of differences across all states.

If the demographic profiles of the benefit populations and general state populations are not statistically different and not exclusionary of low-income and minority populations specifically, then the proposed rule would be assessed as not yielding an unfavorable distribution of benefits, from the perspective of the public policy principles of Executive Order 12898.

9.2.1 Presence of Low Income Populations in the Benefit Population

Facilities in 48 states are expected to install technologies in response to the rule. *Table 9-1* on the following page reports the ratio of low- to *not* low-income individuals for the benefit population and the overall state population,

[205] Users of the resources were identified as the group that receives the largest benefits (including their receipt of non-use benefits) from the Proposed Rule. Non-users of the resource receive smaller benefits (non-use benefits only). Further, non-users could potentially include all individuals in a given state or other defined non-use benefit region, which could be larger than a state. Where a state is used as the defined non-use benefit region, the benefit population's characteristics would not differ from the state's overall population.

by state. Instances in which the ratio of low- to *not* low-income individuals for the *benefit population* is lower than this ratio for the *overall state population* indicate a lower rate of participation in the proposed regulation's expected benefits in the low income population group than in the general population.

As reported in *Table 9-1*, following page, the ratio of low income to *not* low-income populations in the benefit populations is lower than the ratio for the states' general populations in 38 of the 48 states, with an average difference of -0.03, which indicates a lower rate of participation in the proposed regulation's expected benefits in the low income population group than in the general population. The greatest negative difference, -0.14, occurs in West Virginia, followed by Maine and Kentucky, at -0.11. All other negative differences (35 of the 38 instances of negative difference) are less than 0.10 (as an absolute value). In no state would the low income population be *excluded or denied* participation in the benefits of the proposed regulation – that is, in all states the ratio is greater than zero for the benefit population. Although the ratio of low income to *not* low-income populations in the benefit populations is lower than the ratio for the general populations in a substantial number of states, the difference *across states* may not be statistically significant. The following paragraphs review the statistical analysis of these observed relationships.

Table 9-1: Low-Income Population Participation in 316(b) Existing Facilities Rule Benefits by State[a]

States	Ratio of Low-Income to *Not* Low-Income Individuals (< $20,000/year) / (>= $20,000/year)		
	Affected by Facilities	**State Total**	**Difference (Affected *minus* State)**
Alabama	0.40	0.45	-0.04
Alaska[b]	0.23	0.19	0.04
Arizona	0.50	0.31	0.19
Arkansas	0.42	0.45	-0.03
California	0.23	0.27	-0.04
Colorado	0.19	0.20	-0.02
Connecticut	0.25	0.21	0.04
Delaware	0.24	0.23	0.01
Florida	0.30	0.33	-0.02
Georgia	0.31	0.31	0.00
Hawaii[b]	0.18	0.22	-0.04
Illinois	0.24	0.25	-0.01
Indiana	0.24	0.27	-0.03
Iowa	0.27	0.30	-0.03
Kansas	0.25	0.28	-0.03
Kentucky	0.35	0.45	-0.11
Louisiana	0.46	0.51	-0.06
Maine	0.23	0.34	-0.11
Maryland	0.17	0.19	-0.02
Massachusetts	0.23	0.25	-0.02
Michigan	0.24	0.27	-0.03
Minnesota	0.18	0.21	-0.02
Mississippi	0.46	0.54	-0.08
Missouri	0.27	0.34	-0.07
Montana	0.36	0.40	-0.04
Nebraska	0.24	0.29	-0.04
New Hampshire	0.22	0.19	0.03
New Jersey	0.26	0.20	0.06
New Mexico	0.40	0.45	-0.04
New York	0.27	0.33	-0.06
North Carolina	0.31	0.34	-0.02
North Dakota	0.32	0.37	-0.05
Ohio	0.29	0.30	-0.01
Oklahoma	0.37	0.40	-0.03
Oregon	0.22	0.28	-0.06
Pennsylvania	0.26	0.32	-0.06
Rhode Island	0.24	0.34	-0.09
South Carolina	0.33	0.39	-0.06
South Dakota	0.38	0.38	0.01
Tennessee	0.37	0.37	0.01
Texas	0.30	0.35	-0.05
Utah	0.16	0.19	-0.03
Vermont	0.28	0.27	0.01
Virginia	0.23	0.24	-0.01
Washington	0.23	0.24	-0.01
West Virginia	0.42	0.56	-0.14
Wisconsin	0.20	0.24	-0.04
Wyoming	0.28	0.32	-0.05
Total	**0.27**	**0.30**	**-0.03**
Mean	**0.29**	**0.31**	**-0.03**
P-value[c]	0.07		

a. The "Affected Population" includes all individuals within 50 miles of an in-scope facility and any anglers within 50 miles of the reach nearest to these facilities.

b. Additional angler populations were not counted for Alaska and Hawaii facilities due to lack of RF1 network coverage in those states.

c. A p-value of 0.05 or less would support the hypothesis that the ratio of low-income to high-income individuals in areas affected by facilities is statistically different from the overall low-income to high-income ratios in states with facilities based on a 95% confidence interval.

To test the statistical significance of these observed state-by-state relationships, EPA compared the ratios of low- to high-income individuals affected by the 316(b) Existing Facilities to the ratios of low- to high-income individuals on a state-by-state basis using a one-tail *t*-test. This analysis tests whether the mean of the ratios for the affected populations is lower, in a statistically significant way, than that of the ratios for the states' general populations. The analysis is based on the following equation:

$$t = \frac{\overline{X}_a - \overline{X}_s}{\sqrt{\frac{s_a^2}{n_a} + \frac{s_s^2}{n_s}}} \tag{9-1}$$

Where:

t	=	t-statistic
$\overline{X}_a$	=	Mean ratio of low-income to other income (i.e., not low-income) individuals within the affected populations sample
$\overline{X}_s$	=	Mean ratio of low-income to other income individuals within the state populations sample
s_a	=	Variance of ratios of low-income to other income individuals within the affected populations sample
s_s	=	Variance of ratios of low-income to other income individuals within the state populations sample
n_a	=	Sample size of affected populations
n_s	=	Sample size of state populations.

From this *t*-test, the ratio of low-income to not low-income individuals in areas affected by 316(b) Existing Facilities is not significantly lower than the overall low-income to high-income ratios based on a p-value, or observed significance level of 0.07.[206] This finding indicates that lower income populations are not significantly underrepresented in the regulation's estimated "benefit population" as compared to the states' general populations. The proposed regulation thus does not systematically discriminate against, or exclude or deny participation of, the lower income population group in a way that would be contrary to the intent of E.O. 12898. In particular, EPA observes that the lower income population group is materially present in the benefit population for all states and, in all but three states, the amount by which the lower income population group is less present than in the overall population is very small. Indeed, in these states, the finding that low income populations are observed to be less present in the potential benefit population, would mean that this population group has systematically incurred less *damage* from the ongoing operation of cooling water intake structures at 316(b) Existing Facilities than the general population of these states. Finally, because *all* 316(b) Existing Facilities are subject to the proposed Existing Facilities regulation, there can be no systematic discrimination or exclusion of

[206] A p-value of 0.05 or less would support the hypothesis that the ratio of low-income to not low-income individuals in areas affected by 316(b) Existing Facilities is significantly different from the overall low-income to high-income ratios in states with 316(b) facilities based on a 95% confidence interval.

low income populations from participation in the rule's benefits, based, for example, on selection of only specific facilities to which the regulation would apply.

9.2.2 Assessment of Presence of Minority Populations in the Benefit Population

Table 9-2, following page, summarizes the ratio of non-white to white individuals affected by the 316(b) Existing Facilities by state. The state with the highest ratio of non-white to white individuals that are affected by the 316(b) Existing Facilities Rule is Hawaii, with a ratio of 2.08, while Wyoming has the lowest ratio of 0.05.

As reported in *Table 9-2*, non-white populations are, on average, more present in the estimated benefit population than in the states' general populations. On average, the ratio of *Non-White* to *White* individuals in the benefit population exceeds the ratio of Non-White to White individuals in the general populations by 0.04. Thus, on average, minority populations would be expected to participate by a somewhat greater extent than states' general populations in the proposed rule's expected benefits. Of the 48 states with in-scope facilities, the difference in the ratio is negative in 15 states (less presence by minority populations) and is positive in 26 states (greater presence by minority populations). In only one state (Alaska), does the negative difference exceed 0.1 (as an absolute value).

The ratios of non-white to white individuals in areas affected by the 316(b) Existing Facilities versus the ratios of non-white to white individuals on a state-by-state basis were compared to one another using, again, a one-tail *t*-test. Based on this *t*-test, the ratio of Total Non-White to White individuals in areas affected by 316(b) Existing Facilities is not significantly lower than the overall Total Non-White to White ratios in states with Existing Facilities based on a p-value of 0.28.[207]

9.2.3 Overall Finding

Based on this comparison of socio-economic characteristics of individuals affected by the 316(b) Existing Facilities to the affected states' overall populations, neither the low-income population nor minority populations are significantly less present in the estimated benefit population than in the states' general populations. As described in the preceding discussion, EPA's findings on these questions is modestly stronger for the participation of minority populations in the rule's benefits than for the participation of low income populations in the rule's benefits. However, in both instances, any findings *of lower participation* by the low-income population or minority populations are not statistically significant.

Thus, from this analysis, neither population group participates to a lower extent, in a statistically significant way, in the benefits of the proposed regulation than the general population in states with in-scope facilities. EPA judges that the proposed regulation does not systematically discriminate against, or exclude or deny participation of, the lower income population group or minority populations in a way that would be contrary to the intent of E.O. 12898. EPA thus concludes, overall, that the proposed regulation is consistent with the policy intent of E.O. 12898.

[207] A p-value of 0.05 or less would support the hypothesis that the ratio of non-white to white individuals in areas affected by 316(b) Existing Facilities is significantly different from the overall non-white to white ratios in states with Existing Facilities based on a 95% confidence interval.

Table 9-2: Minority Population Participation in 316(b) Existing Facilities Rule Benefits by State[a]

	Ratio of Non-White to White Individuals[b]														
	Affected by Facilities					State Total					Difference (=Affected *minus* State)				
States[c]	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White
Alabama	0.29	0.01	0.01	0.01	0.32	0.36	0.01	0.01	0.01	0.39	-0.07	0.00	0.00	0.00	-0.06
Alaska	0.02	0.02	0.14	0.03	0.22	0.05	0.06	0.22	0.05	0.37	-0.03	-0.03	-0.07	-0.02	-0.15
Arizona	0.02	0.01	0.67	0.07	0.77	0.04	0.02	0.07	0.17	0.30	-0.03	-0.01	0.60	-0.10	0.47
Arkansas	0.17	0.01	0.03	0.02	0.24	0.18	0.01	0.01	0.02	0.22	-0.01	0.00	0.02	0.00	0.02
California	0.14	0.25	0.02	0.32	0.73	0.11	0.17	0.02	0.30	0.60	0.03	0.08	0.00	0.03	0.13
Colorado	0.05	0.03	0.01	0.09	0.19	0.04	0.03	0.01	0.09	0.17	0.01	0.01	0.00	0.00	0.01
Connecticut	0.20	0.08	0.01	0.13	0.42	0.11	0.03	0.00	0.06	0.20	0.09	0.05	0.00	0.07	0.21
Delaware	0.24	0.04	0.00	0.04	0.32	0.26	0.03	0.01	0.04	0.33	-0.03	0.01	0.00	0.00	-0.01
Florida	0.19	0.02	0.01	0.05	0.27	0.19	0.02	0.01	0.05	0.27	0.00	0.00	0.00	0.00	0.00
Georgia	0.50	0.03	0.01	0.04	0.57	0.43	0.03	0.00	0.04	0.50	0.07	0.00	0.00	0.00	0.07
Hawaii	0.11	1.71	0.05	0.21	2.08	0.09	1.44	0.05	0.22	1.80	0.02	0.28	0.00	-0.01	0.28
Illinois	0.18	0.04	0.00	0.06	0.28	0.20	0.04	0.00	0.08	0.33	-0.02	-0.01	0.00	-0.02	-0.05
Indiana	0.18	0.04	0.00	0.06	0.29	0.09	0.01	0.00	0.02	0.13	0.09	0.03	0.00	0.04	0.16
Iowa	0.04	0.01	0.01	0.02	0.07	0.02	0.01	0.00	0.02	0.05	0.02	0.00	0.00	0.00	0.02
Kansas	0.11	0.02	0.02	0.03	0.18	0.06	0.02	0.01	0.04	0.14	0.05	0.00	0.01	-0.01	0.04
Kentucky	0.09	0.01	0.00	0.01	0.11	0.08	0.01	0.00	0.01	0.10	0.01	0.00	0.00	0.00	0.02
Louisiana	0.46	0.02	0.01	0.02	0.50	0.51	0.02	0.01	0.01	0.55	-0.06	0.00	0.00	0.00	-0.05
Maine	0.02	0.03	0.00	0.03	0.07	0.01	0.01	0.01	0.00	0.02	0.01	0.02	0.00	0.02	0.05
Maryland	0.32	0.07	0.01	0.04	0.44	0.41	0.06	0.01	0.03	0.51	-0.09	0.01	0.00	0.01	-0.07
Massachusetts	0.06	0.04	0.01	0.05	0.15	0.06	0.04	0.00	0.05	0.16	0.00	0.00	0.00	0.00	-0.01
Michigan	0.18	0.02	0.01	0.02	0.23	0.18	0.02	0.01	0.02	0.23	0.00	0.00	0.00	0.00	0.00
Minnesota	0.03	0.03	0.01	0.02	0.09	0.03	0.03	0.01	0.02	0.09	0.00	0.00	0.00	0.00	0.00
Mississippi	0.55	0.01	0.01	0.01	0.58	0.58	0.01	0.01	0.01	0.60	-0.03	0.01	0.00	0.00	-0.02
Missouri	0.14	0.02	0.01	0.02	0.18	0.12	0.01	0.01	0.01	0.15	0.02	0.00	0.00	0.00	0.03
Montana	0.00	0.01	0.05	0.02	0.07	0.00	0.01	0.07	0.01	0.09	0.00	0.00	-0.02	0.01	-0.01
Nebraska	0.05	0.01	0.01	0.03	0.10	0.04	0.01	0.01	0.03	0.10	0.01	0.00	0.00	0.00	0.00
New Hampshire	0.06	0.05	0.00	0.04	0.16	0.01	0.01	0.00	0.01	0.03	0.05	0.04	0.00	0.03	0.13
New Jersey	0.26	0.09	0.01	0.11	0.47	0.18	0.08	0.00	0.08	0.34	0.08	0.01	0.00	0.04	0.13
New Mexico	0.01	0.01	0.45	0.10	0.56	0.03	0.02	0.15	0.27	0.47	-0.02	-0.01	0.29	-0.17	0.09
New York	0.20	0.08	0.01	0.10	0.38	0.23	0.07	0.01	0.11	0.42	-0.03	0.00	0.00	-0.01	-0.04
North Carolina	0.31	0.02	0.02	0.03	0.37	0.30	0.02	0.02	0.03	0.37	0.01	0.00	0.00	0.00	0.00
North Dakota	0.01	0.01	0.03	0.01	0.06	0.01	0.01	0.06	0.01	0.08	0.00	0.00	-0.02	0.00	-0.02
Ohio	0.13	0.01	0.00	0.01	0.16	0.14	0.01	0.00	0.01	0.16	-0.01	0.00	0.00	0.00	0.00
Oklahoma	0.11	0.02	0.10	0.04	0.27	0.09	0.02	0.10	0.04	0.26	0.01	0.01	0.00	0.00	0.01
Oregon	0.03	0.05	0.01	0.06	0.15	0.02	0.03	0.02	0.06	0.13	0.00	0.02	0.00	0.00	0.02
Pennsylvania	0.15	0.03	0.00	0.02	0.20	0.11	0.02	0.00	0.02	0.16	0.03	0.01	0.00	0.00	0.04
Rhode Island	0.07	0.05	0.01	0.05	0.17	0.05	0.03	0.01	0.07	0.16	0.02	0.02	0.00	-0.02	0.01
South Carolina	0.38	0.02	0.01	0.02	0.43	0.43	0.01	0.00	0.01	0.46	-0.05	0.00	0.01	0.01	-0.03
South Dakota	0.00	0.01	0.04	0.01	0.06	0.01	0.01	0.10	0.01	0.12	0.00	0.00	-0.05	0.00	-0.06
Tennessee	0.18	0.01	0.00	0.01	0.21	0.20	0.01	0.00	0.01	0.23	-0.01	0.00	0.00	0.00	-0.01
Texas	0.18	0.04	0.01	0.16	0.39	0.15	0.03	0.01	0.16	0.36	0.03	0.01	0.00	-0.01	0.03
Utah	0.01	0.03	0.01	0.05	0.10	0.01	0.02	0.02	0.05	0.09	0.00	0.01	-0.01	0.00	0.01
Vermont	0.04	0.02	0.00	0.05	0.11	0.01	0.01	0.00	0.01	0.02	0.04	0.01	0.00	0.04	0.08
Virginia	0.35	0.05	0.01	0.03	0.45	0.26	0.05	0.01	0.03	0.35	0.09	0.00	0.00	0.00	0.10
Washington	0.04	0.06	0.02	0.07	0.19	0.04	0.07	0.02	0.06	0.19	0.00	-0.01	0.00	0.01	0.00

Table 9-2: Minority Population Participation in 316(b) Existing Facilities Rule Benefits by State[a]

	Ratio of Non-White to White Individuals[b]														
	Affected by Facilities					State Total					Difference (=Affected *minus* State)				
States[c]	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White	Black	Asian & Pacific Islander	American Indian	Other	Total Non-White
West Virginia	0.06	0.01	0.00	0.00	0.07	0.03	0.00	0.00	0.00	0.04	0.03	0.00	0.00	0.00	0.03
Wisconsin	0.10	0.05	0.01	0.07	0.22	0.06	0.02	0.01	0.02	0.11	0.04	0.03	0.00	0.05	0.11
Wyoming	0.01	0.01	0.01	0.03	0.05	0.01	0.01	0.02	0.03	0.07	0.00	0.00	-0.01	0.00	-0.01
Total	**0.18**	**0.05**	**0.01**	**0.07**	**0.30**	**0.16**	**0.05**	**0.01**	**0.08**	**0.30**	**0.02**	**0.00**	**0.00**	**-0.01**	**0.01**
Mean	**0.15**	**0.07**	**0.04**	**0.05**	**0.31**	**0.14**	**0.06**	**0.02**	**0.05**	**0.27**	**0.01**	**0.01**	**0.02**	**0.00**	**0.04**
P-values[d]	**0.39**	**0.40**	**0.20**	**0.50**	**0.28**										

a. The "Affected Population" includes all individuals within 50 miles of an in-scope facility and any anglers within 50 miles of the reach nearest these facilities.

b. The U.S. Census Bureau (U.S. Census Bureau, 2001) defines these racial categories as follows: "'White' refers to people having origins in any of the original peoples of Europe, the Middle East, or North Africa. It includes people who indicated their race or races as 'White' or wrote in entries such as Irish, German, Italian, Lebanese, Near Easterner, Arab, or Polish. 'Black or African American' refers to people having origins in any of the Black racial groups of Africa. It includes people who indicated their race or races as 'Black, African Am., or Negro,' or wrote in entries such as African American, Afro American, Nigerian, or Haitian. 'American Indian and Alaska Native' refers to people having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment. It includes people who indicated their race or races by marking this category or writing in their principal or enrolled tribe, such as Rosebud Sioux, Chippewa, or Navajo. 'Asian' refers to people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent. It includes people who indicated their race or races as 'Asian Indian,' 'Chinese,' 'Filipino,' 'Korean,' 'Japanese,' 'Vietnamese,' or 'Other Asian,' or wrote in entries such as Burmese, Hmong, Pakistani, or Thai. 'Native Hawaiian and Other Pacific Islander' refers to people having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands. It includes people who indicated their race or races as 'Native Hawaiian,' 'Guamanian or Chamorro,' 'Samoan,' or 'Other Pacific Islander,' or wrote in entries such as Tahitian, Mariana Islander, or Chuukese. 'Some other race' was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto Rican, or Cuban) are included in the Some other race category."

c. Additional angler populations were not counted for Alaska and Hawaii facilities due to lack of RF1 network coverage in those states.

d. A p-value of 0.05 or less would support the hypothesis that the ratio of non-white to white individuals in areas affected by facilities is statistically different from the overall non-white to white ratios in states with facilities based on a 95% confidence interval.

9.3 Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks

Executive Order 13045 (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866 and (2) concerns an environmental health or safety risk that EPA has reason to believe might have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health and safety effects of the planned rule on children and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. This proposed rule is an economically significant rule as defined under Executive Order 12866. However, it does not concern an environmental health or safety risk that would have a disproportionate effect on children. This regulation establishes requirements for cooling water intake structures to protect aquatic organisms. Therefore, EPA determined that the Proposed 316(b) Existing Facilities Rule is not subject to Executive Order 13045.

9.4 Executive Order 13132: Federalism

Executive Order 13132 (64 FR 43255, August 10, 1999) requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

Under section 6 of Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments or unless EPA consults with State and local officials early in the process of developing the regulation. EPA also may not issue a regulation that has federalism implications and that preempts State law, unless the Agency consults with State and local officials early in the process of developing the regulation.

This proposed rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. EPA expects an average annual burden of 21,785 hours with total average annual cost of $1.1 million under Option 1, 6,538 hours and $353,000 under Option 2, and 20,395 hours and $1.0 million under Option 3, for States to collectively administer this rule during the compliance period. After the initial compliance period, EPA expects an average annual burden of 23,550 hours with an average annual cost of $1.2 million for Option 1, 2,528 hours and $179,000 for Option 2, and 16,988 hours and $848,000 for Option 3. EPA has identified 47 Existing Facilities generators that are owned by State or local government entities. The estimated average annual compliance cost incurred by these facilities is approximately $452,000 per facility under Option 1, $4.5 million under Option 2, and $1.1 million under Option 3. Based on EPA's preferred Option – Option 2 – the Proposed Rule does not have federalism implications.

The national cooling water intake structure requirements will be implemented through permits issued under the NPDES program. Forty-six States and territories are currently authorized pursuant to section 402(b) of the CWA, to implement the NPDES program. In States not authorized to implement the NPDES program, EPA issues NPDES permits. Under the CWA, States are not required to become authorized to administer the NPDES program. Rather, such authorization is available to States if they operate their programs in a manner consistent with section 402(b) and applicable regulations. Generally, these provisions require that State NPDES programs include requirements that are as stringent as Federal program requirements. States retain the ability to implement requirements that are broader in scope or more stringent than Federal requirements. (See Section 510 of the CWA.)

EPA does not expect the proposed rule to have substantial direct effects on either authorized or nonauthorized States or on local governments because it will not change how EPA and the States and local governments interact or their respective authority or responsibilities for implementing the NPDES program. This rule establishes national requirements for 316(b) Existing Facilities with cooling water intake structures. NPDES-authorized States that currently do not comply with the proposed regulations based on this rule might need to amend their regulations or statutes to ensure that their NPDES programs are consistent with Federal section 316(b) requirements. (See 40 CFR 123.62(e).) For purposes of this rule, the relationship and distribution of power and responsibilities between the Federal government and the State and local governments are established under the CWA (e.g., sections 402(b) and 510); nothing in this rule alters that. Thus, the requirements of section 6 of the Executive Order do not apply to this rule.

9.5 Executive Order 13158: Marine Protected Areas

A Marine Protected Area (MPA) is "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein" (Executive Order No. 13158, 2001). Because MPAs focus on the preservation and maintenance of cultural and natural resources, and/or sustainable production, the ecological importance of MPAs varies widely (NMPAC, 2006). In some states, the majority of coastal waters are found within MPAs (e.g., Massachusetts, Hawaii). Consequently, measuring the impact of CWISs on the entire universe of MPAs is unlikely to provide a realistic estimate of the nonuse values associated with reducing I&E losses. For this reason, EPA focused on MPAs within the National Estuary Program (NEP) to examine public spending on the conservation of natural resources and sustainable production. The NEP was established in the 1987 amendments to the Clean Water Act (CWA) because the "Nation's estuaries are of great importance to fish and wildlife resources and recreation and economic opportunity [and because maintaining] the health and ecological integrity of these estuaries is in the national interest" (Water Quality Act, 1987). In addition to the 28 estuaries designated under the NEP (U.S. EPA, 2008c), EPA included facilities found in Chesapeake Bay (itself protected by the Chesapeake Bay Program [CBP]).

Substantial federal and state resources have been directed to the NEP and Chesapeake Bay Program to enhance conservation of and knowledge about estuaries. From 2005 to 2007, NEP budgeted $965 million to protect and restore aquatic habitat, conduct outreach and research, upgrade stormwater infrastructure, and implement other priority actions to benefit the health of the 28 constituent estuaries. Approximately $130 million (13.5 percent) of the funding was designated for restoration programs (EPA, 2008a). Between fiscal years 1995 and 2004, federal and state governments spent an estimated $3.7 billion in direct funding to restore the Chesapeake Bay (GAO, 2005), with an additional $131 million in direct spending in fiscal year 2005 (CBP, 2007). Moreover, recent governmental action is likely to increase federal spending on restoration efforts in the future (Executive Order No. 13508, 2009). All told, these expenditures reflect high public values for restoring (or protecting) the biological integrity of these ecosystems.

A total of 116 section 316(b) facilities exist on 75 waterbodies within MPAs designed to preserve natural resources and/or to ensure sustainable production (NOAA, 2010; *Figure 9-3*; *Table 9-6*). Although these facilities are found in fresh, brackish, and marine waters, and in all regions of the country except California, the vast majority of 316(b) facilities occurring within MPAs occur in coastal waters, and are most highly concentrated in the Northeastern United States (i.e. both coastal and inland facilities) (*Figure 9-4*; *Table 9-6*). Under Option 1, 87 percent of in-scope facilities found within MPAs obtain reductions in impingement mortality, while entrainment mortality is not necessarily reduced at any facilities (*Table 9-6*). Under Options 2 and 3, impingement mortality is reduced at 92 and 97 percent of 316(b) facilities in MPAs, while the addition of closed-cycle cooling towers results in reduced entrainment mortality at 72 and 92 percent of in-scope facilities found in MPAs, respectively (*Table 9-6*).

Figure 9-5: In-scope Facilities with CWISs Located In Marine Protected Areas

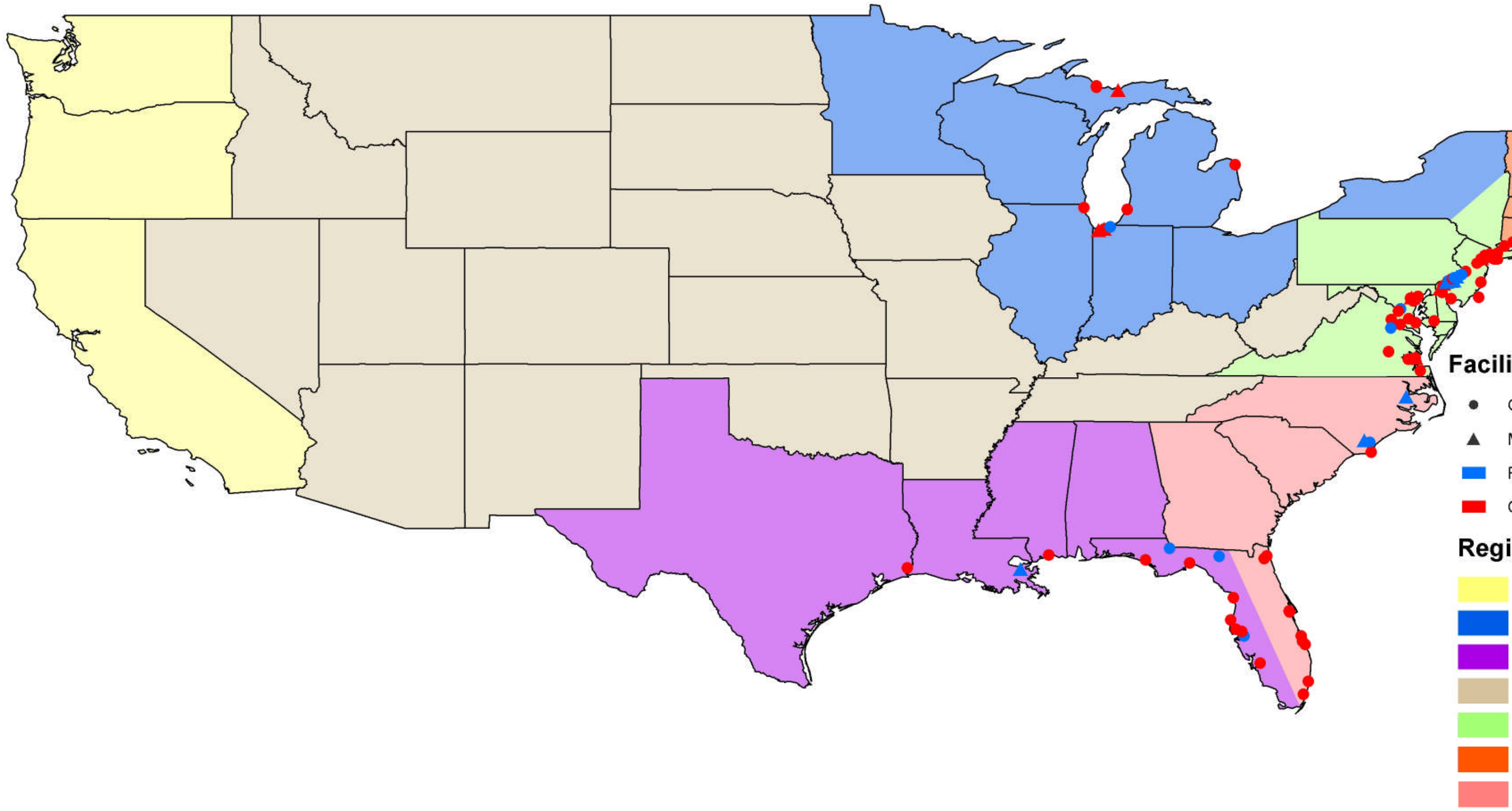

Table 9-6: 316(b) Facilities in Marine Protected Areas, and Improvements in IM&EM Technologies by Policy Option

Benefits Region	Affected Waterbodies	Baseline 316(b) Facilities	Number of Facilities with Improved Technologies					
			Option 1		Option 2		Option 3	
			IM	EM	IM	EM	IM	EM
California	0	0	0	0	0	0	0	0
North Atlantic	18	9	17	0	19	16	20	20
Mid-Atlantic	24	10	40	0	41	31	43	40
South Atlantic	5	23	10	0	10	9	10	9
Gulf of Mexico	9	44	8	0	10	10	10	10
Great Lakes	3	20	8	0	9	8	9	9
Inland	14	10	18	0	18	9	20	18
Total	**75**	**118**	**103**	**0**	**109**	**85**	**114**	**108**

Source: U.S. EPA Analysis, 2010

9.6 Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175 (65 FR 67249, November 6, 2000) requires EPA to develop an accountable process to ensure “meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.” “Policies that have tribal implications” is defined in the Executive Order to include regulations that have “substantial direct effects on one or more Indian Tribes, on the relationship between the Federal government and the Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes.”

The Proposed Existing Facilities Rule does not have tribal implications. It will not have substantial direct effects on tribal governments, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes, as specified in Executive Order 13175. The national cooling water intake structure requirements would be implemented through permits issued under the NPDES program. No tribal governments are currently authorized pursuant to section 402(b) of the CWA to implement the NPDES program. In addition, EPA’s analyses show that no facility subject to the proposed regulation is owned by tribal governments and thus this regulation does not affect Tribes in any way in the foreseeable future. Consequently, Executive Order 13175 does not apply to this regulation.

9.7 Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

The OMB implementation memorandum for E.O. 13211 outlines specific criteria for assessing whether a regulation constitutes a “significant energy action” and would have a “significant adverse effect on the supply, distribution or use of energy.” [208] Those criteria include:

- Reductions in crude oil supply in excess of 10,000 barrels per day;
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million mcf per year;

[208] Executive Order 13211 was issued May 18, 2002. The Office of Management and Budget later released an Implementation Guidance memorandum on July 13, 2002.

- Reductions in electricity production in excess of 1 billion kilowatt-hours per year, or in excess of 500 megawatts of installed capacity;
- Increases in the cost of energy production in excess of 1 percent;
- Increases in the cost of energy distribution in excess of 1 percent;
- Significant increases in dependence on foreign supplies of energy; or
- Having other similar adverse outcomes, particularly unintended ones.

Of the potential significant adverse effects on the supply, distribution, or use of energy (listed above) only four apply to the 316(b) Existing Facilities Rule. Through increases in the cost of generating electricity and shifts in the types of generators employed, the Existing Facilities Rule might affect (1) the production of electricity, (2) the amount of installed capacity, (3) the cost of energy production, and (4) the dependence on foreign supplies of energy. EPA used the results from the electricity Market Model Analysis (see *Chapter 6: Market Model Analysis*) to analyze this rule for each of these potential effects.

9.7.1 Impact on Electricity Generation

The Market Model Analysis (*Chapter 6*) predicts in the aggregate, that the electricity market will generate 29,304,900 KWh less electricity in 2028 (the steady-state post-compliance year) under the preferred regulatory case (IM Everywhere) than it would in the base case. This is significantly less than the 1 billion KWh reduction required for the regulation to be considered a significant energy action. EPA does recognize that generation from the affected in-scope facilities may be reduced more substantially, though this reduction is offset by increased production from other facilities, resulting in a small net decrease in overall production.

9.7.2 Impact on Electric Generating Capacity

From the Market Model Analysis, EPA identified 39 in-scope generating units, representing 9,874 MW of generating capacity that are forecast by IPM to retire by 2028 under the preferred option (IM Everywhere). The Market Model Analysis predicts that another 30 in-scope generating units representing 8,819 MW of capacity will remain open in the policy case, after being predicted to retire in the base case. This results in a net loss of only 1,055 MW of generating capacity from in-scope units, which constitutes only 0.2 percent of total baseline in-scope capacity; consequently, EPA does not believe that the Proposed Existing Facilities Rule constitutes a “significant energy action” in terms of estimated potential effects on electric generating capacity.

Moreover, looking at the total capacity of the electric power industry as forecast by the Market Model Analysis for the year 2028, the policy case for the preferred option actually shows 585 MW *more* capacity than in the base case. Therefore, although the analysis predicts a loss of capacity, however small, for units subject to the Proposed Existing Facilities Rule, it projects an overall increase in the total generating capacity of the industry.

EPA does not consider the loss of capacity to technology installation downtime to fall within the scope of E.O. 13211 because this loss is temporary. However, even if it did, it would be non-consequential. EPA estimates temporary loss of capacity due to technology installation downtime to be 318 MW each year during the five-year compliance window of 2013 though 2017 under the preferred option (see *Chapter 3: Development of Costs for Regulatory Options*). A more detailed analysis of the impact of downtime on electricity reliability at any given point during the compliance period can be found in *Appendix 3B: Downtime Impact of Capacity Availability*.

From this assessment, EPA judges that the preferred regulatory option does not constitute a “significant energy action” and would not cause a “significant adverse effect” based on the criterion of reduced electricity generating capacity.

9.7.3 Cost of Energy Production

This Proposed Existing Facilities Rule will not significantly affect the cost of electricity production in either the short or the long run. In the short run (2015), changes in energy production costs are expected to vary between a drop of 0.003 percent in WECC (due to lower fuel costs) and an increase of 0.12 percent in RFC. EPA estimates that two regions – ERCOT and MRO - will experience decreases in their energy production costs in the short run, while the other six regions will experience increases. In the long-run (2028), six NERC regions are expected to experience a slight drop in electricity prices of no more than 0.03 percent occurring in WECC; the remaining two NERC regions – NPCC and RFC – are expected t o experience a slight increase in electricity prices of 0.12 percent and 0.06 percent, respectively. Consequently, no region will experience energy price increases of more than 1 percent as a result of the Proposed Existing Facilities Rule in either the short or the long run.

9.7.4 Dependence on Foreign Supply of Energy

EPA's electricity market analysis did not allow for an explicit consideration of the effects of the Proposed Rule on foreign imports of energy. However, this Rule only affects electricity generators, which are generally not subject to significant foreign competition. Only Canada and Mexico are connected to the U.S. electricity grid, and transmission losses are substantial when electricity is transmitted over long distances. In addition, the effects on installed capacity and electricity prices are estimated to be small. EPA therefore concludes that this Proposed Rule will not significantly increase dependence on foreign supplies of energy.

9.7.5 Overall E.O. 13211 Finding

From these analyses, EPA concludes that the Proposed Existing Facilities Regulation will not have a *significant adverse effect* at a national or regional level. As a result, EPA did not prepare a Statement of Energy Effects. For more detail on effects of this proposed rule on electricity markets, see *Chapter 6: Electricity Market Model Analysis*.

9.8 Paperwork Reduction Act of 1995

The Paperwork Reduction Act of 1995 (PRA) (superseding the PRA of 1980) is implemented by the Office of Management and Budget (OMB) and requires that agencies submit a supporting statement to OMB for any information collection that solicits the same data from more than nine parties. The PRA seeks to ensure that Federal agencies balance their need to collect information with the paperwork burden imposed on the public by the collection.

The definition of "information collection" includes activities required by regulations, such as permit development, monitoring, record keeping, and reporting. The term "burden" refers to the "time, effort, or financial resources" the public expends to provide information to or for a Federal agency, or to otherwise fulfill statutory or regulatory requirements. PRA paperwork burden is measured in terms of annual time and financial resources the public devotes to meet one-time and recurring information requests (44 U.S.C. 3502(2); 5 C.F.R. 1320.3(b)). Information collection activities may include:

- reviewing instructions;
- using technology to collect, process, and disclose information;
- adjusting existing practices to comply with requirements;
- searching data sources;
- completing and reviewing the response;
- and transmitting or disclosing information.

Agencies must provide information to OMB on the parties affected, the annual reporting burden, the annualized cost of responding to the information collection, and whether the request significantly impacts a substantial number of small entities. An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a currently valid OMB control number.

The OMB previously approved information collection requirements contained in the now suspended Phase II Rule and the Final Phase III Rule under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. and assigned OMB control numbers DCN 6-0001 and DCN 9-0002, respectively. These Rules required applicable facilities to perform several data-gathering activities as part of the permit renewal application process. The information collection requirements included a one-time burden associated with the initial permit application and those activities associated with monitoring and reporting after the permit is issued. The total average annual burden of the information collection requirements associated with the suspended Phase II Final Rule was estimated at 1,700,392 hours. The annual average reporting and record keeping burden for the collection of information by facilities responding to the section 316(b) Phase II Existing Facility Final Rule was estimated to be 5,428 hours per respondent (i.e., an annual average of 1,595,786 hours of burden divided among an anticipated annual average of 294 facilities). The Director reporting and record keeping burden for the review, oversight, and administration of the rule was estimated to average 2,615 hours per respondent (i.e., an annual average of 104,606 hours of burden divided among an anticipated 40 States on average per year).

The Proposed Existing Facilities Rule would also require affected facilities to perform information collection. Like the previous 316(b) rules, the proposed rule would subject facilities to both one-time and continuing requirements. The proposed rule would only require all facilities to monitor for and comply with impingement mortality and entrainment limits. The proposed rule would impose different and more onerous information collection requirements on facilities that would elect to comply with one of the compliance alternatives. EPA notes that no facility is required to use these compliance alternatives and their requirements unless the facility chooses. The proposed information reporting requirements under these compliance alternatives include submission of an initial certification statement and annual certification statements thereafter, and maintenance of on-site compliance paperwork.

A comparison of the proposed requirements and those previously approved by OMB for the suspended Phase II rule and the Phase III Final rule demonstrates that the proposed requirements (whether a facility would elect to comply with one of the compliance alternatives or not) are much less burdensome than those associated with the existing OMB approval. As a result, EPA judges that the existing OMB approved ICR is sufficient to address any of the information collection requirements proposed.

9.9 National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act (NTTAA) of 1995, Pub L. No. 104-113, Sec. 12(d) directs EPA to use voluntary consensus standards in its regulatory activities unless doing so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standard bodies. The NTTAA directs EPA to provide Congress, through the Office of Management and Budget (OMB), explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rule does not involve such technical standards. Therefore, EPA is not considering the use of any voluntary consensus standards.

10 Economy-Wide Output and Employment Effects

EPA estimated the economy-wide output and employment effects of the proposed regulation, accounting for inter-industry linkages at the national level. These economic effects are classified into categories of direct, indirect, and induced effects:

- *Direct effects* include changes in jobs, income, and economic activity associated with the expenditures to achieve compliance with the regulation – for example, installation and operation of compliance technology, and the economic activity effects associated with compliance cost-related price increases.
- *Indirect effects* refer to changes in jobs, income, and economic activity in upstream-linked sectors in the economy that supply materials and services to the directly affected sectors.
- *Induced effects* refer to changes in jobs, income, and economic activity that are induced by the spending of those persons directly and indirectly affected by the project. These effects occur when the income generated by the direct and indirect effects is re-spent in the local economy.

Total economy-wide effects refer to the sum of the direct, indirect, and induced effects. For example, cost outlays to comply with the regulation lead to increased production from those sectors that provide compliance services. This constitutes a direct effect (i.e., a change in demand) due to the regulation. Those sectors, in turn, require inputs from other sectors to produce any given unit of output. The total change in economic activity, accounting for industry linkages, derived from the outlays required for compliance may be thought of as the total increase in the demand for society's resources necessary for compliance to occur, where the value-added components of all the increased activity would be equal to the total cost of compliance.

The key direct effect concepts modeled in this analysis include:

- *Compliance technology and other initial/one-time resource cost outlays*, which include capital outlays for compliance technology, initial permitting costs, and the cost of downtime. These cost outlays primarily occur during the initial compliance period for a given regulatory option. However, some of the compliance technologies have shorter useful lives than the overall analysis period, and these otherwise initial/one-time type outlays may be repeated during the analysis period.
- *Recurring resource cost outlays for compliance*, which may include permit renewal costs, O&M costs, monitoring costs, and energy penalties – depending on the regulatory option under consideration. Recurring costs include all costs that, once initiated, continue with some frequency for the duration of the cost analysis period.

  The initial/one-time and recurring resource costs outlays for compliance are taken directly from the analysis of total social cost, which accounts for costs on an explicit year-by-year basis.
- *Cost recovery in the electricity sector*, which refers to the expectation that in-scope Electric Generators will attempt to recover the cost of the regulation through increased electricity rates. Increased electricity rates for residential and business consumers constitute a direct effect on these entities. Cost recovery in the electricity sector is assumed to occur annually over the entire cost analysis period for a given regulatory option.
- *Cost absorption in manufacturing sectors*, which refers to the expectation that increased costs incurred by in-scope Manufacturers will be absorbed by those entities, manifesting as a reduction in lost profit and ultimately household income. EPA judges that it is reasonable to assume that Manufacturers will absorb all (or a substantial portion) of their costs since these entities constitute a small fraction of the total value

of economic activity in their respective sectors.[209] The effect of total costs absorbed by manufacturing entities is modeled on an annualized basis over the entire cost analysis period for a given regulatory option (i.e., a concept analogous to treatment of electricity sector rate recovery).

EPA performed the analysis of total economy-wide effects for the three regulatory options discussed elsewhere in this document:

- Option 1: IM Everywhere
- Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD
- Option 3: I&E Mortality Everywhere.

For this analysis, EPA assessed economic effects over the same cost analysis period as used in the social cost analysis (see *Chapter 11: Assessment of Total Social Costs*): that is, from rule promulgation at 2012 through 2056, or 45 years of compliance costs. As described more fully in *Chapter 11*, the 45 years of compliance costs reflects the following:

- Rule promulgation and first incurrence of compliance-related costs at 2012
- Achievement of compliance for IM-only facilities, beginning year 2013 and ending 2017
- Achievement of compliance for non-nuclear Electric Generators installing cooling towers, assumed for analysis purposes to begin in year 2018, and ending not later than 2022
- Achievement of compliance for Manufacturers and nuclear Electric Generators installing cooling towers, assumed for analysis purposes to begin in year 2023, and ending not later than 2027
- Beginning of steady state compliance for all facilities in 2027 (the last year in which any facility is expected to achieve compliance) and continuing for 30 compliance years, to 2056. The 30 years of compliance reflects the estimated useful life of the longest-lived compliance technology equipment expected to be implemented in response to any of the regulatory options. Note that the first year of steady state compliance for all facilities overlaps with the last year in which any facility would be expected to achieve compliance under any of the regulatory options.

Because the initial/one-time resource cost outlays are concentrated in the nearer term years following rule promulgation while the recurring cost outlays and cost recovery/cost absorption effects occur on a more steady state basis over the life of the analysis, the profile of effect for these broad categories of outlay/cost recovery event varies substantially over time. For this reason, EPA reviews the cost and effect concepts profiles for these two categories of outlay/cost recovery event separately below.

EPA used an input-output-based multiplier modeling approach to estimate total output and employment effects from the direct effects for each option. In this approach, the value of each direct effect is estimated on an average annual basis for the time period over which the given effect is expected to occur under the regulatory option being considered.[210] All dollar values presented in the analysis are in units of millions of 2009 dollars. After estimating the annual direct effect values, EPA then used the 60-sector input-output multiplier framework from the U.S. Bureau of Economic Analysis' 2006 Regional Input-Output Modeling System (RIMS II) to estimate the total economy effects – also on an annual basis – due to a given direct effect. Multiplying the RIMS multiplier for a directly affected industry sector by its assigned direct effect value yields an estimate of the total economic effect.

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209 An alternative case would model this direct effect by assuming these costs are passed-through by Manufacturers to their customers, causing a demand elasticity response, and ultimately, a reduction in Manufacturers output (assuming some degree of elasticity in consumers' response to increased prices). EPA did not make this assumption for this primary analysis, since the expectation for cost pass-through for affected manufacturing entities is low (see *Appendix 4A: Cost Pass-Through Analysis*).

210 Average annual effects are calculated simply as the aggregate value of a given effect divided by the number of years in the time period applicable to that effect.

Lastly, annual effects are summed for each year of each time period. The RIMS II multipliers for a given direct effect sector are defined as follows:

- *Economic output multiplier.* The output multiplier for a given direct effect sector represents the total dollar output effect that occurs in all sectors for each dollar of final demand effect in the direct effect sector.
- *Employment multiplier.* The employment multiplier for a given direct effect sector represents the total potential job effect that occurs in all sectors for each $1 million of output delivery to final demand in the direct effect sector.

For reasons outlined below, this analysis likely overstates economic impacts. The extent of likely overstatement increases as the estimates are extended farther into the future – i.e., during the long-term steady-state periods of rule compliance and analysis described above. The reasons for overstatement include:

- The input-output based multiplier analysis methodology – by definition – embeds a Leontief, fixed-coefficients model of economic activity. Within this framework, the mix of inputs required to produce a unit of economic activity in a given sector is fixed. In this way, an input-output multiplier approach does not account for potential adjustments to the production framework, such as input substitutions or productivity changes (e.g., technological change over time), which may reasonably occur in response to the rule's cost and price effects. Such changes would potentially moderate the cost and economic impacts estimated in this analysis. In addition, the opportunity for, and likelihood of, these changes increase over time.
- Similarly, on the demand side, this analysis approach does not account for potential elasticity and dynamic behavioral responses over time by affected entities. For example, the analysis of impacts due to cost recovery through electricity rates is based on a level of cost recovery assuming that the profile of electricity consumption and demand characteristics do not change over time. Again, such changes could moderate the cost and economic impacts estimated in this analysis, and the opportunity for these changes increases over time.
- With respect to both points above, the degree to which these responses would potentially affect analysis results increases as one looks farther into the future. The multipliers used in this analysis reflect the structure, composition, and activity profile of the U.S. economy during 2006. And, elasticity/behavior responses are generally greater in the long-run than in the short-run. The combination of these factors means that the accuracy of the results of this analysis declines as the time horizon lengthens. In addition, the likelihood that the results are over-estimates increases over time.

Overall, the preceding observations point to a likelihood that the analysis findings of *longer term* economic and employment effects – for example, resulting from increased electricity production costs, associated electricity price effects and impacts on consumers and the total economy – overstate, perhaps substantially, the impact of the regulation on economic output and employment.[211]

Table 10-1 presents the output and employment multipliers used in this analysis; the multipliers vary by industry defined in the North American Industry Classification (NAICS) framework at the 3-digit NAICS level. The following *Sections 10.1 – 10.4* of this chapter detail the analysis for each direct effect category. *Section 10.5* presents the analysis results.

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[211] Despite these limitations, this analysis approach provides important insights and value in this analysis. Notably, the accessibility of the main data sources required for the analysis makes it possible to produce a conservative estimate of economic impacts without conducting relatively high level-of-effort modeling exercises. In addition, the level of industrial detail desired for this analysis can be captured by the RIMS multipliers, whereas other general equilibrium modeling approaches generally do not provide a sufficient level of industry disaggregation. Additional uncertainties and caveats to this analysis are summarized in *Section 10.6*.

Table 10-1: Key RIMS 2006 Economic Impact Multipliers

RIMS Economic Sector	Output Multiplier	Employment Multiplier
Utilities (NAICS 221)	2.21	8.45
Construction (NAICS 231)	3.23	25.06
Paper manufacturing (NAICS 322)	3.08	16.40
Chemical manufacturing (NAICS 325)	2.98	13.27
Petroleum and coal products manufacturing (NAICS 324)	2.29	7.94
Primary metal manufacturing (NAICS 331)	2.67	12.45
Food, beverage, and tobacco product manufacturing (NAICS 311, 312)	3.45	19.97
Households (NAICS 814)	2.32	17.58

Source: U.S. EPA Analysis, 2010

10.1 Economic Effects Due to Initial/One-Time Compliance Outlays

As described above, the initial/one-time compliance outlays include capital outlays for compliance technology, initial permitting costs, and the cost of downtime. These outlays occur initially during the post-promulgation period based on the compliance schedule requirements of a given regulatory option and the compliance technology being installed to meet compliance requirements. In addition, these outlays may recur during the analysis period as specific compliance technology installations reach the end of their useful life and are assumed to be reinstalled by facilities. EPA assumed that all technologies *except cooling towers* would be reinstalled upon reaching the end of the technology's useful life, with additional technology outlays occurring in the year of reinstallation. In those instances in which the end of the analysis period would be reached before the reinstalled technology had run its full useful life, EPA prorated the technology outlay based on the number of years remaining the analysis period relative to the estimated useful life of the technology.

These initial/one-time cost outlays occur *initially* during the years following rule promulgation and the economic effects of these outlays are therefore concentrated during these initial compliance periods. The intervals of years over which the initial compliance outlays occur vary by regulatory option based on the compliance schedule specified for in-scope facilities under the option. In addition, within a given regulatory option, the cost outlay values vary over time based on the compliance schedule requirements applicable to specific categories of facilities. Finally, the specific cost items incurred – e.g., technology installation, initial permitting, installation downtime – also vary by option and by facility type. For this analysis, EPA assumed the following profile of outlays for the initial compliance outlays:

- Under Option 1: IM Everywhere, all Electric Generators and Manufacturers are expected to incur initial technology installation costs, downtime costs, and initial permitting costs during the period 2012 - 2017.
- Under Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD, facilities installing only IM technology incur initial costs during the period 2012 - 2017 (like Option 1), while facilities that install cooling towers incur initial costs as follows: non-nuclear Electric Generators incur costs during the period 2017 - 2022; Manufacturers and nuclear Electric Generators incur initial costs during the period 2022 - 2027.
- Under Option 3: I&E Mortality Everywhere, non-nuclear Electric Generators incur initial costs during the period 2017 - 2022, while Manufacturers and nuclear Electric Generators incur initial costs during the period 2022 - 2027.

For all options, technology installation-related outlays, whether during the initial compliance period or during reinstallation, are modeled as an increase in demand for goods and services from the Construction sector. Other initial outlays (i.e., initial permitting and downtime) are modeled as an increase in demand in the directly affected sector. For example, annual permitting and downtime costs for Electric Generators are modeled as an increase in demand in the Utilities sector, while permitting and downtime costs for Paper Manufacturers are modeled as an increase in demand in the Paper Manufacturing sector.[212] The total annual economic effect – calculated as the product of a given multiplier and the associated direct effect – is assumed to occur during each year over which the direct effect is applicable.

Table 10-2 summarizes the annual average direct values by regulatory option, for each of the categories of outlay, during the *initial* technology installation/compliance achievement periods.

Table 10-2: Average Annual Initial/One-Time Compliance Costs during Initial Compliance Achievement Periods (Millions; $2009)[a]

Facility and Direct Effect Category	Applicable Time Period	Annual Direct Effect Value		
		Option 1	Option 2	Option 3
Electric Generators				
Technology installation	2012 - 2017	$308.2	$774.2	$783.2
	2018 - 2022	$0.0	$8,443.1	$8,649.0
	2023 - 2027	$0.0	$2,775.5	$2,775.5
Initial permitting costs	2012 - 2017	$3.3	$1.5	$1.1
	2018 - 2022	$0.0	$1.9	$2.4
	2023 - 2027	$0.0	$0.2	$0.2
Cost of downtime	2012 - 2017	$24.0	$43.6	$45.5
	2018 - 2022	$0.0	$1,063.3	$1,192.7
	2023 - 2027	$0.0	$358.6	$377.7
Manufacturers				
Technology installation	2012 - 2017	$54.4	$29.8	$2.7
	2018 - 2022	$0.0	$25.3	$48.8
	2023 - 2027	$0.0	$240.8	$457.0
Initial permitting costs	2012 - 2017	$3.4	$3.0	$0.6
	2018 - 2022	$0.0	$0.1	$0.7
	2023 - 2027	$0.0	$0.3	$2.7
Cost of downtime	2012 - 2017	$3.4	$3.3	$0.2
	2018 - 2022	$0.0	$0.0	$0.0
	2023 - 2027	$0.0	$0.1	$3.9

a. Facilities may also incur these one-time costs at the time of technology re-installation.

Source: U.S. EPA Analysis, 2010

10.2 Economic Effects Due to Recurring Compliance Costs

As previously described, recurring compliance outlays include permit renewal costs, O&M costs, monitoring costs, and the energy penalty cost, depending on the regulatory option under consideration. As described above for initial/one-time compliance outlays, the years in which different categories of facilities incur a particular category of costs vary by regulatory option, as follows:

- Under Option 1: IM Everywhere, Electric Generators and Manufacturers incur O&M, permit renewal, and monitoring costs. O&M and monitoring costs begin in 2013 and are incurred annually for the remainder of the analysis period, while permit renewal costs are incurred on a 5-year interval with the first set of facilities incurring these costs in 2018.
- Under Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD, facilities installing only IM technology, incur recurring costs beginning in 2013, following the same schedule as outlined for Option 1, above. Facilities installing either only a cooling tower or a combination of a cooling tower and IM

212 As described here, economic effects are modeled individually for each regulated manufacturing sector, and reported as an aggregate across all manufacturers. This is significant since compliance costs are not distributed uniformly across regulated manufacturing sectors and multiplier effects differ by sector. If manufacturing sector effects were modeled for an aggregate manufacturing sector, the results would be more crude than in the current analysis.

technology incur the categories of costs over the specified time intervals as summarized for Option 3 in *Table 10-3*.

- Under Option 3: I&E Mortality Everywhere, non-nuclear Electric Generators incur O&M, energy penalty, and permit renewal costs beginning in 2018, while Manufacturers and nuclear Electric Generators incur these costs beginning in 2023. Permit renewal costs begin 5 years later than these start dates for each category of facility. Facilities installing IM technology under this option incur recurring costs beginning in 2013, following the same schedule as outlined for Option 1, above.

The economic effect of recurring cost outlays is modeled as an increase in demand in the directly affected sector. In the same way as described above for the initial/one-time compliance outlays analysis, the total effect of these outlays is calculated as the product of the RIMS multiplier for the direct effect sector and the direct outlay value. *Table 10-3* summarizes the occurrence of these costs over illustrative time periods. The first three periods reported correspond to the periods in which facilities are required to achieve compliance under the regulatory options. As described above, these "compliance achievement" periods vary by regulatory option, but, *looking over all options*, all facilities achieve compliance no later than 2027. The fourth period reported (2028-2056) reflects the steady state compliance period, in which all facilities will be in compliance regardless of regulatory option.

Table 10-3: Average Annual Recurring Compliance Costs by (Millions; $2009)

Facility and Direct Effect Category	Applicable Time Period	Annual Direct Effect Value		
		Option 1	Option 2	Option 3
Electric Generators				
O&M	2013 - 2017	$68.8	$4.0	$1.9
	2018 - 2022	$115.0	$248.1	$250.1
	2023 - 2027	$115.0	$490.0	$495.8
	2028 - 2056	$107.1	$506.5	$511.9
Permit Renewal	2013 - 2017	$0.0	$0.0	$0.0
	2018 - 2022	$1.8	$0.6	$0.3
	2023 - 2027	$1.8	$1.6	$1.6
	2028 - 2056	$1.5	$1.5	$1.5
Monitoring	2013 - 2017	$18.2	$5.2	$2.7
	2018 - 2022	$30.4	$20.3	$18.6
	2023 - 2027	$30.4	$29.5	$29.5
	2028 - 2056	$28.3	$28.3	$28.3
Energy Penalty	2013 - 2017	$0.0	$0.0	$0.0
	2018 - 2022	$0.0	$1,165.0	$1,246.8
	2023 - 2027	$0.0	$2,607.4	$2,743.7
	2028 - 2056	$0.0	$2,840.7	$2,967.7
Manufacturers				
O&M	2013 - 2017	$13.2	$6.9	$0.7
	2018 - 2022	$22.1	$11.6	$1.2
	2023 - 2027	$22.1	$20.5	$16.4
	2028 - 2056	$20.5	$24.7	$24.7
Permit Renewal	2013 - 2017	$0.4	$0.3	$0.1
	2018 - 2022	$1.8	$1.6	$0.3
	2023 - 2027	$1.8	$1.7	$0.6
	2028 - 2056	$1.5	$1.5	$1.5
Monitoring	2013 - 2017	$16.7	$14.7	$2.2
	2018 - 2022	$27.9	$24.6	$3.6
	2023 - 2027	$27.9	$25.9	$9.3
	2028 - 2056	$26.0	$24.9	$12.1
Energy Penalty	2013 - 2017	$4.1	$3.9	$0.2
	2018 - 2022	$0.0	$0.0	$0.0
	2023 - 2027	$0.0	$0.1	$3.9
	2028 - 2056	$0.0	$0.0	$0.0

Source: U.S. EPA Analysis, 2010

10.3 Economic Effects Due to Changes in Electricity Rates

This section presents EPA's assessment of economy-wide output and employment effects due to increased electricity rates for residential and business electricity consumers. This assessment is based on the assumption that electricity sector generators will pass through the cost of the regulation as an increase in electricity rates.

- *For residential electricity customers*, the analysis of total economic effects is based on the expected change in the profile of household-level personal consumption expenditures (PCE) for goods and services in the overall economy in response to higher rates.
- *For business electricity customers*, the framework for modeling the effects of increases electricity rates is slightly more complex. For these customers, the analysis is based on the assumption that business customers will attempt to pass through to their customers as increased prices, the electricity rate increases that they see as a result of this Regulation. The analysis then evaluates the change in consumer demand for the products of these affected business sectors (the *electricity customers*) due to increased prices using demand and supply elasticity values for the products of these sectors. The resulting change in the value of output for affected electricity consuming sectors (due to the supply-demand response to higher production costs and higher prices) then becomes the direct effect input into the multiplier analysis for each affected business sector (the *electricity customers*).

These analyses are described more fully below. However, as a first step in this analysis, EPA initially allocated the aggregate annual change in electricity rates to these categories of residential and business electricity consumers. The aggregate annual change in electricity rates is based on the total annualized, pre-tax compliance cost for Electric Generators facilities as of a given compliance year discounted to the analysis year of 2015. This is the same value that is used in estimating potential rate effects to residential, commercial, industrial, and transportation customers in other parts of this analysis, as described in *Chapter 5: Cost and Economic Impact Analysis – Electric Generators*.

EPA allocated this aggregate annual rate effect across four electricity consuming sectors – residential, commercial, industrial, and transportation – in proportion to each sector's share of national electricity consumption as reported in the 2009 Annual Energy Outlook (EIA). *Table 10-4* presents the annual rate recovery value for each regulatory option and electricity consuming sector, along with the time period over which this annual value is applicable. For this analysis, EPA calculated the rate recovery values as the annual average value over the full time period of potential rate recovery effect and carried these values forward for the analysis on a *constant* annual effect basis (see *Table 10-4,* below). For example, under Option 3, the electricity sector is expected to recover approximately $3.7 billion on a constant annual equivalent value basis, annually from 2013 - 2056, from residential customers. To the extent that the rate increase from compliance costs would phase in before reaching the "steady state" constant value, this analysis will overstate the economic impact from the electricity rate increase.

Table 10-4: Average Annual Electricity Rate Recovery for Generators (Millions; $2009)

Sector Impact Category	Option 1		Option 2		Option 3	
	Applicable Time Period	Annual Direct Effect Value	Applicable Time Period	Annual Direct Effect Value	Applicable Time Period	Annual Direct Effect Value
Residential Consumers						
All Residential	2013 – 2056	$179	2013 – 2056	$2,171	2013 – 2056	$2,235
Non-Residential Consumers						
Commercial	2013 – 2056	$189	2013 – 2056	$2,297	2013 – 2056	$2,365
Industrial	2013 – 2056	$129	2013 – 2056	$1,564	2013 – 2056	$1,610
Transportation	2013 – 2056	$1	2013 – 2056	$12	2013 – 2056	$12

Source: U.S. EPA Analysis, 2010

10.3.1 Residential Electricity Consumer Effects

The assessment of economic effects arising from rate changes to residential electricity customers begins with the residential rate impact values reported for each regulatory option in *Table 10-4*. EPA assumed that increased household expenditures on electricity due to this Regulation cause an offsetting equivalent reduction in household expenditures on other goods and services. This reduction in household expenditures, in turn, leads to a reduction in activity in the economic sectors linked to those sectors that are directly affected by the change in household expenditures. EPA estimated the effect of the residential rate recovery value using multipliers from the RIMS Households sector, which reflects the overall personal consumption expenditure pattern of U.S. households (see *Table 10-1* for Household sector multiplier values).

10.3.2 Business Electricity Consumer Effects

As summarized above, assessing the economy-wide effect of rate changes to business electricity customers involves three principal steps:

1. Allocate the total commercial, industrial, and transportation rate effect (from *Table 10-4*) over the affected business subsectors;
2. Estimate the change in economic activity in directly affected business subsectors; and,
3. Estimate the total economic effect of the activity changes in directly affected subsectors.

Allocating the Business Customer Rate Effect over Directly Affected Business Sub-Sectors

Table 10-4 reports the aggregate annual rate recovery value allocated to the broad commercial, industrial, and transportation business categories, nationally. Using these values as a starting point, EPA then undertook an analysis to allocate the rate effect in each broad business category to individual business sectors (at approximately the 3-digit NAICS level). The rate effect in each broad business category is allocated to related subsectors in proportion to each subsector's estimated electricity consumption out of the total of electricity consumption in the affected business sectors.

The electricity consumption profile by economic subsector is based on (1) estimated electricity consumption intensity by sector (national electricity consumption in relation to economic value-added), and (2) 2007 national-level value-added in these sectors as reported by the Bureau of Economic Analysis of the U.S. Department of Commerce. EPA developed the estimates of electricity consumption intensity using electricity consumption data at the state and national levels by economic sector from several sources, as follows:

- The Manufacturing Energy Consumption Survey (MECS), compiled by the U.S. Department of Energy, Energy Information Administration, which reports energy consumption, including consumption of purchased electricity, at approximately the level of 3-digit NAICS manufacturing sectors. These data are used to estimate electricity consumption intensity by sector, and, in conjunction with value-added by sector, total electricity consumption by manufacturing sector.
- The State Energy Data System (SEDS), also compiled by the U.S. Department of Energy, Energy Information Administration, which reports electricity and other energy consumption by state for aggregate sectors – commercial sector, industrial sector, transportation sector, and electric power sector. SEDS data were used to estimate electricity consumption intensity for the commercial and transportation sectors.
- The Economic Census, which reports electricity consumption data for the construction and mining sectors.

EPA combined the electricity consumption data with value-added data from the BEA to calculate electricity consumption intensity (MWh per million dollars of value added) for key sectors. All electricity consumption intensity values are at the national level and vary by sector and subsector. To estimate electricity consumption by economic sector, EPA multiplied the sector-level electricity intensity values by sector-level value-added. As the final step of this part of the analysis, EPA allocated the total business customer rate effect over all sub-sectors in proportion to the estimated electricity consumption values, by sector. Key results of this part of the analysis are presented in *Table 10-5*, which shows the estimated allocation factors for each broad business category that are used to distribute the annual electricity rate effect across economic subsectors.

Table 10-5: Allocation Factors for Distributing Business Customer Rate Effects Across Economic Sectors

Economic Subsector	Electricity Consumption Intensity (kWh/$Mln; $2009)	2007 Value Added, (Mln; $2009)	Electricity Consumption (Mln kWh)	Rate Effect Allocation Factors
Industrial Sector				
Oil and gas extraction	504,624	168,273	84,914	7.7%
Mining, except oil and gas	504,624	46,283	23,355	2.1%
Support activities for mining	504,624	66,410	33,512	3.0%
Construction	102,467	624,049	63,944	5.8%
Wood product manufacturing	568,440	32,081	18,236	1.7%
Nonmetallic mineral product manufacturing	741,396	55,580	41,207	3.7%
Primary metal manufacturing	2,674,979	63,754	170,539	15.5%
Fabricated metal product manufacturing	369,266	143,445	52,969	4.8%
Machinery manufacturing	215,530	128,427	27,680	2.5%
Computer and electronic product manufacturing	168,836	149,473	25,236	2.3%
Electrical equipment and appliance manuf	230,393	59,667	13,747	1.2%
Motor vehicle, body, trailer, and parts manuf	322,936	100,637	32,499	2.9%
Other transportation equipment manufacturing	322,936	98,185	31,707	2.9%
Furniture and related product manufacturing	196,821	36,168	7,119	0.6%
Miscellaneous manufacturing	148,614	74,583	11,084	1.0%
Food, beverage, and tobacco product manuf	398,795	178,490	71,181	6.5%
Textile and textile product mills	1,153,638	20,229	23,338	2.1%
Apparel, leather, and allied product manuf	158,698	16,449	2,610	0.2%
Paper manufacturing	1,050,221	51,800	54,401	4.9%
Printing and related support activities	275,042	48,939	13,460	1.2%
Petroleum and coal products manufacturing	935,705	71,927	67,303	6.1%
Chemical manufacturing	733,036	254,606	186,635	16.9%
Plastics and rubber products manufacturing	689,201	67,636	46,615	4.2%
Commercial Sector				
Wholesale trade	123,978	822,768	102,005	9.3%
Retail trade	123,978	911,860	113,051	10.3%
Publishing including software	123,978	141,811	17,581	1.6%
Motion picture and sound recording industries	123,978	44,341	5,497	0.5%
Broadcasting and telecommunications	123,978	349,827	43,371	3.9%
Information and data processing services	123,978	63,038	7,815	0.7%
Federal Reserve banks, credit intermediation	123,978	515,341	63,891	5.8%
Securities, commodity contracts, investments	123,978	242,652	30,084	2.7%
Insurance carriers and related activities	123,978	339,712	42,117	3.8%
Funds, trusts, and other financial vehicles	123,978	17,369	2,153	0.2%
Real estate	123,978	1,620,914	200,958	18.2%
Rental and leasing services	123,978	136,191	16,885	1.5%
Professional, scientific, and technical services	123,978	1,029,661	127,655	11.6%
Management of companies and enterprises	123,978	277,185	34,365	3.1%
Administrative and support services	123,978	389,469	48,286	4.4%
Waste management and remediation services	123,978	34,635	4,294	0.4%
Educational services	123,978	132,309	16,403	1.5%
Ambulatory health care services	123,978	508,905	63,093	5.7%
Hospitals and nursing and residential care	123,978	381,806	47,336	4.3%
Social assistance	123,978	87,559	10,855	1.0%
Performing arts, museums, and related activities	123,978	63,141	7,828	0.7%
Amusements, gambling, and recreation	123,978	73,562	9,120	0.8%

Table 10-5: Allocation Factors for Distributing Business Customer Rate Effects Across Economic Sectors

Economic Subsector	Electricity Consumption Intensity (kWh/$Mln; $2009)	2007 Value Added, (Mln; $2009)	Electricity Consumption (Mln kWh)	Rate Effect Allocation Factors
Accommodation	123,978	123,523	15,314	1.4%
Food services and drinking places	123,978	264,209	32,756	3.0%
Other services	123,978	322,446	39,976	3.6%
Transportation Sector				
Air transportation	18,210	56,397	1,027	13.6%
Rail transportation	18,210	41,379	754	9.9%
Water transportation	18,210	10,932	199	2.6%
Truck transportation	18,210	130,368	2,374	31.3%
Transit and ground passenger transportation	18,210	19,719	359	4.7%
Pipeline transportation	18,210	12,260	223	2.9%
Other transportation and support activities	18,210	103,702	1,888	24.9%
Warehousing and storage	18,210	41,174	750	9.9%

Source: U.S. EPA Analysis, 2010

Estimating the Change in Economic Activity in Affected Business Sub-Sectors

EPA assessed the economic effects of the business customer rate increases in a partial equilibrium impact analysis framework, in which directly affected business customers – i.e., those customers incurring an electricity rate increase – will attempt to pass that increase along to *their* customers as price increases. Markets respond to these cost-induced price increases by adjusting to a new supply-demand equilibrium in which prices are typically increased, and total sales and production quantities are typically decreased. The analysis is described as being performed in a partial equilibrium framework because these market responses are assessed only in the context of single affected market(s) and do not consider the interactions of these individual markets with other economically linked markets (e.g., markets for the supplier goods of the directly affected markets, or markets of competitor goods of the directly affected markets), which may also adjust in response to the production cost effects in the individually analyzed markets. Overall, EPA expects the business customer production cost and price effects of increased electricity prices from the Proposed Existing Facilities Rule to be sufficiently small that a partial equilibrium analysis will provide appropriate insight into the potential total market effects of the proposed regulation.

Within a given market, the increase in production costs and resulting potential increase in product prices will likely lead to contractions in the total sales and production (i.e., economic output) in the affected markets. The extent of contraction in output will depend on the expected character of the market response, which is captured by the concepts of price elasticity of demand and supply. *Price elasticity of demand* captures the quantity response of customers of those goods and services for which prices increase, while *price elasticity of supply* captures the quantity response of the suppliers of the affected goods and services to the changes in production cost resulting from increased electricity rates and related price effects. Both of these factors interact to lead to the new market equilibrium.

On the demand side, for markets in which demand is relatively *elastic* – i.e., markets for goods and services for which consumers are relatively *sensitive* to changes in price – the contraction in output will be more substantial, all else equal. For markets in which demand is relatively *inelastic* – i.e., markets for goods and services for which consumers are relatively *insensitive* to changes in price – the contraction in output will be less substantial.

A similar response occurs on the supply side, with supply also responding to change in production cost (resulting from increased electricity prices) and related product price effects. The supply-side response may be thought of as potentially reducing the demand-side response – if the demand-side response is considered independent of the supply-side response. Specifically, for markets in which supply is relatively elastic – i.e., production quantity responds more substantially to changes in product prices, or stated inversely, prices change little in response to changes in market quantity – the contraction in quantity resulting from the demand response will lead to a smaller supply-side price response, with relatively less reduction in the demand response-based quantity effect. Conversely, for markets in which supply is relatively inelastic – i.e., production quantity responds little to changes in product prices, or stated inversely, prices change more substantially in response to changes in market quantity – the contraction in quantity resulting from the demand response will lead to a relatively larger supply-side price response, which in turn will typically lead to a larger reduction in the demand response-based quantity effect.

For its analyses of supply-demand response in affected markets, EPA developed two analysis cases:

- Case 1: Accounting for demand elasticity response only, with no supply elasticity effect
- Case 2: Accounting for both demand and supply elasticity response.

EPA developed and analyzed these two alternative cases in part reflecting that relatively less information is available on supply elasticity and expected supply response than is typically available for demand elasticity and expected demand response. Because Case 1 does not account for potential supply-side response effect, it provides a higher impact value, in terms of potential output contraction in affected markets, than Case 2.

Case 1: Accounting for demand elasticity response only, with no supply elasticity effect

For Case 1, to assess the contraction in output among the directly affected business sectors, EPA compiled a set of demand elasticity values, which are summarized in *Table 10-6*. Mathematically, the elasticity value indicates the percentage change in the quantity demanded of a given product for a percent change in product price. Because the normal demand response to a price increase is a reduction in quantity demanded, elasticity values have a negative sign. For example, the indicated value of -0.50 for wholesale trade means that for a *one percent* increase in product prices, the quantity of wholesale trade activity would contract by *one-half percent*. Elasticity values that are closer to zero (e.g., *Food, Beverage, and Tobacco* at -0.30) are indicative of inelastic demand – demand that is *less* sensitive to changes in product prices. Elasticity values that are farther from zero (e.g., *Accommodation, Food Services* at -2.27) are indicative of elastic demand – demand that is *more* sensitive to changes in product prices.

Table 10-6: Price Elasticity of Demand, By Rate Impact Sector

Sector	Elasticity	Sector	Elasticity
Commercial Sectors		**Manufacturing Sectors**	
Wholesale trade (m)	-0.50	Food & Beverage and Tobacco Products (c, e, l)	-0.30
Retail trade (m)	-0.50	Textile Mills & Textile Product Mills (c)	-0.40
Information (e)	-0.18	Apparel & Leather and Allied Products (e)	-0.70
Finance and insurance (g)	-0.56	Wood Products (m)	-0.78
Real estate and rental and leasing (g)	-0.55	Paper (k, o)	-0.63
Professional and technical services (e)	-0.37	Printing and Related Support (m)	-0.76
Management of companies and enterprises (m)	-0.50	Petroleum and Coal Products (e)	-0.60
Administrative and waste services (j)	-1.00	Chemicals (g, i)	-0.89
Educational services (a)	-1.10	Plastics and Rubber Products (a)	-1.05
Health care and social assistance (a, e, h)	-0.36	Nonmetallic Mineral Products (m)	-0.50
Arts, entertainment, and recreation (d)	-0.69	Primary Metals (c)	-1.00
Accommodation and food services (e)	-2.27	Fabricated Metal Products (g)	-1.52
Other services, except government (e)	-0.40	Machinery (m)	-1.08
Government (m)	-0.10	Computer and Electronic Products (a, b)	-1.43
Other Sectors		Electrical Equip., Appliances, and Components (e, g, n)	-0.64
Construction (f, p)	-0.45	Transportation Equipment (c, e)	-1.17
Mining (c)	-0.50	Furniture and Related Products (g)	-1.26
Transportation (g)	-1.03	Miscellaneous (m)	-0.85

Sources: (a) Anderson et al. (1997), (b) Crandall and Jackson. (2001), (c) De Milo and Tarr (1988), (d) Heilbrun and Gray (2001), (e) McConnell and Brue (2005), (f) Benjamin et al. (1998), (g) Parkin (1998), (h) Ringel et al. (2005), (i) Santerre and Vernon (2004), (j) U.S. EPA (2000), (k) U.S. EPA (1997), (l) You et al. (1998), (m) Professional judgment, (n) Dale (2008), (o) U.S. Congress (1984), (p) U.S. Department of Housing and Urban Development (HUD) (2006)

To apply the demand elasticity concept to estimate the change in output, EPA assumed, in Case 1, that the directly affected business customers would attempt to pass on the entire direct rate effect as a price increase. Holding constant the *quantity of goods and services produced/sold in the sector* – at the outset, before calculating the demand elasticity response from the price increase – this means that the attempted percentage increase in price of the sector's goods and services will equal the total rate effect to the sector as a percentage of the total value of goods and services sold/produced in the sector (nationally) before the rate effect. This percentage change can then be multiplied by the sector's elasticity value to calculate the percentage change in total sector output. Further, multiplying that value by the initial total value of goods and services produced/sold in the sector (again, nationally) yields the direct economic output loss for the sector. This change in economic output by sector is the direct effect of the rate increase for each business sector. The calculation of direct economic impact is as follows:

$$\Delta Output_{\text{sector}} = \left(\frac{Rate\ Effect_{\text{sector}}}{Revenue_{\text{sector}}} \right) x\ Elasticity_{\text{sector, demand}}\ x\ Revenue_{\text{sector}} \qquad (10\text{-}1)$$

Or, simply

$$\Delta Output_{\text{sector}} = Rate\ Effect_{\text{sector}}\ x\ Elasticity_{\text{sector, demand}} \qquad (10\text{-}2)$$

As described below, this direct effect is then used in combination with the RIMS multipliers for each sector to estimate the total economic effect, including direct, indirect, and induced effects.

Case 2: Accounting for both demand and supply elasticity response

For Case 2, EPA researched supply elasticity values for the rate impact sectors listed above. In general, less information is available on supply elasticity values for the sectors of interest than for demand elasticity. In addition, the assessment of supply response and elasticity effects is quite difficult to reduce to a simple concept such as supply elasticity, given the likelihood that supply at any time in an industry is composed of output from multiple producers who may have diverse production characteristics and who may not be uniformly affected by an increase in electricity rates due to the proposed 316(b) regulation. For these reasons, EPA views the Case 2 analysis as more uncertain in terms of market-level effects in the affected business sectors than the analysis under Case 1.[213]

The primary source of supply elasticity values used in this analysis is the Elasticity Databank compiled by the EPA Office of Air Quality Planning and Standards. This database contains elasticity values across a range of sectors and according to different conceptual definitions – for example, supply and demand elasticities, substitution elasticities, trade elasticities. Supply elasticity values compiled from this dataset for this analysis are listed in *Table 10-7*. Where several elasticity values were available within the dataset for a given sector, EPA used the simple arithmetic average of the reported values for this analysis. As stated above, supply elasticity values were not available for most of the sectors of interest in this analysis – for these sectors, EPA used the arithmetic average of the supply elasticity values developed from the EPA dataset for the sectors of interest in this analysis. This value, 2.15, is reported for most of the sectors in *Table 10-7*.

[213] Even acknowledging that the Case 1 analysis is likely an overstatement of market-level effects, given that the Case 1 analysis does not account for supply-side/elasticity response effects.

Table 10-7: Price Elasticity of Supply, By Rate Impact Sector

Sector	Elasticity	Sector	Elasticity
Commercial Sectors		**Manufacturing Sectors**	
Wholesale trade (b)	2.15	Food & Beverage and Tobacco Products (b)	2.15
Retail trade (b)	2.15	Textile Mills & Textile Product Mills (b)	2.15
Information (b)	2.15	Apparel & Leather and Allied Products (b)	2.15
Finance and insurance (b)	2.15	Wood Products (a)	6.77
Real estate and rental and leasing (b)	2.15	Paper (a)	0.80
Professional and technical services (b)	2.15	Printing and Related Support (b)	2.15
Management of companies and enterprises (b)	2.15	Petroleum and Coal Products (b)	1.30
Administrative and waste services (b)	2.15	Chemicals (a)	4.01
Educational services (b)	2.15	Plastics and Rubber Products (a)	4.01
Health care and social assistance (a)	2.15	Nonmetallic Mineral Products (b)	2.15
Arts, entertainment, and recreation (b)	2.15	Primary Metals (a)	1.44
Accommodation and food services (b)	2.15	Fabricated Metal Products (b)	2.15
Other services, except government (b)	2.15	Machinery (b)	2.15
Government (b)	2.15	Computer and Electronic Products (b)	2.15
Other Sectors		Electrical Equip., Appliances, and Components (b)	2.15
Construction (b)	2.15	Transportation Equipment (b)	2.15
Mining (b)	2.15	Furniture and Related Products (b)	2.15
Transportation (b)	2.15	Miscellaneous (b)	2.15

Sources: (a) U.S. Environmental Protection Agency, Elasticity Databank, http://www.epa.gov/ttnecas1/Elasticity.htm (b) default supply elasticity value calculated as average of elasticity values developed from EPA Elasticity Databank.

To apply the combination of demand elasticity values (*Table 10-6*) and supply values (*Table 10-7*) in calculating output effects, EPA used the following relationship, which is a generalized variant of equation (10-2):

$$\Delta Output_{\text{sector}} = \frac{Rate\ Effect_{\text{sector}}\ x\ Elasticity_{\text{sector, demand}}}{\left(1 - \frac{Elasticity_{\text{sector, demand}}}{Elasticity_{\text{sector, supply}}}\right)} \qquad (10\text{-}3)$$

As the supply elasticity value increases towards infinity (i.e., highly elastic supply), the value of the denominator goes to one, and this relationship becomes the same as equation (10-2).

Estimating the Total Economic Effects of Output Changes in Business Sub-Sectors

In the same way as described above, the last step in the business customer electricity rate impact analysis estimates the total output and employment effect from the electricity rate increase, by sector, as the product of each sector's RIMS multipliers and direct output loss (i.e., using multipliers specific to each sector reported in *Table 10-5*). These calculations were performed for both of the business impact cases outlined above:

- Case 1: Accounting for demand elasticity response only, with no supply elasticity effect
- Case 2: Accounting for both demand and supply elasticity response.

10.4 Economic Effects Due to Manufacturer's Compliance Costs

EPA also considered economic output and employment effects due to the compliance costs that are incurred by in-scope Manufacturers. In this part of the analysis, EPA assumes that compliance costs incurred by in-scope Manufacturers will be absorbed by those entities, manifesting as a reduction in lost after-tax profit and ultimately lost household income via the income reduction effect on the owners of the manufacturing facilities.[214] As noted

[214] This effect could occur through several mechanisms: reduced profits and owners' income in privately owned businesses; reduced dividends from publicly traded companies; and/or reduced equity market value in publicly traded companies. Ultimately, these effects are expected to reach to individuals and manifest as a reduction in household income and/or wealth, with attendant impacts on household consumption. For this analysis, EPA assumed that the entire reduction in after-tax profit would result in reduced household consumption in the United States in the relevant time periods. Other analysis concepts are possible – e.g., reduced income reduces

previously, EPA judges that it is reasonable to assume that in-scope Manufacturers will absorb all (or a substantial portion) of their costs since these entities constitute a small fraction of the overall activity in their respective sectors. EPA used the estimate of total, after-tax annualized compliance costs for all regulated manufacturers as the measure of this annual cost effect. In the same way as described for the analysis of electricity rate effects, EPA calculated the Manufacturers' compliance cost effect as the annual average value over the full time period of compliance cost incurrence and carried these values forward for the analysis on a *constant* annual effect basis.

These annual values vary by regulatory option and are presented in *Table 10-8* along with the applicable time periods. EPA again used RIMS Household sector multipliers to estimate the total economic effects from the annual cost effect, assuming that the cost effect ultimately manifests as lost household income (see *Table 10-1* for Household sector multiplier values).

Table 10-8: Manufacturer's Average Annual Compliance Cost (Millions; $2009)

Direct Effect	Option 1		Option 2		Option 3	
	Applicable Time Period	Annual Direct Effect Value	Applicable Time Period	Annual Direct Effect Value	Applicable Time Period	Annual Direct Effect Value
Total annualized, after-tax cost	2013 – 2056	$42	2013 – 2056	$110	2023 – 2056	$150

Source: U.S. EPA Analysis, 2010

10.5 Results of the Economy-Wide Output and Employment Effects Analysis

Table 10-9 and *Table 10-10*, following pages, summarize the annual output and employment effects by cost/outlay category and regulatory option, over specified multiple year intervals (rows in the table). The first three intervals reflect, respectively, the initial compliance periods for:

- IM technology-only installations – 2012-2017, or six years, which includes the first year of cost incurrence following rule promulgation, and the five years of compliance for this compliance technology
- Cooling tower technology installations at non-nuclear Electric Generators – 2018-2022, or five years
- Cooling tower technology installations at nuclear Electric Generators and Manufacturers – 2023-2027, or five years.

The next six intervals report output and employment effects in 5-year intervals over the "steady state" compliance period, with the exception that the first of these intervals (2028-2031) is only four years, reflecting the fact that the first year of full compliance, 2027, looking over all regulatory options, overlaps with the last year of compliance technology installation. The last row for each option reports the annual average values over the full cost analysis period: 2012-2056.

The results reported below capture the economic effects resulting, on the one hand, from increased demand in some parts of the economy from initial and recurring compliance outlays, and on the other hand, from decreased demand resulting from increased electricity rates and reductions in household income and business activity. These values do not represent "benefits" or "costs" (depending on the sign of each value) of the Rule, but rather are a measure of the sum of inter-industry transfers that arise from the regulation.

Table 10-9 and *Table 10-10* indicate that all three regulatory options cause an increase in overall economic activity during the periods in which the larger outlays occur for technology installation and other initial compliance activities. As expected, these effects are larger for the options that would require installation of cooling tower technology – *Option 2* and *Option 3* – than for *Option 1*, which would not require cooling tower installation. However, the analysis also show that, during other periods, the regulation's impact on electricity rates

household savings but not household consumption, which might in turn affect the flow of savings into, and/or the cost of capital for, U.S. capital formation, which would lead, over the longer term, to reduced domestic economic product.

and manufacturers' compliance costs results in a reduction in overall economic activity. As described in this chapter, the estimated reductions in economic activity from increased electricity rates are higher when only the demand elasticity response is accounted for in the analysis, and conversely, lower when the supply elasticity response in electricity customer markets is also taken into account. The reductions in economic activity due to increased electricity rates and manufacturers' compliance costs are greater in Options 2 and 3 than in Option 1.

Table 10-9: Output Effect, Reported as Average Annual Values by Effect Category for Indicated Time Periods

(Millions; $2009)	Compliance Outlay Effects		Household Sector Effects	Electricity Price Effects in Dependent Product Markets		Total Output Effect	
Year Interval	Initial/ One-Time	Recurring		Demand Elasticity only	with Supply Elasticity	Demand Elasticity only	With Supply Elasticity
Option 1: IM Everywhere							
2012 - 2017	$1,253	$245	-$426	-$500	-$361	$572	$711
2018 - 2022	$0	$478	-$512	-$600	-$433	-$633	-$467
2023 - 2027	$0	$478	-$512	-$600	-$433	-$633	-$467
2028 - 2031	$0	$478	-$512	-$600	-$433	-$633	-$467
2032 - 2036	$815	$478	-$512	-$600	-$433	$181	$348
2037 - 2041	$373	$478	-$512	-$600	-$433	-$261	-$95
2042 - 2046	$55	$478	-$512	-$600	-$433	-$579	-$413
2047 - 2051	$3	$478	-$512	-$600	-$433	-$630	-$464
2052 - 2056	$0	$282	-$512	-$600	-$433	-$829	-$663
2012 - 2056	$305	$425	-$500	-$586	-$424	-$356	-$194
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD							
2012 - 2017	$2,719	$81	-$4,279	-$6,075	-$4,391	-$7,554	-$5,869
2018 - 2022	$29,742	$3,287	-$5,134	-$7,291	-$5,269	$20,605	$22,626
2023 - 2027	$10,550	$7,070	-$5,134	-$7,291	-$5,269	$5,195	$7,216
2028 - 2031	$0	$8,194	-$5,134	-$7,291	-$5,269	-$4,230	-$2,209
2032 - 2036	$96	$8,194	-$5,134	-$7,291	-$5,269	-$4,134	-$2,112
2037 - 2041	$58	$8,194	-$5,134	-$7,291	-$5,269	-$4,173	-$2,151
2042 - 2046	$40	$8,194	-$5,134	-$7,291	-$5,269	-$4,190	-$2,169
2047 - 2051	$9	$8,194	-$5,134	-$7,291	-$5,269	-$4,222	-$2,200
2052 - 2056	$0	$4,912	-$5,134	-$7,291	-$5,269	-$7,513	-$5,491
2012 - 2056	$4,862	$6,078	-$5,020	-$7,129	-$5,152	-$1,209	$768
Option 3: I&E Mortality Everywhere							
2012 - 2017	$2,647	$16	-$4,403	-$4,521	-$1,609	-$6,261	-$3,349
2018 - 2022	$30,773	$3,371	-$5,283	-$5,425	-$1,931	$23,436	$26,931
2023 - 2027	$11,310	$7,331	-$5,283	-$5,425	-$1,931	$7,932	$11,426
2028 - 2031	$0	$8,468	-$5,283	-$5,425	-$1,931	-$2,240	$1,254
2032 - 2036	$24	$8,468	-$5,283	-$5,425	-$1,931	-$2,216	$1,278
2037 - 2041	$23	$8,468	-$5,283	-$5,425	-$1,931	-$2,217	$1,277
2042 - 2046	$41	$8,468	-$5,283	-$5,425	-$1,931	-$2,199	$1,295
2047 - 2051	$10	$8,468	-$5,283	-$5,425	-$1,931	-$2,230	$1,264
2052 - 2056	$0	$5,076	-$5,283	-$5,425	-$1,931	-$5,632	-$2,137
2012 - 2056	$5,040	$6,272	-$5,166	-$5,304	-$1,888	$841	$4,258

Source: U.S. EPA Analysis, 2010

Table 10-10: Employment Effect, Reported as Average Annual Values by Effect Category for Indicated Time Periods

(full-time-equivalent jobs)				Electricity Price Effects in Dependent Product Markets		Total Employment Effect	
	Compliance Outlay Effects		Household	Demand	with	Demand	with
Year Interval	Initial/ One-Time	Recurring	Sector Effects	Elasticity only	Supply Elasticity	Elasticity only	Supply Elasticity
Option 1: IM Everywhere							
2012 - 2017	9,421	1,029	-3,229	-3,319	-2,370	3,902	4,851
2018 - 2022	0	1,985	-3,875	-3,983	-2,844	-5,873	-4,734
2023 - 2027	0	1,985	-3,875	-3,983	-2,844	-5,873	-4,734
2028 - 2031	0	1,985	-3,875	-3,983	-2,844	-5,873	-4,734
2032 - 2036	6,313	1,985	-3,875	-3,983	-2,844	440	1,579
2037 - 2041	2,887	1,985	-3,875	-3,983	-2,844	-2,986	-1,847
2042 - 2046	423	1,985	-3,875	-3,983	-2,844	-5,450	-4,311
2047 - 2051	24	1,985	-3,875	-3,983	-2,844	-5,849	-4,710
2052 - 2056	0	1,170	-3,875	-3,983	-2,844	-6,688	-5,550
2012 - 2056	2,328	1,767	-3,789	-3,894	-2,781	-3,588	-2,475
Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD							
2012 - 2017	20,625	385	-32,411	-40,349	-28,812	-51,751	-40,214
2018 - 2022	221,193	12,672	-38,894	-48,419	-34,574	146,553	160,397
2023 - 2027	78,619	27,143	-38,894	-48,419	-34,574	18,449	32,294
2028 - 2031	0	31,456	-38,894	-48,419	-34,574	-55,856	-42,012
2032 - 2036	748	31,456	-38,894	-48,419	-34,574	-55,109	-41,264
2037 - 2041	449	31,456	-38,894	-48,419	-34,574	-55,408	-41,563
2042 - 2046	312	31,456	-38,894	-48,419	-34,574	-55,544	-41,700
2047 - 2051	69	31,456	-38,894	-48,419	-34,574	-55,788	-41,943
2052 - 2056	2	18,852	-38,894	-48,419	-34,574	-68,459	-54,614
2012 - 2056	36,238	23,346	-38,029	-47,343	-33,806	-25,788	-12,251
Option 3: I&E Mortality Everywhere							
2012 - 2017	20,096	66	-33,353	-41,543	-29,664	-54,734	-42,855
2018 - 2022	228,047	12,879	-40,023	-49,852	-35,597	151,051	165,306
2023 - 2027	84,294	28,081	-40,023	-49,852	-35,597	22,499	36,754
2028 - 2031	0	32,454	-40,023	-49,852	-35,597	-57,421	-43,167
2032 - 2036	187	32,454	-40,023	-49,852	-35,597	-57,235	-42,980
2037 - 2041	179	32,454	-40,023	-49,852	-35,597	-57,242	-42,987
2042 - 2046	318	32,454	-40,023	-49,852	-35,597	-57,103	-42,848
2047 - 2051	79	32,454	-40,023	-49,852	-35,597	-57,343	-43,088
2052 - 2056	2	19,451	-40,023	-49,852	-35,597	-70,422	-56,168
2012 - 2056	37,469	24,030	-39,134	-48,744	-34,806	-26,379	-12,441

Source: U.S. EPA Analysis, 2010

Table 10-11, following page, reports these effects on a present value and annualized (*constant annual equivalent effect*) basis, using the 7 and 3 percent discount rates used in the social cost analysis. Reporting these values on a constant annual equivalent effect basis is appropriate for understanding the economic effect, given that the estimated effects do not occur uniformly over time. As shown in *Table 10-11*, on a constant annual equivalent effect basis, EPA estimates that Option 1: IM Everywhere would cause an overall modest effect on economic activity, ranging from an annual reduction of approximately $260 million to an annual increase of approximately $15 million, depending on whether supply elasticity is accounted for in estimating the impact of increased electricity rates and discount rate. EPA estimates that Options 2 and 3 would both lead to annualized increases in economic activity, due to the total economy effect of the outlays for technology installation. For Option 2, the estimated annual effect ranges from $33 million to $2.8 billion, and for Option 3, from $2.1 billion to $6.2 billion. A key reason that the analysis indicates estimated increases in economic activity, on an constant annual equivalent effect basis, for Options 2 and 3 is that the large outlays for cooling tower technology installation occur relatively early in the total analysis period, and thus see less “reduction” from present value discounting, while the impacts from increased electricity rates are spread over the analysis period. These effects are thus subject to a greater discounting effect in this analysis.

The estimated employment effects follow a similar profile, with Option 1 estimated to yield a more modest effect than Options 2 and 3. On an equivalent annual effect basis, Option 1 yields job losses ranging from approximately 800 to 2,800; both Options 2 and 3 yield employment effects ranging from a loss of approximately 14,000 jobs to an increase of approximately 10,000 jobs.

Table 10-11: Total Present Value and Annualized Values of Output and Employment Effects

Direct Effect	Option 1		Option 2		Option 3	
	Present Value	*Annualized Value*	*Present Value*	*Annualized Value*	*Present Value*	*Annualized Value*
Total Output Effect ($millions, $2009)						
without accounting for elasticity of supply response in industrial sectors affected by electricity price increase						
7 percent discount rate	-$1,900	-$140	$12,339	$907	$39,466	$2,901
3 percent discount rate	-$6,354	-$259	$821	$33	$51,017	$2,081
with accounting for elasticity of supply response in industrial sectors affected by electricity price increase						
7 percent discount rate	$207	$15	$37,955	$2,790	$83,742	$6,155
3 percent discount rate	-$2,438	-$99	$48,427	$1,975	$133,300	$5,437
Total Employment Effect (full-time-equivalent jobs)						
without accounting for elasticity of supply response in industrial sectors affected by electricity price increase						
7 percent discount rate	-25,361	-1,864	-42,037	-3,090	-43,169	-3,173
3 percent discount rate	-69,464	-2,833	-336,916	-13,741	-343,494	-14,009
with accounting for elasticity of supply response in industrial sectors affected by electricity price increase						
7 percent discount rate	-10,931	-803	133,389	9,804	137,449	10,102
3 percent discount rate	-42,648	-1,739	-10,903	-445	-7,830	-319

Source: U.S. EPA Analysis, 2010

10.6 Key Uncertainties and Limitations

Key uncertainties and limitations to consider for this analysis include:

- *RIMS Multipliers.* EPA used 2006 economic impact multipliers from the BEA's RIMS system to support this analysis. These multipliers reflect the structure, composition, and activity profile of the U.S. economy during 2006. Using these multipliers to estimate economic effects for any year other than 2006 introduces uncertainty into the analysis because it implicitly assumes that the economy is similarly structured in those years.

- *Measure of Annual Electricity Rate Effect.* The aggregate annual change in electricity rates is based on the total annualized, pre-tax compliance cost for all regulated generators as of a single benchmark year, 2015, and is assumed to be a constant value for each regulatory option, over the analysis period. The estimates of increase in electricity rates are subject to considerable uncertainty due to a number of factors, including, in particular, the assumed recovery of cost increases through electricity rates. The analysis in effect assumes that all Electric Generators' compliance costs will be passed forward to ratepayers through the conventional utility rate regulation framework. To the extent that generators operate in a deregulated wholesale generation environment, the electricity rate effect may differ substantially from the effect estimated in this analysis. If in-scope generators *are typically not* price setters, or cannot otherwise increase rates (e.g., via contract renegotiation) in deregulated markets, then the implicitly estimated rate effect would be less than estimated here. Alternatively, if in-scope generators *typically are* price setters in deregulated markets, then the overall rate impact in those markets *could* be greater in those markets than estimated in this analysis.[215] The assumption of a constant annual rate effect is also subject to

215 Because the increased prices in the deregulated market would apply not only to the in-scope generators, but would also apply to the electricity sold by other generators that are producing electricity at the same time in those markets.

considerable error as the recovery profile for capital outlays in a regulated utility framework is not likely to be constant over time.

- *Annual Effect Concept.* The direct effect inputs and economic impact results are representative of the estimated average annual effect over specified periods of time. These average annual effects are computed simply as the sum of a given direct effect over a given time period divided by the number of years in the applicable time period. The actual economic effects that occur during each specific year over that same time period will vary from this average.
- *Cost Pass-Through.* The degree of cost pass-through is a critical, but uncertain, assumption in these estimates of total economic output and employment effects. For instance, EPA's assumption that compliance costs incurred by Manufacturers will be 100% absorbed by those entities is uncertain. As noted earlier, EPA judges that it is reasonable to assume that manufacturing entities will absorb a substantial portion of their costs since these entities constitute a small fraction of the overall activity in their respective sectors; however, whether that fraction is 100% is uncertain.
- *Estimates of Electricity Consumption Intensity, by Economic Sector.* EPA relied on estimates of electricity consumption, by economic sector, to allocate the regulation's non-residential customer rate effect to affected sectors. The estimates of electricity consumption, in turn, are based on estimates of electricity consumption intensity, by sector, which measures the quantity of electricity consumed per unit of sector-level value-added. Due to data limitations, electricity consumption intensity estimated for the commercial and transportation sectors is based on the 2006 relationship between electricity consumption and value-added. These estimates are based on 2002 data for the manufacturing, mining, and construction sectors. To the degree that electricity consumption intensity has since changed, EPA's estimates of electricity consumption by sector are subject to error.
- *Estimates of Price Elasticity of Supply and Demand.* EPA estimated the direct impact on business sector output from electricity rate increases using estimates of each sector's price elasticities of supply and demand. These elasticity values are used to estimate the change in the quantity supplied and/or demanded in a given market in response to a change in the price of the outputs of that market. These elasticity values were drawn from a range of publically available sources and are subject to considerable uncertainty in terms of the quality of the analysis underlying estimates. Moreover, elasticity values/ estimates may vary substantially over time, and geographically, according to supply and demand conditions in specific product segments, which in turn may further reduce the robustness of the estimates of change in output for the current analysis. In addition, elasticity values may vary substantially based on the duration of the response period to which the estimates apply: in general, both supply and demand elasticity would be expected to become more elastic as the response period lengthens. For these analyses, EPA used available elasticity estimates regardless of the response period to which the estimates are assumed to apply. Finally, as described above, fewer supply elasticity values were available to support this analysis, and the estimates of supply elasticity are generally regarded as being subject to greater uncertainty than the estimates of demand elasticity. All of these factors point to considerable uncertainty in the estimates of quantity response in the affected markets based on changes in electricity prices and the resulting changes in prices of goods and services that depend on electricity in their production.
- *Reliance on a Static Partial Equilibrium/Fixed Relationships Analysis Framework.* As described in this chapter, EPA's analysis is based on a static partial equilibrium/fixed production relationships analysis, which does not account for inter-sectoral feedback and production adjustment effects (see discussion at *pages 10-3* and *10-10*, and following pages). In general, as described at *page 10-3*, EPA expects that use of the static partial equilibrium/fixed production relationships framework leads to *larger* estimated output and employment effects, in particular when those effects are *negative*, than would likely occur in the *real* economy. EPA assesses that the static partial equilibrium framework may tend to overstate effects

because the framework does not account for inter-sectoral feedbacks, and because the response relationships are assumed to be constant over time and do not reflect the likely adjustments in the economy and affected sectors, that would result from increased production costs and product prices that would likely result from the regulation. In general, these adjustments would tend to moderate the impacts that are estimated to occur in the partial equilibrium, rigid production relationships framework.

11 Assessment of Total Social Costs

This chapter develops EPA's estimates of the costs to society resulting from the proposed rule. As analyzed in this chapter, the *social costs* of regulatory actions are the *opportunity costs* to society of employing scarce resources to prevent the environmental damage otherwise occurring from the design and operation of cooling water intake structures.

11.1 Overview of Social Costs

Chapter 3: Development of Costs for Regulatory Options presents EPA's development of costs to complying facilities and governments, which are also used as the basis of the social cost analysis. The social cost analysis considers costs on an as-incurred, year-by-year basis – that is, this analysis takes the components of costs before escalation to compliance year, discounting, or annualizing and assigns them to the years in which they are assumed to occur relative to the assumed promulgation and compliance years.[216] For this analysis, EPA assumed that facilities, *in the aggregate*, would achieve compliance as follows. For facilities already in compliance or installing technologies other than cooling towers, the compliance period is assumed to be a 5-year period from 2013 to 2017; for facilities required to install cooling towers, the compliance period is assumed to be a 5-year period from 2018 to 2022 for non-nuclear electric power facilities, and from 2023 to 2027 for manufacturing and nuclear facilities. As described further below, all costs and activities associated with the achievement of compliance are estimated to occur uniformly within these periods for the relevant facilities. Following the achievement of compliance, all costs and other operational effects of compliance are also assumed to occur as though they originated from a compliance schedule that is uniformly spread over these compliance windows.

The year-explicit treatment of compliance costs for the social cost analysis differs from the analysis of facility and firm impacts described in Chapters 3, 4, and 5. In those chapters, all facilities within a given compliance requirement specification (e.g., nuclear facilities installing closed cycle cooling system) were assumed to achieve compliance at the mid-point of the respective 5-year compliance periods. This assignment to an approximate compliance year is sufficient for the cost impact analysis, which looks at the potential impact on individual facilities or firms. However, for the social cost analysis, which looks at the aggregate of costs across complying facilities and for which costs are needed on a year-explicit basis for developing total present value and annual equivalent values of cost to society, it was necessary to "spread" the costs out within the respective compliance windows. For the social cost analysis, EPA developed a year-explicit schedule of compliance outlays, assuming that compliance would be achieved uniformly over the respective 5-year compliance windows for each category of complying facility.

To develop the year-explicit schedule of compliance costs and operational effects, EPA first assigned a *pro forma* compliance year of 2015 for facilities not installing cooling towers, 2020 for non-nuclear Electric Generators installing cooling towers, and 2025 for Manufacturers and nuclear Electric Generators installing cooling towers. EPA then determined the last year of *initial* compliance for these facilities based on the year of technology installation, and the technology life of the longest-lived compliance technology (cooling tower) installed at any facility (30 years). This step yields an *initial compliance* analysis period of 2012 through the end of 2044 for facilities not installing cooling towers, and through the end of 2054 for facilities installing cooling towers (due to the later compliance year for manufacturing and nuclear facilities). After creating a cost incurrence schedule for each cost component, EPA summed the costs expected to be incurred in each year for each facility, then

[216] The specific assumptions of when each cost component is incurred can be found in *Chapter 3: Development of Costs for Regulatory Options*

aggregated these costs to estimate the total cost to the industry for each year in the analysis period, still using compliance years of 2015, 2020, and 2025.

To account for the specific compliance windows of 2013 to 2017, 2017 to 2022, and 2023 to 2027, during which facilities are actually expected to achieve compliance, EPA distributed the total costs calculated for each year evenly over the surrounding years of the compliance window. For example, costs for facilities assigned the compliance year 2015 were distributed evenly over 5 years: the 2 years prior to 2015, 2015 itself, and the 2 years after 2015. After being distributed, costs were adjusted for real change between their stated year and the year(s) of their incurrence using as follows: technology costs were adjusted to their incurrence year(s) using the Construction Cost Index (CCI) and GDP deflator; administrative costs were adjusted to their incurrence year(s) using the Employment Cost Index (ECI) and GDP deflator; energy penalty and downtime costs were adjusted to 2030 based on Energy Outlook (AEO) 2009 electricity price projections (which do not require adjustment for inflation).[217] Note that costs must be aggregated in three separate groups according to the index used to adjust them, and are then summed to estimate total industry cost. CCI and ECI adjustment factors were only available through 2015 and AEO adjustment factors through 2030; after these years, the real change in prices is assumed to be zero – that is, costs are expected to change in line with general inflation. EPA judges this to be a reasonable assumption, given the uncertainty of long-term future price projections. This distribution of costs represents the overall burden to society in each year, assuming that the costs to facilities coming into compliance in each year will be equal over the relevant distribution periods, which is consistent with the assignment of costs in the market model analysis. This analysis accounts for technology costs associated with repowering and new generating units starting in the first year after promulgation, i.e., 2013 (for more information on repowering and new units see *Chapter 3: Development of Costs for Regulatory Options*).

After developing the year-explicit schedule of total social costs and adjusting them for predicted real change to the year of their incurrence, EPA calculated the present value of these cost outlays as of the promulgation year by discounting the cost in each year back to 2012, using both 3 percent and 7 percent discount rates. These discount rate values reflect guidance from the Office of Management and Budget (OMB) regulatory analysis guidance document, Circular A-4 (OMB, 2003). EPA also calculated the constant annual equivalent value (annualized value) of these present values, again using the two values of the discount rate, 3 percent and 7 percent, over a 50-year analysis period. The 50-year analysis period results from several considerations: the compliance periods specified in the rule for different categories of facilities, the expected useful life of compliance technology installed at these facilities, and the duration of benefits achieved by the compliance technology. The analysis is structured to account for the longest life of compliance technology at the latest complying facility, and the duration of benefits from that “last” compliance installation. This analysis period thus reflects the “first round” of full compliance by existing in-scope facilities, and does not mean that the rule’s compliance requirements and resulting costs and benefits would end at that point. More specifically, the 50-year analysis period reflects the following:

- Rule promulgation and first incurrence of compliance-related costs at 2012
- Achievement of compliance for IM-only facilities, beginning year 2013 and ending 2017
- Achievement of compliance for non-nuclear Electric Generators installing cooling towers, assumed for analysis purposes to begin in year 2018, and ending not later than 2022
- Achievement of compliance for Manufacturers and nuclear Electric Generators installing cooling towers, assumed for analysis purposes to begin in year 2023, and ending not later than 2027

[217] The stated year for technology and labor costs is 2009, in 2009 dollars. Energy penalty costs are estimated using average revenue from the market model analysis over a period of 4 years, expressed in 2009 dollars, so their stated year is effectively an average of the AEO projected electricity prices in these 4 years. Future cost escalations were calculated in terms of change from this average.

- Beginning of steady state compliance for all facilities in 2027 (the last year in which any facility is expected to achieve compliance) and continuing for 30 compliance years, to 2056. The 30 years of compliance reflects the estimated useful life of the longest-lived compliance technology equipment expected to be implemented in response to any of the regulatory options. Note that the first year of steady state compliance for all facilities overlaps with the last year in which any facility would be expected to achieve compliance under any of the regulatory options.
- Beginning of the 5-year period after the last year of compliance technology operation, during which benefits continue to decline to zero. That is, benefits are estimated to continue for 5 years after the end of the useful life of a compliance technology, but to decline to zero over this period.[218]

In summary, under this framework, the last year for which costs were tallied in the analysis is 2056, with benefits continuing on a diminishing basis through 2061. Because the estimated useful life for some IM compliance technology installations would cease before the end of the compliance period (i.e., before 2056), the social cost analysis accounts for *re-installation* of IM compliance technologies after the end of their initial useful life periods. EPA does not expect in-scope facilities to re-install cooling towers. In those instances in which the estimated useful life a technology reinstallation would extend beyond the remaining number of compliance years in the overall analysis period, EPA prorated the initial capital value based on the remaining number of compliance years in the analysis.

11.1.1 Costs of Regulatory Compliance

The compliance costs used to estimate total social costs differ in their consideration of taxes from those in *Section 1* of *Chapter 3: Development of Costs for Regulatory Options*, which were calculated for the purpose of estimating the private costs and impacts of the rule, with the exception of the cost of downtime for generators, which is discussed in the following section. The cost of downtime for manufacturers used in the social cost analysis continues to be based on the cost estimated to be incurred by complying facilities.

For the impact analyses, compliance costs are measured as they affect the financial performance of the regulated facilities and firms. The economic impact analyses therefore explicitly consider the tax deductibility of compliance expenditures as appropriate, depending on the tax status of the complying entity. In the analysis of costs to society, however, these compliance costs are considered without accounting for any tax effects. The costs to society are the full value of the resources used, whether they are paid for by the regulated facilities or by all taxpayers in the form of lost tax revenues. Thus pre-tax costs are used in calculating social costs.

Cost of Installation Downtime for Electric Generators

For the assessment of impacts to private firms, the cost of downtime was calculated as the lost net income to facilities required to suspend operation in order to install new equipment. However, this approach does not accurately capture the cost to society of downtime at electric generating stations. Specifically, when generating units are taken out of service to install compliance technology, other generating units provide the electricity that would otherwise have been generated by the out-of-service units. In this case, the opportunity cost to society from installation downtime is the *increase* in energy production costs from using the alternative generating units to supply electricity compared to the cost that would have been incurred if the 316(b) compliance units remained in service – *and not the loss in net income to the individual generating units that are temporarily out of service*. Under the principles of economic dispatch (i.e., at any point of time, electricity is supplied by the combination of available electric generating units, which in the aggregate, can provide electricity at the lowest total cost), the alternative generating units are presumed to provide the replacement electricity at a somewhat higher production

[218] See *Chapter 10, Section 1* for a summary of benefits methodology and the phase-down of benefits following termination of compliance activities.

cost than would otherwise be incurred.[219] This increase in short-term energy production cost is then the appropriate concept for social cost of downtime. The Market Model Analysis, described in *Chapter 6: Electricity Market Model Analysis* of this document, provides an estimate of the increase in energy production costs resulting from installation downtime. EPA used this estimated increase in energy production costs as the social cost of installation downtime.

Specifically, EPA calculated the aggregate increase, from baseline to post-compliance case, in the annual variable O&M and annual fuel costs from the Market Model Analysis output for the 2015, 2020, and 2025 model run-years.[220,221,222] Each model run-year represents a five-year period beginning two years before and ending two years after the indicated run-year. These single year cost values were applied to *each* of the five years in the respective run-year windows as a measure of the social cost of installation downtime for electric power generators during those run-year windows.

Cost of Installation Downtime for Manufacturing Facilities

EPA does not expect installation downtime to interrupt the production of goods at Manufacturer facilities, but only to interrupt their ability to produce their own power, requiring them to purchase power from the grid. As a result, EPA did not perform an analogous market-level analysis for Manufacturers. The cost of installation downtime at Manufacturers facilities for the purposes of the social costs analysis is thus the same as that stated in *Chapter 3: Development of Costs for Regulatory Options*. Downtime requires Manufacturers to temporarily curtail electricity-generation and purchase power from the grid in order to continue operation. The cost of this temporary suspension of power generation is calculated as the cost of purchasing replacement power plus the loss of any revenues received from selling power but minus the variable costs of generating electricity. If a Manufacturer does not sell power to the grid, then its cost of downtime is simply the cost of purchasing replacement power minus the variable cost of generation.

Other Considerations in Estimating the Social Costs of Regulatory Compliance

To assess the economic costs to society of the Proposed Rule, EPA relied first on the estimated costs to facilities for the labor, equipment, material, and other economic resources needed to comply with the proposed rule. In this analysis, EPA assumed that the market prices for labor, equipment, material, and other compliance resources represent the opportunity costs to society for use of those resources in regulatory compliance. Finally, EPA assumed in its social cost analysis that the regulation does not affect the aggregate quantity of electricity that would be sold to consumers and, thus, that the regulation's social cost will include no loss in consumer and

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[219] This is a considerable simplification of the economic dispatch concept, in that it doesn't account for a range of factors – for example, "must run" requirements for certain generating units. However, overall, the least-cost-solution concept is the applicable governing concept in the management of electric power generation throughout the country.

[220] EPA assumed that facilities will incur technology installation downtime during the spring or fall seasons so as not to coincide with either the winter or summer higher demand periods. The IPM modeling framework is built around winter and summer seasons, which last 7 and 5 months, respectively. Within this framework, in-scope facilities are expected to incur downtime during the lower electricity demand season, which lasts 9 months, and includes the entire winter season (7 months) and 2 of the 5 summer months. To the extent that using *total annual* variable costs to estimate the social cost of downtime includes changes in variable costs outside of the 9 months of lower electricity demand period (i.e., 3 months of the summer period), the downtime impact of the Proposed Rule may be overestimated.

[221] Updated from 2006 to 2009 dollars using the GDP deflator.

[222] Under Option 1, total market-level variable costs are less than those reported in the base case (i.e., pre-policy) run for IPM run-years 2020 and 2025. Under Options 2 and 3, total market-level variable costs are less than those reported in the base case run for IPM run years 2015 and 2020. For all three Options, this change is the result of reduced total fuel costs due to changes in the energy input mix for electricity generation (decreased use of higher cost fuels and higher use of lower cost fuels). In these instances – i.e., in 2020 and 2025 for Option 1 and for 2015 and 2020 for Options 2 and 3 – EPA assumed no change in variable costs between the base case and a given policy run. That is, variable costs were assumed not to decline for the calculation of installation downtime.

producer surplus *from lost electricity sales* by the electricity industry in aggregate. Given the small impact of the regulation on electricity production cost for the total industry, EPA believes this assumption is reasonable for the social cost analysis.

EPA's estimates include compliance costs for facilities estimated to close because of the rule. This approach may overstate the social costs of compliance, to the extent that the net economic loss to society in facility closures is less than the estimated cost to society of compliance.[223]

11.1.2 Government Administrative Costs

Administrative costs to NPDES permitting authorities and the Federal government are taken from *Section 2 of Chapter 3: Development of Costs for Regulatory Options*, again on an as-incurred, year-explicit basis and before adjustment to incurrence year, discounting, or annualizing. For the social cost analysis, government administrative costs reflect the opportunity cost of expending taxpayer dollars to administer this regulation in lieu of other public projects.

11.2 Key Findings for Regulatory Options

The following sections present EPA's estimates of the components of, and total values for, social costs of the regulatory options.

11.2.1 Costs of Regulatory Compliance

Table 11-1 presents annualized compliance costs for each of the regulatory options. At a 3 percent discount rate, EPA estimates annualized costs of compliance of $380.1 million under Option 1, $4,461.3 million under Option 2, and $4,630.7 million under Option 3; at a 7 percent discount rate, these costs are $454.6 million, $4,697.6 million, and $4,861.1 million, respectively. These costs include: the direct costs of compliance, the cost of installation downtime as described above, and the administrative costs incurred by complying facilities.

Table 11-1: Summary of Annualized Costs of Compliance (Millions; $2009)

Discount Rate	Option 1: IM Everywhere	Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD	Option 3: I&E Mortality Everywhere
3%	$380.08	$4,461.28	$4,630.71
7%	$454.58	$4,697.62	$4,861.14

Source: U.S. EPA Analysis, 2010.

11.2.2 Costs of Government Administration of the Proposed Existing Facilities Rule

Table 11-2 summarizes government administrative costs under each of the regulatory options. EPA estimates that Option 1 will result in $3.7 and $4.2 million (3 and 7 percent discount rates, respectively) in government administrative costs. Option 2 is expected to result in $1.6 and $1.7 million (3 and 7 percent discount rates, respectively) in administrative costs to governments. For Option 3, EPA estimates that about $0.9 and $0.9 million (3 and 7 percent discount rates, respectively) will be incurred by governments administering the rule. Under all options, State and Territory governments bear almost all administrative costs, with Federal administrative costs ranging between $30,000 and $60,000.

223 Including costs for regulatory closures yields an estimate of social costs assuming that all facilities, except those assessed as baseline closures, would incur the costs of regulatory compliance and continue to operate post-regulation. Calculating costs as if all facilities continue operating will overstate social costs if the social cost of compliance is greater than the net economic loss to society from facility closure. Whether this result will hold depends, in part, on the difference between social and private discount rates, and the marginal cost to society to replace the lost production of goods and services in closing facilities.

Table 11-2: Summary of Annualized Government Administrative Costs (Millions; $2009)

Discount Rate	Government Level	Option 1: IM Everywhere	Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD	Option 3: I&E Mortality Everywhere
3%	State/Territory	$3.68	$1.59	$0.89
	Federal	$0.03	$0.03	$0.03
	Total[a]	**$3.71**	**$1.62**	**$0.92**
7%	State/Territory	$4.18	$1.68	$0.87
	Federal	$0.06	$0.05	$0.04
	Total[a]	**$4.23**	**$1.72**	**$0.91**

a. Values may not sum to the reported total to due independent rounding.
Source: U.S. EPA Analysis, 2010.

11.2.3 Total Social Cost

Table 11-3 combines the information presented above for each regulatory option and reports the total social costs discounted at both 3 and 7 percent rates. At a 3 percent discount rate, total social costs are approximately $383.8 million under Option 1, $4,462.9 million under Option 2, and $4,631.6 million under Option 3. Using a 7 percent discount rate, these costs are $458.8 million, $4,699.4 million, and $4,862.1 million for Options 1, 2, and 3, respectively. Under all options, compliance costs account for the larger share of total social costs, with government administrative costs accounting for approximately 1 percent of costs (under Option 1 at a 3 percent rate) and as little as 0.02 percent (under Option 3 at a 3 percent rate).

Table 11-3: Summary of Total Social Costs (Millions; $2009)

Discount Rate	Cost Category	Option 1: IM Everywhere	Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD	Option 3: I&E Mortality Everywhere
3%	Compliance Cost	$380.08	$4,461.28	$4,630.71
	Gov. Admin.	$3.71	$1.62	$0.92
	Total[a]	**$383.80**	**$4,462.90**	**$4,631.62**
7%	Compliance Cost	$454.58	$4,697.62	$4,861.14
	Gov. Admin.	$4.23	$1.72	$0.91
	Total[a]	**$458.81**	**$4,699.35**	**$4,862.05**

a. Values may not add up to total to due independent rounding.
Source: U.S. EPA Analysis, 2010.

Table 11-4, Table 11-5 and *Table 11-6* provide additional detail on the social cost calculations. The tables compile, for each of the three options, the time profiles of costs incurred in the broad cost categories: compliance costs, administrative costs, and total costs. The costs presented for each year are in undiscounted 2009 dollars. The tables also report the calculated present and annualized values of costs at 3 percent and 7 percent discount rates. The maximum compliance outlays are incurred over the years 2017 (Option 1) and 2021 (Options 2 and 3), when compliance is being achieved and complying facilities are making outlays for compliance technology and incurring installation downtime. As stated above, EPA does not expect in-scope facilities to re-install cooling towers. Replacement of IM capital equipment and consequent additional capital outlays are required at years 20, 25, or 30 for all facilities under Option 1 and some facilities under Options 2 and 3, reflected in the higher costs in years 2033-2047. As a note of clarification in interpreting the cost profiles, under Options 2 and 3, although no facilities installing cooling towers would be expected to incur permitting or other costs before 2017, compliance costs still start in 2012, because facilities with cooling towers *already* in place are assumed to incur permitting costs beginning in 2012.

Table 11-4: Time Profile of Costs to Society for Option 1: IM Everywhere (Millions; $2009)

Year	Compliance Costs [a]	Administrative Costs	Total
2012	$7.49	$0.48	**$7.96**
2013	$799.92	$4.51	**$804.43**
2014	$858.25	$7.09	**$865.34**
2015	$906.24	$7.59	**$913.84**
2016	$776.98	$5.34	**$782.33**
2017	$799.03	$3.64	**$802.67**
2018	$370.95	$5.30	**$376.25**
2019	$213.80	$4.75	**$218.54**
2020	$201.37	$2.62	**$203.99**
2021	$370.95	$5.30	**$376.25**
2022	$213.80	$2.62	**$216.41**
2023	$201.37	$2.62	**$203.99**
2024	$370.95	$5.30	**$376.25**
2025	$213.80	$2.62	**$216.41**
2026	$201.37	$2.62	**$203.99**
2027	$370.95	$5.30	**$376.25**
2028	$213.80	$2.62	**$216.41**
2029	$201.37	$2.62	**$203.99**
2030	$370.95	$5.30	**$376.25**
2031	$213.80	$2.62	**$216.41**
2032	$201.37	$2.62	**$203.99**
2033	$682.23	$5.30	**$687.54**
2034	$525.08	$2.62	**$527.70**
2035	$512.65	$2.62	**$515.27**
2036	$682.23	$5.30	**$687.54**
2037	$525.08	$2.62	**$527.70**
2038	$266.65	$2.62	**$269.27**
2039	$436.23	$5.30	**$441.53**
2040	$279.07	$2.62	**$281.69**
2041	$266.65	$2.62	**$269.27**
2042	$436.23	$5.30	**$441.53**
2043	$218.31	$2.62	**$220.92**
2044	$205.88	$2.62	**$208.50**
2045	$375.46	$5.30	**$380.76**
2046	$218.31	$2.62	**$220.92**
2047	$205.88	$2.62	**$208.50**
2048	$370.95	$5.30	**$376.25**
2049	$213.80	$2.62	**$216.41**
2050	$201.37	$2.62	**$203.99**
2051	$370.95	$5.30	**$376.25**
2052	$212.17	$2.62	**$214.79**
2053	$158.39	$1.73	**$160.12**
2054	$175.32	$2.19	**$177.51**
2055	$79.19	$0.86	**$80.06**
2056	$39.60	$0.43	**$40.03**
2057	$0.00	$0.00	**$0.00**
2058	$0.00	$0.00	**$0.00**
2059	$0.00	$0.00	**$0.00**
2060	$0.00	$0.00	**$0.00**
2061	$0.00	$0.00	**$0.00**
2062	$0.00	$0.00	**$0.00**
Present Value, 3%	**$9,779.49**	**$95.48**	**$9,874.98**
Annualized, 3%	**$380.08**	**$3.71**	**$383.80**
Present Value, 7%	**$6,273.49**	**$58.44**	**$6,331.93**
Annualized, 7%	**$454.58**	**$4.23**	**$458.81**

Source: U.S. EPA Analysis, 2010.

Table 11-5: Time Profile of Costs to Society for Option 2: IM Everywhere and EM for Facilities with DIF > 125 MGD (Millions; $2009)

Year	Compliance Costs [a]	Administrative Costs	Total
2012	$4.55	$0.48	**$5.03**
2013	$79.92	$1.12	**$81.04**
2014	$90.23	$1.36	**$91.59**
2015	$100.77	$1.62	**$102.39**
2016	$110.42	$1.86	**$112.28**
2017	$4,633.83	$2.10	**$4,635.93**
2018	$9,959.87	$1.90	**$9,961.77**
2019	$10,430.62	$1.91	**$10,432.53**
2020	$10,903.58	$1.91	**$10,905.49**
2021	$11,364.17	$1.92	**$11,366.09**
2022	$8,982.36	$1.92	**$8,984.29**
2023	$6,139.80	$1.77	**$6,141.57**
2024	$6,451.86	$1.78	**$6,453.64**
2025	$6,780.65	$1.80	**$6,782.45**
2026	$7,108.56	$1.81	**$7,110.37**
2027	$5,775.32	$1.83	**$5,777.14**
2028	$3,996.90	$1.74	**$3,998.64**
2029	$4,023.75	$1.74	**$4,025.49**
2030	$4,054.26	$1.74	**$4,056.00**
2031	$4,054.26	$1.74	**$4,056.00**
2032	$4,054.26	$1.74	**$4,056.00**
2033	$4,088.31	$1.74	**$4,090.05**
2034	$4,088.31	$1.74	**$4,090.05**
2035	$4,088.31	$1.74	**$4,090.05**
2036	$4,088.31	$1.74	**$4,090.05**
2037	$4,088.31	$1.74	**$4,090.05**
2038	$4,067.32	$1.74	**$4,069.07**
2039	$4,067.32	$1.74	**$4,069.07**
2040	$4,067.32	$1.74	**$4,069.07**
2041	$4,067.32	$1.74	**$4,069.07**
2042	$4,067.32	$1.74	**$4,069.07**
2043	$4,066.11	$1.74	**$4,067.86**
2044	$4,066.11	$1.74	**$4,067.86**
2045	$4,066.11	$1.74	**$4,067.86**
2046	$4,066.11	$1.74	**$4,067.86**
2047	$4,066.11	$1.74	**$4,067.86**
2048	$4,054.62	$1.74	**$4,056.37**
2049	$4,054.62	$1.74	**$4,056.37**
2050	$4,054.62	$1.74	**$4,056.37**
2051	$4,054.62	$1.74	**$4,056.37**
2052	$4,052.99	$1.74	**$4,054.74**
2053	$3,240.70	$1.04	**$3,241.74**
2054	$2,430.53	$0.78	**$2,431.31**
2055	$1,620.35	$0.52	**$1,620.87**
2056	$810.18	$0.26	**$810.44**
2057	$0.00	$0.00	**$0.00**
2058	$0.00	$0.00	**$0.00**
2059	$0.00	$0.00	**$0.00**
2060	$0.00	$0.00	**$0.00**
2061	$0.00	$0.00	**$0.00**
2062	$0.00	$0.00	**$0.00**
Present Value, 3%	**$114,901.39**	**$41.72**	**$114,943.11**
Annualized, 3%	**$4,465.70**	**$1.62**	**$4,467.32**
Present Value, 7%	**$64,921.00**	**$23.80**	**$64,944.79**
Annualized, 7%	**$4,704.17**	**$1.72**	**$4,705.89**

Source: U.S. EPA Analysis, 2010.

Table 11-6: Time Profile of Costs to Society for Option 3: I&E Mortality Everywhere (Millions; $2009)

Year	Compliance Costs	Administrative Costs	Total
2012	$1.31	$0.48	**$1.79**
2013	$25.48	$0.31	**$25.79**
2014	$28.17	$0.38	**$28.55**
2015	$30.95	$0.44	**$31.39**
2016	$33.48	$0.50	**$33.98**
2017	$4,666.89	$0.56	**$4,667.45**
2018	$10,205.15	$0.91	**$10,206.06**
2019	$10,705.04	$0.92	**$10,705.95**
2020	$11,207.30	$0.92	**$11,208.23**
2021	$11,696.37	$0.93	**$11,697.30**
2022	$9,337.34	$0.93	**$9,338.28**
2023	$6,479.28	$1.24	**$6,480.52**
2024	$6,805.73	$1.31	**$6,807.04**
2025	$7,149.41	$1.38	**$7,150.79**
2026	$7,491.78	$1.45	**$7,493.23**
2027	$6,065.51	$1.52	**$6,067.03**
2028	$4,178.79	$1.11	**$4,179.89**
2029	$4,206.84	$1.11	**$4,207.95**
2030	$4,238.71	$1.11	**$4,239.82**
2031	$4,238.71	$1.11	**$4,239.82**
2032	$4,238.71	$1.11	**$4,239.82**
2033	$4,247.97	$1.11	**$4,249.08**
2034	$4,247.97	$1.11	**$4,249.08**
2035	$4,247.97	$1.11	**$4,249.08**
2036	$4,247.97	$1.11	**$4,249.08**
2037	$4,247.97	$1.11	**$4,249.08**
2038	$4,245.33	$1.11	**$4,246.43**
2039	$4,245.33	$1.11	**$4,246.43**
2040	$4,245.33	$1.11	**$4,246.43**
2041	$4,245.33	$1.11	**$4,246.43**
2042	$4,245.33	$1.11	**$4,246.43**
2043	$4,252.61	$1.11	**$4,253.72**
2044	$4,252.61	$1.11	**$4,253.72**
2045	$4,252.61	$1.11	**$4,253.72**
2046	$4,252.61	$1.11	**$4,253.72**
2047	$4,252.61	$1.11	**$4,253.72**
2048	$4,239.07	$1.11	**$4,240.18**
2049	$4,239.07	$1.11	**$4,240.18**
2050	$4,239.07	$1.11	**$4,240.18**
2051	$4,239.07	$1.11	**$4,240.18**
2052	$4,237.45	$1.11	**$4,238.55**
2053	$3,388.26	$0.55	**$3,388.81**
2054	$2,541.20	$0.41	**$2,541.61**
2055	$1,694.13	$0.27	**$1,694.41**
2056	$847.07	$0.14	**$847.20**
2057	$0.00	$0.00	**$0.00**
2058	$0.00	$0.00	**$0.00**
2059	$0.00	$0.00	**$0.00**
2060	$0.00	$0.00	**$0.00**
2061	$0.00	$0.00	**$0.00**
2062	$0.00	$0.00	**$0.00**
Present Value, 3%	**$119,147.01**	**$23.57**	**$119,170.58**
Annualized, 3%	**$4,630.71**	**$0.92**	**$4,631.62**
Present Value, 7%	**$67,087.36**	**$12.55**	**$67,099.91**
Annualized, 7%	**$4,861.14**	**$0.91**	**$4,862.05**

Source: U.S. EPA Analysis, 2010.

11.2.4 Compliance Costs for New Generating Units

Table 11-7 presents annualized compliance costs for new units (for details see *Chapter 3: Development of Costs for Regulatory Options*). As discussed in *Chapter 3* of this document, compliance costs for new generating units are not included in total compliance cost estimates because benefits associated with reduced I&E mortality at these new units has not been estimated.

Table 11-7: Annualized Costs of Compliance for New Generating Units (Millions; $2009)

Discount Rate	Annualized Costs
3%	$14.66
7%	$10.94

Source: U.S. EPA Analysis, 2010.

12 Social Costs and Benefits of the Proposed Rule

This chapter compares total monetized benefits and social costs for the three options considered for the proposed 316(b) Existing Facilities rule. Benefits and costs are compared on two bases: (1) for each of the options analyzed and (2) incrementally across options. For more information on the analysis of social costs and benefits, see *Chapter 11: Social Costs* in this document and the *Environmental and Economic Benefits Assessment (EEBA)* report. This chapter also satisfies the requirements of Executive Order 12866: Regulatory Planning and Review.

Table 12-1 summarizes compliance requirements for the proposed options based on the performance standard each facility would need to meet and its baseline technologies in-place. The cooling tower installation values listed in *Table 12-1* are the minimum number of cooling tower installations anticipated by EPA under the direct requirements of regulatory Options 2 and 3. Additional cooling tower installations may occur under Options 1 and 2 as the result of case by case determinations of the permitting authority. Additional cooling tower installations may occur under all options as the result of units increasing their generating capacity and becoming subject to the cooling tower requirement under the *new* units provisions of the regulatory options. The cost of these potential cooling tower installations for new units has *not* been accounted for in the social cost and benefits analysis.

Table 12-1: Weighted Number of In-Scope Facilities by Technology Standard[a]

Facility Compliance Action	Option 1	Option 2	Option 3
Total Facilities Estimated Subject to Regulation	1,077	1,077	1,077
Facilities Required to Install IM Technology Only	855	477	122
Facilities Required to Install Cooling Towers	0	382	740
Facilities Required to Install IM Technology and Cooling Towers	0	40	149
No Upgrade Required[b]	222	177	66

a. These numbers reflect facility-count based weighting, see *Appendix 3A* for details.

b. These facilities meet compliance requirements in the baseline and thus would require no action to comply with the regulation.

Source: U.S. EPA Analysis, 2010

12.1 Summary of Benefits Estimation for the Proposed Regulation

Benefits from the proposed existing facilities rule occur due to the reduction in impingement and entrainment at cooling water intake structures affected by the rule. Impingement and entrainment kills or injures large numbers of aquatic organisms at all life stages. By reducing the levels of impingement and entrainment, the proposed options would increase the number of fish, shellfish, and other aquatic organisms in the affected water bodies. This in turn would directly and indirectly improve use benefits such as those associated with recreational and commercial fisheries. Other types of benefits, including nonuse values of the affected resources, would also be enhanced. *Chapter 4: Economic Benefit Categories Associated with I&E Mortality Reduction* of the EEBA report provides an overview of the types and sources of benefits anticipated and how these benefits are estimated (i.e., monetized, quantified but not monetized, or assessed qualitatively) (U.S. EPA 2010). Chapters 5 through 8 of the *EEBA* provide detailed descriptions of the methodologies used in analyzing benefits and the estimated benefits of the proposed options.

Economic benefits of the proposed options can be broadly defined according to categories of goods and services provided by the species that are affected by impingement and entrainment from cooling water intake structures. The first category includes benefits that pertain to the use (direct or indirect) of the affected fishery resources. The “direct use” benefits of the options include both “market” commodities (e.g., commercial fisheries) and “nonmarket” goods (e.g., recreational angling). Indirect use benefits also can be linked to either market or nonmarket goods and services. An example of an indirect use benefit would be the manner in which reduced impingement and entrainment related losses of forage species leads through the aquatic ecosystem food web to enhance the biomass of species targeted for commercial (market) and recreational (nonmarket) uses.

The second category includes benefits that are independent of any current or anticipated use of the resource; these are known as “nonuse” or “passive use” values. Nonuse benefits reflect human values associated with existence and bequest motives, or willingness to pay for the knowledge that an ecosystem is functioning as if it were not affected by human activity, or to pass such ecosystem function on to future generations.

EPA estimated the economic benefits from the regulatory options using a range of valuation methods, depending on the benefit category, data availability, and other suitable factors. Commercial fishery benefits are valued using market data. Recreational angling benefits are valued using a benefits transfer approach. Nonuse values were estimated for two of the seven benefits regions using a separate benefits transfer approach. Agency benefits estimates are based on projected numbers of age-one equivalent fish saved and changes in harvest under proposed regulatory options.

EPA derived national benefit estimates for the proposed options from a series of regional studies across the country representing a range of water body types and aquatic resources. National benefit estimates are obtained by summing regional benefits. EPA calculated the monetary value of benefits of the national categorical regulatory options for existing facilities using two discount rate values: 3 percent and 7 percent. All dollar values presented are in 2009 dollars (average or mid-year). Because avoided fish deaths occur mainly in fish that are younger than harvestable age (eggs, larvae, and juveniles), the benefits from avoided impingement and entrainment would be realized typically 3-4 years after their avoided death. Appendix C of the EEBA report provides detail on the time profile of expected benefits.

12.2 Comparison of Benefits and Social Costs by Option

Chapter 11: Assessment of Total Social Costs in this document and *Chapter 10: National Benefits* in the *EEBA*, present estimates of social cost and benefit for the three regulatory options evaluated in developing the proposed 316(b) Existing Facilities regulation.

As documented in the EEBA, the monetized benefit values developed by EPA for the regulatory options presented in this chapter, include estimated use values for commercial and recreational fishing (including recreational use value of threatened and endangered species) for all benefits regions, and estimated nonuse values for two of the seven benefit regions. EPA was unable, at this time, to estimate a monetized value of non-use benefits from reduced impingement and entrainment (I&E) mortality in all of the seven benefits regions. As *Chapter 3* of the *EEBA* reports, the harvested commercial and recreational fish species that have direct use values comprise between 1 and 9 percent of baseline IM&EM losses in each region, with a national average of 3 percent. The remaining 97 percent of I&E mortality losses include unharvested recreational and commercial fish and forage fish which do not have direct use values. EPA’s nonuse analysis was limited to two of the seven benefit regions and values were not estimated for unharvested fish in the remaining five benefits regions. The total estimated benefits are likely to be significantly understated due to the regional limitations of EPA’s nonuse analysis and the relatively large fraction of I&E mortality reductions which are not commercially or recreationally harvested. EPA did not assess use values other than commercial and recreational fishing, such as improved recreation opportunities for non-fishing activities such as diving or wildlife viewing, in this analysis. EPA notes, however, that recreational users other than fishers (e.g., divers) are likely to have positive use values for all fish and shellfish species including commercially and recreationally targeted species as well as for forage species. Although the analysis omits some categories of use benefits (i.e., benefits for recreational users other than fishers), EPA judges that the largest use-value categories (i.e., commercial and recreational fishing) have been captured.

As stated above, EPA was unable to use benefit transfer to generate national estimates of non-use benefits for the proposed regulatory options. EPA’s nonuse analysis generated estimates of nonuse values for resource changes expected to result in the North Atlantic and Mid-Atlantic benefit regions from the proposed options, but EPA was unable to estimate reliable nonuse valuations for changes expected to result in other study regions. EPA is in the process of developing a stated preference survey to estimated total willingness to pay for improvements to fishery resources affected by I&E mortality from in-scope 316(b) facilities (75 FR 42,438). However, EPA did not have sufficient time to fully develop and implement this survey for the proposed regulation. Thus, the monetized benefit values that are compared with the estimated total social cost values in this chapter represent a partial estimate of the total social benefits of the given option.

Table 12-2 presents EPA's estimates of use benefits and social costs for the regulatory options for existing facilities, at 3 percent and 7 percent discount rates, and annualized over 50 years. At a 3 percent discount rate, EPA estimates that social costs exceed mean monetized benefits by $366 million for Option 1, by $4.3 billion for Option 2, and by $4.5 billion for Option 3. At a 7 percent discount rate, social costs exceed mean monetized benefits by $443 million for Option 1, by $4.6 billion for Option 2, and by $4.8 billion for Option 3. These values are all in 2009 dollars and are based on the discounting of costs and benefits to the beginning of the year 2012, the assumed date when the rule would take effect.

Table 12-2: Total Benefits and Social Costs by Option (Millions; $2009)

Option	Total Monetized Benefits[a]		Total Social Costs[b]	
	3%	7%	3%	7%
Option 1	$17.63	$16.04	$383.80	$458.81
Option 2	$120.79	$92.20	$4,462.90	$4,699.35
Option 3	$125.65	$95.71	$4,631.62	$4,862.05

a. The benefit values presented in this table are the estimated "mean" values. Additional "low" and "high" value estimates are presented in Chapter 11 of the EEBA.

b. Total Social Costs include compliance costs to facilities and government administrative costs.

Source: U.S. EPA Analysis, 2010.

Table 12-3, following page, provides additional detail on net benefits. *Table 12-3* compiles for the three options, the time profiles of benefits and costs as presented in the preceding chapters. The table also reports the calculated present and annualized values of benefits and costs at 3 percent and 7 percent discount rates. Benefits were estimated assuming the same compliance years as costs (see *Chapter 3, Section 1.5: Development of Compliance Years*). *Table 12-3* distributes these benefits over the assumed compliance window for each option, according to the methodology described in *Chapter 9, Section 1*.

Table 12-3: Time Profile of Benefits and Social Costs (Millions; $2009)

Year	Option 1		Option 2		Option 3	
	Monetized Benefits	Total Social Costs	Monetized Benefits	Total Social Costs	Monetized Benefits	Total Social Costs
2012	$0.00	$7.96	$0.00	**$5.03**	$0.00	$1.79
2013	$0.48	$804.43	$0.03	**$81.04**	$0.01	$25.79
2014	$1.39	$865.34	$0.09	**$91.59**	$0.02	$28.55
2015	$4.55	$913.84	$0.29	**$102.39**	$0.08	$31.39
2016	$8.40	$782.33	$0.52	**$112.28**	$0.14	$33.98
2017	$12.48	$802.67	$0.76	**$4,635.93**	$0.21	$4,667.45
2018	$16.29	$376.25	$17.25	**$9,961.77**	$17.21	$10,206.06
2019	$19.70	$218.54	$34.67	**$10,432.53**	$35.19	$10,705.95
2020	$20.86	$203.99	$56.26	**$10,905.49**	$57.56	$11,208.23
2021	$21.33	$376.25	$80.22	**$11,366.09**	$82.40	$11,697.30
2022	$21.57	$216.41	$104.80	**$8,984.29**	$107.88	$9,338.28
2023	$21.59	$203.99	$119.08	**$6,141.57**	$122.82	$6,480.52
2024	$21.59	$376.25	$133.20	**$6,453.64**	$137.63	$6,807.04
2025	$21.59	$216.41	$144.72	**$6,782.45**	$149.94	$7,150.79
2026	$21.59	$203.99	$156.68	**$7,110.37**	$162.72	$7,493.23
2027	$21.59	$376.25	$168.55	**$5,777.14**	$175.43	$6,067.03
2028	$21.59	$216.41	$174.76	**$3,998.64**	$182.09	$4,179.89
2029	$21.59	$203.99	$180.39	**$4,025.49**	$188.12	$4,207.95

Table 12-3: Time Profile of Benefits and Social Costs (Millions; $2009)

Year	Option 1		Option 2		Option 3	
	Monetized Benefits	Total Social Costs	Monetized Benefits	Total Social Costs	Monetized Benefits	Total Social Costs
2030	$21.59	$376.25	$184.33	**$4,056.00**	$192.23	$4,239.82
2031	$21.59	$216.41	$185.42	**$4,056.00**	$193.38	$4,239.82
2032	$21.59	$203.99	$185.96	**$4,056.00**	$193.95	$4,239.82
2033	$21.59	$687.54	$186.18	**$4,090.05**	$194.18	$4,249.08
2034	$21.59	$527.70	$186.18	**$4,090.05**	$194.18	$4,249.08
2035	$21.59	$515.27	$186.18	**$4,090.05**	$194.18	$4,249.08
2036	$21.59	$687.54	$186.18	**$4,090.05**	$194.18	$4,249.08
2037	$21.59	$527.70	$186.18	**$4,090.05**	$194.18	$4,249.08
2038	$21.59	$269.27	$186.18	**$4,069.07**	$194.18	$4,246.43
2039	$21.59	$441.53	$186.18	**$4,069.07**	$194.18	$4,246.43
2040	$21.59	$281.69	$186.18	**$4,069.07**	$194.18	$4,246.43
2041	$21.59	$269.27	$186.18	**$4,069.07**	$194.18	$4,246.43
2042	$21.59	$441.53	$186.18	**$4,069.07**	$194.18	$4,246.43
2043	$21.59	$220.92	$186.18	**$4,067.86**	$194.18	$4,253.72
2044	$21.59	$208.50	$186.18	**$4,067.86**	$194.18	$4,253.72
2045	$21.59	$380.76	$186.18	**$4,067.86**	$194.18	$4,253.72
2046	$21.59	$220.92	$186.18	**$4,067.86**	$194.18	$4,253.72
2047	$21.59	$208.50	$186.18	**$4,067.86**	$194.18	$4,253.72
2048	$21.59	$376.25	$186.18	**$4,056.37**	$194.18	$4,240.18
2049	$21.59	$216.41	$186.18	**$4,056.37**	$194.18	$4,240.18
2050	$21.59	$203.99	$186.18	**$4,056.37**	$194.18	$4,240.18
2051	$21.59	$376.25	$186.18	**$4,056.37**	$194.18	$4,240.18
2052	$21.59	$214.79	$186.18	**$4,054.74**	$194.18	$4,238.55
2053	$21.59	$160.12	$186.18	**$3,241.74**	$194.18	$3,388.81
2054	$21.59	$177.51	$186.18	**$2,431.31**	$194.18	$2,541.61
2055	$21.59	$80.06	$186.18	**$1,620.87**	$194.18	$1,694.41
2056	$21.59	$40.03	$186.18	**$810.44**	$194.18	$847.20
2057	$19.39	$0.00	$160.24	**$0.00**	$167.09	$0.00
2058	$17.20	$0.00	$135.35	**$0.00**	$141.09	$0.00
2059	$4.49	$0.00	$68.61	**$0.00**	$71.71	$0.00
2060	$2.29	$0.00	$42.67	**$0.00**	$44.62	$0.00
2061	$1.15	$0.00	$21.86	**$0.00**	$22.86	$0.00
2062	$0.00	$0.00	$0.00	**$0.00**	$0.00	$0.00
PV 3%	**$453.68**	**$9,874.98**	**$3,108.23**	**$114,943.11**	**$3,232.89**	**$119,170.58**
Annualized at 3%	**$17.63**	**$383.80**	**$120.79**	**$4,467.32**	**$125.65**	**$4,631.62**
PV 7%	**$221.34**	**$6,331.93**	**$1,272.59**	**$64,944.79**	**$1,320.89**	**$67,099.91**
Annualized at 7%	**$16.04**	**$458.81**	**$92.20**	**$4,705.89**	**$95.71**	**$4,862.05**

Source: U.S. EPA Analysis, 2010

12.3 Incremental Analysis of Benefits and Social Costs

In addition to comparing benefits and costs for each primary analysis option, as presented in the preceding section, EPA also analyzed the benefits and costs of the options on an incremental basis. The comparison in the preceding section addresses the simple quantitative relationship between estimated benefits and costs for each option by itself: for a given option, which is greater – costs or benefits – and by how much in relative terms? In contrast, incremental analysis looks at the differential relationship of benefits and costs across options and poses a different question: as increasingly more costly options are considered, by what amount do benefits, costs, and net benefits (i.e., benefits minus costs) change from option to option? Incremental net benefit analysis provides insight into the net gain to society from imposing increasingly more costly requirements and may aid regulatory decision-makers in choosing among a set of regulatory proposals that otherwise have a similar quantitative relationship between benefits and costs based on a one-option-at-a-time comparison.

The Agency conducted the incremental net benefit analysis by calculating, for each option, the change in net benefits, from option to option, in moving from the least stringent option to successively more stringent options. As described previously, the regulatory options differ in the technology standard required of facilities and the criteria by which these technologies are assigned to facilities. Thus, the difference in benefits and costs across the options derives from the effectiveness of the installed technology in reducing impingement mortality and entrainment, and in the case of Option 2, from the number of facilities installing a re-circulating system. As reported in *Table 12-4*, at a 3 percent discount rate, the incremental change in mean net benefits in moving from Option 1 to Option 2 is -$4.1 billion, and from Option 2 to Option 3 is another -$74 million. Thus, for both incremental steps, calculated net benefits become increasingly more negative but the step from Option 1 to Option 2 is more costly to society, on a net benefit basis, than the step from Option 2 to Option 3. The same pattern of change occurs for the analysis under a 7 percent discount rate: the incremental change in mean net benefits in moving from Option 1 to Option 2 is -$4.2 billion, and from Option 2 to Option 3 is -$159 million.

Table 12-4: Incremental Net Benefit Analysis (Millions; $2009)

	Net Benefits[b]		Incremental Net Benefits[c]	
Option[a]	**3%**	**7%**	**3%**	**7%**
Option 1	-366.17	-442.77	-366.17	-442.77
Option 2	-4,432.11	-4,607.15	-4,065.94	-4,164.38
Option 3	-4,505.97	-4,766.34	-73.86	-159.19

a. Options are presented in order of increasing stringency.

b. Net benefits are calculated by subtracting total annualized costs from total annual benefits.

c. Incremental net benefits are equal to the difference between net benefits of an option and net benefits of the previous, less stringent option.

Source: U.S. EPA Analysis, 2010

13 Cost and Economic Impact of Additional Regulatory Option (Option 4 – IM for Facilities with Design Intake Flow Greater than 50 MGD)

In addition to the three regulatory options presented in the preceding chapters of this report, i.e., Options 1, 2, and 3, EPA analyzed an additional regulatory option – *Option 4: IM for Facilities with a Design Intake Flow Greater than 50 MGD* – in developing the Proposed 316(b) Existing Facilities Regulation. Option 4 is the same as Option 1: IM Everywhere, in all respects except that Option 4 requires only in-scope existing facilities with a design intake flow greater that 50 million gallons per day to achieve the uniform impingement mortality design and performance standards; existing in-scope facilities between 2 and 50 MGD would continue to receive permits based on best professional judgment (BPJ).

Because EPA analyzed Option 4 *after* completing the analysis and documentation of the three regulatory options presented elsewhere in this EA report, the analysis results for Option 4 are presented separately in this chapter. The same analyses that were conducted in the preceding chapters for Options 1, 2, and 3 were conducted for Option 4; findings from these analyses are presented in this chapter.

This chapter includes:

- Private cost estimates (*Section 13.1*)
- Social costs and benefits estimates (*Section 13.2*)
- Unfunded Mandates Reform Act (*Section 13.3*)
- Cost and Economic Impact for Manufacturers (*Section 13.4*)
- Cost and Economic Impact for Electric Generators (*Section 13.5)*
- Regulatory Flexibility Act (*Section 13.6)*

The cost and economic impact analyses for Option 4 were conducted using the same methodology and assumptions, and relied on the same data sources, as the analyses conducted for Options 1, 2, and 3 (for details see *Chapter 3: Development of Costs for Regulatory Options*, *Chapter 5: Cost and Economic Impact Analysis – Electric Generators*, *Chapter 11: Assessment of Total Social Costs*, and *Chapter 12: Social Costs and Benefits of the Proposed Rule*)

13.1 Annualized Compliance Costs to Complying Facilities

Table 13-1 and *Table 13-2* on the following pages present pre-tax and after-tax compliance costs for Manufacturers and Electric Generators under Option 4. *Table 13-3* presents the total national annualized compliance costs for Manufacturers and Electric Generators.

Table 13-1: Option 4 – Annualized Compliance Costs for Manufacturers by Industry Sector (millions, $2009, at 2012)

Sector	One-Time Costs			Recurring Costs				Total
	Capital Technology	Connection Outage	Initial Permit Application	O&M	Monitoring, Record Keeping, and Reporting	Energy Penalty	Permit Renewal	
Option 4: IM for Facilities with DIF>50 MGD								
Pre-Tax Compliance Costs								
Aluminum	$0.16	$0.04	$0.01	$0.42	$0.12	$0.00	$0.01	$0.77
Chemicals and Allied Products	$6.98	$0.00	$0.13	$4.67	$2.34	$0.00	$0.12	$14.25
Food and Kindred Products	$0.99	$0.00	$0.03	$0.77	$0.18	$0.00	$0.02	$2.00
Paper and Allied Products	$0.26	$0.03	$0.01	$0.55	$0.17	$0.00	$0.01	$1.03
Petroleum Refining	$3.01	$0.15	$0.08	$3.68	$1.55	$0.00	$0.08	$8.57
Steel	$1.53	$0.00	$0.03	$2.03	$0.56	$0.00	$0.03	$4.18
Other (Misc)	$0.26	$0.03	$0.01	$0.55	$0.17	$0.00	$0.01	$1.03
Total	**$16.11**	**$0.23**	**$0.35**	**$16.62**	**$5.93**	**$0.00**	**$0.33**	**$39.58**
After-Tax Compliance Costs								
Aluminum	$0.10	$0.03	$0.01	$0.27	$0.08	$0.00	$0.01	$0.49
Chemicals and Allied Products	$4.30	$0.00	$0.08	$2.89	$1.44	$0.00	$0.07	$8.79
Food and Kindred Products	$0.57	$0.00	$0.02	$0.44	$0.10	$0.00	$0.01	$1.14
Paper and Allied Products	$0.15	$0.02	$0.01	$0.32	$0.10	$0.00	$0.01	$0.60
Petroleum Refining	$1.82	$0.09	$0.05	$2.22	$0.94	$0.00	$0.05	$5.17
Steel	$0.91	$0.00	$0.02	$1.21	$0.34	$0.00	$0.02	$2.49
Other (Misc)	$0.15	$0.02	$0.01	$0.32	$0.10	$0.00	$0.01	$0.60
Total	**$9.78**	**$0.14**	**$0.21**	**$10.05**	**$3.60**	**$0.00**	**$0.20**	**$23.98**

Source: U.S. EPA analysis, 2010

Table 13-2: Option 4 – Annualized Compliance Costs for Electric Generators by NERC Region (millions, $2009, at 2012)[a]

NERC Region	One-Time Costs: Capital Technology	One-Time Costs: Connection Outage	One-Time Costs: Initial Permit Application	Recurring Costs: O&M	Recurring Costs: Monitoring, Record Keeping, and Reporting	Recurring Costs: Energy Penalty	Recurring Costs: Permit Renewal	Total
Option 4: IM for Facilities with DIF>50 MGD								
Pre-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$11.80	$3.59	$0.11	$15.02	$1.68	$0.00	$0.10	$32.29
FRCC	$15.84	$6.21	$0.06	$10.46	$1.05	$0.00	$0.06	$33.68
HICC	$1.38	$0.00	$0.01	$1.91	$0.17	$0.00	$0.01	$3.48
MRO	$5.84	$5.82	$0.12	$8.60	$1.65	$0.00	$0.11	$22.15
NPCC	$14.21	$0.00	$0.16	$24.84	$2.51	$0.00	$0.15	$41.87
RFC	$45.98	$3.17	$0.41	$56.01	$7.22	$0.00	$0.39	$113.17
SERC	$35.03	$6.28	$0.40	$47.47	$6.10	$0.00	$0.38	$95.65
SPP	$5.96	$31.03	$0.09	$12.60	$1.44	$0.00	$0.08	$51.20
WECC	$0.26	$0.00	$0.06	$0.16	$0.21	$0.00	$0.06	$0.75
Total	**$136.30**	**$56.09**	**$1.41**	**$177.07**	**$22.03**	**$0.00**	**$1.33**	**$394.23**
After-Tax Compliance Costs								
ASCC	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ERCOT	$8.25	$2.33	$0.08	$11.11	$1.26	$0.00	$0.07	$23.36
FRCC	$9.75	$3.81	$0.04	$6.44	$0.69	$0.00	$0.04	$20.77
HICC	$0.84	$0.00	$0.00	$1.16	$0.11	$0.00	$0.00	$2.12
MRO	$4.48	$5.76	$0.08	$5.81	$1.12	$0.00	$0.07	$17.96
NPCC	$8.46	$0.00	$0.10	$14.78	$1.49	$0.00	$0.09	$25.16
RFC	$27.59	$1.87	$0.26	$33.85	$4.49	$0.00	$0.25	$71.37
SERC	$24.85	$3.81	$0.28	$34.13	$4.19	$0.00	$0.26	$68.70
SPP	$3.86	$18.96	$0.06	$8.13	$0.95	$0.00	$0.05	$32.55
WECC	$0.23	$0.00	$0.04	$0.14	$0.17	$0.00	$0.04	$2.17
Total	**$88.31**	**$36.54**	**$0.94**	**$115.54**	**$14.47**	**$0.00**	**$0.89**	**$264.16**

a. EPA data indicate that no DQ in-scope facilities are located in the ASCC NERC region; an STQ facility in ASCC facility was grouped with STQ facilities in the WECC region (see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses).*

Source: U.S. EPA analysis, 2010

Table 13-3: Option 4 – Annualized Compliance Costs For Manufacturers and Electric Generators (millions, $2009, at 2012)[a]

Facility Group	One-Time Costs: Capital Technology	One-Time Costs: Connection Outage	One-Time Costs: Initial Permit Application	Recurring Costs: O&M	Recurring Costs: Monitoring, Record Keeping, and Reporting	Recurring Costs: Energy Penalty	Recurring Costs: Permit Renewal	Total
Option 4: IM for Facilities with DIF>50 MGD								
Pre-Tax Compliance Costs								
Manufacturers	**$16.11**	**$0.23**	**$0.35**	**$16.62**	**$5.93**	**$0.00**	**$0.33**	**$39.58**
Generators	$136.30	$56.09	$1.41	$177.07	$22.03	$0.00	$1.33	$394.23
Total	**$152.41**	**$56.32**	**$1.76**	**$193.69**	**$27.96**	**$0.00**	**$1.66**	**$433.80**
After-Tax Compliance Costs								
Manufacturers	**$9.78**	**$0.14**	**$0.21**	**$10.05**	**$3.60**	**$0.00**	**$0.20**	**$23.98**
Generators	$88.31	$36.54	$0.94	$115.54	$14.47	$0.00	$0.89	$264.16
Total	**$98.09**	**$36.68**	**$1.15**	**$125.59**	**$18.07**	**$0.00**	**$1.09**	**$288.14**

Source: U.S. EPA analysis, 2010

13.2 Total Social Costs and Benefits

Table 13-4 reports total social costs for Option 4 discounted at 3 and 7 percent rates. At a 3 percent discount rate, total annual social costs are $326.55 million; at a 7 percent discount rate, these costs are $383.10 million.

Table 13-4: Option 4 –Total Social Costs (Millions; $2009)[a,b,c]

Cost Category	Discounted and Annualized at	
	3%	**7%**
Compliance Cost	$323.77	$379.84
Gov. Admin.	$2.79	$3.26
Total[a]	**$326.55**	**$383.10**

a. Values may not add up to total to due independent rounding.
b. Values include costs for Electric Generators and Manufacturers.
c. Social cost values do not include costs potentially incurred for installation of entrainment mortality (cooling tower) technology at new generating units.
Source: U.S. EPA Analysis, 2010.

Table 13-5 presents EPA's estimates of benefits and social costs for Option 4 for existing facilities, at 3 percent and 7 percent discount rates, and annualized over 50 years. At a 3 percent discount rate, EPA estimates that social costs exceed mean monetized benefits by $309.2 million; at a 7 percent discount rate, social costs exceed mean monetized benefits by $367.3 million. These values are all in 2009 dollars and are based on discounting of costs and benefits to the beginning of the year 2012, the assumed date when the rule would take effect.

Table 13-5: Option 4 – Total Benefits and Social Costs (Millions; $2009)

Option	Total Monetized Benefits[a]		Total Social Costs[b]	
	3%	**7%**	**3%**	**7%**
Option 4	$17.33	$15.76	$326.55	$383.10

a. The benefit values presented in this table are the estimated "mean" values. Additional "low" and "high" value estimates are presented in Chapter 11 of the EEBA.
b. Total Social Costs include compliance costs to facilities and government administrative costs; reported social costs do not include costs potentially incurred for installation of entrainment mortality (cooling tower) technology at new generating units.
Source: U.S. EPA Analysis, 2010.

Table 13-6 provides additional detail on net benefits; this Table compiles the time profiles of benefits and social costs for Option 4. *Table 13-6* also reports the discounted present value and annualized value of benefits and costs at 3 percent and 7 percent discount rates. The time profiles of social costs and benefits reflect the same compliance schedules as described previously (see *Chapter 3, Section 1.5: Development of Compliance Years*). *Table 13-6* distributes these benefits over the assumed compliance window for each option, according to the methodology described in *Chapter 9, Section 1*.

Table 13-6: Option 4 – Time Profile of Benefits and Social Costs (Millions; $2009)

Year	Option 4	
	Monetized Benefits	**Total Social Costs**
2012	$0.00	$5.33
2013	$0.48	$639.82
2014	$1.37	$694.49
2015	$4.47	$735.92
2016	$8.25	$597.73
2017	$12.26	$612.73
2018	$16.00	$344.30
2019	$19.35	$186.59
2020	$20.49	$172.03
2021	$20.96	$344.30
2022	$21.19	$184.46
2023	$21.22	$172.03
2024	$21.22	$344.30
2025	$21.22	$184.46
2026	$21.22	$172.03
2027	$21.22	$344.30
2028	$21.22	$184.46

Table 13-6: Option 4 – Time Profile of Benefits and Social Costs (Millions; $2009)

Year	Option 4	
	Monetized Benefits	**Total Social Costs**
2029	$21.22	$172.03
2030	$21.22	$344.30
2031	$21.22	$184.46
2032	$21.22	$172.03
2033	$21.22	$641.87
2034	$21.22	$482.04
2035	$21.22	$469.61
2036	$21.22	$641.87
2037	$21.22	$482.04
2038	$21.22	$232.52
2039	$21.22	$404.78
2040	$21.22	$244.94
2041	$21.22	$232.52
2042	$21.22	$404.78
2043	$21.22	$186.96
2044	$21.22	$174.53
2045	$21.22	$346.79
2046	$21.22	$186.96
2047	$21.22	$174.53
2048	$21.22	$344.30
2049	$21.22	$184.46
2050	$21.22	$172.03
2051	$21.22	$344.30
2052	$21.22	$184.02
2053	$21.22	$135.63
2054	$21.22	$159.15
2055	$21.22	$67.82
2056	$21.22	$33.91
2057	$19.06	$0.00
2058	$16.90	$0.00
2059	$4.42	$0.00
2060	$2.26	$0.00
2061	$1.13	$0.00
2062	$0.00	$0.00
PV 3%	**$445.83**	**$8,402.17**
Annualized at 3%	**$17.33**	**$326.55**
PV 7%	**$217.50**	**$5,287.03**
Annualized at 7%	**$15.76**	**$383.10**

Source: U.S. EPA Analysis, 2010

13.3 Unfunded Mandates Reform Act (UMRA) Analysis

13.3.1 Administrative Costs

Table 13-7 shows that for Option 4: IM for Facilities with DIF > 50 MGD, compliance costs for government-owned Electric Generators are approximately $9.5 million annually in the aggregate (total weighted compliance cost annualized at 7 %), with an average annual cost per facility of about $0.2 million. Municipally-owned Electric Generators account for approximately $3.8 million of this cost, and State-owned Electric Generators account for the remaining $5.7 million. The average cost to a State-owned Electric Generator is $0.3 million, compared to about $0.2 million for the average municipal Electric Generator. The maximum annualized compliance costs expected to be incurred by any single government-owned Electric Generator is $1.0 million for a State-owned Electric Generator and $0.5 million for a municipal Electric Generator.[224]

Table 13-7: Option 4 – Compliance Costs to Government-Owned Electric Generators (Millions; $2009)

Ownership Type	Number of In-scope Facilities (weighted)	Total Weighted, Annualized Pre-tax Compliance Cost	Average Annual Compliance Cost (per facility)	Maximum Annualized Facility Compliance Cost[a]
Option 4: IM for Facilities with DIF>50 MGD				
Municipality	25	$3.8	$0.2	$0.5
State	17	$5.7	$0.3	$1.0
Other Political Subdivision[b]	0	$0.0	$0.0	$0.0
Total	**42**	**$9.5**	**$0.2**	**$1.0**

a. Reflects maximum of un-weighted costs to explicitly analyzed facilities only.
b. EPA's analysis indicates there are 3 *Other Political Subdivision* entities. These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed Other Political Subdivision parent entity to represent these implicitly analyzed Other Political Subdivision parent entities. As a result, the weighted entity counts do not include the 3 known Other Political Subdivision entities even though they are known to be part of the regulated facility and entity universe.
Source: U.S. EPA analysis, 2010

13.3.2 Compliance Costs

As shown in *Table 13-8*, government entities are expected to incur annualized costs of $4.06 million to administer Option 4. Administrative costs are higher for this Option than for Options 2 and 3 because, like Option 1, they do not require cooling tower technology to be installed. As discussed in *Chapter 8: UMRA Analysis*, facilities with cooling towers incur no monitoring costs and no entrainment study costs, thereby reducing the administrative burden on the permitting authority.

Unlike Options 1, 2, and 3, *entrainment study* activities are expected to account for the largest portion of administrative costs under Option 4 – $2.16 of the $4.06 million in annualized administrative costs incurred for this option. Other administrative costs of approximately $0.04 for start-up activities and $0.52 for permit issuance and reissuance.

Table 13-8: Option 4 – Annualized Government Administrative Costs (Millions; $2009)

Activity	Annualized Cost, Electric Generators	Annualized Cost, Manufacturers	Total Annualized Cost
Option 4: IM for Facilities with DIF>50 MGD			
Start-Up Activities	$0.02	$0.02	$0.04
First Permit Issuance Activities	$0.23	$0.06	$0.29
Annual Monitoring Activities	$1.04	$0.31	$1.35
Entrainment Study	$1.19	$0.97	$2.16
Permit Reissuance Activities	$0.18	$0.05	$0.23
Total	**$2.65**	**$1.41**	**$4.06**

a. These costs reflect the assumption that all facilities will comply in one year, and were discounted accordingly because individual components of costs were not distributed over the 5-year compliance window, as described in *Chapter 11, Section 1*.
Source: U.S. EPA analysis, 2010

13.3.3 Analysis Impact on Small Governments

As presented in *Table 13-9*, costs are lower for small governments in comparison to large governments in the aggregate, and approximately the same on a per facility basis. Under Option 1, the 10 facilities owned by small

224 Maximum per facility values are reported on an unweighted basis.

government entities, all of which are municipalities, incur total annualized costs of $1.4 million, which is substantially less than the total of $8.1 million in costs incurred by the 31 facilities owned by large governments. Small and large governments incur costs of approximately $0.1 million and $0.3 million per facility, respectively.[225] Small government-owned facilities are also expected to incur lower costs per facility than the 16 small privately owned facilities, for which compliance costs are estimated to be $6.0 million in the aggregate, or about $0.4 million per facility. Moreover, the largest annualized cost to any individual facility owned by a small government is about $0.2 million, significantly lower than the maximum facility costs of around $1.0 million for large government-owned facilities and $2.5 million for small privately-owned facilities.

Table 13-9: Option 4 – Compliance Costs for Electric Generators by Ownership Type and Size (Millions; $2009)

Ownership Type	Entity Size	Number of Facilities (weighted)	Total Annualized Pre-Tax Compliance Costs	Average Annualized Pre-tax Compliance Cost per Facility	Maximum Facility Annualized Pre-tax Compliance Cost[b]
Option 4: IM for Facilities with DIF>50 MGD					
Government (excluding Federal)	Small	10	$1.4	$0.1	$0.2
	Large	31	$8.1	$0.3	$1.0
Private	Small	16	$6.0	$0.4	$2.5
	Large	485	$346.1	$0.7	$7.2
All Facilities[a]		**559**	**$383.0**	**$0.7**	**$7.2**

a. Facility counts and cost estimates reported for All Facilities include 15 federal government-owned facilities and costs estimated for these facilities.

b. Reflects maximum of un-weighted costs to explicitly analyzed facilities only.

Source: U.S. EPA analysis, 2010

13.3.4 Analysis Summary

Table 13-10 presents a summary of compliance costs under Option 4 for publicly- and privately-owned facilities, along with government administrative costs, for each regulatory option.

For Option 4, EPA estimates total annual compliance costs for government-owned Electric Generators at $9.5 million. NPDES permitting authorities are expected to incur another $3.2 million per year to implement this option for both Electric Generators and Manufacturers, resulting in a total annual cost of approximately $12.7 million for State and local governments. The maximum compliance cost for government-owned Electric Generators in any one year under Option 4 is $17.6 million in 2033. The maximum administrative cost to NPDES authorities in any single year for administering this option is $4.0 million in 2015 and $2.5 million in 2016 for the Electric Generators and Manufacturers rule segments, respectively. Privately owned Electric Generators and Manufacturers are expected to incur annualized compliance costs of $387.0 million under this option, with a maximum yearly value of $0.7 billion in 2015 for Electric Generators and $0.2 billion in 2015 for Manufacturers.

225 Excluding federal government-owned facilities.

Table 13-10: Option 4 – Summary of UMRA Costs (Millions; $2009)

Sector Incurring Costs	Total Annualized Cost: Facility Compliance Costs[a]	Total Annualized Cost: Government Administrative Costs[b]	Total Annualized Cost: Total	Maximum One-Year Cost: Facility Compliance Costs	Maximum One-Year Cost: Government Administrative Costs	Maximum One-Year Cost: Total
Option 4: IM for Facilities with DIF>50 MGD						
Electric Generators						
Government (excluding Federal)	$9.5	$2.4	$11.9	$17.6	$4.0	$21.6
Private	$352.2	N/A	$352.2	$734.5	N/A	$734.5
Manufacturers						
Government (excluding Federal)	$0.00	$0.8	$0.8	$0.0	$2.5	$2.5
Private	$34.8	N/A	$34.8	$239.7	N/A	$239.7

a. Cost values for Electric Generators are lower than those presented in *Table 13-9* because they reflect a distribution over the compliance window, as described in Chapter 11: Assessment of Total Social Costs, thus changing the amount discounted in each year.
b. These values are slightly lower than those presented in *Table 13-8* because they reflect a distribution over the compliance window, as described in *Chapter 11: Assessment of Total Social Costs*, thus changing the amount discounted in each year.
Source: U.S. EPA analysis, 2010

13.4 Cost and Economic Impact Analysis – Manufacturers

Table 13-11 summarizes the results from the firm impact analysis for Option 4 assuming that facilities represented by sample weights are owned by the same firm that owns the sample facility (Case 1). The following table, *Table 13-12*, reports the results from the firm impact analysis assuming that the facilities presented by sample weights are owned by different firms than that owning the sample facility (Case 2). Both tables show the number of firms that incur costs in three ranges: less than 1 percent of a firm's revenue, within 1 and 3 percent of revenue, and greater than 3 percent of revenue.

Under Option 4/Case 1, of the 123 entities estimated to own facilities subject to the proposed regulation; all are estimated to incur costs less than 1 percent of revenue with none incurring costs greater than 1 or 3 percent of revenue. Under Option 4/Case 2, 356 entities are estimated to own facilities subject to regulation; all are estimated to incur costs less than 1 percent of revenue, while zero incur costs greater than 1 or 3 percent of revenue.

Table 13-11: Option 4 – Entity-Level Cost-to-Revenue Analysis Results, Assuming that Facilities Represented by Sample Weights are Owned by the Same Firm that Owns the Sample Facility (Case 1)

Entity Type	Total Number of Facilities	Total Number of Entities	Number of Firms with a Ratio of: <1%	1-3%	>3%	Unknown[a]	Minimum Ratio	Maximum Ratio
Option 4: IM for Facilities with DIF>50 MGD								
Food	31	8	8	0	0	0	0	0.00
Paper	198	42	42	0	0	0	0	0.01
Petroleum	30	17	17	0	0	0	0	0.00
Chemicals	167	26	26	0	0	0	0	0.00
Steel	46	16	16	0	0	0	0	0.03
Aluminum	24	5	5	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.01
Total	**504**	**123**	**123**	**0**	**0**	**0**	**0**	**0.03**

a. EPA was unable to determine revenues for 3 parent entities.
Source: U.S. EPA Analysis, 2010

Table 13-12: Option 4 – Entity-Level Cost-to-Revenue Analysis Results, Assuming that Facilities Represented by Sample Weights are Owned by Different Firms than those Owning the Sample Facility (Case 2)

Entity Type	Total Number of Facilities	Total Number of Entities	Number of Firms with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[a]		
Option 4: IM for Facilities with DIF>50 MGD								
Food	31	24	24	0	0	0	0	0.00
Paper	198	126	126	0	0	0	0	0.00
Petroleum	30	24	24	0	0	0	0	0.00
Chemicals	167	116	116	0	0	0	0	0.00
Steel	46	43	43	0	0	0	0	0.01
Aluminum	24	14	14	0	0	0	0	0.02
Other	7	9	9	0	0	0	0	0.01
Total	**504**	**356**	**356**	**0**	**0**	**0**	**0**	**0.02**

a. EPA was unable to determine revenues for 9 parent entities.

Source: U.S. EPA Analysis, 2010

13.5 Cost and Economic Impact Analysis – Electric Generators

13.5.1 Cost-to-Revenue Analysis: Facility-Level Screening Analysis

Table 13-13 reports facility-level cost-to-revenue results for Option 4 by North American Reliability Corporation (NERC) region.[226] EPA estimates that 488 Electric Generators facilities subject to the Proposed Existing Facilities Rule will on incur annualized costs of *less than* 1 percent of revenue under Option 4 (87 percent); this finding applies to all NERC regions.

Table 13-13: Facility-Level Cost-to-Revenue Analysis Results by NERC Region and Regulatory Option[a,b]

NERC Region	Total Number of Facilities[c]	No Revenue[d]	Number of Facilities with a Ratio of			Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%		
Option 4: IM for Facilities DIF>50 MGD							
ASCC	0	0	0	0	0	0.00%	0.00%
ERCOT	42	5	28	7	2	0.00%	3.28%
FRCC	25	0	18	4	4	0.00%	3.49%
HICC	3	0	2	2	0	0.34%	1.04%
MRO	46	0	43	4	0	0.00%	1.80%
NPCC	63	0	52	11	0	0.00%	2.64%
RFC	164	0	151	12	2	0.00%	3.54%
SERC	157	0	148	5	5	0.00%	3.61%
SPP	34	0	28	6	0	0.00%	2.38%
WECC	23	0	19	0	4	0.00%	3.38%
Total	**559**	**5**	**488**	**49**	**17**	**0.00%**	**3.61%**

a. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.

b. Facility counts may not add up due to rounding.

c. Facility counts exclude baseline closures.

d. IPM and EIA report no revenue for 2 facilities (5 on a weighted basis); consequently, the facility-level cost-to-revenue analysis is performed for 257 facilities (559 on a weighted basis).

Source: U.S. EPA Analysis, 2010

226 NERC is responsible for the overall reliability, planning, and coordination of the power grids; it is organized into regional councils that are responsible for the overall coordination of bulk power policies that affect their regions' reliability and quality of service (see *Chapter 2.H: Profile of the Electric Power Industry*). As noted previously, NERC region definitions have recently changed.

13.5.2 Cost-to-Revenue Analysis: Entity-Level Screening Analysis

Using *facility weights*, EPA estimates that 97 unique parent entities own 559 facilities subject to the Proposed Existing Facilities Rule (*Table 13-14*). EPA estimates that 86 parent entities will incur annualized costs of less than 1 percent of revenues under Option 4 (89 percent). This finding applies across all parent entity types under Option 4. EPA estimates that 2 out of 97 parent entities will incur costs exceeding 3 percent under Option 4. As described previously, *the analysis using only facility-level weights is likely to overstate the costs to individual parent entities but may undercount the number of parent entities in a given impact range*.

Using *entity weights*, EPA estimates that 141 parent entities own 257 explicitly analyzed facilities subject to the Proposed Existing Facilities Rule (*Table 13-14*).[227] EPA estimates that 130 of these parent entities will incur annualized costs of less than 1 percent of revenues under Option 4 (92 percent). This finding applies to all ownership categories. As described above, *the analysis using only entity-level weights is likely to understate the costs to individual parent entities but provides a more comprehensive estimate of the number of parent entities incurring costs*.

Table 13-14: Entity-Level Cost-to-Revenue Analysis Results for Option 4: IM for Facilities with DIF>50 MGD

Entity Type	Total Number of Facilities[a]	Total Number of Entities[b]	Number of Facilities with a Ratio of				Minimum Ratio	Maximum Ratio
			<1%	1-3%	>3%	Unknown[b]		
Using Facility-Level Weights								
Cooperative	25	11	10	0	1	0	0.00%	4.09%
Federal	16	1	1	0	0	0	0.22%	0.22%
Investor-owned	306	38	38	0	0	0	0.00%	0.65%
Municipality	25	13	10	3	0	0	0.00%	1.46%
Nonutility	170	30	23	0	1	6	0.00%	22.44%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	17	4	4	0	0	0	0.00%	0.67%
Total	**559**	**97**	**86**	**3**	**2**	**6**	**0.00%**	**22.44%**
Using Entity-Level Weights								
Cooperative	13	20	18	2	0	0	0.00%	1.78%
Federal	7	1	1	0	0	0	0.09%	0.09%
Investor-owned	138	42	42	0	0	0	0.00%	0.16%
Municipality	13	36	36	0	0	0	0.00%	0.76%
Nonutility	78	38	29	0	1	8	0.00%	10.04%
Other Political Subdivision	0	0	0	0	0	0	0.00%	0.00%
State	8	4	4	0	0	0	0.00%	0.29%
Total	**257**	**141**	**130**	**2**	**1**	**8**	**0.00%**	**10.04%**

a. Facility counts exclude baseline closures.
b. EPA was unable to determine revenues for 6 parent entities (8 weighted).
b. There are a total of 143 parent entities on an unweighted basis, 3 of which are other political subdivision entities. These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed other political subdivision parent entity to represent these implicitly analyzed parent entities and total weighted entity counts do not include 3 other political subdivision entities.
Source: U.S. EPA Analysis, 2010

13.5.3 Impact of Compliance Costs on Household Electricity Costs

Table 13-15 reports the results of this analysis by NERC region for Option 4. These results for this option show that the average annual cost per residential household is expected to range from $0.01 in WECC to $3.86 in SPP.

[227] There are a total of 143 small parent entities on an unweighted basis, 3 of which are *Other Political Subdivision* entities. These entities own only implicitly analyzed facilities; consequently, there is no explicitly analyzed Other Political Subdivision parent entity to represent these implicitly analyzed Other Political Subdivision parent entities. As a result, the weighted entity counts do not include the 3 known Other Political Subdivision entities even though they are known to be part of the regulated facility and entity universe.

On average, for a typical U.S. household, Option 4 is expected to result in a cost of $1.37 per household, which is the lowest cost of all regulatory options (comparing to the 3 regulatory options presented previously in this EA report).

Table 13-15: Option 4 – Average Annual Cost per Household in 2015 by NERC Region ($2009)[a]

NERC Region[b]	Total Annual Compliance Cost (at 2015; Million; $2009)	Total Electricity Sales (at 2015; MWh)	Compliance Cost per Unit of Sales ($2009/MWh)	Residential Electricity Sales (at 2015; MWh)	Number of Households (at 2015)	Residential Sales per Residential Consumer (MWh)	Compliance Cost per Household ($2009)
Option 4: IM for Facilities DIF>50 MGD							
ASCC	$0	6,326,610	$0.00	2,114,456	265,449	7.97	$0.00
ECAR	$61,651,375	569,849,487	$0.11	190,477,670	16,899,104	11.27	$1.22
ERCOT	$39,560,948	313,395,966	$0.13	91,064,812	6,603,322	13.79	$1.74
FRCC	$41,259,203	242,320,908	$0.17	110,173,004	7,923,249	13.91	$2.37
HICC	$4,259,468	10,585,038	$0.40	3,200,675	407,140	7.86	$3.16
MAAC	$56,749,132	294,365,234	$0.19	104,073,139	10,285,013	10.12	$1.95
MAIN	$40,018,375	275,415,009	$0.15	86,988,500	8,939,201	9.73	$1.41
MAPP	$26,744,938	165,189,056	$0.16	55,172,815	5,146,199	10.72	$1.74
NPCC	$51,290,663	284,990,412	$0.18	95,584,731	12,557,410	7.61	$1.37
SERC	$97,785,654	887,073,303	$0.11	332,332,257	22,705,585	14.64	$1.61
SPP	$62,721,433	204,172,272	$0.31	68,368,566	5,439,270	12.57	$3.86
WECC	$913,556	701,826,043	$0.00	240,757,548	26,073,156	9.23	$0.01
U.S.	**$482,954,744**	**3,960,424,805**	**$0.12**	**1,380,308,173**	**123,244,098**	**11.20**	**$1.37**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.
b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2009b; U.S. DOE, 2007c

13.5.4 Impact of Compliance Costs on Electricity Prices

As reported in *Table 13-16*, annualized compliance costs (in cents per KWh sales) range from 0.011¢ in the ECAR and SERC regions to 0.040¢ in the HICC region for Option 4. On average, across the United States, Option 4 results in the lowest cost, 0.012¢ per kWh, across all regulatory options.

Table 13-16: Compliance Cost per KWh of Sales by NERC Region for Option 4 in 2015 ($2009) [a]

NERC Region [b]	Annualized Pre-Tax Compliance Costs (at 2015; $2009; million)	Total Electricity Sales (at 2015; KWh)	Costs per Unit of Sales (2009¢/KWh Sales)
Option 4: IM Everywhere Without New Unit Requirements			
ASCC	$0	6,326,610,000	0.000
ECAR	$61,651,375	569,849,487,305	0.011
ERCOT	$39,560,948	313,395,965,576	0.013
FRCC	$41,259,203	242,320,907,593	0.017
HICC	$4,259,468	10,585,038,000	0.040
MAAC	$56,749,132	294,365,234,375	0.019
MAIN	$40,018,375	275,415,008,545	0.015
MAPP	$26,744,938	165,189,056,396	0.016
NPCC	$51,290,663	284,990,412,176	0.018
SERC	$97,785,654	887,073,303,223	0.011
SPP	$62,721,433	204,172,271,729	0.031
WECC	$913,556	701,826,043,025	0.000
U.S.	**$482,954,744**	**3,960,424,804,688**	**0.012**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.
b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.
Source: U.S. EPA Analysis, 2010; U.S. DOE 2009b; U.S. DOE 2007c

To determine the potential significance of these compliance costs on electricity prices, EPA compared the per KWh compliance cost to baseline electricity prices by consuming sector, and for the average of the sectors. As reported in *Table 13-17* across the United States, Option 4 is expected to result in the lowest electricity price increase and is tied with Option 1 at 0.13 percent. Looking across the three consumer groups, industrial consumers are expected to experience the highest price increases: 0.19 percent under Option 4, and residential consumers are expected to experience the lowest price increases: 0.11 percent.

Table 13-17: Option 4 – Projected 2015 Price (Cents per KWh of Sales) and Potential Price Increase Due to Compliance Costs by NERC Region ($2009) [a]

NERC Region [b]	Compliance Cost (¢/KWh)	Residential		Commercial		Industrial		Transportation		All Sector Average	
		Baseline Price	% Change	Baseline Price	% Change	Baseline Price	% Change	Baseline Price	% Change	Baseline Price	% Change
Option 4: IM Everywhere Without New Unit Requirements											
ASCC	0.000	15.69	0.00%	12.59	0.00%	13.06	0.00%	NA	NA	13.73	0.00%
ECAR	0.011	9.83	0.11%	8.97	0.12%	6.15	0.18%	7.90	0.14%	8.21	0.13%
ERCOT	0.013	13.28	0.10%	9.37	0.13%	7.47	0.17%	10.59	0.12%	10.39	0.12%
FRCC	0.017	13.38	0.13%	11.28	0.15%	9.16	0.19%	8.94	0.19%	12.19	0.14%
HICC	0.040	24.93	0.16%	22.64	0.18%	18.99	0.21%	NA	NA	22.00	0.18%
MAAC	0.019	13.09	0.15%	11.35	0.17%	8.14	0.24%	11.06	0.17%	11.32	0.17%
MAIN	0.015	10.15	0.14%	8.24	0.18%	5.64	0.26%	7.52	0.19%	7.99	0.18%
MAPP	0.016	8.02	0.20%	7.45	0.22%	5.68	0.29%	6.84	0.24%	7.04	0.23%
NPCC	0.018	18.23	0.10%	14.42	0.12%	9.69	0.19%	15.84	0.11%	14.92	0.12%
SERC	0.011	9.04	0.12%	7.67	0.14%	5.56	0.20%	5.97	0.18%	7.60	0.15%
SPP	0.031	9.71	0.32%	8.25	0.37%	6.15	0.50%	7.56	0.41%	8.23	0.37%
WECC	0.000	11.37	0.00%	9.63	0.00%	7.00	0.00%	8.87	0.00%	9.64	0.00%
U.S. [c]	**0.012**	**11.20**	**0.11%**	**9.57**	**0.13%**	**6.46**	**0.19%**	**10.64**	**0.11%**	**9.35**	**0.13%**

a. The rate impact analysis assumes full pass-through of all compliance costs to electricity consumers.
b. No explicitly analyzed facilities are located in the ASCC region. For more information on explicitly and implicitly analyzed facilities see *Appendix 3.A: Use of Sample Weights in the Proposed Existing Facilities Rule Analyses*.
Source: U.S. EPA Analysis, 2010; U.S. DOE, 2009b; U.S. DOE, 2007c

13.6 Assessing the Potential Impact of the Proposed Existing Facilities Rule on Small Entities – Regulatory Flexibility Act (RFA) Analysis

13.6.1 Analysis of Manufacturers

As reported in *Table 13-18*, for Option 4, EPA estimated that no small entities within the Primary Manufacturing Industries or entities owning facilities in Other Industries would receive costs exceeding 1 or 3 percent of revenue, under either of the sample-weighting approaches used for this analysis. Thus, this option would have no material impact on small Manufacturers entities.

Table 13-18: Option 4 – Estimated Cost-To-Revenue Impact on Small Manufacturers Entities, by Industry

Firm Sector	Case 1: Lower bound estimate of number of firms owning facilities that face requirements under the regulatory analysis				Case 2: Upper bound estimate of number of firms owning facilities that face requirements under the regulatory analysis			
	Total In-Scope Firms	Small In-Scope Firms	Small Firms with Costs Exceeding		Total In-Scope Firms	Small In-Scope Firms	Small Firms with Costs Exceeding	
			1% of Revenue	3% of Revenue			1% of Revenue	3% of Revenue
Option 4: IM Everywhere Without New Unit Requirements								
Paper	42	9	0	0	126	29	0	0
Chemicals	26	4	0	0	116	18	0	0
Petroleum	17	4	0	0	24	4	0	0
Steel	16	3	0	0	43	8	0	0
Aluminum	5	2	0	0	14	5	0	0
Food	8	1	0	0	24	1	0	0
Multiple	3	0	0	0	13	0	0	0
Firms that own facilities in Primary Manufacturing Industries	**117**	**23**	**0**	**0**	**359**	**64**	**0**	**0**
Additional firms that own known facilities in Other Industries	9	4	0	0	9	4	0	0

a. Includes all firms with less than 500 employees from 2006 Statistics of U.S. Businesses (SUSB) of the U.S. Department of Commerce (U.S. DOC). mall Business Administration defines firms in nearly all profiled NAICS codes according to the firm's number of employees; however, for some in-manufacturing NAICS codes this threshold is 500 employees while for others this threshold is 750, 1,100, or 1,500 employees. Because the SUSB yment size categories do not correspond to the SBA entity size classifications, EPA was had to used the 500 employee threshold for all in-scope NAICS

Sources: U.S. EPA Analysis, 2010; D&B, 2009; U.S. EPA, 2000; U.S. DOC, 2006; SBA, 2009

13.6.2 Analysis of Electric Generators

Table 13-19 summarizes the findings for Option 4 from the analyses outlined in *Chapter 7: Regulatory Flexibility Act Analysis* in terms of numbers of small Electric Generators entities incurring costs exceeding the significant impact thresholds of 1 percent and 3 percent of revenue.

Under the *facility-level sample-weighting approach*, EPA estimates that 4 small entities owning Electric Generators, or 12.1 percent of all small in-scope entities, will incur costs exceeding 1 percent of revenue, and that 2 small entities, or 6.1 percent of all the estimated 33 small in-scope entities, will incur costs exceeding 3 percent of revenue under Option 4. In all instances, the numbers of small entities incurring costs exceeding either the 1 or 3 percent impact threshold are small percentages of the total estimated number of small entities in the affected industry segments.

Under the *entity-level sample-weighting approach*, EPA estimates that 6 small entities or 18.2 percent of the 33 estimated small in-scope Electric Generators entities, will incur costs exceeding 1 percent of revenue, and that 2 small entities, or 6.1 percent of estimated small in-scope entities, will incur costs exceeding 3 percent of revenue.

EPA assesses these impacts – both in number of entities incurring costs in excess of the 1 or 3 percent of revenue thresholds and as percentage of estimated small in-scope entities – as supportive of a finding of "No Significant Impact on a Substantial Number of Small Entities" (No SISNOSE) for the Electric Generators regulated industry segment of Option 4.

Table 13-19: Option 4 – Estimated Cost-to-Revenue Impact on Small Electric Generators Entities, by Entity Type[a]

Parent Entity Type[b]	Cost Impact Category: Cost > 1% of Revenue: Number of Small Entities	Cost Impact Category: Cost > 1% of Revenue: % of All Small Entities	Cost Impact Category: Cost > 3% of Revenue: Number of Small Entities	Cost Impact Category: Cost > 3% of Revenue: % of All Small Entities
Using Facility-Level Weights				
Rural Electric Cooperative	1	12.5%	1	12.5%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	2	11.8%	0	0.0%
Nonutility	1	20.0%	1	20.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**4**	**12.1%**	**2**	**6.1%**
Using Entity-Level Weights				
Rural Electric Cooperative	4	50.0%	0	0.0%
Investor-Owner Utility	0	0.0%	0	0.0%
Municipality	0	0.0%	0	0.0%
Nonutility	2	40.0%	2	40.0%
Other Political Subdivision	0	0.0%	0	0.0%
Total	**6**	**18.2%**	**2**	**6.1%**

a. The number of entities with cost-to-revenue impact exceeding 3 percent is a subset of the number of entities with such ratios exceeding 1 percent.

Source: U.S. EPA Analysis, 2010

13.6.3 Overall Small Entity Impact Assessment for Option 4

Given that no Manufacturers small entities are estimated to incur a significant impact and no more than 6 Electric Generators small entities (18 percent of the estimated total of Electric Generators small in-scope entities) are estimated to incur a significant impact, EPA concludes that Option 4 would qualify overall for a finding of “No Significant Impact on a Substantial Number of Small Entities.”

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