February 2009

Regulatory Impact Analysis (RIA) for Existing Stationary Reciprocating Internal Combustion Engines (RICE) NESHAP

Draft Report

Prepared for

Larry Sorrels
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards (OAQPS)
Air Benefit and Cost Group (ABCG)
(MD-C439-02)
Research Triangle Park, NC 27711

Prepared by

RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709

RTI Project Number 0209897.003.061

RTI Project Number
0209897.003.061

Regulatory Impact Analysis (RIA) for Existing Stationary Reciprocating Internal Combustion Engines (RICE) NESHAP

Draft Report

February 2009

Prepared for

Larry Sorrels
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards (OAQPS)
Air Benefit and Cost Group (ABCG)
(MD-C439-02)
Research Triangle Park, NC 27711

Prepared by

RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709

RTI International is a trade name of Research Triangle Institute.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1
EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA) has characterized the facilities and companies potentially affected by the proposed reciprocating internal combustion engines (RICE) National Emissions Standards for Hazardous Air Pollutants (NESHAP) by examining existing sources and the companies that own them.

EPA estimates that complying with the proposed RICE rule will have an annualized cost of approximately $345 million per year (2007 dollars) in the year of full implementation of the rule (2013). Using these costs, EPA estimates in its economic impact analysis that the NESHAP will have limited impacts on the eight industries affected and their consumers. Using sales data obtained for affected small entities in an analysis of the impacts of this proposal on small entities, EPA expects that the proposed NESHAP will not result in a SISNOSE (a significant economic impacts for a substantial number of small entities). EPA also does not expect significant adverse energy impacts based on Executive Order 13211, an Executive Order that requires analysis of energy impacts for rules such as this one that are economically significant under Executive Order 12866.

The proposed RICE rule is also considered subject to the requirements of the Office of Management and Budget's (OMB's) Circular A-4 because EPA expects that either the benefits or the costs are potentially $1 billion or higher. EPA's estimate of the benefits of the NESHAP, based on information from the $PM_{2.5}$ expert elicitation study released in October, 2006 and other data, is a range from $0.9 billion to $2.0 billion (2007 dollars) in 2013. EPA believes that the benefits are likely to exceed the annualized costs of $345 million by a substantial margin under this rulemaking even when taking into account uncertainties in the cost and benefit estimates.

SECTION 2
INTRODUCTION

The Environmental Protection Agency (EPA) is currently preparing a proposed National Emissions Standards for Hazardous Air Pollutants (NESHAP) to reduce hazardous air pollutants (HAP) emissions from existing reciprocating internal combustion engines (RICE). This rulemaking is on a court-ordered schedule to be proposed by February 25, 2009, and then promulgated by February 10, 2010. Regulations affecting new and reconstructed stationary diesel HAP and criteria pollutant emissions were issued in March 2004, July 2006, and December 2007. This latest rulemaking is meant to target those emissions sources (HAP, primarily) in the same industries that were not affected by these three different regulations. This rulemaking consists of a Maximum Achievable Control Technology (MACT) standard that will be applied to major sources of HAP emissions and a Generally Available Control Technology (GACT) standard that will be applied to area sources of HAP emissions. The proposed rule is economically significant according to Executive Order 12866. As part of the regulatory process of preparing these standards, EPA has prepared an economic impact analysis (RIA). This analysis includes an analysis of impacts to small entities as part of compliance with the Small Business Regulatory Enforcement Fairness Act (SBREFA) and an analysis of impacts on energy consumption and production to comply with Executive Order 13211 (Statement of Energy Effects).

2.1 Organization of this Report

The remainder of this report supports and details the methodology and the results of the EIA:

- Section 3 presents a profile of the affected industries.
- Section 4 presents a summary of regulatory alternatives considered in the proposed rule, and provides the compliance costs of the rule.
- Section 5 describes the estimated costs of the regulation and describes the EIA methodology and reports market, welfare, and energy impacts.
- Section 6 presents estimated impacts on small entities.
- Section 7 presents the benefits estimates.

SECTION 3
INDUSTRY PROFILE

This section provides an introduction to the industries affected by the proposed rule. The purpose is to give the reader a general understanding of the economic aspects of the industry; their relative size, relationships with other sectors in the economy, trends for the industries, and financial statistics. The sectors discussed are

- electric power generation, transmission, and distribution,
- oil and gas extraction (including marginal wells),
- pipeline transportation of natural gas,
- general medical and surgical hospitals, and
- irrigation sets and welding equipment.

3.1 Electric Power Generation, Transmission, and Distribution

3.1.1 Overview

Electric power generation, transmission, and distribution (NAICS 2211) is an industry group within the utilities sector (NAICS 22). It includes establishments that produce electrical energy or facilitate its transmission to the final consumer.

From 1997 to 2002, revenues from electric power grew about 10% to over $373 billion ($2007) (Table 3-1). At the same time, payroll rose about 6.5% and the number of employees decreased by over 5%. The number of establishments rose by over 15%, resulting in a decrease in average establishment revenue of almost 7%. Industrial production within NAICS 2211 has increased 25% since 1997 (Figure 3-1).

Electric utility companies have traditionally been tightly regulated monopolies. Since 1978, several laws and orders have been passed to encourage competition within the electricity market. In the late 1990s, many states began the process of restructuring their utility regulatory framework to support a competitive market. Following market manipulation in the early 2000s, however, several states have suspended their restructuring efforts. The majority (58%) of diesel power generators controlled by combined heat and power (CHP) or independent power producers are located in states undergoing active restructuring (Figure 3-2).

Table 3-1. Key Statistics: Electric Power Generation, Transmission, and Distribution (NAICS 2211) ($2007)

	1997	2002
Revenue ($\$10^6$)	337,490	373,309
Payroll ($\$10^6$)	38,176	40,842
Employees	564,525	535,675
Establishments	7,935	9,394

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

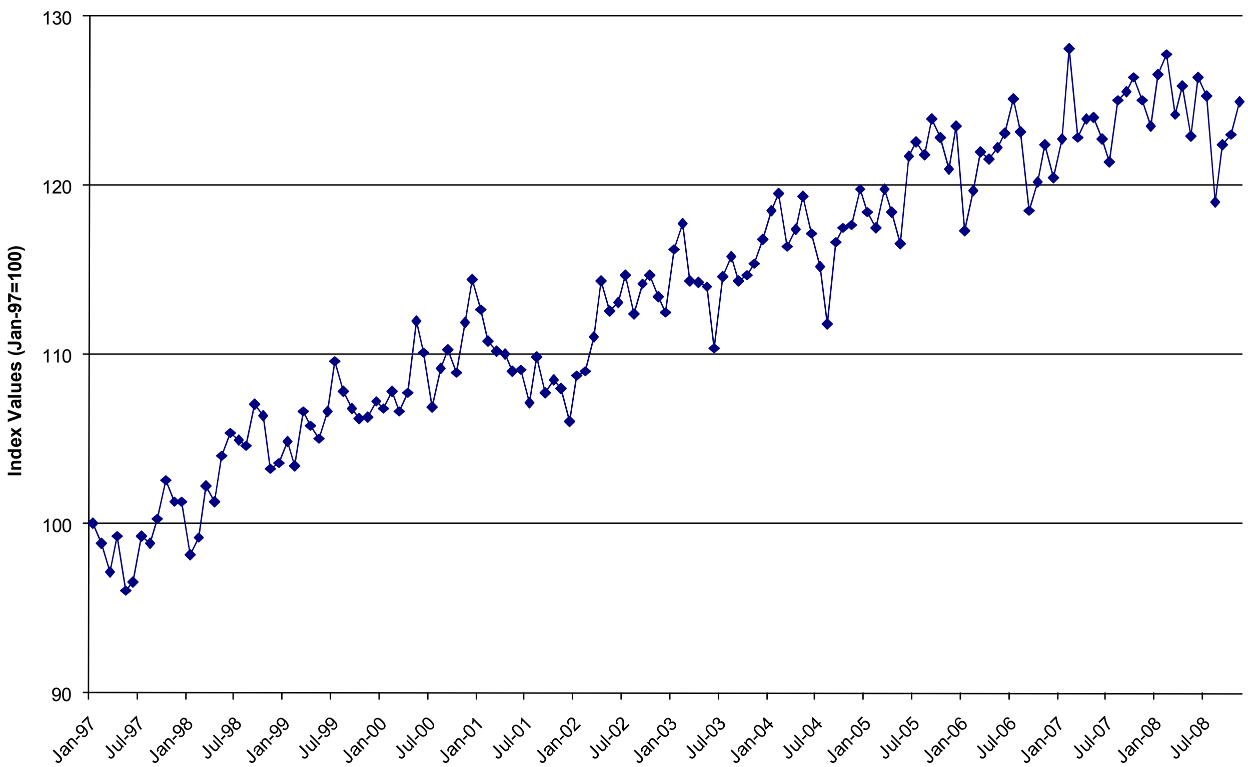


Figure 3-1. Industrial Production Index (NAICS 2211)

Source: The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G2211.S <http://www.federalreserve.gov/datadownload/>. (15 December, 2008)

3.1.2 Goods and Services Used

In Table 3-2, we use the latest detailed benchmark input-output data report by the Bureau of Economic Analysis (BEA) (2002) to identify the goods and services used in electric power generation. As shown, labor and tax requirements represent a significant share of the value of

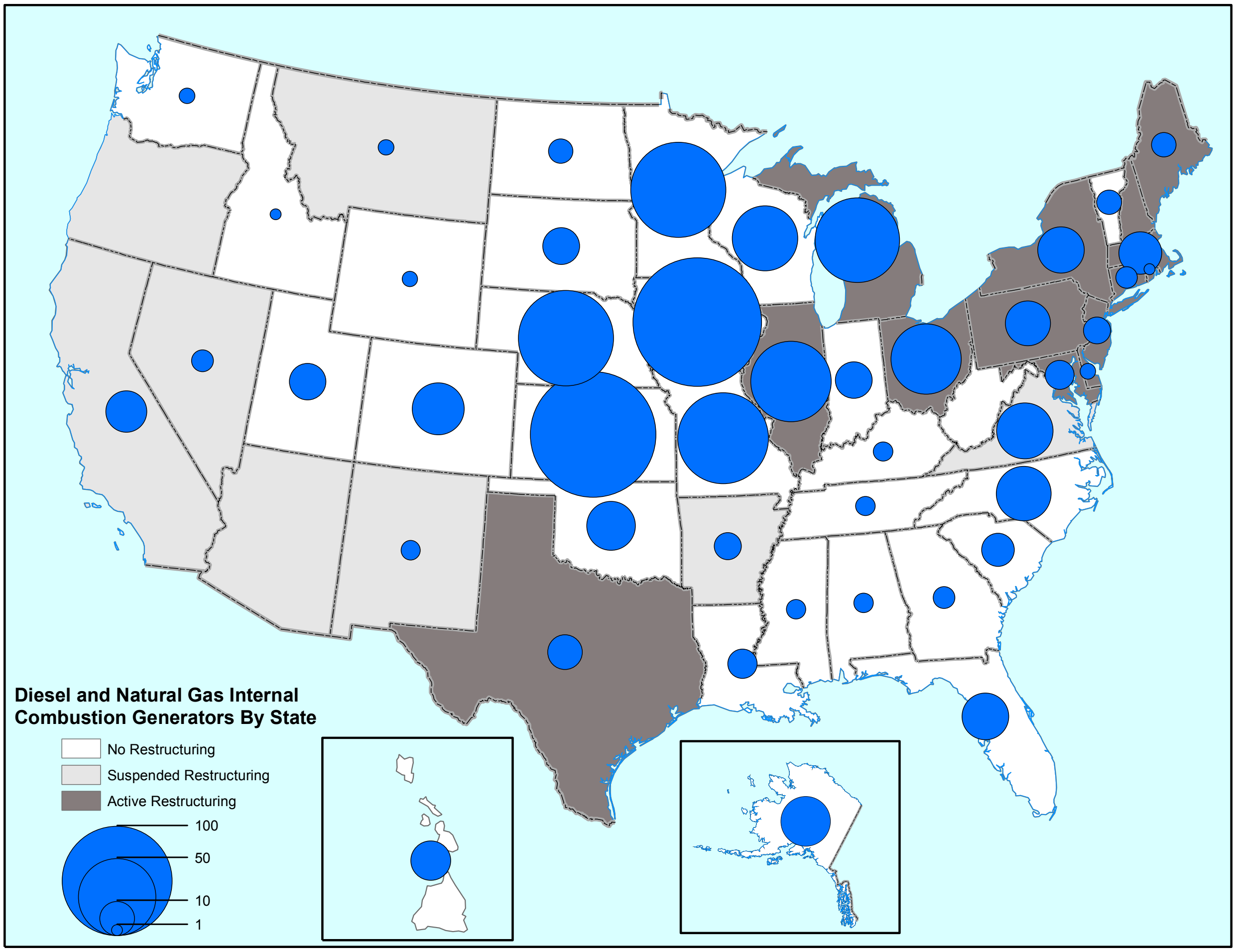


Figure 3-2. Internal Combustion Generators by State: 2006

Source: U.S. Department of Energy, Energy Information Administration. 2007. "2006 EIA-906/920 Monthly Time Series."

power generation. Extraction, transportation, refining, and equipment requirements potentially associated with reciprocating internal combustion engines (oil and gas extraction, pipeline transportation, petroleum refineries, and turbine manufacturing) represent around 10% of the value of services.

3.1.3 Business Statistics

The U.S. Economic Census and Statistics of U.S. Businesses (SUSB) programs provide national information on the distribution of economic variables by industry, location, and size of business. Throughout this section and report, we use the following definitions:

- *Establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.

Table 3-2. Direct Requirements for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	20.52%
V00200	Taxes on production and imports, less subsidies	13.71%
211000	Oil and gas extraction	6.16%
212100	Coal mining	5.86%
482000	Rail transportation	3.01%
230301	Nonresidential maintenance and repair	2.83%
486000	Pipeline transportation	1.70%
722000	Food services and drinking places	1.40%
52A000	Monetary authorities and depository credit intermediation	1.39%
541100	Legal services	1.13%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.

- *Firm*: A firm is a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control. The firm and the establishment are the same for single-establishment firms. For each multiestablishment firm, establishments *in the same industry within a state* are counted as one firm; the firm employment and annual payroll are summed from the associated establishments.

- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise; the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

In 2002, Texas had almost 1,000 power establishments, while California, Georgia, and Ohio all had between 400 and 500 (Figure 3-3). Hawaii, Nebraska, and Rhode Island all had fewer than 20 establishments in their states.

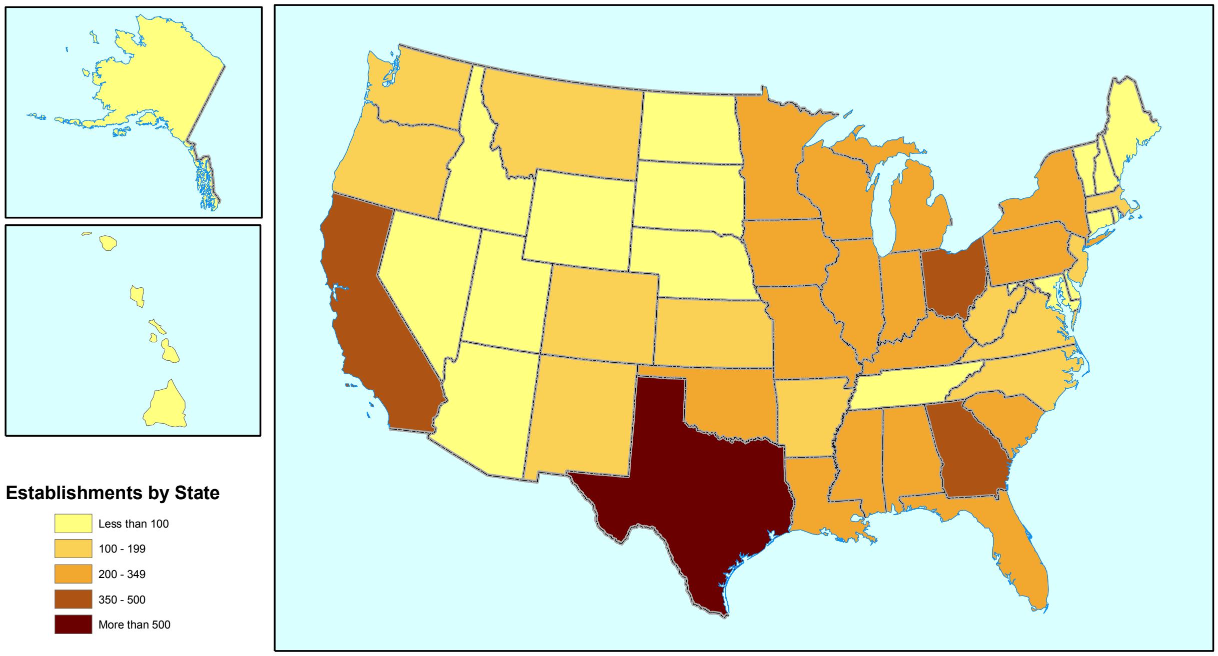


Figure 3-3. 2002 Regional Distribution of Establishments: Electric Power Generation, Transmission, and Distribution Industry (NAICS 2211)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002." <http://factfinder.census.gov>; (November 10, 2008).

As shown in Table 3-3, the four largest firms owned over 1,200 establishments and accounted for about 16% of total industry receipts/revenue. The 50 largest firms accounted for almost 6,000 establishments and about 78% of total receipts/revenue.

Investor-owned energy providers accounted for 67.5% of retail electricity sold in the United States in 2006 (Table 3-4). In 2007, less regulated investor-owned electric utility companies were on average more profitable than companies with greater regulation (Table 3-5). In 2006, enterprises within NAICS 2211 had a pre-tax profit margin of only 0.9% (Table 3-6).

In 2002, about 82% of firms generating, transmitting, or distributing electric power had receipts of under $50 million (Table 3-7). However, these firms accounted for only 11% of employment, with 89% of employees working for firms with revenues in excess of $100 million.

3.2 Oil and Gas Extraction

3.2.1 Overview

Oil and gas extraction (NAICS 211) is an industry group within the mining sector (NAICS 21). It includes establishments that operate or develop oil and gas field properties

Table 3-3. Firm Concentration for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

Commodity	Establishments	Receipts/Revenue Amount ($10^6)	Receipts/Revenue Percentage of Total	Number of Employees	Employees per Establishment
All firms	9,394	$325,028	100.0%	535,675	57
4 largest firms	1,260	$52,349	16.1%	68,432	54
8 largest firms	2,566	$95,223	29.3%	151,575	59
20 largest firms	3,942	$173,207	53.3%	271,393	69
50 largest firms	5,887	$253,015	77.8%	408,021	69

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002." <http://factfinder.census.gov>; (November 21, 2008).

through such activities as exploring for oil and gas, drilling and equipping wells, operating on-site equipment, and conducting other activities up to the point of shipment from the property.

Oil and gas extraction consists of two industries: crude petroleum and natural gas extraction (NAICS 211111) and natural gas liquid extraction (NAICS 211112). Crude petroleum and natural gas extraction is the larger industry; in 2002, it accounted for 93% of establishments and 75% of oil and gas extraction revenues.

Industrial production in this industry is particularly sensitive to hurricanes in the Gulf Coast. In September of both 2005 and 2008, production dropped 14% from the previous month. Production is currently 6% lower than it was in 1997 (Figure 3-4).

From 1997 to 2002, revenues from crude petroleum and natural gas extraction (NAICS 211111) grew less than 1% to almost $100 billion ($2007) (Table 3-8). At the same time, payroll dropped almost 8% and the number of employees dropped by almost 6%. The number of establishments dropped by over 8%; as a result, the average establishment revenue increased by 2.5%. Materials costs were approximately 25% of revenue over the period.

From 1997 to 2002, revenue from natural gas liquid extraction (NAICS 211112) grew over 7% to about $34 billion (Table 3-9). At the same time, payroll dropped 12% and the number of employees dropped by almost 9%. The number of establishments dropped by over 3%, resulting in an increase of revenue per establishment of about 10%.

Table 3-4. United States Retail Electricity Sales Statistics: 2006

	Full-Service Providers					Other Providers		
Item	**Investor-Owned**	**Public**	**Federal**	**Cooperative**	**Facility**	**Energy**	**Delivery**	**Total**
Number of entities	215	2,010	9	882	49	150	64	3,379
Number of retail customers	100,245,547	20,345,236	39,430	17,465,423	2,166	2,306,163	NA	140,403,965
Retail Sales (10^3 megawatthours)	2,476,445	549,124	42,359	370,410	12,397	219,185	NA	3,669,919
Percentage of retail sales	67.48	14.96	1.15	10.09	0.34	5.97	NA	100
Revenue from retail sales (\$$10^6$)	224,637	44,271	1,494	31,411	868	16,784	7,040	326,506
Percentage of revenue	68.8	13.56	0.46	9.62	0.27	5.14	2.16	100
Average retail price (cents/kWh)	9.06	8.06	3.53	8.48	7	7.66	3.21	8.9

Table 3-5. FY 2007 Financial Data for 70 U.S. Shareholder-Owned Electric Utilities

	Profit Margin	Net Income	Operating Revenues
Investor-Owned Utilities	8.36%	$33,933	$405,938
Regulated[a]	7.12%	$12,078	$169,699
Mostly regulated[b]	8.89%	$13,776	$154,916
Diversified[c]	9.93%	$8,078	$81,323

[a]80%+ of total assets are regulated.

[b]50% to 80% of total assets are regulated.

[c]Less than 50% of total assets are regulated.

Source: Edison Electric Institute. "Income Statement: Q4 2007 Financial Update. Quarterly Report of the U.S. Shareholder-Owned Electric Utility Industry." <http://www.eei.org>.

Table 3-6. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 2211

Number of enterprises[a]	836
Total receipts (10^3)	$308,702,953
Net sales(10^3)	$289,887,930
Profit margin before tax	0.9%
Profit margin after tax	—

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

3.2.2 Goods and Services Used

The oil and gas extraction industry has similar labor and tax requirements as the electric power generation sector. Extraction, support, power, and equipment requirements potentially associated with reciprocating internal combustion engines (oil and gas extraction, support activities, electric power generation, machinery and equipment rental and leasing, and pipeline transportation) represent around 8% of the value of services (Table 3-10).

3.2.3 Business Statistics

The U.S. Economic Census and SUSB programs provide national information on the distribution of economic variables by industry, location, and size of business. Throughout this section and report, we use the following definitions:

- *Establishmen*t: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.

Table 3-7. Key Enterprise Statistics by Receipt Size for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

		Owned by Enterprises with								
Variable	**All Enterprises**	**0–99K Receipts**	**100–499.9K Receipts**	**500–999.9K Receipts**	**1,000–4,999.9K Receipts**	**5,000,000–9,999,999K Receipts**	**<10,000K Receipts**	**10,000–49,999K Receipts**	**50,000–99,999K Receipts**	**100,000K+ Receipts**
Firms	1,756	129	250	80	232	205	896	538	112	210
Establishments	9,493	129	250	85	245	262	971	978	403	7,141
Employment	515,769	429	834	3,139	2,712	5,620	12,734	31,573	14,858	456,604
Receipts ($\$10^3$)	$320,502,670	$5,596	$63,339	$57,363	$627,414	$1,472,405	$2,226,117	$12,171,098	$7,607,166	$298,498,289
Receipts/firm ($\$10^3$)	$182,519	$43	$253	$717	$2,704	$7,182	$2,485	$22,623	$67,921	$1,421,420
Receipts/establishment ($\$10^3$)	$33,762	$43	$253	$675	$2,561	$5,620	$2,293	$12,445	$18,876	$41,801
Receipts/employment ($)	$621,407	$13,044	$75,946	$18,274	$231,347	$261,994	$174,817	$385,491	$511,991	$653,736

Source: U.S. Small Business Administration (SBA). 2008. "Firm Size Data from the Statistics of U.S. Businesses: U.S. All Industries Tabulated by Receipt Size: 2002." <http://www.census.gov/csd/susb/susb02.htm>.

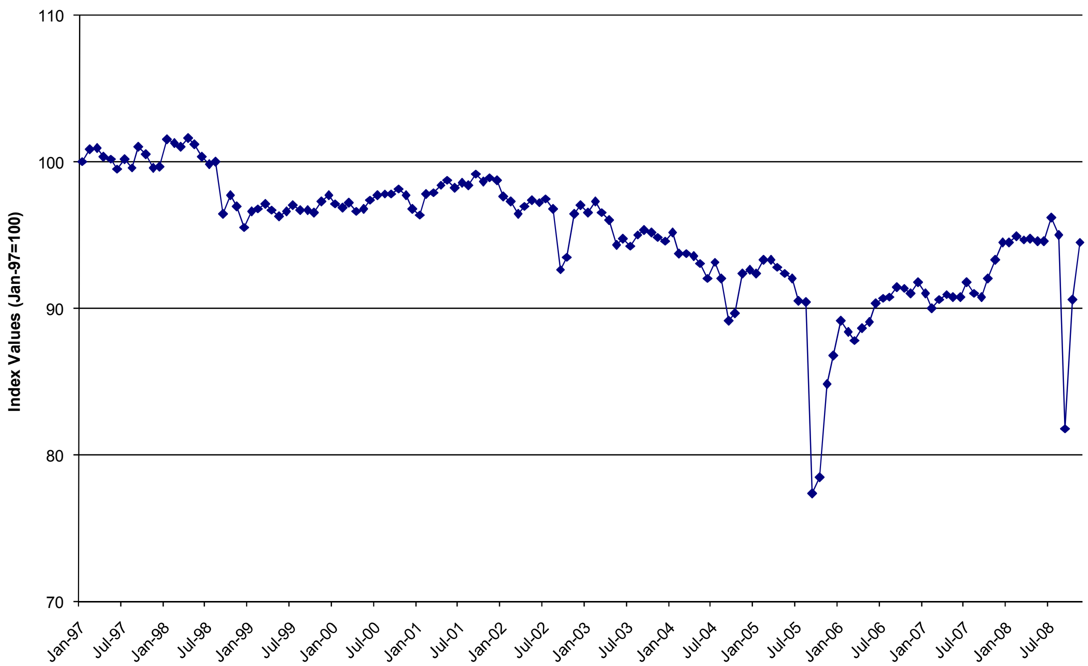


Figure 3-4. Industrial Production Index (NAICS 211)

Source: The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G211.S <http://www.federalreserve.gov/datadownload/>. (December 15, 2008).

Table 3-8. Key Statistics: Crude Petroleum and Natural Gas Extraction (NAICS 211111): ($2007)

	1997	2002
Revenue ($$10^6$)	97,832	98,667
Payroll ($$10^6$)	6,232	5,785
Employees	100,333	94,886
Establishments	7,784	7,178

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.
- *Firm*: A firm is a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control. The firm and the establishment are the same for single-

Table 3-9. Key Statistics: Natural Gas Liquid Extraction (NAICS 211112) ($2007)

	1997	2002
Revenue ($$10^6$)	31,139	33,579
Payroll ($$10^6$)	679	607
Employees	10,548	9,693
Establishments	528	511

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

Table 3-10. Direct Requirements for Oil and Gas Extraction (NAICS 211): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00200	Taxes on production and imports, less subsidies	8.93%
V00100	Compensation of employees	6.67%
230301	Nonresidential maintenance and repair	6.36%
211000	Oil and gas extraction	1.91%
213112	Support activities for oil and gas operations	1.51%
221100	Electric power generation, transmission, and distribution	1.47%
541300	Architectural, engineering, and related services	1.24%
532400	Commercial and industrial machinery and equipment rental and leasing	1.20%
33291A	Valve and fittings other than plumbing	1.10%
541511	Custom computer programming services	0.99%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

establishment firms. For each multiestablishment firm, establishments *in the same industry within a state* are counted as one firm; the firm employment and annual payroll are summed from the associated establishments.

- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise; the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size

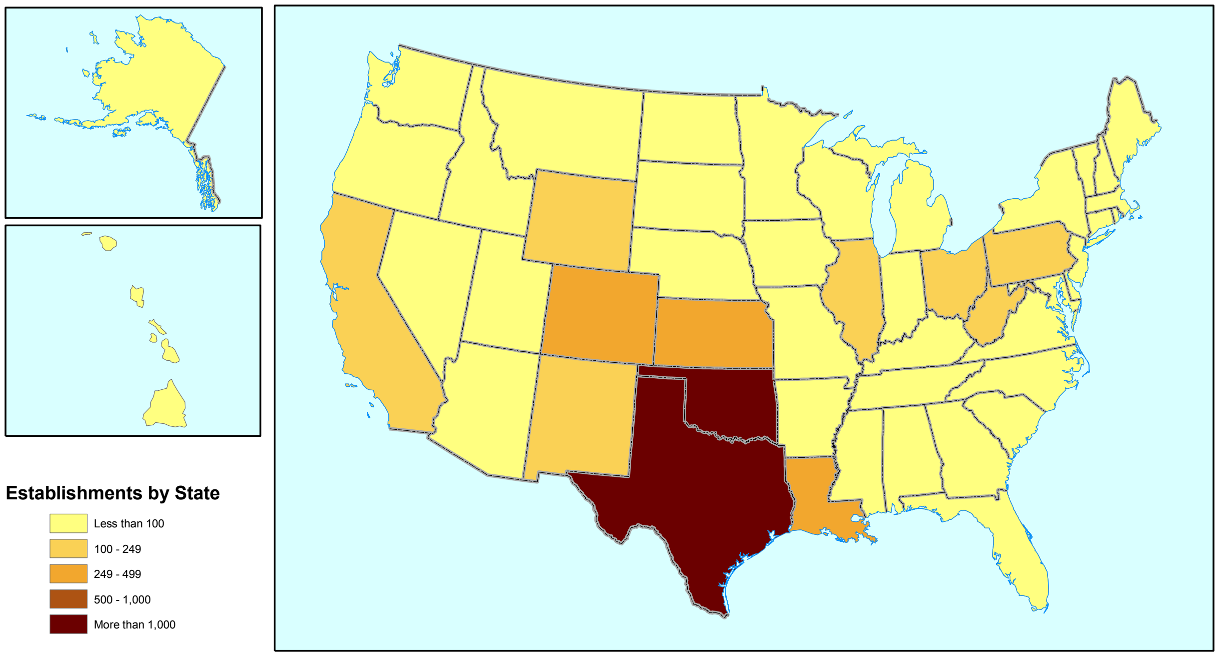


Figure 3-5. 2002 Regional Distribution of Establishments: Crude Petroleum and Natural Gas Extraction Industry (NAICS 211111)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Geographic Area Series: Industry Statistics for the State or Offshore Areas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

designations are determined by the summed employment of all associated establishments.

In 2002, Texas had almost 3,000 crude petroleum and natural gas extraction establishments, Oklahoma had about 1,000, and every other state had under 450 (Figure 3-5). Twenty states had fewer than 10 establishments. Similarly, Texas had 180 natural gas liquid extraction establishments, Louisiana had 76, and every other state had under 40 (Figure 3-6). Only nine states had 10 or more establishments, and 17 had no establishments.

According to the SUSB, 89% of crude petroleum and natural gas extraction firms had fewer than 500 employees in 2002 (Table 3-11). Sixty-three percent of natural gas liquid extraction firms had fewer than 500 employees in 2002 (Table 3-12).

Enterprises within this industry generated $165 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after-tax profit margin of 18.3% (Table 3-13).

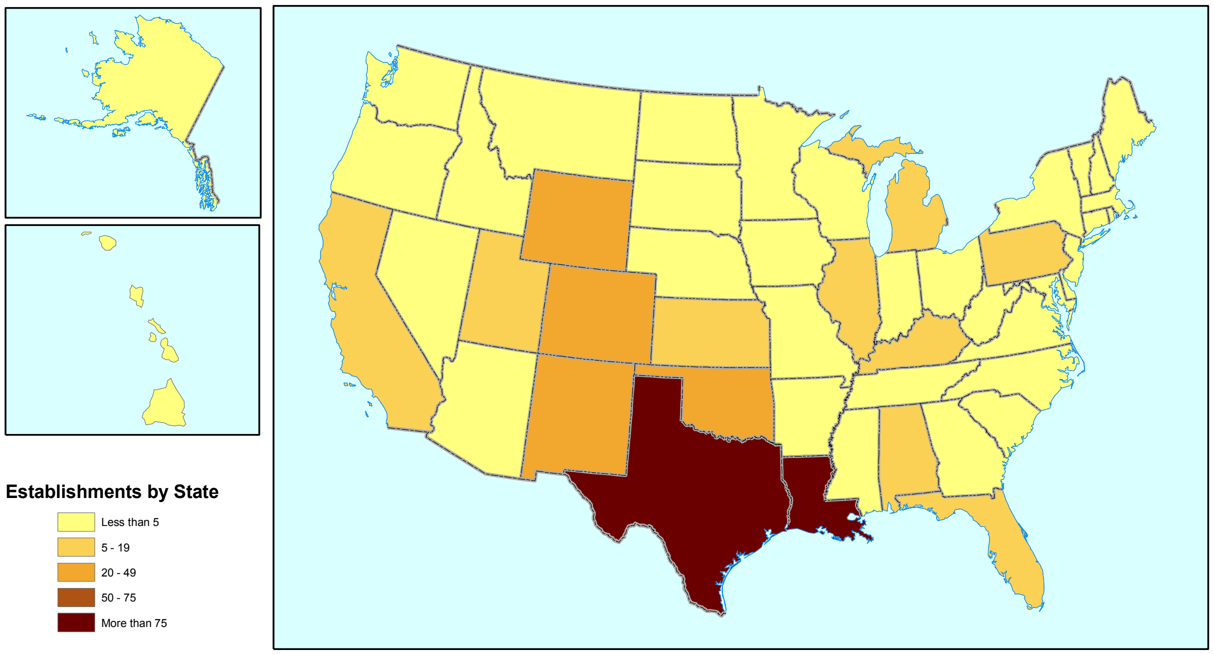


Figure 3-6. 2002 Regional Distribution of Establishments: Natural Gas Liquid Extraction Industry (NAICS 211112)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Geographic Area Series: Industry Statistics for the State or Offshore Areas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

Table 3-11. Key Enterprise Statistics by Employment Size for Crude Petroleum and Natural Gas Extraction (NAICS 211111): 2002

		Owned by Enterprises with					
Variable	All Enterprises	1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees	750–999 Employees	1,000–1,499 Employees
Firms	6,238	5,130	348	85	11	11	5
Establishments	7,135	5,185	449	254	37	63	25
Employment	76,794	5,825	5,171	2,757	Not disclosed	Not disclosed	Not disclosed
Receipts ($$10^3$)	$88,388,300	$2,353,181	$2,559,239	$2,051,860	Not disclosed	Not disclosed	Not disclosed
Receipts/firm ($$10^3$)	$14,169	$459	$7,354	$24,140	Not disclosed	Not disclosed	Not disclosed
Receipts/establishment ($$10^3$)	$12,388	$454	$5,700	$8,078	Not disclosed	Not disclosed	Not disclosed
Receipts/employment ($)	$1,150,979	$403,980	$494,921	$744,236	Not disclosed	Not disclosed	Not disclosed

Source: U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed%20sizes_6digitnaics.txt>.

3.2.4 Case Study: Marginal Wells

To provide additional context for understanding energy sectors that use reciprocating internal combustion engines, we examine one segment of the oil and gas sector: marginal wells.

Table 3-12. Key Enterprise Statistics by Employment Size for Crude Natural Gas Liquid Extraction (NAICS 211112): 2002

		Owned by Enterprises with					
Variable	All Enterprises	1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees	750–999 Employees	1,000–1,499 Employees
Firms	113	54	7	10	2	1	2
Establishments	494	54	7	38	23	1	6
Employment	11,486	65	Not disclosed	241	Not disclosed	Not disclosed	Not disclosed
Receipts ($$10^3$)	$72,490,930	$13,862	Not disclosed	$383,496	Not disclosed	Not disclosed	Not disclosed
Receipts/firm ($$10^3$)	$641,513	$257	Not disclosed	$38,350	Not disclosed	Not disclosed	Not disclosed
Receipts/establishment ($$10^3$)	$146,743	$257	Not disclosed	$10,092	Not disclosed	Not disclosed	Not disclosed
Receipts/employment ($)	$6,311,242	$213,262	Not disclosed	$1,591,270	Not disclosed	Not disclosed	Not disclosed

Source: U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed%20sizes_6digitnaics.txt>.

Table 3-13. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 211

Number of enterprises[a]	17,097
Total receipts (10^3)	$164,841,432
Net sales(10^3)	$142,424,188
Profit margin before tax	24.6%
Profit margin after tax	18.3%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. “Almanac of Business and Industrial Financial Ratios: 2009 Edition.” CCH.

This industry includes small-volume wells that are mature in age, are more difficult to extract oil or natural gas from than other types of wells, and generally operate at very low levels of profitability. As a result, well operations can be quite responsive to small changes in the benefits and costs of their operation.

In 2006, there were approximately 420,000 marginal oil wells and 300,000 marginal gas wells (Interstate Oil and Gas Compact Commission [IOGCC], 2007). These wells provide the United States with 18% of oil and 9% of natural gas (IOGCC, 2007). Data for 2006 show that revenue from the over 700,000 wells was approximately $31.3 billion (Table 3-14).

Historical data show marginal oil production fluctuated between 1997 and 2006, reflecting the industry’s sensitivity to changes in economic conditions of fuel markets (see

Table 3-14. Reported Gross Revenue Estimates from Marginal Wells: 2006

Well Type	Number of Wells	Production from Marginal Wells	Estimated Gross Revenue ($$10^9$)
Oil	422,255	335.312467 MMbbls	$20.1
Natural gas	296,721	1708.407584 MCF	$11.1
Total	718,976		$31.3

Source: Interstate Oil & Gas Compact Commission. 2007. "Marginal Wells: Fuel for Economic Growth." Table 3.B. Available at <http://iogcc.publishpath.com/Websites/iogcc/pdfs/2007-Marginal-Well-Report.pdf>.

Figure 3-7). In contrast, the number of marginal gas wells has continually increased during the past decade; the IOGCC estimates that daily production levels from these wells reached a 10-year high in 2005. Although we have been unable to find data on what fraction of these marginal wells are operated by small businesses, the IOGCC states that many are run by "mom and pop operators" (IOGCC, 2007).

3.3 Pipeline Transportation of Natural Gas

3.3.1 Overview

Pipeline transportation of natural gas (NAICS 48621) is an industry group within the transportation and warehousing sector (NAICS 48-49), but more specifically in the pipeline transportation subsector (486). It includes the transmission of natural gas as well as the distribution of the gas through a local network to participating businesses.

From 1997 to 2002, natural gas transportation revenues fell by 7% to just under $23 billion ($2007) (Table 3-15). At the same time, payroll decreased by 7%, while the number of paid employees decreased by nearly 9%. However, the number of establishments increased by 17% from 1,450 establishments in 1997 to 1,701 in 2002.

3.3.2 Goods and Services Used

The BEA reports pipeline transportation of natural gas only for total pipeline transportation (3-digit NAICS 486). In addition to pipeline transportation of natural gas (NAICS 4862), this industry includes pipeline transportation of crude oil (NAICS 4861) and other pipeline transportation (NAICS 4869. However, the BEA data are likely representative of the affected sector since pipeline transportation of natural gas accounts for 68% of NAICS 486 establishments and 72% of revenues (Figures 3-8 and 3-9).

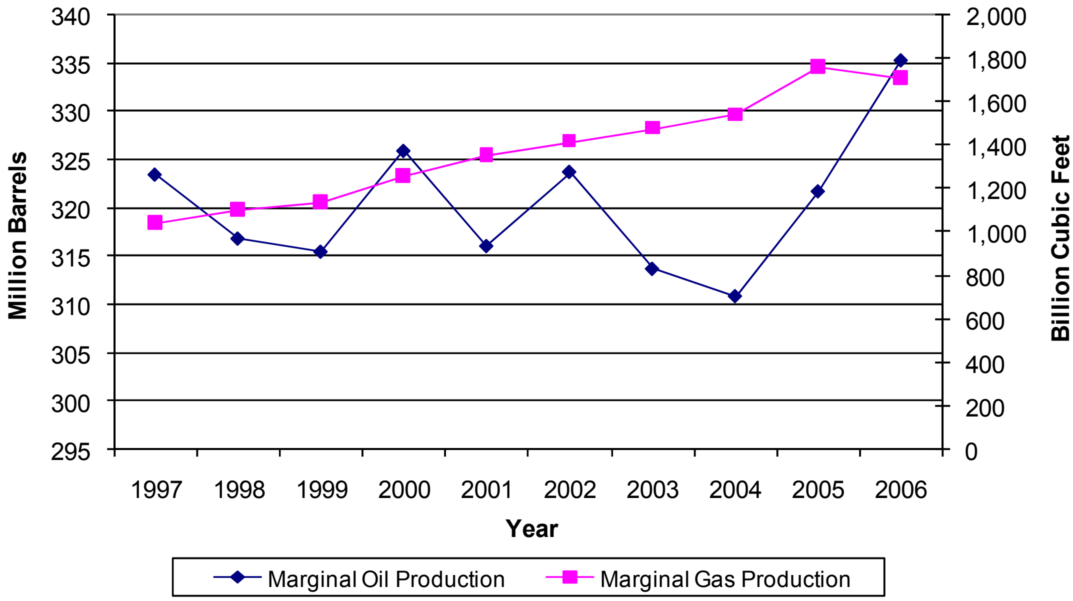


Figure 3-7. Trends in Marginal Oil and Gas Production: 1997 to 2006

Source: Interstate Oil & Gas Compact Commission. 2007. "Marginal Wells: Fuel for Economic Growth." Pages 3 and 11. Available at < http://iogcc.myshopify.com/collections/frontpage/products/2007-marginal-well-report-2007.pdf>.

Table 3-15. Key Statistics: Pipeline Transportation of Natural Gas (NAICS 48621) ($2007)

Year	1997	2002
Revenue ($$10^6$)	24,646	22,964
Payroll ($$10^6$)	2,662	2,438
Employees	35,789	32,542
Establishments	1,450	1,701

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Comparative Statistics for the United States (1997 NAICS Basis): 2002 and 1997" <http://factfinder.census.gov>; (December 12, 2008).

In Table 3-16, we use the latest detailed benchmark input-output data report by the BEA (2002) to identify the goods and services used by pipeline transportation (NAICS 486). As shown, labor, refineries, and maintenance requirements represent significant share of the cost associated with pipeline transportation. Power and equipment requirements potentially associated with reciprocating internal combustion engines (electric power generation and commercial and industrial machinery and equipment repair and maintenance) represent less than 2% of the value of services.

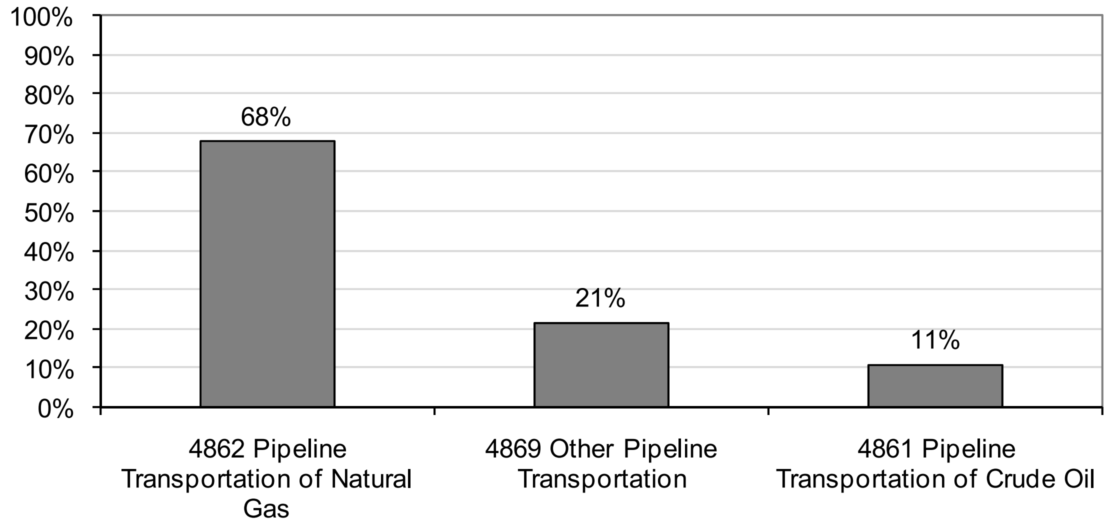


Figure 3-8. Distribution of Establishments within Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Summary Statistics for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

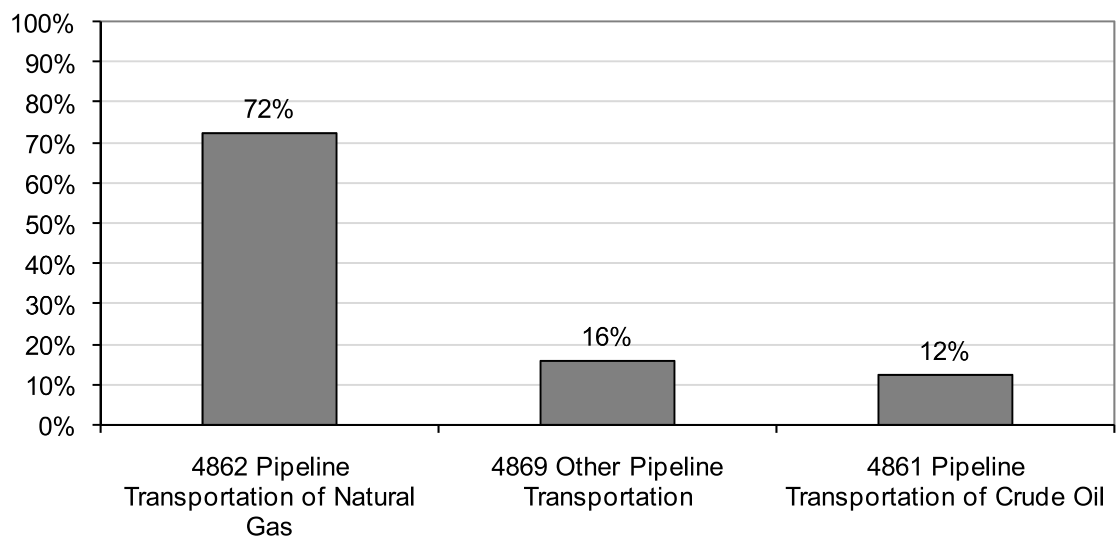


Figure 3-9. Distribution of Revenue within Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Summary Statistics for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Table 3-16. Direct Requirements for Pipeline Transportation (NAICS 486): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	14.78%
324110	Petroleum refineries	13.55%
230301	Nonresidential maintenance and repair	6.07%
211000	Oil and gas extraction	4.94%
333415	Air conditioning, refrigeration, and warm air heating equipment manufacturing	4.40%
561300	Employment services	4.26%
5416A0	Environmental and other technical consulting services	3.04%
541300	Architectural, engineering, and related services	3.04%
420000	Wholesale trade	2.79%
332310	Plate work and fabricated structural product manufacturing	2.72%
5419A0	All other miscellaneous professional, scientific, and technical services	2.48%
524100	Insurance carriers	2.38%
531000	Real estate	2.33%
52A000	Monetary authorities and depository credit intermediation	1.76%
V00200	Taxes on production and imports, less subsidies	1.41%
541100	Legal services	1.19%
221100	Electric power generation, transmission, and distribution	1.13%

[a] These values show the amount of the commodity required to produce \$1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

3.3.3 Business Statistics

The pipeline transportation of natural gas is clearly concentrated in the two states closest to the refineries in the Gulf of Mexico. In 2002, Texas and Louisiana contributed to 31% of all pipeline transportation establishments in the United States (Figure 3-10) and 41% of all U.S. revenues. Other larger contributors with over 50 establishments in their states include Oklahoma, Pennsylvania, Kansas, Mississippi, and West Virginia.

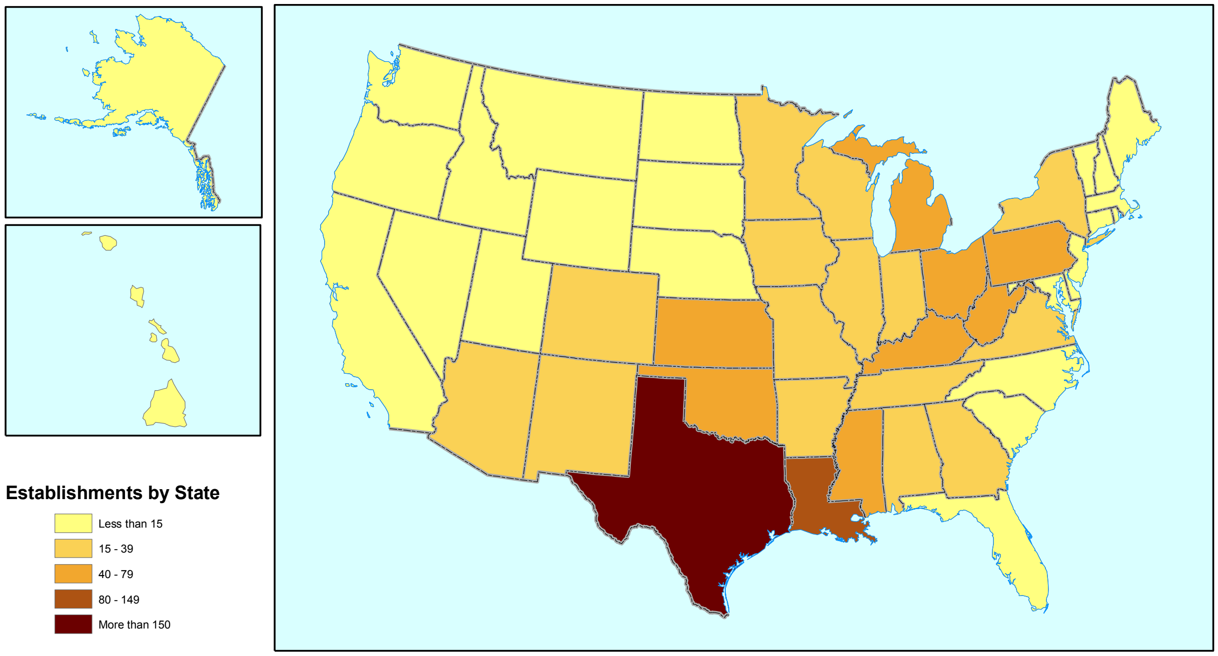


Figure 3-10. 2002 Regional Distribution of Establishments: Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Geographic Distribution—Pipeline transportation of natural gas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

According to 2002 U.S. Census data, about 86% of transportation of natural gas establishments were owned by corporations and about 8% were owned by individual proprietorships. About 6% were owned by partnerships (Figure 3-11). As shown in Table 3-17, the four largest firms accounted for nearly half of the establishments with 698, and just over half, 51%, of total revenue. The 50 largest firms accounted for over 1,354 establishments and about 99% of total revenue. The average number of employees per establishment was approximately 17 across all groups of firms.

Enterprises within pipeline transportation (NAICS 486) generated $6.6 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after-tax profit margin of 7.9% (Table 3-18).

The 2002 SUSB shows that 47% of all firms in this industry made under $5 million in revenue. Enterprises with revenue over $100 million provided an overwhelming share of employment in this industry (98%) (Table 3-19).

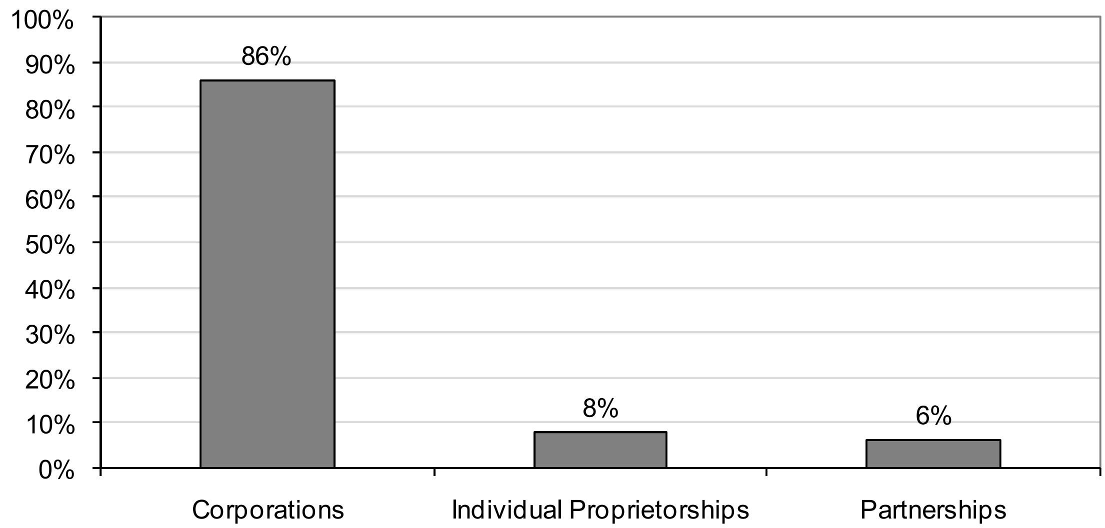


Figure 3-11. Share of Establishments by Legal Form of Organization in the Pipeline Transportation of Natural Gas Industry (NAICS 48621): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Transportation and Warehousing: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Table 3-17. Firm Concentration for Pipeline Transportation of Natural Gas (NAICS 48621): 2002

		Receipts/Revenue			
Commodity	Establishments	Amount ($\$10^6$)	Percentage of Total	Number of Employees	Employees per Establishment
All firms	1,431	$14,797	100%	23,677	16.5
4 largest firms	698	$7,551	51%	11,814	16.9
8 largest firms	912	$10,059	68%	15,296	16.8
20 largest firms	1,283	$13,730	93%	21,792	17.0
50 largest firms	1,354	$14,718	99%	23,346	17.2

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Table 3-18. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 486

Number of enterprises[a]	410
Total receipts (10^3)	$6,606,472
Net sales(10^3)	$6,118,827
Profit margin before tax	12.9%
Profit margin after tax	7.8%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. “Almanac of Business and Industrial Financial Ratios: 2009 Edition.” CCH.

3.4 General Medical and Surgical Hospitals

3.4.1 Overview

General medical and surgical hospitals (NAICS 6221) is an industry group within the health care and social assistance sector (NAICS 62). It includes hospitals engaged in diagnostic and medical treatment (both surgical and nonsurgical) for inpatients with a broad range of medical conditions. They usually provide other services as well, including outpatient care, anatomical pathology, diagnostic X-rays, clinical laboratory work, and pharmacy services.

From 1997 to 2002, hospital revenues grew about 18% to over $500 billion ($2007) (Table 3-20). At the same time, payroll rose about 14%, while the number of employees increased by only 5%. The number of establishments declined during this period by almost 6%, resulting in an increase in revenue per establishment of almost 22%.

3.4.2 Goods and Services Used

The BEA reports hospital expenditures only for hospitals (3-digit NAICS 622). In addition to general hospitals (NAICS 6221), this industry includes psychiatric and substance abuse hospitals (NAICS 6222) and specialty hospitals (NAICS 6223). However, these data should be representative of the affected sector since in 2002, general medical and surgical hospitals accounted for 92% of NAICS 622 establishments and 94% of revenues.

In Table 3-21, we use the latest detailed benchmark input-output data report by the BEA (2002) to identify the goods and services used by hospitals (NAICS 622). As shown, labor and land requirements represent a significant share of the value of hospital services. Power and equipment requirements potentially associated with reciprocating internal combustion engines (electric power generation and commercial and industrial machinery and equipment repair and maintenance) represent less than 2% of the value of services.

Table 3-19. Key Enterprise Statistics by Receipt Size for Pipeline Transportation of Natural Gas (NAICS 48621): 2002

		Owned by Enterprises with								
Variable	All Enterprises	0–99K Receipts	100–499.9K Receipts	500–999.9K Receipts	1,000–4,999.9K Receipts	5,000,000–9,999,999K Receipts	<10,000K Receipts	10,000–49,999K Receipts	50,000–99,999K Receipts	100,000K+ Receipts
Firms	154	8	32	10	22	6	78	11	4	61
Establishments	1,936	8	32	10	22	7	79	21	4	1,832
Employment	37,450	15	58	69	138	88	368	216	274	36,592
Receipts ($\$10^3$)	\$35,896,535	\$524	\$8,681	\$7,451	\$46,429	\$40,967	\$104,052	\$188,424	\$154,384	\$35,449,675
Receipts/firm ($\$10^3$)	\$233,094	\$66	\$271	\$745	\$2,110	\$6,828	\$1,334	\$17,129	\$38,596	\$581,142
Receipts/establishment ($\$10^3$)	\$18,542	\$66	\$271	\$745	\$2,110	\$5,852	\$1,317	\$8,973	\$38,596	\$19,350
Receipts/employment (\$)	\$958,519	\$34,933	\$149,672	\$107,986	\$336,442	\$465,534	\$282,750	\$872,333	\$563,445	\$968,782

Source: U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

Table 3-20. Key Statistics: General Medical and Surgical Hospitals (NAICS 6221) ($2007)

	1997	2002
Revenue ($$10^6$)	444,141	539,502
Payroll ($$10^6$)	178,874	209,063
Employees	4,526,591	4,772,422
Establishments	5,487	5,193

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: 2002 and 1997." <http://factfinder.census.gov>; (November 10, 2008).

Table 3-21. Direct Requirements for Hospitals (NAICS 622): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	51.90%
531000	Real estate	10.76%
550000	Management of companies and enterprises	4.02%
621B00	Medical and diagnostic labs and outpatient and other ambulatory care services	2.22%
561300	Employment services	1.90%
325412	Pharmaceutical preparation manufacturing	1.86%
325413	In-vitro diagnostic substance manufacturing	1.66%
524100	Insurance carriers	1.66%
420000	Wholesale trade	1.62%
221100	Electric power generation, transmission, and distribution	1.14%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

3.4.3 Business Statistics

In 2002, California and Texas each had around 400 hospitals, and New York, Pennsylvania, Florida, and Illinois all had more than 200 (Figure 3-12). Vermont, Rhode Island, Delaware, and the District of Columbia all had fewer than 20 hospital establishments in their states.

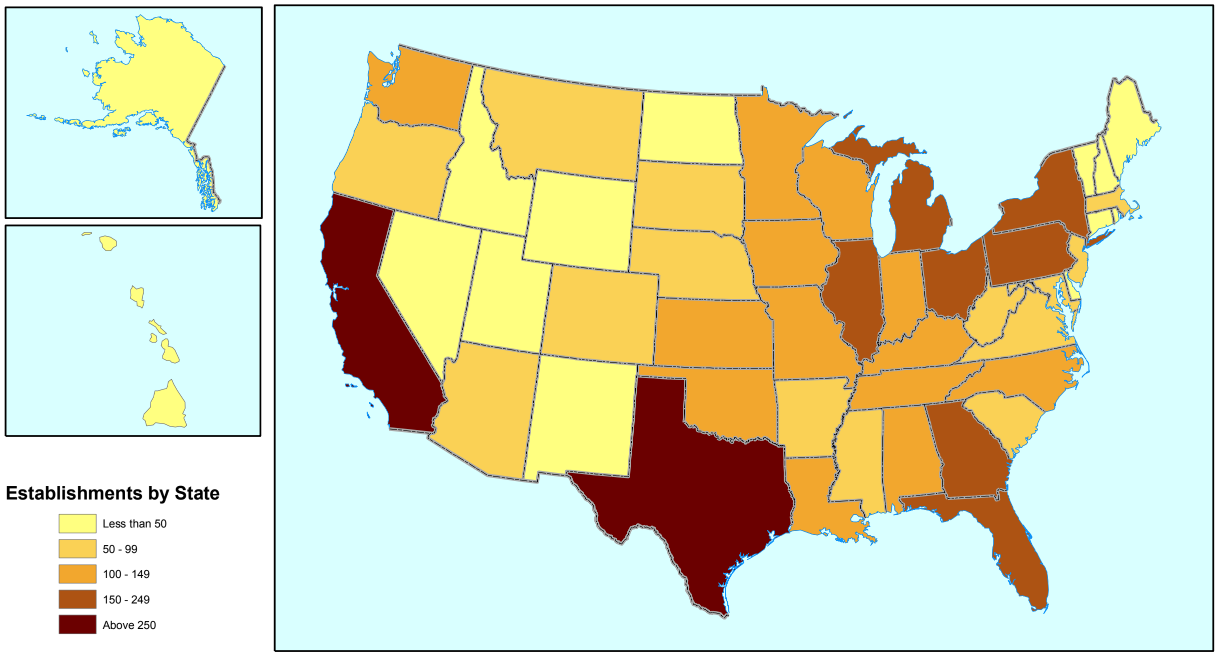


Figure 3-12. 2002 Regional Distribution of Establishments: General Medical and Surgical Hospital Industry (NAICS 6221)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: Summary Statistics: 2002." <http://factfinder.census.gov>; (November 10, 2008).

According to 2002 Census data, 79.6% of general hospitals were owned by corporations, 19.5% were individual proprietorships, and about 0.7% were partnerships (Figure 3-13). As shown in Table 3-22, the four largest firms accounted for almost 400 establishments and about 10% of total revenue. The 50 largest firms accounted for over 1,100 establishments and about 30% of total revenue. In addition, about 27% of all general hospitals are owned or controlled by the government, with most of those at the local level (Table 3-23).

In 2006, the United States had 4,927 community hospitals (Table 3-24); nongovernmental not-for-profit hospitals accounted for 59% of these hospitals, and 75% of the expenses of all community hospitals.

Enterprises including hospitals, nursing and residential care facilities, and social assistance (NAICS 622-4) generated $108 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after- tax profit margin of 3.1% (Table 3-25).

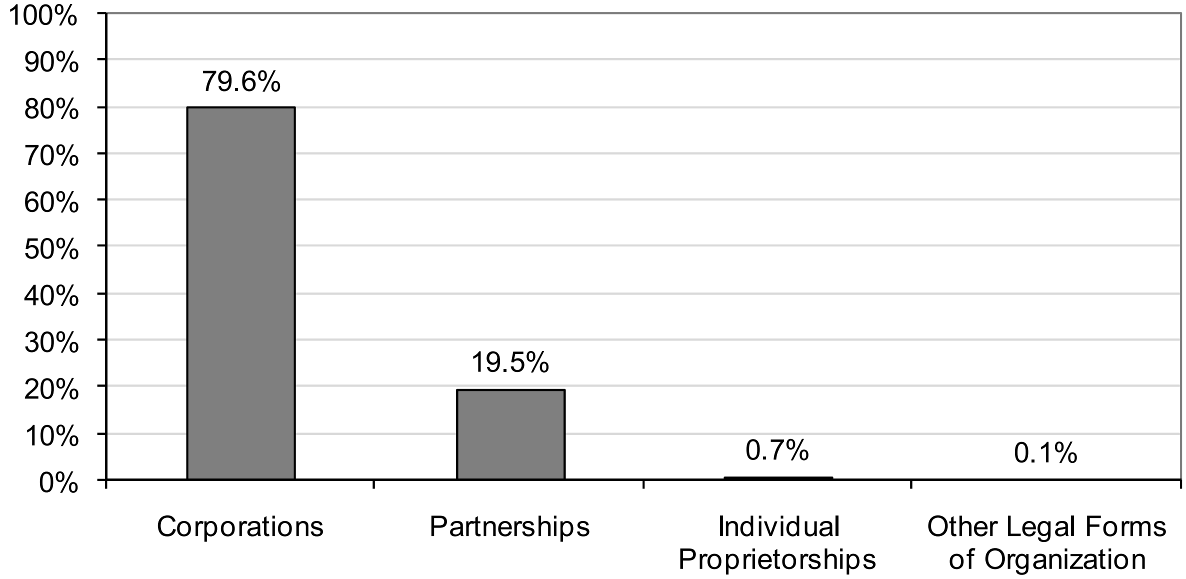


Figure 3-13. Share of Establishments by Legal Form of Organization in the General Medical and Surgical Hospitals Industry (NAICS 6221): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-22. Firm Concentration for General Medical and Surgical Hospitals (NAICS 6221): 2002

		Receipts/Revenue			
Commodity	Establishments	Amount ($\$10^6$)	Percentage of Total	Number of Employees	Employees per Establishment
All firms	5,193	$469,727	100.0%	4,772,422	919
4 largest firms	391	$44,124	9.4%	389,152	995
8 largest firms	507	$60,708	12.9%	537,695	1,061
20 largest firms	777	$92,466	19.7%	831,988	1,071
50 largest firms	1,138	$139,501	29.7%	1,279,444	1,124

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-23. Government Control and Ownership for General Medical and Surgical Hospitals (NAICS 6221): 2002

			Receipts/Revenue			
Commodity	**Establishments**	**Percentage of Total**	**Amount ($\$10^6$)**	**Percentage of Total**	**Number of Employees**	**Employees per Establishment**
All firms	5,193	100.0%	$469,727	100.0%	4,772,422	919
All government owned and controlled hospitals	1,408	27.1%	$91,956	19.6%	962,772	684
Federal government	258	5.0%	$25,993	5.5%	257,766	999
State government	98	1.9%	$19,029	4.1%	176,754	1,804
Local government	1,052	20.3%	$46,934	10.0%	528,252	502

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-24. Hospital Statistics: 2006

Community Hospitals	**Number**	**Total Expenses (10^3)**	**Total Net Revenue (10^3)**
Total	4,927	$551,835,328	$587,050,914
Nongovernment not-for-profit	2,919	$412,867,575	NA
Investor-owned	889	$54,994,199	NA
State and local government	1,119	$83,973,554	NA

NA = Not available

Source: American Hospital Association. 2007. "AHA Hospital Statistics: 2008 Edition." Health Forum.

Table 3-25. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 622-4

Number of enterprises[a]	18,263
Total receipts (10^3)	$108,074,793
Net sales(10^3)	$102,300,229
Profit margin before tax	4.4%
Profit margin after tax	3.1%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

The SUSB reports 27% of general hospitals have receipts of less than $10 million and 41% report receipts above $50 million (Table 3-26). Large hospitals employ a significant share of the people working in this industry.

3.5 Irrigation Sets and Welding Equipment

3.5.1 Overview

The U.S. Economic Census classifies irrigation equipment under the farm machinery and equipment manufacturing industry group (NAICS 333111). This U.S. industry comprises establishments primarily engaged in manufacturing agricultural and farm machinery and equipment and other turf and grounds care equipment, including planting, harvesting, and grass-mowing equipment (except lawn and garden type).

From 1997 to 2002, farm machinery and equipment manufacturing revenues fell by $3 billion from $18 billion to $15 billion (Table 3-27). At the same time, payroll decreased by 19% and the number of paid employees decreased by nearly 19%. The number of establishments dropped by 9% from 1,339 establishments in 1997 to 1,214 in 2002. Industrial production in the industry is currently 13% lower than in 1997 (Figure 3-14).

The U.S. Economic Census classifies welding equipment under the welding and soldering equipment manufacturing industry group (NAICS 333992). This U.S. industry comprises establishments primarily engaged in manufacturing welding and soldering equipment and accessories (except transformers), such as welding electrodes, welding wire, and soldering equipment (except handheld).

From 1997 to 2002 welding and soldering equipment manufacturing revenue fell by about 22% to $1 billion (Table 3-28). At the same time, payroll decreased by 21% and the number of paid employees decreased by nearly 28%. The number of establishments dropped by 8% from 250 establishments in 1997 to 231 in 2002.

3.5.2 Irrigation and Welding Services

The demand for equipment is derived from the demand for the services the equipment provides. We describe uses and industrial consumers of this equipment.

3.5.2.1 Irrigation

Demand for irrigation equipment is driven by farm operation decisions, optimal replacement considerations, and climate and weather conditions. The National Agriculture Statistics Service (NASS) 2003 Farm and Ranch Irrigation Survey (USDA-NASS, 2004) shows

Table 3-26. Key Enterprise Statistics by Receipt Size for General Medical and Surgical Hospitals (NAICS 6221): 2002 ($2007)

		Owned by Enterprises with								
Variable	**All Enterprises**	**0–99K Receipts**	**100–499.9K Receipts**	**500–999.9K Receipts**	**1,000–4,999.9K Receipts**	**5,000,000–9,999,999K Receipts**	**<10,000K Receipts**	**10,000–49,999K Receipts**	**50,000–99,999K Receipts**	**100,000K+ Receipts**
Firms	3,581	64	77	59	344	437	981	1,116	438	1,046
Establishments	5,971	64	77	59	356	454	1,010	1,203	519	3,239
Employment	4,713,450	2,500-4999	250-499	730	18,675	56,296	78,980	347,613	337,885	3,948,972
Receipts ($$10^3$)	$468,007,640	Not disclosed	Not disclosed	$42,017	$1,084,945	$3,165,513	$4,317,321	$26,036,570	$29,039,799	$408,613,950
Receipts/firm ($$10^3$)	$130,692	Not disclosed	Not disclosed	$712	$3,154	$7,244	$4,401	$23,330	$66,301	$390,644
Receipts/establishment ($$10^3$)	$78,380	Not disclosed	Not disclosed	$712	$3,048	$6,972	$4,275	$21,643	$55,953	$126,154
Receipts/employment ($)	$99,292	Not disclosed	Not disclosed	$57,558	$58,096	$56,230	$54,663	$74,901	$85,946	$103,473

Source: U.S. Small Business Administration (SBA). 2008. “Firm Size Data from the Statistics of U.S. Businesses: U.S. All Industries Tabulated by Receipt Size: 2002.” <http://www.census.gov/csd/susb/susb02.htm>.

Table 3-27. Key Statistics: Farm Machinery and Equipment Manufacturing (NAICS 333111) ($2007)

	1997	2002
Revenue ($$10^6$)	$17,838	$15,006
Payroll ($$10^6$)	$2,644	$2,132
Employees	66,370	53,817
Establishments	1,339	1,214

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years" <http://factfinder.census.gov>; (November 25, 2008).

Industrial Production Index (NAICS 333111)

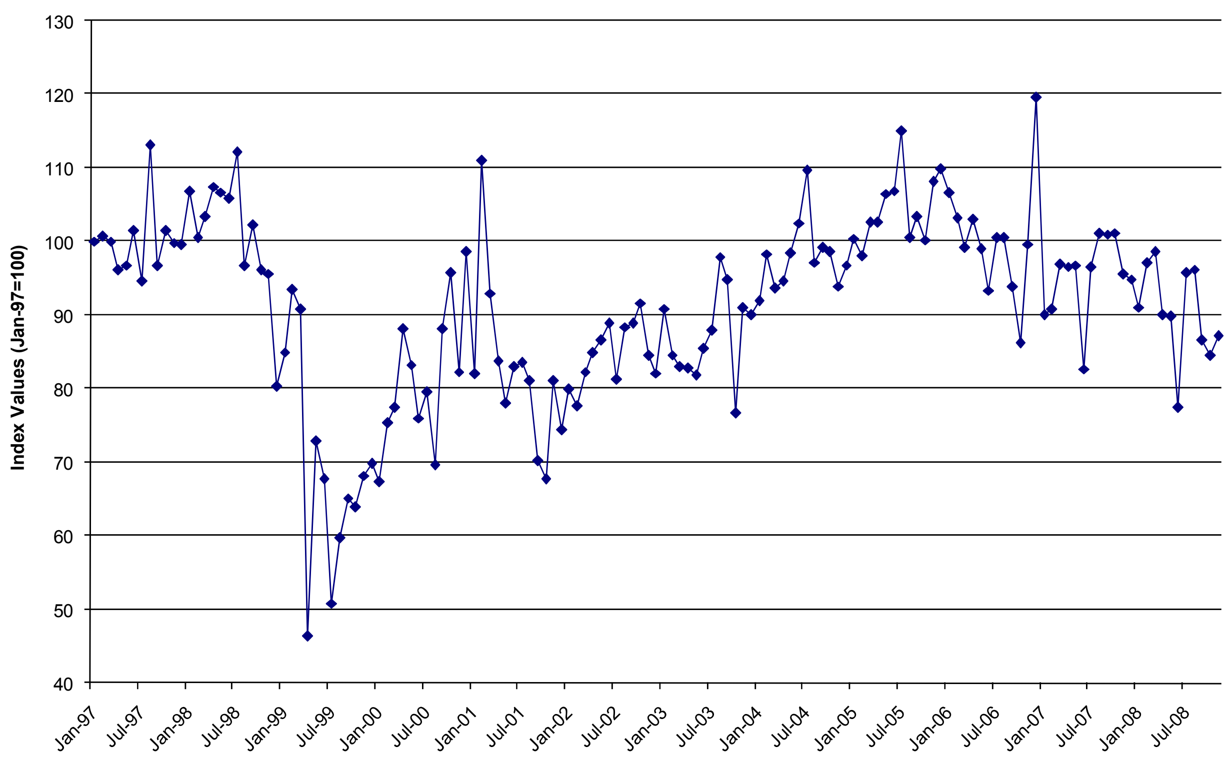


Figure 3-14. Industrial Production Index (NAICS 333111)

Table 3-28. Key Statistics: Welding and Soldering Equipment Manufacturing (NAICS 333992) ($2007)

	1997	2002
Revenue ($$10^6$)	$4,957	$3,880
Payroll ($$10^6$)	$1,024	$811
Employees	22,505	16,128
Establishments	250	231

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; “Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years.” <http://factfinder.census.gov>; (November 25, 2008).

that the top five states ranked by total acres irrigated are California, Nebraska, Texas, Arkansas, and Idaho. Approximately 32 million of the 53 million, or 68%, of U.S. irrigated acres are used to support oilseed and grain farming and other crop farming (tobacco, cotton, sugar cane, and other).

The survey reported that approximately 500,000 pumps were used on U.S. farms in 2003 with energy expenses totaling $1.6 billion. Electricity is the dominant form of energy expense for irrigation pumps, accounting for 60% of total energy expenses. Diesel fuel is second (18%), followed by natural gas (18%) and other forms of energy such as gasoline (4%).

Per-acre operating costs for these irrigation systems vary by fuel type, and natural gas was the most expensive in 2003 ($57 per acre for well systems and $34 per acre for surface water systems) (Table 3-29). Systems using diesel fuel were operated at approximately half of these per-acre costs ($25 per acre for well systems and $16 per acre for surface water systems). Gasoline- and gasohol-powered systems offered the least expensive operating costs ($12 per acre for well systems and $18 per acre for surface water systems).

As shown in Table 3-30, the number of on-farm pumps fell from 508,727 to 497,443 (2%) between 1998 and 2003. However, the use of electric- and diesel-powered pumps increased during this period (3% and 4%, respectively), while other fuel sources such as gasoline declined significantly. Pumps powered by gasoline and gasohol, for example, declined from 8,965 to 6,178, a 31% change during this period. Pumps powered by natural gas, LP gas, propane, and butane also declined by 26% to 29%. Although 1998 operating cost data are not available, the change in relative costs of operation across fuels between 1998 and 2003 may partly explain

Table 3-29. Expenses per Acre by Type of Energy: 2003

Fuel Type	Irrigated by Water from Wells	Irrigated by Surface Water
Electricity	$42.64	$29.84
Natural gas	$57.25	$33.67
LP gas, propane, butane	$27.21	$22.68
Diesel fuel	$25.09	$16.27
Gasoline and gasohol	$11.60	$18.05
Total	$39.50	$26.39

Source: U.S. Department of Agriculture, National Agricultural Statistics Service. 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 20.

Table 3-30. Number of On-Farm Pumps of Irrigation Water by Type of Energy: 1998 and 2003

Fuel Type	1998	2003	Percentage Change
Electricity	308,579	319,102	3%
Natural gas	58,880	41,771	–29%
LP gas, propane, butane	23,964	17,792	–26%
Diesel fuel	108,339	112,600	4%
Gasoline and gasohol	8,965	6,178	–31%
Total	508,727	497,443	–2%

Source: U.S. Department of Agriculture, National Agricultural Statistics Service. 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 20.

these patterns. Although no information is available on the use and construction of on-farm pumps specifically, their use is tied to the amount of agricultural land in production. USDA reports that planted acres of the eight major crops hit a 5-year high of 252 million acres in 2008 but will fall and level off to around 244 million acres over the next 2 to 4 years (USDA, 2008).

3.5.2.2 Welding

Welding is used in a wide variety of applications. One of the biggest manufacturers of welding products identifies the following key end-user segments:

- general metal fabrication;
- infrastructure including oil and gas pipelines and platforms, buildings, bridges, and power generation;

- transportation and defense industries (automotive, trucks, rail, ships, and aerospace);
- equipment manufacturers in construction, farming, and mining;
- retail resellers; and
- rental market (Lincoln Electric Holdings, 2006).

Lincoln Electric further describes the following key applications: power generation and process industries, offshore production of oil and gas, pipelines/pipemills, and heavy fabrication (earthmoving and construction equipment and agricultural and farm equipment.

3.5.3 Business Statistics

In 2003, California and Texas each had more than 5 million irrigated acres (Figure 3-15). Midwest states like Arkansas and Nebraska had more than 2.5 million irrigated acres. Heavy and civil engineering construction establishments are spread throughout the United States, particularly in areas such as California, Texas, North Carolina, and Florida (Figure 3-16). Each of these states has more than 2,000 establishments.

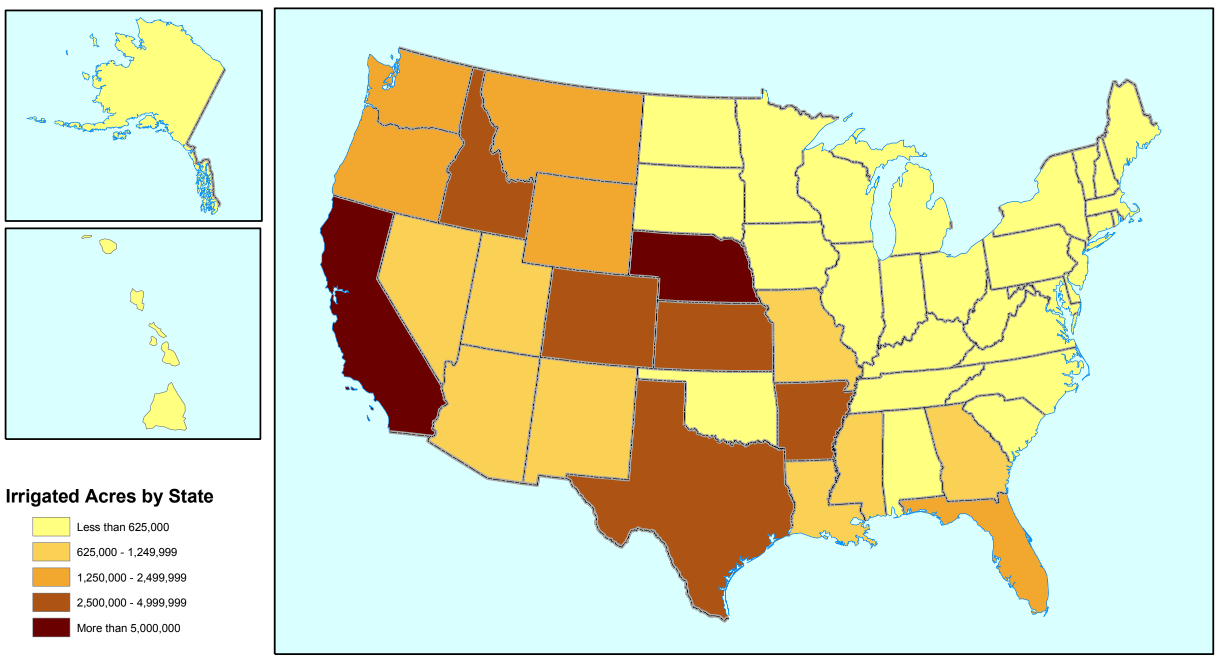


Figure 3-15. 2003 Regional Distribution of Irrigated Acres

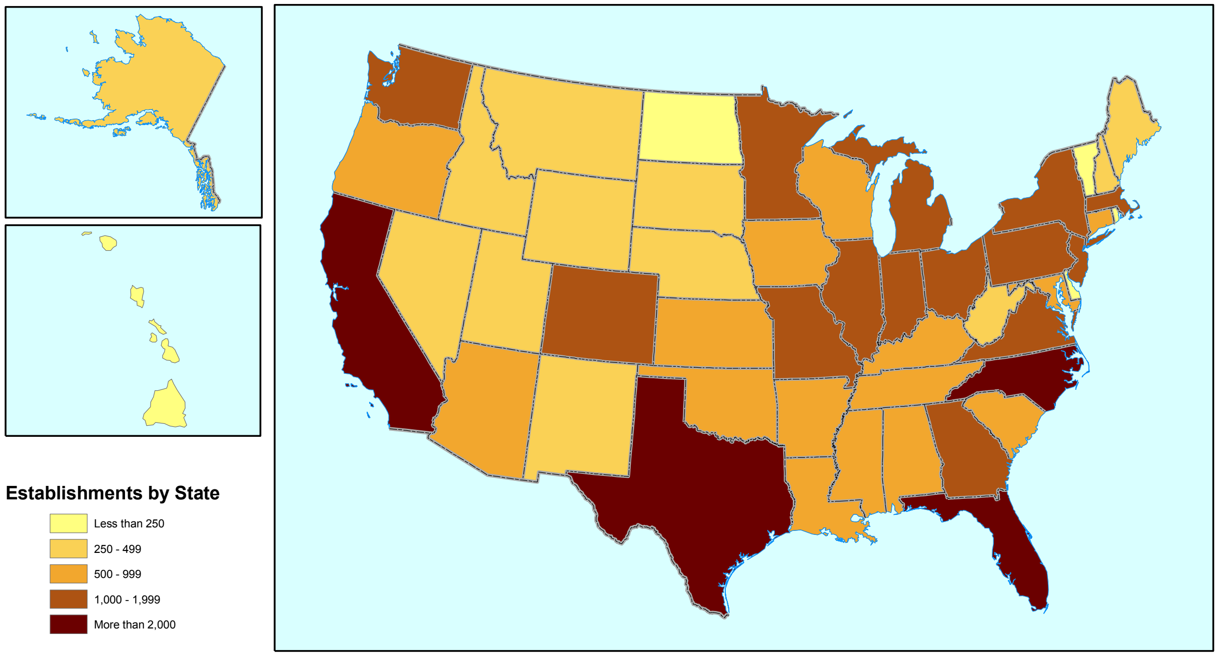


Figure 3-16. 2002 Regional Distribution of Establishments: Heavy and Civil Engineering Construction (NAICS 237)

As shown in Table 3-31, the market value of agriculture products sold was less than $25,000 per year on almost half the irrigated farms in the 2003 Farm and Ranch Irrigation Survey. Over 90% of the irrigated farms had agricultural product revenue below $750,000. It is not clear what fraction of these farms use stationary diesel engines or are owned by corporate farming operations. However, SUSB data also suggest 65% of firms in NAICS 11 have receipts less than $500,000 per year.

Table 3-31. Distribution of Farm Statistics by Market Value of Agricultural Products Sold: 2003

Variable	All Farms	<$25K	$25–$49K	$50–$99K	$100–$250K	$250–$500K	$500–$999K	$1,000K or More
Farms	220,163	48%	10%	11%	13%	8%	5%	4%
Land in farms (acres)	196,515,390	8%	6%	9%	21%	17%	16%	23%
Acres irrigated	52,583,431	5%	4%	7%	18%	18%	19%	29%
Irrigate cropland harvest (acres)	48,626,955	4%	3%	7%	18%	19%	20%	30%

Source: U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 34.

Enterprises within agriculture, construction, and mining machinery manufacturing (NAICS 3331) generated $118 billion of total receipts in 2006, while those in other general purpose machinery manufacturing (NAICS 3339) generated $69.8 billion. The average after-tax profit margin in these two industries was 6.9% and 4.7%, respectively (Table 3-32).

Table 3-32. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 3331,9

	Agriculture, Construction, & Mining Machinery Manufacturing	Other General Purpose Machinery Manufacturing
Number of enterprises[a]	2,485	7,288
Total receipts (10^3)	$118,369,636	$69,813,244
Net sales(10^3)	$108,210,188	$65,256,901
Profit margin before tax	9.1%	6.1%
Profit Margin after tax	6.9%	4.7%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

As noted earlier, welding equipment is used in heavy fabrication such as earthmoving and construction equipment. We focus on the size distribution for a representative sector in this section (NAICS 327, Heavy and Civil Engineering Construction); other subsections in Section 2 cover other sectors that potentially use equipment powered by diesel engines (e.g., power generation and offshore gas distribution). As shown in Table 3-33, SUSB data suggest 60% of firms in this industry have receipts less than $1 million per year; 90% are below the Small Business Administration (SBA) threshold on $50 million per year. However, it is not clear what fraction of these firms use stationary diesel engines.

Table 3-33. Key Enterprise Statistics by Receipt Size for Heavy Construction: 2002[a]

Variable	All Enterprises	Owned by Enterprises with 0–99K Receipts	100–499.9K Receipts	500–999.9K Receipts	1,000–4,999.9K Receipts	5,000,000–9,999,999K Receipts	<10,000K Receipts	10,000–49,999K Receipts	50,000–99,999K Receipts	100,000K+ Receipts
Firms	38,610	4,570	12,733	5,882	9,994	2,398	35,577	2,395	294	344
Establishments	39,949	4,570	12,733	5,883	10,025	2,427	35,638	2,561	405	1,345
Employment	856,312	5,219	35,592	37,498	156,941	87,858	323,108	199,532	64,681	268,991
Receipts ($$10^3$)	$174,384,008	$237,458	$3,346,936	$4,191,113	$22,641,664	$16,573,417	$46,990,588	$46,244,065	$16,728,737	$64,420,618
Receipts/firm ($$10^3$)	$4,517	$52	$263	$713	$2,266	$6,911	$1,321	$19,309	$56,900	$187,269
Receipts/establishment ($$10^3$)	$4,365	$52	$263	$712	$2,259	$6,829	$1,319	$18,057	$41,306	$47,896
Receipts/employment ($)	$203,645	$45,499	$94,036	$111,769	$144,269	$188,639	$145,433	$231,763	$258,634	$239,490

[a] 2002 SUSB NAICS 224. The most comparable 2002 NAICS code for this industry is 237.

Source: U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

SECTION 4
REGULATORY ALTERNATIVES, COSTS, AND EMISSION IMPACTS

4.1 Background

This action proposes national emission standards for hazardous air pollutants (NESHAP) from existing stationary reciprocating internal combustion engines (RICE) with a site rating of less than or equal to 500 hp located at major sources, and existing stationary RICE located at area sourcesThe final NESHAP for stationary RICE would be promulgated under 40 CFR part 63, subpart ZZZZ, which already contains standards applicable to new stationary RICE and existing stationary RICE with a site rating above 500 hp located at major sources. In addition, EPA is proposing national emission standards for hazardous air pollutants for existing stationary compression ignition engines greater than 500 brake horsepower that are located at major sources, based on a new review of these engines following the first RICE NESHAP rulemaking in 2004. In addition, EPA is proposing to amend the previously promulgated regulations regarding operation of stationary reciprocating internal combustion engines during periods of startup, shutdown and malfunction. EPA is proposing these requirements to meet its statutory obligation to address hazardous air pollutants (HAP) emissions from these sources under sections 112(d) and 112(k) of the CAA.

EPA promulgated NESHAP (in this case, a MACT standard) for existing, new, and reconstructed stationary RICE greater than 500 hp located at major sources on June 15, 2004 (69 FR 33474). EPA promulgated NESHAP for new and reconstructed stationary RICE that are located at area sources of HAP emissions and for new and reconstructed stationary RICE that have a site rating of less than or equal to 500 hp that are located at major sources of HAP emissions on January 18, 2008 (73 FR 3568). At that time, EPA did not promulgate a final decision for existing stationary RICE that are located at area sources of HAP emissions or for existing stationary RICE that have a site rating of less than or equal to 500 hp that are located at major sources of HAP emissions due to comments received indicating that the proposed MACT determinations for existing sources were inappropriate and because of a U.S. Court of Appeals for the District of Columbia Circuit ruling on March 13, 2007, involving litigation on the "Brick MACT," which set emission standards for major sources in that source category (40 CFR part 63, subpart JJJJJ), that appeared to impact EPA's ability to finalize its proposed "no reduction" MACT standards for existing sources. *Sierra Club* v. *EPA*, 479 F.3d 875 (DC Cir 2007). Among other things, the D.C. Circuit found that EPA's no emission reduction MACT determination in the challenged rule was unlawful. Because in the proposed stationary RICE rule EPA used a

MACT floor methodology similar to the methodology used in the Brick MACT, EPA decided to re-evaluate the MACT floors for existing major sources that have a site rating of less than or equal to 500 brake hp consistent with the Court's decision in the Brick MACT case. EPA has also re-evaluated the standards for existing area sources in light of the comments received on the proposed rule.

This proposal initiates a separate rulemaking process that focuses on existing sources. EPA has gathered further information on existing engines and has considered comments it received on the original proposed rule and the intervening court decision in creating this proposed rulemaking.

In addition, stakeholders have encouraged the Agency to review whether there are further ways to reduce emissions of pollutants from existing stationary diesel engines. In its comments on EPA's 2006 proposed rule for new stationary diesel engines,[1] Environmental Defense Fund suggested several possible avenues for the regulation of existing stationary diesel engines, including use of diesel oxidation catalysts or catalyzed diesel particulate filters (CDPF), as well as the use of ultra low sulfur diesel (ULSD) fuel. Environmental Defense Fund suggested that such controls can provide significant pollution reductions at reasonable cost. EPA issued an advance notice of proposed rulemaking (ANPRM) in January 2008, where it solicited comment on several issues concerning options to regulate emissions of pollutants from existing stationary diesel engines, generally, and specifically from larger, older stationary diesel engines. EPA solicited comment and collected information to aid decision-making related to the reduction of HAP emissions from existing stationary diesel engines and specifically from larger, older engines under Clean Air Act (CAA) section 112 authorities. The Agency sought comment on the larger, older engines because available data indicate that those engines emit the majority of particulate matter (PM) and toxic emissions from non-emergency stationary engines as a whole.

EPA has taken several actions over the past several years to reduce exhaust pollutants from stationary diesel engines, but believes that further reducing exhaust pollutants from stationary diesel engines, particularly existing stationary diesel engines that have not been subject to Federal standards, are justified. Therefore, EPA is proposing emissions reductions from existing stationary diesel engines.

[1] "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines and National Emission Standards for Hazardous Air Pollution for Reciprocating Internal Combustion Engines," 71 FR 33803–33855, www.epa.gov/ttn/atw/rice/ricepg.html, June 12, 2006.

4.2 Summary of the Proposed Rule

4.2.1 What Is the Source Category Regulated by this Proposed Rule?

This proposed rule addresses emissions from existing stationary engines less than or equal to 500 hp located at major sources and all stationary engines located at area sources. A major source of HAP emissions is a plant site that emits or has the potential to emit any single HAP at a rate of 10 tons (9.07 megagrams) or more per year or any combination of HAP at a rate of 25 tons (22.68 megagrams) or more per year, except that for oil and gas production facilities, a major source of HAP emissions is determined for each surface site. An area source of HAP emissions is a source that is not a major source. This proposed rule also addresses emissions from existing compression ignition (CI) engines greater than 500 hp located at major sources.

4.2.1.1 Stationary RICE ≤500 hp at Major Sources

This action proposes to revise 40 CFR part 63, subpart ZZZZ, to address HAP emissions from existing stationary RICE less than or equal to 500 hp located at major sources. For stationary engines less than or equal to 500 hp at major sources, EPA must determine what is the appropriate MACT for those engines under section 112(d)(3) of the CAA.

EPA has divided the source category into the following subcategories: stationary RICE less than 50 hp, landfill and digester gas stationary RICE greater than or equal to 50 hp, CI stationary RICE greater than or equal to 50 hp, and spark ignition (SI) stationary RICE greater than or equal to 50 hp. The CI stationary RICE greater than or equal to 50 hp subcategory was further subcategorized into emergency and non-emergency engines, as was the subcategory of SI stationary RICE greater than or equal to 50 hp. Spark ignition non-emergency stationary RICE greater than or equal to 50 hp were then subcategorized into 2-stroke lean burn (2SLB), 4-stroke lean burn (4SLB), and 4-stroke rich burn (4SRB) stationary RICE. The 2SLB and 4SLB stationary RICE greater than or equal to 50 hp subcategories were further subcategorized into below 250 hp and greater than or equal to 250 hp.

4.2.1.2 Stationary RICE at Area Sources

This action proposes to revise 40 CFR part 63, subpart ZZZZ, in order to address HAP emissions from existing stationary RICE located at area sources. For stationary engines located at area sources, EPA has the flexibility to promulgate standards based on generally available control technology or management practices (GACT) under CAA section 112(d)(5). EPA is required to address HAP emissions from stationary RICE located at area sources under section 112(k) of the CAA, based on criteria set forth by EPA in the Urban Air Toxics Strategy.

The subcategories for area sources are the same as those for major sources and are: stationary RICE less than 50 hp, landfill and digester gas stationary RICE greater than or equal to 50 hp, CI emergency stationary RICE greater than or equal to 50 hp, CI non-emergency stationary RICE greater than or equal to 50 hp, SI emergency stationary RICE greater than or equal to 50 hp, SI non-emergency 2SLB stationary RICE greater than or equal to 50 hp and less than 250 hp, SI non-emergency 2SLB greater than or equal to 250 hp, SI non-emergency 4SLB stationary RICE greater than or equal to 50 hp and less than 250 hp, SI non-emergency 4SLB greater than or equal to 250 hp, and SI non-emergency 4SRB stationary RICE greater than or equal to 50 hp.

4.2.1.3 Stationary CI RICE >500 hp at Major Sources

In addition, EPA is proposing emission standards for stationary CI engines greater than 500 hp at major sources under its authority to review and revise emission standards as necessary under section 112(d)(6) of the CAA.

4.2.2 What Are the Pollutants Regulated by this Proposed Rule?

The rule being proposed in this action would regulate emissions of HAP. Available emissions data show that several HAP, which are formed during the combustion process or which are contained within the fuel burned, are emitted from stationary engines. The HAP which have been measured in emission tests conducted on natural gas fired and diesel fired RICE include: 1,1,2,2-tetrachloroethane, 1,3-butadiene, 2,2,4-trimethylpentane, acetaldehyde, acrolein, benzene, chlorobenzene, chloroethane, ethylbenzene, formaldehyde, methanol, methylene chloride, n-hexane, naphthalene, polycyclic aromatic hydrocarbons, polycyclic organic matter, styrene, tetrachloroethane, toluene, and xylene. Metallic HAP from diesel fired stationary RICE that have been measured are: cadmium, chromium, lead, manganese, mercury, nickel, and selenium.

EPA described the health effects of these HAP and other HAP emitted from the operation of stationary RICE in the preamble to 40 CFR part 63, subpart ZZZZ, published on June 15, 2004 (69 FR 33474). These HAP emissions are known to cause, or contribute significantly to air pollution, which may reasonably be anticipated to endanger public health or welfare.

EPA is proposing to limit emissions of HAP through emissions standards for formaldehyde for non-emergency 4SRB engines, emergency SI engines, and engines less than 50 HP, and through emission standards for carbon monoxide (CO) for all other engines. For the RICE NESHAP promulgated in 2004 (69 FR 33474) for engines greater than 500 HP located at major sources, EPA chose to select formaldehyde to serve as a surrogate for HAP emissions. Formaldehyde is the hazardous air pollutant present in the highest concentration in the exhaust from stationary engines. In addition, emissions data show that formaldehyde emission levels are related to other HAP emission levels.

For the NESHAP promulgated in 2004, EPA also found that there is a relationship between CO emissions reductions and HAP emissions reductions from 2SLB, 4SLB, and CI stationary engines. Therefore, because testing for CO emissions has many advantages over testing for formaldehyde, CO emissions were chosen as a surrogate for HAP emissions reductions for 2SLB, 4SLB, and CI stationary engines operating with oxidation catalyst systems for that rule. However, EPA could not confirm the same relationship between CO and formaldehyde for 4SRB engines, so emission standards for such engines were provided in terms of formaldehyde.

For the standards being proposed in this action, EPA believes that previous decisions regarding the appropriateness of using formaldehyde and CO both in concentration (ppm) levels as has been done for stationary sources before as surrogates for HAP are still valid.[2] Consequently, EPA is proposing emission standards for formaldehyde for 4SRB engines and emission standards for CO for lean burn and CI engines in order to regulate HAP emissions. Information EPA has received from stationary engine manufacturers indicate that most SI emergency engines and engines below 50 HP are and will be 4SRB engines. As discussed above, EPA could not confirm a relationship between CO and formaldehyde emissions for 4SRB engines. Therefore, EPA is proposing standards for formaldehyde for those engines.

We recognize that stationary diesel engines emit trace amounts of metal HAP that remain in the particle phase. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP. Although metal HAP emissions from existing diesel engines are very small – about 130 tons per year – we are interested in receiving comments and data about more appropriate surrogates, if any, for the metallic HAP emissions.

In addition to reducing HAP and CO, the proposed rule would likely result in the reduction of PM emissions from existing diesel engines. The aftertreatment technologies expected to be used to reduce HAP and CO emissions also reduce emissions of PM from diesel

[2] In contrast, mobile source emission standards for diesel engines (both nonroad and on-highway) are promulgated on a mass basis rather than concentration.

engines. Furthermore, this proposed rule would also result in nitrogen oxides (NO_x) reductions from rich burn engines since these engines would likely need to install non-selective catalytic reduction (NSCR) technology that helps reduce NO_x in addition to CO and HAP emissions. Also, the proposed rule requires the use of ultra-low sulfur diesel (ULSD) for stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder that use diesel fuel, which would result in lower emissions of sulfur oxides (SO_x) and sulfate particulate by reducing the sulfur content in the fuel.

4.2.3 What Are the Proposed Standards?

4.2.3.1 Existing Stationary RICE at Major Sources

The emission standards proposed in this action for stationary RICE less than or equal to 500 hp located at major sources and stationary CI RICE greater than 300 hp located at major sources are shown in Table 4-1.

Table 4-1. Emission Standards for Stationary RICE Located at Major Sources

Subcategory	**Emission Standards at 15% O_2 (ppm volume on a dry basis)**	
	Except during periods of startup, shutdown, or malfunction	**During periods of startup, shutdown, or malfunction**
Non-Emergency 2SLB 50≥hp≤249	85 ppmvd CO	85 ppmvd CO
Non-Emergency 2SLB 250≥hp≤500	8 ppmvd CO or 90% CO reduction	85 ppmvd CO
Non-Emergency 4SLB 50≥hp≤249	95 ppmvd CO	95 ppmvd CO
Non-Emergency 4SLB 250≥hp≤500	9 ppmvd CO or 90% CO reduction	95 ppmvd CO
Non-Emergency 4SRB 50≥hp≤500	200 ppbvd formaldehyde or 90% formaldehyde reduction	2 ppmvd formaldehyde
All CI 50≥hp≤300	40 ppmvd CO	40 ppmvd CO
Emergency CI 300>hp≤500	40 ppmvd CO	40 ppmvd CO
Non-Emergency CI >300 hp	4 ppmvd CO or 90% CO reduction	40 ppmvd CO
<50 hp	2 ppmvd formaldehyde	2 ppmvd formaldehyde
Landfill/Digester 50≥hp≤500	177 ppmvd CO	177 ppmvd CO

Emergency SI 50≥hp≤500	2 ppmvd formaldehyde	2 ppmvd formaldehyde

In addition, certain existing stationary RICE located at major sources are subject to fuel requirements. Owners and operators of existing stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder located at major sources that use diesel fuel must use only diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 parts per million (ppm) and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

4.2.3.2 Stationary RICE at Area Sources

The emission standards and requirements proposed in this action for stationary RICE located at existing area sources are shown in Table 4-2.

Table 4-2. Emission Standards and Requirements for Stationary RICE Located at Area Sources

	Emission Standards at 15 percent O_2, as applicable, or Management Practice	
Subcategory	**Except during periods of startup, shutdown, or malfunction**	**During periods of startup, shutdown, or malfunction**
Non-Emergency 2SLB 50≥HP≤249	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency 2SLB HP≥250	8 ppmvd CO or 90% CO reduction	85 ppmvd CO
Non-Emergency 4SLB 50≥HP≤249	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency 4SLB HP≥250	9 ppmvd CO or 90% CO reduction	95 ppmvd CO

Non-Emergency 4SRB HP≥50	200 ppbvd formaldehyde or 90% formaldehyde reduction	2 ppmvd formaldehyde
Emergency CI 50≥HP≤500	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours, inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours, inspect all hoses and belts every 500 hours and replace as necessary
Emergency CI HP>500	40 ppmvd CO	40 ppmvd CO

(continued)

Table 4-2. Emission Standards and Requirements for Stationary RICE Located at Area Sources (continued)

Subcategory	Emission Standards at 15 percent O_2, as applicable, or Management Practice: Except during periods of startup, shutdown, or malfunction	Emission Standards at 15 percent O_2, as applicable, or Management Practice: During periods of startup, shutdown, or malfunction
Non-Emergency CI 50≥HP≤300	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency CI HP>300	4 ppmvd CO or 90% CO reduction	40 ppmvd CO
HP<50	Change oil and filter every 200 hours; replace spark plugs every 500 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 200 hours; replace spark plugs every 500 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Landfill/Digester Gas 50≥HP≤500	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Landfill/Digester Gas HP>500	177 ppmvd CO	177 ppmvd CO
Emergency SI 50≥HP≤500	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Emergency SI HP>500	2 ppmvd formaldehyde	2 ppmvd formaldehyde

4.2.3.3 Operating Limitations

The EPA is proposing operating limitations for stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source. Owners and operators of engines that are equipped with oxidation catalyst or NSCR must maintain the catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water from the pressure drop across the catalyst that was measured during the initial performance test. Owners and operators of these engines must also maintain the temperature of the stationary RICE exhaust so that the catalyst inlet temperature is between 450 and 1,350°F for engines with an oxidation catalyst and 750 to 1,250°F for engines with NSCR. Owners and operators of engines that are not using oxidation catalyst or NSCR must comply with any operating limitations approved by the Administrator.

4.2.3.4 Fuel Requirements

In addition to emission standards and management practices, certain stationary CI RICE located at existing area sources are subject to fuel requirements. Owners and operators of stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder located at existing area sources that use diesel fuel must only use diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

4.2.3.5 New or Reconstructed Stationary RICE >500 HP at Major Sources, New or Reconstructed 4SLB Stationary RICE ≥ 250 HP at Major Sources and Existing 4SRB Stationary RICE >500 HP at Major Sources

The EPA is co-proposing, in the alternative, as explained below, to amend the existing regulations for new and reconstructed non-emergency 2SLB and CI stationary RICE >500 HP at major sources, new and reconstructed non-emergency 4SLB stationary RICE ≥ 250 HP at major sources, and existing 4SRB stationary RICE >500 HP at major sources, in order to set limits during periods of startup and malfunction. These emission limitations are shown in Table 4-3. Note that EPA is also co-proposing that the same standards apply during both normal operation and periods of startup and malfunctions.

4.2.3.6 Operating Limitations and Management Practices

The EPA is proposing operating limitations for existing stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 HP and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 HP and are located at a major source. These are large sources that are subject to proposed standards that would require the use of aftertreatment. Owners and operators of engines that are equipped with oxidation catalyst or NSCR must maintain the catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water from the pressure drop across the catalyst that was measured during the initial performance test.

Table 4-3. Emission Standards for New or Reconstructed Non-Emergency Stationary RICE >500 HP at Major Sources and Existing Non-Emergency 4SRB Stationary RICE >500 HP at Major Sources During Periods of Startup, Shutdown or Malfunction

Subcategory	Emission Standards at 15 percent O_2
New or reconstructed non-emergency 2SLB >500 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 259 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
New or reconstructed non-emergency 4SLB >250 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 420 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
Existing non-emergency 4SRB >500 HP located at a major source of HAP emissions; or New or reconstructed non-emergency 4SRB >500 HP located at a major source of HAP emissions	Limit concentration of formaldehyde in the stationary RICE exhaust to 2 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
New or reconstructed non-emergency CI >500 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 77 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.

Owners and operators of these engines must also maintain the temperature of the stationary RICE exhaust so that the catalyst inlet temperature is between 450 and 1350 degrees Fahrenheit (°F) for engines with an oxidation catalyst and 750 to 1250°F for engines with NSCR. Owners and operators of engines that are not using oxidation catalyst or NSCR must comply with any operating limitations approved by the Administrator.

As shown in Table 4-2 above, the EPA is also proposing management practices for several subcategories of engines located at area sources. Such management practices include maintenance requirements that are expected to ensure that emission control systems are working properly. EPA asks for comments on these management practices and requests suggestions of additional maintenance requirements that may be needed for some of these engine subcategories.

4.2.4 What Are the Requirements for Demonstrating Compliance?

The following sections describe the requirements for demonstrating compliance under the proposed rule.

4.2.4.5 Stationary RICE at Major Sources

Owners and operators of stationary non-emergency RICE located at major sources that are less than 100 hp and stationary emergency RICE located at major sources must operate and maintain their stationary RICE and aftertreatment control device (if any) according to the manufacturer's emission-related written instructions or develop their own maintenance plan. Owners and operators of stationary non-emergency RICE located at major sources that are less than 100 hp and stationary emergency RICE located at major sources do not have to conduct any performance testing.

Owners and operators of stationary non-emergency RICE located at major sources that are greater than or equal to 100 hp and less than or equal to 500 hp must conduct an initial performance test to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency RICE located at major sources that are greater than 500 hp must conduct an initial performance test and must test every 8,760 hours of operation or 3 years, whichever comes first, to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source must continuously monitor and record the catalyst inlet temperature if an oxidation catalyst is being used on the engine. The pressure drop across the catalyst must also be measured monthly. If an oxidation catalyst is not being used on the engine, the owner or operator must continuously monitor and record the operating parameters (if any) approved by the Administrator.

4.2.4.6 Stationary RICE at Area Sources

Owners and operators of stationary emergency RICE located at existing area sources and stationary RICE that are located at existing area sources that are not subject to any numerical emission standards, as shown in Table 4-2, must operate and maintain their stationary RICE and after-treatment control device (if any) according to the manufacturer's emission-related written instructions or develop their own maintenance plan. Owners and operators of stationary RICE that are located at existing area sources that are not subject to any numerical emission standards do not have to conduct any performance testing.

Owners and operators of stationary RICE that are located at existing area sources subject to numerical emission standards, as shown in Table 4-2, must conduct an initial performance test to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency RICE located at existing area sources that are greater than 500 hp must conduct an initial performance test and must test every 8,760 hours of operation or 3 years, whichever comes first, to demonstrate that they are achieving the required emission standards.

In addition to emission standards and management practices, certain stationary CI RICE located at existing area sources are subject to fuel requirements. These fuel requirements are proposed in order to reduce the potential formation of sulfate compounds that are emitted when high sulfur diesel fuel is used in combination with oxidation catalysts and to assist in the efficient operation of the oxidation catalysts. Thus, owners and operators of stationary non-emergency diesel-fueled CI engines greater than 300 HP with a displacement of less than 30 liters per cylinder located at existing area sources must only use diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

Owners and operators of stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source must continuously monitor and record the catalyst inlet temperature if an oxidation catalyst or NSCR is being used on the engine. The pressure drop across the catalyst must also be measured monthly. If an oxidation catalyst or NSCR is not being used on the engine, the owner or operator must continuously monitor and record the operating parameters (if any) approved by the Administrator.

4.2.5 What Are the Reporting and Recordkeeping Requirements?

The following sections describe the reporting and recordkeeping requirements that are required under the proposed rule.

Owners and operators of stationary emergency RICE that do not meet the requirements for non-emergency engines are required to keep records of their hours of operation. Owners and operators of stationary emergency RICE must install a non-resettable hour meter on their engines to record the necessary information. Emergency stationary RICE may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. Owners and operators can petition the Administrator for additional hours, beyond the allowed 100 hours per year, if such additional hours should prove to be necessary for maintenance and testing reasons. A petition is not required if the hours beyond 100 hours per year for maintenance and testing purposes are mandated by regulation such as State or local requirements. There is no time limit on the use of emergency stationary engines in emergency situations, however, the owner or operator is required to record the length of operation and the reason the engine was in operation during that time. Records must be maintained documenting why the engine was operating to ensure the 100 hours per year limit for maintenance and testing operation is not exceeded. In addition, owners and operators are allowed to operate their stationary emergency RICE for non-emergency purposes for 50 hours per year, but those 50 hours are counted towards the total 100 hours provided for operation other than for true emergencies and owners and operators may not engage in income-generating activities during those 50 hours. The 50 hours per year for non-emergency purposes cannot be used to generate income for a facility, for example, to supply power to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

Owners and operators of existing stationary RICE located at area sources, that are subject to management practices as shown in Table 2, are required to keep records that show that management practices that are required are being met. Such records are to be kept on-site by owners and operators. These records must include, but may not be limited to: oil and filter change dates, oil amounts added and corresponding hour on the hour meter, fuel consumption rates, air filter change dates, records of repairs and other maintenance performed.

In terms of reporting requirements, owners and operators of existing stationary RICE, except stationary RICE that are less than 100 hp, existing emergency stationary RICE, and existing stationary RICE that are not subject to any numerical emission standards, must submit all of the applicable notifications as listed in the NESHAP General Provisions (40 CFR part 63, subpart A), including initial an initial notification, notification of performance test, and a notification of compliance for each stationary RICE which must comply with the specified emission limitations.

4.3 Rationale for Proposed Rule

4.3.3 Which Control Technologies Apply to Stationary RICE?

EPA reviewed various control technologies applicable to stationary engines. For detailed information on the control technology review that EPA conducted, refer to information in the docket for this proposed rule. The following sections provide general descriptions of currently available controls that can be used to reduce emissions from stationary engines.

Non-selective catalytic reduction (NSCR) has been commercially available for many years and has been widely used on stationary engines. The technology can be applied to rich burn stationary engines and is capable of significantly reducing HAP emissions from stationary RICE. The technology is also capable of considerably reducing CO and NO_x emissions from rich burn stationary RICE. Based on available information, NSCR appears to be technically feasible for rich burn engines down to 25 hp.

Oxidation catalyst is another type of aftertreatment that can be applied to stationary engines and is typically used with lean burn engines. The technology can be applied to either diesel or gas fired lean burn engines. Significant reductions in HAP and CO are achieved with oxidation catalyst and applying the technology to diesel fired engines also yields PM emissions reductions. Oxidation catalyst control has been widely used and has been available for decades for use with lean burn stationary engines. While oxidation catalysts are very effective at reducing HAP and CO emissions, there is some concern about increasing NO_2 emissions as a result of using highly catalyzed devices. Thus, EPA requests comments and information on the potential increase in NO_2 emissions and any strategies to help reduce their formation.

Catalyzed diesel particulate filters (CDPF) are applicable to CI engines using diesel fuel and are primarily used to reduce PM emissions. The technology is a newer technology than other aftertreatment control devices, but is becoming increasingly widespread. Applying CDPF can significantly reduce PM emissions, while also limiting emissions of HAP and CO. Catalyzed diesel particulate filters are the basis for the Tier 4 emission standards for PM for most nonroad CI engines regulated by 40 CFR part 1039 and also for most new non-emergency stationary CI engines regulated under 40 CFR part 60, subpart IIII. Recently finalized standards for stationary CI engines in California are also based on the use of particulate filters in some cases.

4.3.4 How Did EPA Determine the Basis and Level of the Proposed Standards?

4.3.4.5 Stationary RICE at Major Sources

Section 112 of the CAA requires that EPA establish NESHAP for the control of HAP from new and existing sources in regulated source categories. The CAA requires the NESHAP for major sources to reflect the maximum degree of reduction in emissions of HAP that is achievable. This level of control is commonly referred to as the MACT.

The MACT floor is the minimum control level allowed for NESHAP and is defined under section 112(d)(3) of the CAA. In essence, the MACT floor ensures that the standards are set at a level that assures that all major sources achieve the level of control at least as stringent as that already achieved by the better controlled and lower emitting sources in each source category or subcategory.

The MACT floor standards for existing sources must be no less stringent than the average emission limitation achieved by the best performing 12% of existing sources in the category or subcategory (or the best performing 5 sources for categories or subcategories with fewer than 30 sources). The MACT standard must be no less stringent than the MACT floor.

In developing MACT, EPA also considers control options that are more stringent than the floor. EPA may establish standards more stringent than the floor (or, "beyond-the-floor") based on the consideration of cost of achieving the emissions reductions, any non-air quality health and environmental impacts, and energy requirements. Section 112 of the CAA allows EPA to establish subcategories among a group of sources, based on criteria that differentiate such sources. The subcategories that have been developed for stationary RICE were previously listed and are necessary in order to capture the distinct differences, which could affect the emissions of HAP from these engines. The complete rationale explaining the development of these subcategories is provided in the memorandum titled "Subcategorization and MACT Floor Determination for Stationary Reciprocating Internal Combustion Engines ≤500 hp at Major Sources" and is available from the docket.

For the MACT floor determination, EPA reviewed the data in its Office of Air Quality Planning and Standards' RICE Population Database (hereafter referred to as the "Population Database") and RICE Emissions Database (hereafter referred to as the "Emissions Database"). The Population and Emissions Databases represent the best information available to EPA. Information in the Population and Emissions Database was obtained from several sources and is further described in the notice of proposed rulemaking for the RICE NESHAP for engines greater than 500 hp at major sources (67 FR 77830, December 19, 2002) and in the docket for the RICE NESHAP rulemaking (EPA-HQ-OAR-2002-0059). EPA queried the Population Database to determine how many stationary RICE less than or equal to 500 hp in each subcategory have catalyst type controls to determine the relevant technology for the MACT floor. In order to establish the emission standard for each subcategory of stationary existing RICE, EPA referred to the Emissions Database. The following sections describe the MACT floor review and proposed MACT determinations for each subcategory of stationary RICE.

a. Stationary RICE <50 hp. According to the Population Database there are no existing stationary RICE less than 50 hp using catalyst type controls. Therefore, EPA determined that the MACT floor is the emission level that is achievable by existing engines of this size operating without add-on controls. EPA is not expecting any stationary CI engines less than 50 hp since such engines are typically considered nonroad mobile engines. Also, EPA does not expect any lean burn engines in this subcategory as lean burn engines tend to be found in larger engine size segments. Therefore, it is assumed that engines less than 50 hp would be 4SRB engines. Subsequently, EPA reviewed formaldehyde emissions from 4SRB engines and averaged the best performing 12% without add-on controls. As a result, the MACT floor for engines below 50 hp is 2 parts per million by volume, dry basis (ppmvd) of formaldehyde at 15% oxygen (O_2).

EPA considered regulatory options more stringent than the MACT floor, specifically NSCR. However, the cost per ton of HAP reduced for engines less than 50 hp equipped with NSCR is high and outweighs the potential HAP reduction benefit. Therefore, MACT is equivalent to the MACT floor. For details on the cost per ton analysis, refer to the memorandum entitled “Above-the-Floor Determination for Stationary RICE,” included in the docket.

b. Stationary Landfill/Digester Gas ≥50 hp. According to the Population Database there are no existing landfill or digester gas engines using catalyst type controls. Therefore, EPA determined that the MACT floor for this subcategory is the level achievable by existing landfill and digester gas engines operating without add-on controls. EPA consulted several sources, including the Emissions Database, in order to determine the level being achieved by landfill and digester gas engines.

Based on reviewing recently obtained test reports for landfill and digester gas engines, EPA concluded that the latest information obtained on the current levels being achieved by landfill gas engines is the most appropriate and representative information and therefore was used to determine the MACT floor limit. EPA analyzed the CO emissions from landfill and digester gas test reports. EPA has previously discussed the appropriateness of using CO emissions as a surrogate for HAP emissions and therefore reviewed CO emissions from landfill and digester gas engines without add-on controls. EPA selected the best performing 12% and averaged those 12% to determine the MACT floor. As a result, the MACT floor for landfill and digester gas stationary RICE greater than or equal to 50 hp is 177 ppmvd of CO at 15% O_2.

Currently, there are no viable above-the-floor options for engines that combust landfill or digester gas. Aftertreatment controls could theoretically be applied to engines burning waste gas; however, numerous studies have shown that a family of silicon-based compounds named siloxanes can foul add-on catalyst controls. Such fouling can render the catalyst inoperable within short periods of time. Pre-treatment systems could be applied to clean the fuel prior to combustion theoretically allowing catalysts to be used, but has not shown to be a reliable technology at this time. Therefore, MACT is equivalent to the MACT floor.

c. Stationary Emergency CI 50≥hp≤500. No existing CI emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp were found to have catalyst type controls in the Population Database. For that reason, the MACT floor is the level achievable by existing CI engines operating without add-on controls. EPA reviewed CO emissions from CI engines without add-on controls and selected the best performing 12% without add-on controls. As a result, the MACT floor for CI emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 40 ppmvd of CO at 15% O_2.

As part of the analysis to consider beyond-the-floor options, EPA considered add-on controls for emergency engines. However, due to the limited operation of emergency engines (about 50 hours per year on average), the cost-effectiveness of such controls is poor. The estimated cost of oxidation catalyst per ton of HAP reduced ranges from $1 million to $2.8 million for emergency CI engines in this size range. For CDPF, the estimated cost per ton of HAP reduced for emergency CI engines between 50 and 500 HP ranges from $3.7 million to $8.7 million. In addition, the total reductions achieved by applying aftertreatment controls would be minimal. Other relevant concerns include technical feasibility and the need for emergency engines to start quickly and operate without problems. Therefore, MACT is equivalent to the MACT floor. EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

d. Stationary Non-Emergency CI 50≥hp≤500. No existing CI non-emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp were found to have catalyst type controls, according the Population Database. For that reason, the MACT floor for this subcategory is the level achievable by existing CI engines operating without add-on controls. In terms of non-cumulative emissions, there is no difference between emissions from non-emergency and emergency CI engines. Therefore, the MACT floor for non-emergency CI engines between 50 and 500 hp engines is equivalent to the MACT floor for emergency CI engines between 50 and 500 hp and EPA analyzed the same data in order to determine the MACT floor limit. As a result, the MACT floor for CI non-emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 40 ppmvd of CO at 15% O_2.

EPA again considered add-on controls for this subcategory of engines. The applicable add-on controls that yield significant HAP reductions are oxidation catalyst and CDPF. Diesel oxidation catalysts are capable of reducing HAP emissions by significant amounts in excess of 90% in some cases. Diesel oxidation catalysts also reduce emissions of CO as well as PM emissions. Achievable reductions of PM are on the order of 30% for oxidation catalyst. Catalyzed diesel particulate filters are capable of reducing HAP and CO emissions by similar amounts, but are more efficient in reducing PM. Achievable PM reductions are on the order of 90% or more with CDPF. However, CDPF is considerably more expensive than diesel oxidation catalysts.

EPA estimated the cost per ton of HAP removal by potentially applying oxidation catalysts and CDPF to existing non-emergency CI engines. The specific costs associated with add-on controls can be found in memoranda available from the rulemaking docket. The cost per ton of HAP removed for CDPF is in general significantly higher than the cost per ton of HAP removed for oxidation catalyst, but the cost per ton for both options drastically increases as the size of the engine decreases and is more favorable towards larger size engines. EPA requests data and other information on the ability of oxidation catalysts to remove HAP compared to CDPF. In addition, we request comment on the performance capability of these control devices to remove metallic HAP.

Considering the HAP emission reductions capable from oxidation catalysts, the cost of oxidation catalyst control compared to CDPF, and the low capital costs associated with oxidation catalyst make oxidation catalysts a favorable option for reduction of HAP emissions from larger existing non-emergency stationary diesel engines. However, going above-the-floor and requiring oxidation catalyst on all non-emergency stationary CI engines would require significant total capital investment and total annual control costs. For the greater than 300 hp segment the cost per ton removed, which includes a mixture of organic and metallic HAP, is estimated to be $51,973. This cost is almost a third less than the estimated cost per ton of $140,395 for stationary engines 50 to 100 hp.

Stationary existing diesel engines were largely uncontrolled at the Federal level prior to the promulgation of EPA's emission standards for stationary diesel engines in 2004, which affected engines constructed beginning in 2002. Non-emergency diesel engines are estimated to emit 90% of total combined PM and NO_x emissions from all existing stationary diesel engines, with emergency engines emitting the remaining 10%. Of the non-emergency diesel engines, about 50,000 non-emergency engines rated 300 hp or higher were built prior to 2002, which is about 29% of the existing population of non-emergency stationary diesel engines. These 50,000 non-emergency diesel engines emit approximately 72% of the total HAP emissions, 66% of the total PM emissions, and 62% of the total NO_x emissions from existing non-emergency stationary diesel engines. This information is based on data from the Power Systems Research Database that was presented in Tables 1-4 of EPA's January 24, 2008 ANPRM for stationary diesel engines emission standards (73 FR 4136).

For these reasons, EPA concluded that it can achieve the highest level of emission reduction relative to cost, while requiring controls where appropriate, by requiring more stringent emission standards on non-emergency stationary diesel engines with a power rating greater than 300 hp. For these reasons and considering the higher level of HAP reductions achievable from engines greater than 300 hp and the reduced annual cost of control, EPA believes that requiring above-the-floor levels that rely on oxidation catalyst control is appropriate for engines greater than 300 hp. EPA solicits comments and data on whether 300 hp is the appropriate size division for setting beyond-the-floor MACT standards requiring the use of add-on controls. Specifically, EPA is soliciting comment on whether it would be appropriate to extend the more stringent standards to engines that are less than 300 hp.

Of further consideration are the co-benefits that would be achieved by the use of oxidation catalyst as it will reduce other pollutants such as CO and PM, which is of significant health concern. Taking into account the reductions in CO and PM associated with applying oxidation catalyst to non-emergency CI engines, the cost per ton of pollutants reduced if one sums the reductions together decreases. The total co-benefits of this proposed regulation are presented in a separate memorandum discussing the costs and emissions impacts of this regulation.

EPA believes that the emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified under section 112(d). Therefore, EPA is proposing MACT to be the level that is achieved by applying oxidation catalyst to non-emergency CI engines greater than 300 HP, which is 4 ppmvd of CO at 15 percent O_2, or 90 percent CO efficiency. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

While these proposed HAP emission standards would not require the use of CDPFs, EPA notes that when compared to oxidation catalysts, CDPFs provide significantly greater reductions in levels of PM (including black carbon) from diesel engines, which are a significant health concern.

EPA estimates that the range of PM2.5 emission reductions would increase from 2,600 tons to 7,600 tons if CDPFs are used rather than oxidation catalysts.

Black carbon emissions contribute to climate warming by absorbing incoming and reflected sunlight in the atmosphere and by darkening clouds, snow and ice. The Fourth Assessment Report (2007) of the Intergovernmental Panel on Climate Change (IPCC) estimated that the global mean radiative forcing (or heating) effect of black carbon ranged from roughly 10 to 50% of the radiative forcing due to carbon dioxide (CO_2). A more recent study estimates an even higher global mean heating effect for black carbon.[3] The National Academy of Sciences states "Regulations targeting black carbon emissions or ozone precursors would have combined benefits for public health and climate."[4] While mobile diesel engines have been the largest black carbon source in the U.S., these emissions are expected to be reduced significantly over the next several decades based on CDPFs for new vehicles. EPA is interested in comments and information on other regulatory and non-regulatory approaches that could help address black carbon emissions from existing stationary diesel engines.

Sources may wish to review whether it is appropriate for some existing CI engines to use CDPFs to meet the requirements of this rule, given the considerable co-benefits of using CDPF. For example, the cost effectiveness associated with reducing PM2.5 with oxidation catalysts on a 300 HP diesel engine is $27,000 per ton, while using a CDPF improves the cost effectiveness to about $9,000 per ton. These cost effectiveness numbers include any potential reductions of metallic HAP which would be emitted in the particle phase. EPA notes, however, that some have suggested that the use of CDPF on older uncontrolled engines may be more problematic than for newer engines that already have some level of engine control.

One of the potential problems raised by industry are the difficulties with retrofitting CDPFs on mechanically-controlled engines versus those that use electronic controls. Furthermore, the diesel PM levels from older engines are, according to some, too high for efficient operation of a CDPF. EPA is requesting comment on the use of CDPF to meet the HAP standards for this rule and on the benefits generally of using CDPFs on older stationary CI engines. EPA also asks for comment on technical feasibility issues that might preclude the use of such devices on older diesel engines.

[3] Ramanathan and Carmichael, "Global and regional climate changes due to black carbon," Nature Geoscience 2008

[4] National Academy of Sciences, "Radiative Forcing of Climate Change: Expanding the Concept and Addressing Uncertainties," October 2005.

Stationary diesel engines also emit trace amounts of metallic HAP. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP, including these very small trace emissions of metals. Nonetheless, EPA is taking comment on whether there are more appropriate surrogates for metallic HAP from stationary diesel engines. EPA does not have data regarding the use of other surrogates for these emissions from stationary diesel engines, so EPA is soliciting data on any other such surrogates.

The proposed rule requires the use of ULSD for existing non-emergency stationary diesel engines greater than 300 hp with a displacement of less than 30 liters per cylinder. The use of ULSD is necessary due to concerns about oxidation catalysts simultaneously oxidizing SO_2 to form sulfate particulate. A limit on the diesel fuel sulfur level of 15 ppm will reduce the potential for increased sulfate emissions from diesel engines equipped with oxidation catalysts and will improve the efficiency of the catalyst. The use of ULSD will also enable stationary diesel engines to utilize CDPF if desired. EPA has already promulgated similar diesel fuel sulfur standards for highway and nonroad diesel engines and for new stationary diesel engines.

e. Stationary Non-Emergency CI >500 hp. EPA is proposing to address emissions from existing non-emergency CI engines greater than 500 hp located at major sources by limiting the CO to 4 ppmvd at 15% O_2 or by reducing CO by 90% or more. The proposed standards are based on what is achievable by applying oxidation catalyst. A regulation covering existing stationary diesel engines was promulgated in 2004. However, based on the MACT floor analysis conducted at that time, the regulation subjected diesel engines to emission standards of no further emission control.

However, due to the availability of technically feasible and reasonably cost-effective technologies to control emissions from these existing large stationary CI engines , and the potential of reducing exhaust HAP (as well as PM), EPA is proposing to address HAP emissions from these existing diesel engines > 500 HP pursuant to its authority under CAA section 112(d).

As a result of our review of the Emissions Database, the MACT floor for CI non-emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 40 ppmvd of CO at 15 percent O_2.

As part of our analysis of going beyond the MACT floor, EPA considered the emissions associated with the use of oxidation catalysts. Similar to EPA's analysis of the emission reductions and costs associated with the use of oxidation catalysts for diesel engines from 300-500 HP, EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified under section 112(d). A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

EPA is proposing to address emissions from existing non-emergency CI engines greater than 500 HP located at major sources by limiting the CO to 4 ppmvd at 15 percent O_2 or by reducing CO by 90 percent or more. The proposed standards are based on what is achieved by applying oxidation catalyst controls. Oxidation catalyst controls reduce HAP, CO, and PM from diesel engines. The proposed emission standard is in terms of CO, which has been shown to be an appropriate surrogate for HAP. Stationary diesel engines also emit trace amounts of metallic HAP. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP, including these very small trace emissions of metals. Nonetheless, EPA is taking comment on whether there are more appropriate surrogates for metallic HAP from stationary diesel engines. EPA does not have data regarding the use of other surrogates for these emissions from stationary diesel engines, so EPA is soliciting data on any other such surrogates.

For the same reasons provided above for non-emergency diesel engines between 300-500 HP, EPA is requiring the use of ULSD for non-emergency diesel engines above 500 HP.

f. Stationary Emergency SI 50≥hp≤500. As a result of our review of the Emissions Database and industry estimates, EPA determined the MACT floor for SI emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 2 ppmvd of formaldehyde at 15 percent O2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered add-on controls for this subcategory. However, the same issues apply to emergency SI engines as to emergency CI engines; in particular, the cost-effectiveness of such controls on emergency engines and questions about the feasibility of such controls on emergency engines. According to the Population Database there are no SI emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP using catalyst type controls. Therefore, it is not appropriate to require add-on controls on emergency SI engines. EPA also found no other techniques appropriate to go beyond the MACT floor. MACT is therefore equivalent to the MACT floor.

g. Stationary Non-Emergency 2SLB 50≥HP≤500. EPA selected the best performing 12 percent of engines for formaldehyde, identified the corresponding CO tests, and averaged the CO emissions from the corresponding tests. As a result, the MACT floor for non-emergency 2SLB stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 85 ppmvd of CO at 15 percent O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst controls to this subcategory and estimated the cost per ton of HAP removed. EPA believes the costs to be reasonable for engines 250 HP and above equipped with oxidation catalyst and can be justified in light of the significant reductions of HAP that would be achieved. Oxidation catalysts can reduce HAP and CO from stationary spark-ignition engines. The proposed emission limit is in terms of CO, which has been shown to be an appropriate surrogate for HAP. EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified. Therefore, MACT for engines 250 HP and above is the level that is achievable by applying oxidation catalyst and is 8 ppmvd of CO at 15 percent O_2 or 90 percent CO efficiency. MACT for engines below 250 HP is equivalent to the MACT floor.

g. Non-Emergency 2SLB 50≥hp≤500. According to the Population Database, there are no non-emergency 4SLB stationary RICE greater than or equal to 50 HP and less than or equal to 249 HP using catalyst type controls.

EPA reviewed formaldehyde emissions tests from 4SLB engines. EPA selected the best performing 12 percent of engines for formaldehyde and identified the corresponding CO values from the top 12 tests for formaldehyde. The corresponding CO values were then averaged. As a result, the MACT floor for 4SLB stationary RICE greater than or equal to 50 HP and less than or equal to 249 HP is 95 ppmvd of CO at 15 percent O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst controls to this subcategory. However the cost per ton of HAP removed was determined to be too significant and to outweigh the expected HAP reductions from these stationary engines. Therefore, MACT is equivalent to the MACT floor.

h. Non-Emergency 4SLB 50≥hp≤249. According to the Population Database, there are no non-emergency 4SLB stationary RICE greater than or equal to 50 hp and less than or equal to 249 hp using catalyst type controls. Therefore, the MACT floor for this subcategory is the level achieved by 4SLB engines 50 to 249 hp operating without add-on controls.

EPA reviewed formaldehyde emissions tests from 4SLB engines without add-on controls. EPA selected the best performing 12% of engines for formaldehyde and identified the corresponding CO values from the top 12 tests for formaldehyde. The corresponding CO values were then averaged. As a result, the MACT floor for 4SLB stationary RICE greater than or equal to 50 hp and less than or equal to 249 hp is 95 ppmvd of CO at 15% O_2.

EPA considered applying oxidation catalyst controls to this subcategory as part of the beyond-the-floor analysis. However, the cost per ton of HAP removed was determined to outweigh the potential reductions. Therefore, MACT is the level achievable without add-on control and is equivalent to the MACT floor.

i. Non-Emergency 4SLB 250≥hp≤500. For non-emergency 4SLB engines between 250 and 500 hp, EPA found that 5.7% of the population is controlled with aftertreatment that yields HAP reductions. EPA analyzed formaldehyde emissions from 4SLB tests for engines without add-on controls. EPA took the average of the best performing 12% of engines for formaldehyde and identified the corresponding CO values from the best performing 12% of tests. The corresponding CO values were then averaged. The result for 4SLB stationary RICE greater than or equal to 250 hp and less than or equal to 500 hp is 95 ppmvd of CO at 15% O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst and estimated the cost per ton of HAP removed. The use of oxidation catalysts on these engines can achieve 90 percent HAP reductions. EPA concluded that the control costs associated with installing oxidation catalysts are reasonable for this type of stationary engine, and thus can be justified considering the significant reductions of HAP that would be achieved by using oxidation catalysts. Oxidation catalysts can reduce HAP and CO from stationary spark-ignition engines. The proposed emission limit is in terms of CO, which has been shown to be an appropriate surrogate for HAP. EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified.

EPA determined that the appropriate numerical MACT level could be determined by analyzing uncontrolled levels of HAP and reducing the levels by the expected reductions from oxidation catalysts. EPA analyzed formaldehyde emissions from 4SLB tests for engines without add-on controls. EPA took the average of the best performing 12 percent of engines for formaldehyde and identified the corresponding CO values from the best performing 12 percent of tests. The corresponding CO values were then averaged. The result for 4SLB stationary RICE greater than or equal to 250 HP and less than or equal to 500 HP is 95 ppmvd of CO at 15 percent O_2.

Given an expected 90 percent reduction from the use of oxidation catalysts, MACT is 9 ppmvd of CO at 15 percent O_2 or 90 percent CO efficiency. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

j. Non-Emergency 4SRB 50≥hp≤500. For SI non-emergency stationary 4SRB engines greater than or equal to 50 hp and less than or equal to 500 hp, EPA found that 5.6% of the population are using catalyst type controls, according to the Population Database. EPA determined that the appropriate numerical MACT level could be determined by analyzing uncontrolled levels of HAP and reducing the levels by the expected reductions from NSCR. EPA analyzed formaldehyde emissions from 4SRB engines without add-on controls and averaged the emissions from the best performing 12% of engines. The result for 4SRB stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 2 ppmvd of formaldehyde at 15% O_2.

The add-on controls that apply to this subcategory of engines is NSCR. As part of the beyond-the-floor analysis, EPA considered the application of NSCR to this engine subcategory. The technology is proven, has been applied to thousands of rich burn engines, and is efficient at reducing HAP emissions. EPA considered applying NSCR and estimated the cost per ton of HAP removed. EPA believes the costs are reasonable and appropriate and can be justified considering the significant reductions of HAP that would be achieved by using NSCR on this subcategory of engines. Other pollutants are also reduced through the use of NSCR including significant reductions in NO_x and CO emissions. Taking into consideration the emission reductions achieved by applying NSCR to 4SRB engines greater than 50 hp, the cost per ton of emissions reduced is favorable. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

Therefore, MACT is the level that is achievable by applying NSCR and is 200 ppbvd of formaldehyde at 15% O_2 or 90% formaldehyde efficiency.

4.4 Engines at Area Sources

Under section 112(k) of the CAA, EPA developed a national strategy to address air toxic pollution from area sources. The strategy is part of EPA's overall national effort to reduce toxics, but focuses on the particular needs of urban areas. Section 112(k) requires EPA to list area source categories and to ensure 90% of the emissions from area sources are subject to standards pursuant to section 112(d) of the CAA. Under section 112(k), the CAA specifically mandated that EPA develop a strategy to address public health risks posed by air toxics from area sources in urban areas. Section 112(k) also mandates that the strategy achieve a 75% reduction in cancer incidence attributable to HAP emitted by stationary sources. As mentioned, stationary RICE are listed as a source category under the Urban Air Toxics Strategy developed under the authority of sections 112(k) and 112(c)(3) of the CAA. These area sources are subject to standards under section 112(d).

Section 112(d)(5) of the CAA indicates that EPA may elect to promulgate standards or requirements to area sources "which provide for the use of generally available control technologies or management practices by such sources to reduce emissions of hazardous air pollutants." For determining emission limitations, GACT standards can be more flexible requirements than MACT standards. For example, the CAA provisions for setting GACT do not require to set a control baseline or "floor" that is equal to the average emission levels achieved by the best performing 12% of a type of facility, for existing sources, or the emission control achieved in practice by the best controlled similar source, for new sources. EPA is permitted to consider costs and other factors during each phase of the GACT analysis. Control technology options available to stationary RICE located at area sources are the same as those discussed for engines located at major sources.

The requirements being proposed in this action are applicable to stationary RICE located at area sources of HAP emissions. EPA has chosen to propose national requirements, which not only focus on urban areas, but address emissions from area sources in all areas (urban and rural).

For stationary RICE, it would not be practical or appropriate to limit the applicability to urban areas and EPA has determined that national standards are appropriate. Stationary RICE are located in both urban and rural areas. In fact, there are some rural areas with high concentrations of stationary RICE. Stationary RICE are employed in various industries used for both the private and public sector for a wide range of applications such as generator sets, irrigation sets, air and gas compressors, pumps, welders, and hydro power units. Stationary RICE may be used by private entities for agricultural purposes and be located in a rural area, or it may be used as a standby generator for an office building located in an urban area. Other stationary RICE may operate at large sources for electric power generation, transmission, or distribution purposes.

In previous rulemakings, EPA had determined that stationary RICE are located all over the U.S., and EPA cannot say that these sources are more prevalent in certain areas of the country. Therefore, for the source category of stationary RICE, EPA is proposing national requirements without a distinction between urban and non-urban areas.

For subcategories of larger engines, particularly those above 500 hp and those for which EPA has based MACT on the use of add-on controls, the proposed GACT requirement for area sources is equal to MACT for similar engines at major sources. The control technologies that create the basis for the emission standards for engines located at major sources are readily available and feasible for all engines. Further, for those cases where EPA is basing the MACT emission standards on add-on controls, EPA determined that costs associated with implementing HAP-reducing technologies are reasonable and justified. Hence, there is no reason why GACT should be any different than MACT for larger engines located at area sources. Consequently, EPA has determined that for area sources that are non-emergency 2SLB engines greater than or equal to 250 hp, non-emergency 4SLB engines greater than or equal to 250 hp, non-emergency 4SRB greater than or equal to 50 hp, emergency CI engines greater than 500 hp, non-emergency CI engines greater than 300 hp, landfill and digester gas engines greater than 500 hp, and emergency SI engines greater than 500 hp, GACT is equal to MACT.

As discussed, GACT provides EPA more flexibility in setting requirements than MACT and can include available control technologies or management practices to reduce HAP emissions. EPA has determined that for area sources that are non-emergency 2SLB engines greater than or equal to 50 hp and less than 250 hp, non-emergency 4SLB engines greater than or equal to 50 hp and less than 250 hp, emergency CI engines greater than or equal to 50 hp and less than or equal to 500 hp, non-emergency CI engines greater than or equal to 50 hp and less than or equal to 300 hp, engines less than 50 hp, landfill and digester gas engines greater than or equal to 50 hp and less than or equal to 500 hp, and emergency SI engines greater than or equal to 50 hp and less than or equal to 500 hp, EPA proposes that GACT is management practices.

Management practices include requiring owners and operators to operate and maintain their stationary RICE and aftertreatment control device (if any) according to the manufacturer's emission-related written instructions. Alternatively, owners and operators may develop their own maintenance plans to follow. Owners and operators using such maintenance plans must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. Add-on controls are feasible for some engines located at area sources, but control costs are high and EPA believes that it is possible to achieve reasonable controls using management practices. EPA is also attempting to minimize the burden of the proposed rule, specifically on small businesses and individual owners and operators. EPA does not believe that management practices would be a substantial burden on owners and operators such as private owners and small entities. Therefore, EPA is proposing management practices for smaller engines located at area sources, particularly those where the MACT standard was not determined to be based on add-on technology.

4.4.3 How Did EPA Determine the Compliance Requirements?

EPA discussed the specific compliance requirements that are being proposed earlier in this chapter. In general, EPA has attempted to reduce the burden on affected owners and operators. The following presents the rationale for the proposed compliance requirements.

Stationary non-emergency RICE located at major sources that are less than 100 hp, stationary RICE located at area sources that are not subject to numerical emission standards, and all stationary emergency RICE are only subject to minimal compliance requirements in the form of management practices to minimize emissions and are not subject to performance testing. EPA does not believe that following the manufacturer's instructions is a burdensome requirement, and it is expected that most owners and operators are already doing so. It is in the owner's best interest to operate and maintain the engine and aftertreatment device (if one is installed) properly. This proposed requirement minimizes the burden on individual owners and operators and small entities, while ensuring that the engine and aftertreatment device is operated and maintained correctly. Further, EPA does not believe that it is reasonable to subject small stationary RICE and stationary emergency RICE to performance testing. Subjecting the engines to maintenance requirements will assist in minimizing and maintaining emissions below the emission standards. The cost of requiring performance testing on these engines would be too significant when compared to the cost of the unit itself and to the benefits of such testing. Subjecting stationary RICE located at area sources that are not subject to numerical emission standards to performance testing would not serve a meaningful purpose.

For stationary non-emergency RICE located at major sources that are greater than or equal to 100 hp and stationary RICE located at area sources that are subject to numerical emission standards, EPA determined that performance testing is necessary to confirm that the emission standards are being met. Again, EPA has attempted to reduce compliance requirements and is proposing a level of performance testing commensurate with ensuring that the emission standards are being met. Therefore, for non-emergency stationary RICE located at major sources that are greater than or equal to 100 hp and less than or equal to 500 hp and stationary RICE located at area sources that are subject to numerical emission standards, EPA chose to require an initial performance test only. However, if the engine is rebuilt or overhauled, the engine must be re-tested to demonstrate that it meets the emission standards.

For non-emergency stationary RICE greater than 500 hp, testing every 8,760 hours of operation of 3 years, whichever comes first, is also required. EPA believes such a requirement is appropriate for these size engines, but does not believe that further testing is necessary for smaller engines, i.e., those less than or equal to 500 hp. Subsequent performance testing is appropriate for engines greater than 500 hp due to their size and frequency of operation. Plus, many States mandate more stringent compliance requirements for large engines. Finally, the RICE NESHAP for engines greater than 500 hp located at major sources also required further performance testing following the initial compliance demonstration.

Owners and operators of stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source must continuously monitor pressure drop across the catalyst and catalyst inlet temperature if the engine is equipped with oxidation catalyst or NSCR. These parameters serve as surrogates of the catalyst performance. The pressure drop across the catalyst can indicate if the catalyst is damaged or fouled, in which case, catalyst performance would decrease. If the pressure drop across the catalyst deviates by more than two inches of water from the pressure drop across the catalyst measured during the initial performance test, the catalyst might be damaged or fouled. If the catalyst is changed, the pressure drop across the catalyst must be reestablished. The catalyst inlet temperature is a requirement for proper performance of the catalyst. In general, the catalyst performance will decrease as the catalyst inlet temperature decreases. In addition, if the catalyst inlet temperature is too high, it might be an indication of ignition misfiring, poisoning, or fouling, which would decrease catalyst performance. In addition, the catalyst requires inlet temperatures to be greater than or equal to the specified temperature for the reduction of HAP emissions.

4.4.4 How Did EPA Determine the Reporting and Recordkeeping Requirements?

EPA discussed the specific reporting and recordkeeping requirements that are being proposed earlier in this report. In general, EPA has attempted to reduce the reporting and recordkeeping burden on affected owners and operators. The following presents the rationale for the proposed reporting and recordkeeping requirements.

Owners and operators of emergency engines are required to keep records of their hours of operation (emergency and non-emergency). Owners and operators must install a non-resettable hour meter on their engines to record the necessary information. The owner and operators are required to record the time of operation and the reason the engine was in operation during that time. EPA believes these requirements are appropriate for emergency engines. The requirement to maintain records documenting why the engine was operating will ensure that regulatory agencies have the necessary information to determine if the engine was in compliance with the maintenance and testing hour limitation of 100 hours per year.

EPA does not believe the recordkeeping requirements being placed upon owners and operators of stationary emergency engines are onerous. Emergency engines are often equipped with the equipment necessary to record hours of operation and operators may already be recording the information. Even as a brand new requirement, recording the time and reason of operation should take minimal time and effort. Further, recording the hours and reason for operation is necessary to assure that the engine is in compliance. Finally, these requirements are consistent with previously promulgated requirements affecting the same or similar engines, namely under the CI and SI NSPS.

The reporting requirements being proposed in this rule are consistent with those required for engines subject to the 2004 rule, i.e., stationary RICE greater than 500 hp located at major sources and are based on the General Provisions. Owners and operators of existing emergency stationary RICE, existing stationary RICE that are less than 100 hp and existing stationary RICE that are not subject to any numerical emission standards, do not have to submit the notifications listed in the NESHAP General Provisions (40 CFR part 63, subpart A). Owners and operators of all other engines must submit an initial notification, notification of performance test, and a notification of compliance for each stationary RICE which must comply with the specified emission limitations.

4.5 How Cost Estimates Are Derived

4.5.3 Introduction

The cost impacts associated with the proposed rule consist of different types of costs, which include the annual and capital costs of controls, costs associated with keeping records of information necessary to demonstrate compliance, costs associated with reporting requirements under the General Provisions of 40 CFR part 63, subpart A, costs of purchasing and operating equipment associated with continuous parametric monitoring, and the cost of conducting performance testing to demonstrate compliance with the emission standards. The costs presented in this section are calculated based on the control cost methodology presented in the EPA (2002) Air Pollution Control Cost Manual prepared by the U.S. Environmental Protection Agency.[5] This

[5] Available on the Internet at http://epa.gov/ttn/catc/products.html#cccinfo.

methodology sets out a procedure by which capital and annualized costs are defined and estimated, and this procedure is often used to estimate the costs of rulemakings such as this one. The capital costs presented in this section are annualized using a 7% interest rate, a rate that is consistent with the guidance provided in the Office of Management and Budget's (OMB's) (2003) Circular A-4.[6] The following sections describe how the various cost elements were estimated.

4.5.3.5 Control Costs

For engines that will need to add control technology to meet the emission standards, the following equations were used to estimate capital and annual control costs:

Cost Equations for RICE Add-on Control Technologies

Technology	Capital Cost	Annual Cost
NSCR	$19.7 x hp + $1,799	$2.65 x hp + $657
Oxidation catalyst	$11.3 x hp - $170	$1.52 x hp + $393

The control costs were obtained from a memorandum of information developed for previous engine rulemakings and is available from Docket ID EPA-HQ-OAR-2005-0030.[7]

4.5.3.6 Recordkeeping

No costs were attributed to the requirement of following the manufacturer's emission-related operation and maintenance (O&M) requirements or the owner or operator's own maintenance plan. It is expected that the majority of owners and operators are already following some type of O&M requirements and minimal to no additional burden is expected. Costs associated with recording the hours of operation of emergency engines are based on labor rates obtained from the Bureau of Labor Statistics web site (http://www.bls.gov/news.release/ecec.toc.htm) and is $68 per hour for technical labor. The final total wage rate was based on the 2005 compensation rates for professional staff and adjusted by an overhead and profit rate of 167%. The year 2005 was used for consistency in order to have the same basis for all costs. All costs were later converted to 2007 dollars for purposes of presenting costs associated with the rule in present day terms. One hour per year is expected to be sufficient to records hours of

[6] Available on the Internet at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.
[7] Memorandum from Bradley Nelson, Alpha-Gamma Technologies, Inc. to Jaime Pagán, EPA Energy Strategies Group, Control Costs for Reciprocating Internal Combustion Engines at Major and Area Sources, April 28, 2006.

operating for stationary emergency engines. No cost is attributed to purchasing and installing an hour-meter since most stationary engines already come equipped with such equipment.

4.5.3.7 Reporting

Most engines affected by this rule will be subject to reporting requirements such as reading instructions, training personnel, submitting an initial notification, submitting a notification of performance test(s), and submitting a compliance report. Owners and operators of engines less than 100 hp, emergency engines, and engines that are not subject to any numerical emission standards (e.g., 2SLB less than or equal to 249 hp located at area sources) are not subject to any reporting requirements. The reporting requirements are based on $68 per hour for technical labor to comply with the reporting requirements. It is estimated that a total of 14 hours will be needed.

4.5.3.8 Monitoring

The cost of monitoring includes the purchase of a continuous parametric monitoring system (CPMS). Non-emergency engines greater than 500 hp that have add-on controls are required to use a CPMS to monitor the catalyst inlet temperature and pressure drop across the catalyst to ensure those parameters do not exceed the operating limitations. The cost of purchasing and operating a CPMS was obtained from vendor quotes received for previous rulemaking and adjusted to 2007 dollars.[8] The capital cost of a CPMS for a large engine facility is $531. It is estimated that 30 hours per year is necessary to operate and maintain the CPMS and that 6 hours per year (or 0.5 hours per month) is needed to record information from the CPMS. It is assumed that all engines subject to continuous monitoring would be located at large engine facilities.

4.5.3.9 Performance Testing

The cost of conducting performance testing is based on the cost of portable analyzer testing and is $1,000 per engine. Since in most cases only an initial performance test is required, it is expected that a testing firm will be conducting the performance test. The cost of testing is based on testing two engines where facilities have engines less than 500 hp for a reduction in cost of testing per engine. The testing cost is based on testing three engines where facilities have engines larger than 500 hp. The testing costs are based on information previously obtained from

[8] Part A of the Supporting Statement for Standard Form 83 Stationary Reciprocating Internal Combustion Engines, November 17, 2003.

engine testing firms[9] and recently obtained information summarized in the memorandum "Portable Analyzer Testing Costs."

Summary of Cost Impacts. A summary of the total capital and annualized costs associated with the rule and a breakdown of the costs by NAICS codes are presented in Tables 4-4 through 4-7. Costs are presented by type of cost (i.e., control device, or administrative), industry, and engine size category, and they are also listed with the number of affected engines by size category. All of these estimates are taken from the memo "Impacts Associated with NESHAP for Existing Stationary RICE" that is found in the docket for this rulemaking.

The total national capital cost for the proposed rule is estimated to be $528 million, and the total national annualized cost is $345 million (2007 dollars). The total national capital costs for area sources are about four times higher than those for major sources, and the total national annualized costs for area sources are about twice that for major sources. The electric power generation and natural gas transmission industries are each expected to receive 43% of the capital costs and 44 and 33% of the annualized costs, respectively.

Summary of Emission Reductions. The proposed rule is expected to reduce total HAP emissions from stationary RICE by approximately 13,000 tons per year (tpy) beginning in the year 2013 or the first year the rule will become effective. EPA estimates that approximately 290,000 stationary SI engines will be subject to the rule and nearly 1 million stationary CI engines will be subject to the rule. These estimates include stationary engines located at major and area sources; however, not all stationary engines are subject to numerical emission standards. Further information regarding the estimated reductions of the proposed rule can be found in the memorandum entitled "Impacts Associated with NESHAP for Existing Stationary RICE," which is available in the docket.

In addition to HAP emissions reductions, the proposed rule will reduce other pollutants such as CO, NO_x, PM, SOx, and VOC. The proposed rule is expected to reduce emissions of CO by more than 511,000 tpy in the year 2013. Emissions of NO_x are expected to be reduced by 79,000 tpy in the year 2013. Reductions of PM are estimated at close to 2,600 tpy in the year 2013, and all of the PM is in the $PM_{2.5}$ fraction. SO_x reductions are expected to be more than 4,600 tpy in the year 2013. Emissions of volatile organic compounds (VOC) are estimated to be reduced by 90,000 tpy in the year 2013. Table 4-8 provides a listing of these pollutant reductions.

[9] Memorandum from Bradley Nelson, Alpha-Gamma Technologies, Inc. to Sims Roy, EPA/OAQPS/ESD/Combustion Group, Portable Emissions Analyzer Cost Information, August 31, 2005.

Table 4-4. Summary of Major Source and Area Source Costs for the RICE NESHAP[a]

Size Range (hp)	Non-Emergency 4SRB Capital Control Cost	Non-Emergency 4SRB Annual Control Cost	Non-Emergency 4SLB Capital Control Cost	Non-Emergency 4SLB Annual Control Cost	Non-Emergency 2SLB Capital Control Cost	Non-Emergency 2SLB Annual Control Cost	Non-Emergency CI Capital Control Cost	Non-Emergency CI Annual Control Cost
Major Sources								
50-100	$4,480,916	$1,170,317	$0	$0	$0	$0	$0	$0
100-175	$11,282,481	$2,556,407	$0	$0	$0	$0	$0	$0
175-300	$4,508,605	$895,335	$3,692,584	$1,107,592	$916,460	$274,892	$0	$0
300-500	$3,735,882	$662,724	$8,858,948	$2,038,576	$2,198,696	$505,953	$46,543,747	$10,710,412
500-600	$0	$0	$0	$0	$0	$0	$5,734,073	$1,165,786
600-750	$0	$0	$0	$0	$0	$0	$3,620,899	$688,978
>750	$0	$0	$0	$0	$0	$0	$11,920,816	$2,048,924
Total	$24,007,884	$5,284,784	$12,551,531	$3,146,168	$3,115,156	$780,845	$67,819,535	$14,614,100
Area Sources								
50-100	$6,721,523	$1,755,515	$0	$0	$0	$0	$0	$0
100-175	$16,923,926	$3,834,657	$0	$0	$0	$0	$0	$0
175-300	$6,762,908	$1,343,003	$5,538,876	$1,661,387	$1,374,690	$412,339	$0	$0
300-600	$9,259,947	$1,605,989	$22,518,639	$4,934,400	$5,588,886	$1,224,665	$118,325,168	$25,928,017
600-750	$1,468,729	$237,945	$3,828,149	$728,414	$950,106	$180,784	$30,094,612	$5,726,350
>750	$21,757,967	$3,346,835	$59,432,703	$10,215,163	$14,750,564	$2,535,295	$79,569,541	$13,676,238
Total	$62,894,999	$12,123,944	$91,318,367	$17,539,363	$22,664,246	$4,353,083	$227,989,320	$45,330,605
Total	**$86,902,882**	**$17,408,727**	**$103,869,898**	**$20,685,531**	**$25,779,402**	**$5,133,928**	**$295,808,855**	**$59,944,705**

[a]Costs are presented in 2007 dollars.

Table 4-4. Summary of Major Source and Area Source Costs for the RICE NESHAP (continued)[a]

Size Range (hp)	Initial Test	Recordkeeping	Reporting	Monitoring - Capital Cost	Monitoring - Annual Cost	Total Annual Costs	Total Capital Costs
Major Sources							
50-100	$0	$5,044,730	$0	$0	$0	$6,215,047	$4,480,916
100-175	$25,927,200	$6,609,981	$12,341,347	$0	$0	$47,434,935	$11,282,481
175-300	$13,045,400	$5,012,634	$6,209,610	$0	$0	$26,545,463	$9,117,649
300-500	$6,972,600	$2,637,366	$3,318,958	$0	$0	$26,846,589	$61,337,272
500-600	$214,900	$0	$204,585	$456,501	$2,104,301	$3,689,572	$6,190,574
600-750	$110,000	$0	$104,720	$233,667	$1,077,120	$1,980,818	$3,854,567
>750	$242,650	$0	$231,003	$515,449	$2,376,029	$4,898,605	$12,436,265
Total	$46,512,750	$19,304,710	$22,410,223	$1,205,618	$5,557,450	$117,611,029	$108,699,724
Area Sources							
50-100	$0	$7,567,094	$0	$0	$0	$9,322,609	$6,721,523
100-175	$8,505,714	$9,914,944	$4,048,720	$0	$0	$26,304,035	$16,923,926
175-300	$3,423,995	$7,518,950	$1,629,821	$0	$0	$15,989,495	$13,676,474
300-600	$12,733,739	$5,934,061	$7,176,595	$4,918,641	$22,673,106	$82,210,572	$160,611,280
600-750	$1,182,000	$994,704	$1,092,688	$2,297,271	$10,589,565	$20,732,451	$38,638,867
>750	$4,404,900	$1,762,179	$3,854,596	$7,135,234	$32,890,773	$72,685,978	$182,646,009
Total	$30,250,347	$33,691,933	$17,802,420	$14,351,147	$66,153,444	$227,245,140	$419,218,078
Total	**$76,763,097**	**$52,996,643**	**$40,212,643**	**$15,556,764**	**$71,710,894**	**$344,856,169**	**$527,917,802**

[a]Costs are presented in 2007 dollars.

Table 4-5. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP[a]

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Electric Power Generation (2211)	$50,442,105	$57,897,442	$174,944,005	$225,386,110	$156,540,989
Hospitals (622110)	$6,305,263	$7,237,180	$21,868,001	$28,173,264	$19,567,624
Natural Gas Transmission (48621)	$39,276,661	$25,297,242	$189,817,689	$229,094,350	$115,382,960
Crude Petroleum & NG Production (211111)	$1,274,843	$4,242,990	$2,494,602	$3,769,445	$7,232,675
Natural Gas Liquid Producers (211112)	$1,274,843	$4,242,990	$2,494,602	$3,769,445	$7,232,675
National Security (92811)	$6,305,263	$7,237,180	$21,868,001	$28,173,264	$19,567,624
Hydro Power Units (335312)	$10,447	$14,489	$15,670	$26,117	$36,224
Irrigation Sets (335312)	$2,912,018	$10,056,184	$4,368,057	$7,280,075	$16,028,767
Welders (333992)	$898,282	$1,385,331	$1,347,452	$2,245,733	$3,266,633
Total	**$108,699,724**	**$117,611,029**	**$419,218,078**	**$527,917,802**	**$344,856,169**

[a]Costs are presented in 2007 dollars.

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a]

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Electric Power Generation (2211)					
50–100 hp	$2,205,292	$3,058,748	$3,308,012	$5,513,304	$7,646,890
100–175 hp	$6,018,272	$25,302,623	$9,027,518	$15,045,790	$39,333,655
175–300 hp	$4,328,077	$12,600,924	$6,492,115	$10,820,192	$20,191,012
300–600 hp	$32,088,690	$14,510,538	$76,321,189	$108,409,878	$53,576,340
600–750 hp	$1,160,986	$596,617	$11,637,927	$12,798,913	$6,841,178
>750 hp	$4,640,789	$1,827,992	$68,157,244	$72,798,033	$28,951,913
Total Electric Power Generation 2211	**$50,442,105**	**$57,897,442**	**$174,944,005**	**$225,386,110**	**$156,540,989**
Hospitals (622110)					
50–100 hp	$275,662	$382,344	$413,501	$689,163	$955,861
100–175 hp	$752,284	$3,162,828	$1,128,440	$1,880,724	$4,916,707
175–300 hp	$541,010	$1,575,115	$811,514	$1,352,524	$2,523,876
300–600 hp	$4,011,086	$1,813,817	$9,540,149	$13,551,235	$6,697,043
600–750 hp	$145,123	$74,577	$1,454,741	$1,599,864	$855,147
>750 hp	$580,099	$228,499	$8,519,656	$9,099,754	$3,618,989
Total Hospitals (622110)	**$6,305,263**	**$7,237,180**	**$21,868,001**	**$28,173,264**	**$19,567,624**
Natural Gas Transmission (48621)					
50–100 hp	$159,582	$221,341	$239,379	$398,961	$553,355
100–175 hp	$482,532	$2,028,709	$723,807	$1,206,339	$3,153,686
175–300 hp	$2,362,712	$6,878,887	$3,544,068	$5,906,779	$11,022,342
300–600 hp	$27,314,729	$12,351,748	$64,966,584	$92,281,312	$45,605,577
600–750 hp	$2,403,335	$1,235,047	$24,091,458	$26,494,793	$14,161,796
>750 hp	$6,553,772	$2,581,510	$96,252,394	$102,806,166	$40,886,204
Total Natural Gas Transmission (48621)	**$39,276,661**	**$25,297,242**	**$189,817,689**	**$229,094,350**	**$115,382,960**

(continued)

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a] (continued)

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Crude Petroleum & NG Production (211111)					
50–100 hp	$273,040	$378,708	$409,570	$682,610	$946,772
100–175 hp	$909,557	$3,824,050	$1,364,352	$2,273,908	$5,944,595
175–300 hp	$364	$1,060	$546	$910	$1,698
300–600 hp	$51,128	$23,120	$121,605	$172,733	$85,365
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$40,754	$16,053	$598,530	$639,283	$254,244
Total Crude Petroleum & NG Production (211111)	**$1,274,843**	**$4,242,990**	**$2,494,602**	**$3,769,445**	**$7,232,675**
Natural Gas Liquid Producers (211112)					
50–100 hp	$273,040	$378,708	$409,570	$682,610	$946,772
100–175 hp	$909,557	$3,824,050	$1,364,352	$2,273,908	$5,944,595
175–300 hp	$364	$1,060	$546	$910	$1,698
300–600 hp	$51,128	$23,120	$121,605	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	$40,754	$16,053	$598,530	$639,283	$254,244
Total Natural Gas Liquid Producers (211112)	**$1,274,843**	**$4,242,990**	**$2,494,602**	**$3,769,445**	**$7,232,675**
National Security (92811)					
50–100 hp	$275,662	$382,344	$413,501	$689,163	$955,861
100–175 hp	$752,284	$3,162,828	$1,128,440	$1,880,724	$4,916,707
175–300 hp	$541,010	$1,575,115	$811,514	$1,352,524	$2,523,876
300–600 hp	$4,011,086	$1,813,817	$9,540,149	$13,551,235	$6,697,043
600–750 hp	$145,123	$74,577	$1,454,741	$1,599,864	$855,147
>750 hp	$580,099	$228,499	$8,519,656	$9,099,754	$3,618,989
Total Natural Gas Liquid Producers (211112)	**$6,305,263**	**$7,237,180**	**$21,868,001**	**$28,173,264**	**$19,567,624**

(continued)

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a] (continued)

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Hydro Power Units (335312)					
50–100 hp	$10,447	$14,489	$15,670	$26,117	$36,224
100–175 hp	$0	$0	$0	$0	$0
175–300 hp	$0	$0	$0	$0	$0
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Hydro Power Units (335312)	**$10,447**	**$14,489**	**$15,670**	**$26,117**	**$36,224**
Irrigation Sets (335312)					
50–100 hp	$159,393	$221,079	$239,095	$398,488	$552,699
100–175 hp	$1,408,511	$5,921,803	$2,112,792	$3,521,303	$9,205,613
175–300 hp	$1,344,113	$3,913,302	$2,016,170	$3,360,283	$6,270,455
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Irrigation Sets (335312)	**$2,912,018**	**$10,056,184**	**$4,368,057**	**$7,280,075**	**$16,028,767**
Welders (333992)					
50–100 hp	$848,798	$1,177,286	$1,273,225	$2,122,023	$2,943,221
100–175 hp	$49,484	$208,045	$74,227	$123,711	$323,412
175–300 hp	$0	$0	$0	$0	$0
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Welders (333992)	**$898,282**	**$1,385,331**	**$1,347,452**	**$2,245,733**	**$3,266,633**
Total	**$108,699,724**	**$117,611,029**	**$419,218,078**	**$527,917,802**	**$344,856,169**

[a] Costs are presented in 2007 dollars

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a]

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Electric Power Generation (2211)					
50–100 hp	53,049	79,573	132,622	$5,513,304	$7,646,890
100–175 hp	79,511	119,267	198,778	$15,045,790	$39,333,655
175–300 hp	47,377	71,066	118,443	$10,820,192	$20,191,012
300–600 hp	27,099	56,377	83,476	$108,409,878	$53,576,340
600–750 hp	663	5,830	6,493	$12,798,913	$6,841,178
>750 hp	1,811	16,245	18,056	$72,798,033	$28,951,913
Total Electric Power Generation 2211	**209,510**	**348,358**	**557,868**	**$225,386,110**	**$156,540,989**
Hospitals (622110)					
50–100 hp	6,631	9,947	16,578	$689,163	$955,861
100–175 hp	9,939	14,908	24,847	$1,880,724	$4,916,707
175–300 hp	5,922	8,883	14,805	$1,352,524	$2,523,876
300–600 hp	3,387	7,047	10,435	$13,551,235	$6,697,043
600–750 hp	83	729	812	$1,599,864	$855,147
>750 hp	226	2,031	2,257	$9,099,754	$3,618,989
Total Hospitals (622110)	**26,189**	**43,545**	**69,734**	**$28,173,264**	**$19,567,624**
Natural Gas Transmission (48621)					
50–100 hp	3,839	5,758	9,597	$398,961	$553,355
100–175 hp	6,375	9,563	15,938	$1,206,339	$3,153,686
175–300 hp	25,863	38,795	64,658	$5,906,779	$11,022,342
300–600 hp	23,068	47,990	71,057	$92,281,312	$45,605,577
600–750 hp	1,372	12,069	13,440	$26,494,793	$14,161,796
>750 hp	2,557	22,942	25,499	$102,806,166	$40,886,204
Total Natural Gas Transmission (48621)	**63,074**	**137,116**	**200,190**	**$229,094,350**	**$115,382,960**

(continued)

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a] (continued)

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Crude Petroleum & NG Production (211111)					
50–100 hp	6,568	9,852	16,420	$682,610	$946,772
100–175 hp	12,017	18,025	30,042	$2,273,908	$5,944,595
175–300 hp	4	6	10	$910	$1,698
300–600 hp	43	90	133	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	16	143	159	$639,283	$254,244
Total Crude Petroleum & NG Production (211111)	**18,648**	**28,116**	**46,763**	**$3,769,445**	**$7,232,675**
Natural Gas Liquid Producers (211112)					
50–100 hp	6,568	9,852	16,420	$682,610	$946,772
100–175 hp	12,017	18,025	30,042	$2,273,908	$5,944,595
175–300 hp	4	6	10	$910	$1,698
300–600 hp	43	90	133	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	16	143	159	$639,283	$254,244
Total Natural Gas Liquid Producers (211112)	**18,648**	**28,116**	**46,763**	**$3,769,445**	**$7,232,675**
National Security (92811)					
50–100 hp	6,631	9,947	16,578	$689,163	$955,861
100–175 hp	9,939	14,908	24,847	$1,880,724	$4,916,707
175–300 hp	5,922	8,883	14,805	$1,352,524	$2,523,876
300–600 hp	3,387	7,047	10,435	$13,551,235	$6,697,043
600–750 hp	83	729	812	$1,599,864	$855,147
>750 hp	226	2,031	2,257	$9,099,754	$3,618,989
Total Natural Gas Liquid Producers (211112)	**26,189**	**43,545**	**69,734**	**$28,173,264**	**$19,567,624**

(continued)

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a] (continued)

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Hydro Power Units (335312)					
50–100 hp	251	377	628	$26,117	$36,224
100–175 hp	0	0	0	$0	$0
175–300 hp	0	0	0	$0	$0
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Hydro Power Units (335312)	**251**	**377**	**628**	**$26,117**	**$36,224**
Irrigation Sets (335312)					
50–100 hp	3,834	5,751	9,586	$398,488	$552,699
100–175 hp	18,609	27,913	46,522	$3,521,303	$9,205,613
175–300 hp	14,713	22,070	36,783	$3,360,283	$6,270,455
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Irrigation Sets (335312)	**37,156**	**55,734**	**92,891**	**$7,280,075**	**$16,028,767**
Welders (333992)					
50–100 hp	20,418	30,627	51,045	$2,122,023	$2,943,221
100–175 hp	654	981	1,634	$123,711	$323,412
175–300 hp	0	0	0	$0	$0
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Welders (333992)	**21,072**	**31,608**	**52,679**	**$2,245,733**	**$3,266,633**
Total	**420,736**	**716,514**	**1,137,250**	**$527,917,802**	**$344,856,169**

[a]Costs are presented in 2007 dollars.

4.6 Baseline Emissions and Emission Reductions

Tables 4-8 through 4-10 present the baseline emissions by pollutant, engine type (CI and SI, non-emergency and emergency), and engine size. Tables 4-8 and 4-9 present this information for the CI engines; Table 4-10 presents this information for the SI engines. As shown in these tables, there are no emission reductions from emergency CI engines. Table 4-11 presents the emission reductions by pollutant, engine type and engine size, and Table 4-12 presents a summary of the emission reductions across all pollutants, engine types and sizes. All emission estimates are for the year in which full implementation of this proposal is required (2013). More information on these emissions, emission reductions, and how these estimates are generated can be found in the memo "Impacts Associated with NESHAP for Existing Stationary RICE" that is available in the public docket for this rulemaking.

Table 4-8. Baseline Emissions for Major and Area Sources (tons per year) – Non-Emergency CI Engines

	HAP - Non-Emergency CI	NO_x - Non-Emergency CI	PM - Non-Emergency CI*	SO_2 - Non-Emergency CI	VOC - Non-Emergency CI	CO - Non-Emergency CI
Major Sources (hp)						
50-100	74	15,301	487	281	2,010	6,454
100-175	179	36,756	1,170	676	4,828	8,457
175-300	234	48,145	1,532	885	6,324	6,413
300-500	207	42,663	1,357	784	5,604	3,374
500-600	25	5,201	165	96	683	299
600-750	16	3,267	104	60	429	153
>750	52	10,677	340	196	1,402	338
Total	788	162,010	5,155	2,979	21,281	25,489
Area Sources (hp)						
50-100	112	22,952	730	422	3,015	9,681
100-175	268	55,134	1,754	1,014	7,242	12,685
175-300	351	72,218	2,298	1,328	9,486	9,620
300-600	525	107,991	3,436	1,765	14,186	7,592
600-750	132	27,153	864	499	3,567	1,273
>750	347	71,265	2,268	1,310	9,361	2,255
Total	1,735	356,712	11,350	6,338	46,857	43,106
Total	**2,523**	**518,722**	**16,505**	**9,317**	**68,139**	**68,595**

* All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Table 4-9. Summary of Major Source and Area Source Baseline Emissions (tons per year) – Emergency CI Engines

	HAP - Emergency CI	*NO_x - Emergency CI*	*PM - Emergency CI***	*SO_2 - Emergency CI*	*VOC - Emergency CI*	*CO - Emergency CI*
Major Sources (hp)						
50-100	15	3,060	97	56	402	1,291
100-175	36	7,351	234	135	966	1,691
175-300	47	9,629	306	177	1,265	1,283
300-500	41	8,533	271	157	1,121	675
500-600	N/A	N/A	33	19	N/A	N/A
600-750	N/A	N/A	21	12	N/A	N/A
>750	N/A	N/A	68	39	N/A	N/A
Total	139	28,573	1,031	596	3,753	4,940
Area Sources (hp)						
50-100	22	4,590	146	84	603	1,936
100-175	54	11,027	351	203	1,448	2,537
175-300	70	14,444	460	266	1,897	1,924
300-600	105	21,598	687	353	2,837	1,518
600-750	26	5,431	173	100	713	255
>750	69	14,253	454	262	1,872	451
Total	347	71,342	2,270	1,268	9,371	8,621
Total	**486**	**99,916**	**3,301**	**1,863**	**13,125**	**13,561**

** All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Table 4-10. Summary of Major Source and Area Source Baseline Emissions (tons per year) – SI Engines

	HAP - SI	***NO_x - SI***	***VOC - SI***	***CO - SI***
Major Sources (hp)				
50-100	765	34,777	3,937	285,964
100-175	2,568	116,687	13,208	523,359
175-300	1,217	56,048	6,259	145,537
300-500	1,113	52,348	5,726	80,708
500-600	N/A	N/A	N/A	N/A
600-750	N/A	N/A	N/A	N/A
>750	N/A	N/A	N/A	N/A
Total	5,663	259,859	29,130	1,035,568
Area Sources (hp)				
50-100	1,148	52,167	5,905	428,955
100-175	3,852	175,033	19,813	785,048
175-300	1,825	84,071	9,389	218,305
300-600	2,817	132,488	14,493	181,570
600-750	474	22,266	2,436	20,343
>750	7,297	343,143	37,538	211,619
Total	17,413	809,167	89,573	1,845,840
Total	**23,076**	**1,069,026**	**118,703**	**2,881,408**

Table 4-11. Summary of Major Source and Area Source Emission Reductions (tons per year) – by Pollutant and Engine Type*

	HAP - SI	*HAP - CI*	*CO - SI*	*CO - CI*	*NO_x - SI*	*NO_x - CI*	*PM - CI*	*SO_2 - CI*	*VOC - SI*	*VOC - CI*
Major Sources (hp)										
50-100	81	N/A	39,195	N/A	2,577	N/A	0	0	414	0
100-175	270	N/A	71,733	N/A	8,645	N/A	0	0	1,391	0
175-300	472	N/A	29,290	N/A	4,152	N/A	0	0	2,428	0
300-500	920	187	24,014	3,037	3,878	N/A	407	761	4,733	5,044
500-600	N/A	23	N/A	269	N/A	N/A	50	93	N/A	23
600-750	N/A	14	N/A	138	N/A	N/A	31	58	N/A	14
>750	N/A	47	N/A	304	N/A	N/A	102	190	N/A	47
Total	1,743	271	164,232	3,748	19,252	0	590	1,102	8,966	5,128
Area Sources (hp)										
50-100	121	0	58,794	N/A	3,865	N/A	0	0	622	0
100-175	406	0	107,601	N/A	12,968	N/A	0	0	2,086	0
175-300	708	0	43,935	N/A	6,229	N/A	0	0	3,642	0
300-600	2,329	473	54,025	6,833	9,816	N/A	1,031	1,712	11,978	12,767
600-750	391	119	6,053	1,145	1,650	N/A	259	484	2,013	3,210
>750	6,031	312	62,966	2,029	25,423	N/A	680	1,271	31,024	8,425
Total	9,985	904	333,375	10,007	59,950	0	1,970	3,467	51,365	24,402
Total	**11,728**	**1,174**	**497,607**	**13,755**	**79,202**	**0**	**2,560**	**4,570**	**60,330**	**29,530**

* There are no emission reductions from either CI or SI emergency engines. Thus, all of these emission reductions are from non-emergency engines.
** All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Table 4-12. Summary of Major Source and Area Source Emissions Reductions for the RICE NESHAP, 2013

Size Range (hp)	Emission Reductions (tons per year)					
	HAP	CO	NO_x	PM[a]	SO_2	VOC
Major Sources						
50–100	81	39,195	2,577	0	0	414
100–175	270	71,733	8,645	0	0	1,391
175–300	472	29,290	4,152	0	0	2,428
300–500	1,107	27,051	3,878	407	761	9,777
500–600	23	269	NA	50	93	23
600–750	14	138	NA	31	58	14
>750	47	304	NA	102	190	47
Total	2,013	167,980	19,252	590	1,102	14,093
Area Sources						
50–100	121	58,794	3,865	0	0	622
100–175	406	107,601	12,968	0	0	2,086
175–300	708	43,935	6,229	0	0	3,642
300–600	2,801	60,858	9,816	1,031	1,712	24,745
600–750	510	7,198	1,650	259	484	5,223
>750	6,343	64,996	25,423	680	1,271	39449
Total	10,889	343,382	59,950	1,970	3,467	75,767
Total	**12,902**	**511,362**	**79,202**	**2,560**	**4,570**	**89,860**

[a]All of the PM emissions from the affected RICE sources are in the $PM_{2.5}$ fraction.

SECTION 5
ECONOMIC IMPACT ANALYSIS, ENERGY IMPACTS, AND SOCIAL COSTS

The EIA provides decision makers with social cost estimates and enhances understanding of how the costs may be distributed across stakeholders (EPA, 2000). Although several economic frameworks can be used to estimate social costs for regulations of this size and sector scope, OAQPS has typically used partial equilibrium market models. However, the current data do not provide sufficient details to develop a market model; the data that are available have little or no sector/firm detail and are reported at the national level. In addition, some sectors have unique market characteristics (e.g., hospitals) that make developing partial equilibrium models difficult. Given these constraints, we used the direct compliance costs as a measure of total social costs. In addition, we also provide a qualitative analysis of the proposed rule's impact on stakeholder decisions, a qualitative discussion on if unfunded mandates occur as a result of this proposed rule, and the potential distribution of social costs between consumers and producers.

5.1 Compliance Costs of the Proposed Rule

For the year 2013, EPA's engineering cost analysis estimates the total annualized costs of the proposed rule are $345 million (in 2007 dollars) (Nelson and Paries, 2008).

As shown in Figure 5-1, the majority of the costs fall on the electric power sector (46%), followed by the natural gas transmission sector (31%). The remaining industries each account for less than 10% of the total annualized cost.

The proposed rule will affect approximately 1.3 million existing stationary diesel engines. As shown in Figure 5-2, most of the affected engines fall within the 100 to 175 hp category (31%). The next highest categories are 50 to 100 hp (23%) and 175 to 300 hp (21%). The remaining engines are concentrated in the 300 to 600 hp category (16%).

The annualized compliance costs per engine vary by the engine size (see Figure 5-3). For 300 hp engines or less, the annualized per-engine costs are below $200 per engine. Per-engine costs for higher horsepower (hp) engines range between $600 and $1,600.

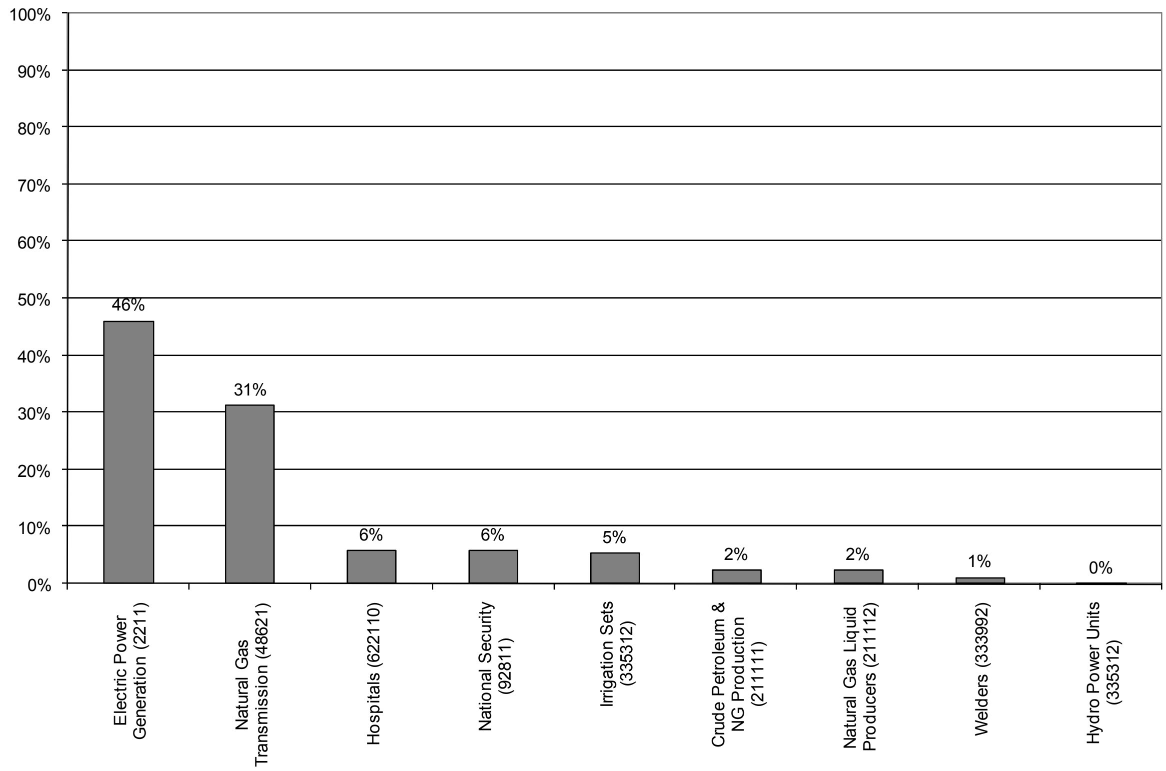


Figure 5-1. Distribution of Annualized Direct Compliance Costs by Industry: 2013 ($2007)

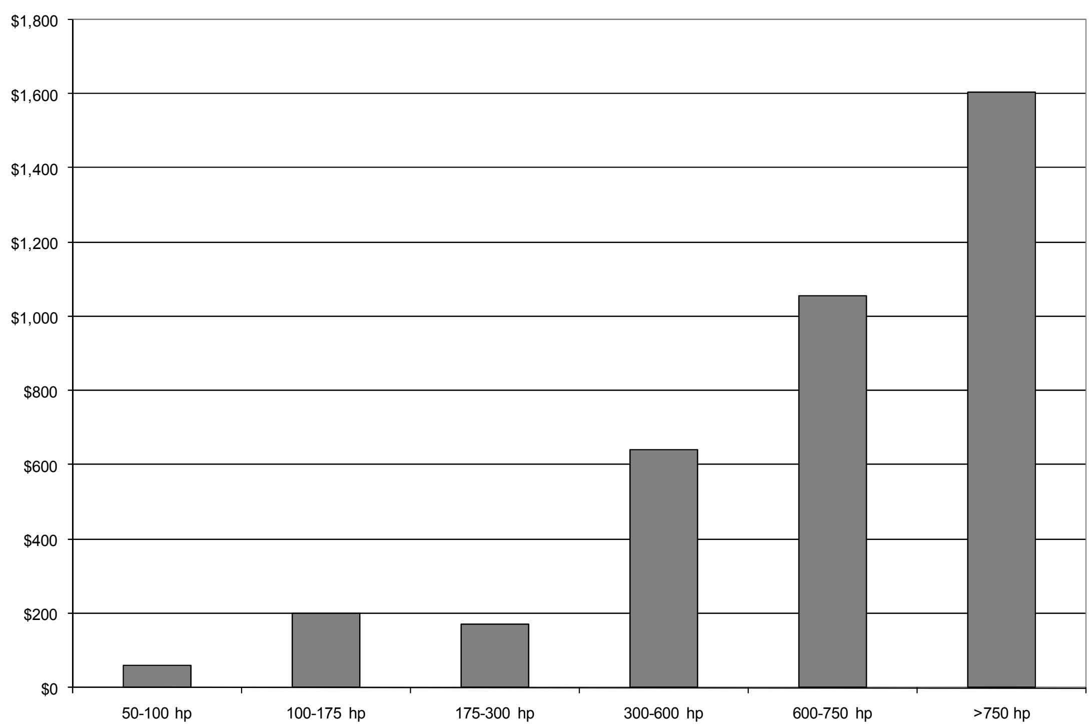


Figure 5-2. Distribution of Engine Population by Horsepower Group: 2013

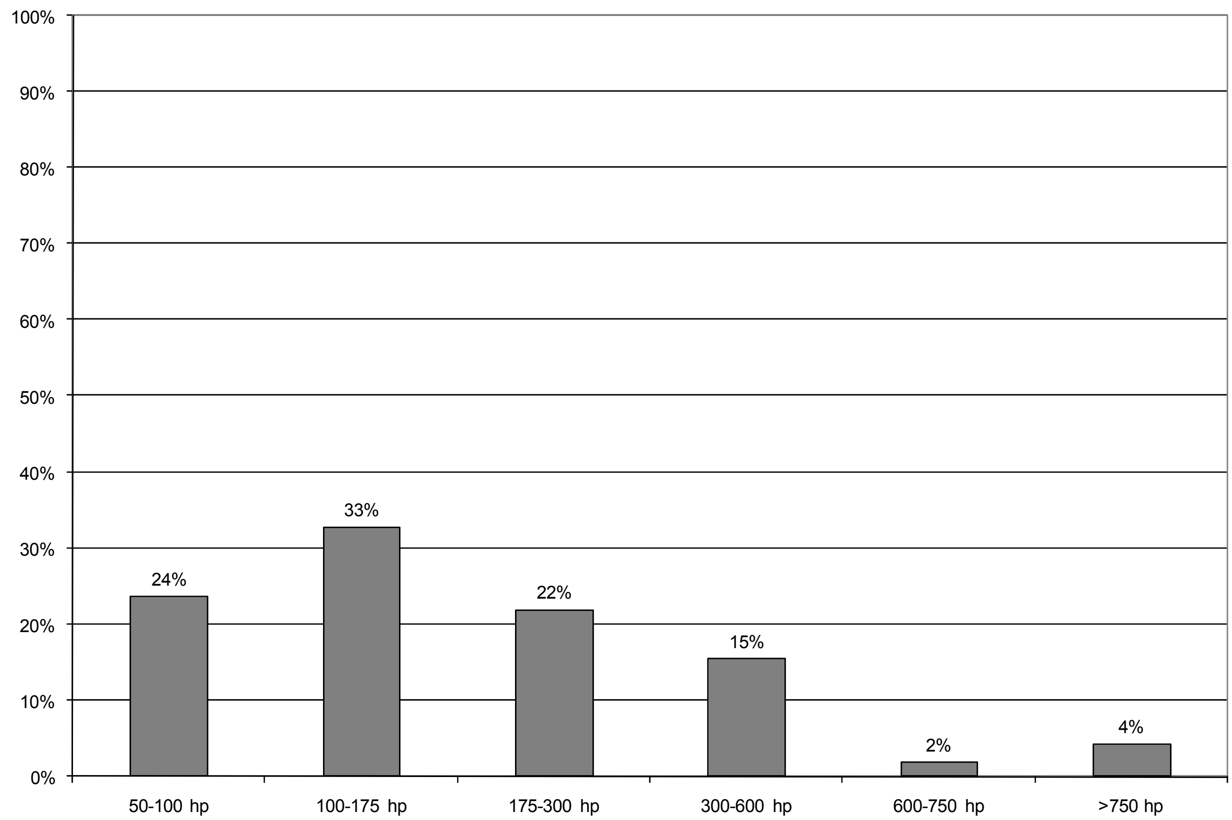


Figure 5-3. Average Annualized Cost per Engine by Horsepower Group: 2013 ($2007)

To assess the size of the compliance relative to the value of the goods and services for industries using affected engines, we collected census data for selected industries. At the industry level, the annualized costs represent a very small fraction of revenue (less than 0.7%) (Table 5-1). These industry level cost-to-sales ratios can be interpreted as an average impact on potentially affected firms in these industries. Based on the cost-to-sales ratios, we can conclude that the annualized cost of this rule should be no higher than 1% of the sales for a firm in each of these industries.

5.2 How Might People and Firms Respond? A Partial Equilibrium Analysis

Markets are composed of people as consumers and producers trying to do the best they can given their economic circumstances. One way economists illustrate behavioral responses to pollution control costs is by using market supply and demand diagrams. The market supply curve describes how much of a good or service firms are willing and able to sell to people at a particular price; we often draw this curve as upward sloping because some production resources are fixed. As a result, the cost of producing an additional unit typically rises as more units are made. The market demand curve describes how much of a good or service consumers are willing

Table 5-1. Selected Industry-Level Annualized Compliance Costs as a Fraction of Total Industry Revenue: 2002

Industry (NAICS)	Industry Name	Total Annual Costs ($$10^6$)	Revenue ($2002 10^9)	Revenue ($2007 10^9)	Cost-to-Sales Ratio
2211	Electric Power Generation, Transmission and Distribution	$156.5	$325.0	$373.8	0.04%
48621	Pipeline transportation of natural gas	$115.4	$14.8	$17.0	0.68%
622110	General medical & surgical hospitals	$19.6	$469.7	$540.2	<0.01%
111 and 112	Agriculture using irrigation	$16.0	$20.7 (estimate)[a]	$23.9	0.07%
211111	Crude Petroleum & Natural Gas	$7.2	$85.9	$98.8	0.01%
211112	Natural Gas Liquid Extraction	$7.2	$29.2	$33.6	0.02%

[a]Assumes 10 percent of U.S. agricultural revenue is associated with farms with irrigation.

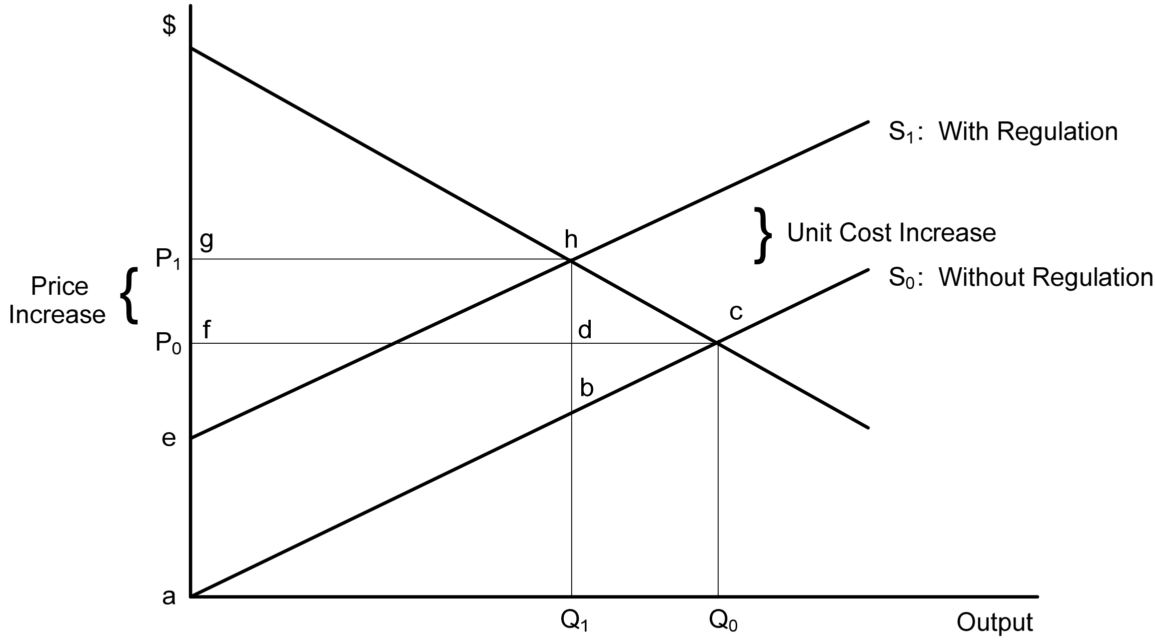
Sources: Nelson, B., EC/R Inc. and T. Parise, Alpha-Gamma Technologies, Inc. December 1, 2008. Memorandum to Jamie Pagan, U.S. Environmental Protection Agency. Impacts associated with NESHAP for existing stationary RICE.

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 00: All sectors: Geographic Area Series: Economy-Wide Key Statistics: 2002" <http://factfinder.census.gov>; (December 17, 2008).

and able to buy at some price. Holding other factors constant, the quantity demand is assumed to fall when prices rise. In a perfectly competitive market, equilibrium price (P_0) and quantity (Q_0) is determined by the intersection of the supply and demand curves (see Figure 5-4).

5.2.1 Changes in Market Prices and Quantities

To qualitatively assess how the regulation may influence the equilibrium price and quantity in the affected markets, we assumed the market supply function shifts up by the additional cost of producing the good or service; the unit cost increase is typically calculated by dividing the annual compliance cost estimate by the baseline quantity (Q_0) (see Figure 5-4). As shown, this model makes two predictions: the price of the affected goods and services are likely to rise and the consumption/production levels are likely to fall.



consumer surplus = –[fghd + dhc]

producer surplus = [fghd – aehb] – bdc

total surplus = consumer surplus + producer surplus = –[aehb + dhc + bdc]

Figure 5-4. Market Demand and Supply Model: With and Without Regulation

The size of these changes depends on two factors: the size of the unit cost increase (supply shift) and differences in how each side of the market (supply and demand) responds to changes in price. Economists measure responses using the concept of price elasticity, which represents the percentage change in quantity divided by the percentage change in price. This dependence has been expressed in the following formula:[1]

$$\text{Share of per-unit cost} = \frac{\text{Price Elasticity of Supply}}{\left(\text{Price Elasticity of Supply - Price Elasticity of Demand}\right)}$$

As a general rule, a higher share of the per-unit cost increases will be passed on to consumers in markets where

- goods and services are necessities and people do not have good substitutes that they can switch to easily (demand is inelastic) and

[1] For examples of similar mathematical models in the public finance literature, see Nicholson (1998), pages 444–447, or Fullerton and Metcalf (2002).

- suppliers have excess capacity and can easily adjust production levels at minimal costs, or the time period of analysis is long enough that suppliers can change their fixed resources; supply is more elastic over longer periods.

Short-run demand elasticities for energy goods (electricity and natural gas), agricultural products, and construction are often inelastic. Specific estimates of short-run demand elasticities for these products can be obtained from existing literature. For the short-run demand of energy products, the National Energy Modeling System (NEMS) buildings module uses values between 0.1 and 0.3; a 1% increase in price leads to a 0.1 to 0.3% decrease in energy demand (Wade, 2003). For the short-run demand of agriculture and construction, the EPA has estimated elasticities to be 0.2 for agriculture and approximately 1 for construction (EPA, 2004). As a result, a 1% increase in the prices of agriculture products would lead to a 0.2% decrease in demand for those products, while a 1% increase in construction prices would lead to approximately a 1% decrease in demand for construction. Given these demand elasticity scenarios (shaded in gray), approximately a 1% increase unit costs would result in a price increase of 0.1 to 1% (Table 5-2). As a result, 10 to 100% of the unit cost increase could be passed on to consumers in the form of higher goods/services prices. This price increase would correspond to a 0.1 to 0.8% decline in consumption in these markets (Table 5-3).

Table 5-2. Hypothetical Price Increases for a 1% Increase in Unit Costs

Market Demand Elasticity	Market Supply Elasticity						
	0.1	**0.3**	**0.5**	**0.7**	**1**	**1.5**	**3**
−0.1	**0.5%**	0.8%	0.8%	0.9%	0.9%	0.9%	1.0%
−0.3	0.3%	**0.5%**	0.6%	0.7%	0.8%	0.8%	0.9%
−0.5	0.2%	0.4%	**0.5%**	0.6%	0.7%	0.8%	0.9%
−0.7	0.1%	0.3%	0.4%	**0.5%**	0.6%	0.7%	0.8%
−1.0	0.1%	0.2%	0.3%	0.4%	**0.5%**	0.6%	0.8%
−1.5	0.1%	0.2%	0.3%	0.3%	0.4%	**0.5%**	0.7%
−3.0	0.0%	0.1%	0.1%	0.2%	0.3%	0.3%	**0.5%**

5.2.2 Regulated Markets: The Electric Power Generation, Transmission, and Distribution Sector

Given that the electric power sector bears close to half of the estimated compliance costs (Figure 5-1) and the industry is also among the last major regulated energy industries in the United States (EIA, 2000), the competitive model is not necessarily applicable for this industry.

Table 5-3. Hypothetical Consumption Decreases for a 1% Increase in Unit Costs

Market Demand Elasticity	Market Supply Elasticity						
	0.1	**0.3**	**0.5**	**0.7**	**1**	**1.5**	**3**
−0.1	**−0.1%**	−0.1%	−0.1%	−0.1%	−0.1%	−0.1%	−0.1%
−0.3	−0.1%	**−0.2%**	−0.2%	−0.2%	−0.2%	−0.3%	−0.3%
−0.5	−0.1%	−0.2%	**−0.3%**	−0.3%	−0.3%	−0.4%	−0.4%
−0.7	−0.1%	−0.2%	−0.3%	**−0.4%**	−0.4%	−0.5%	−0.6%
−1.0	−0.1%	−0.2%	−0.3%	−0.4%	**−0.5%**	−0.6%	−0.8%
−1.5	−0.1%	−0.3%	−0.4%	−0.5%	−0.6%	**−0.8%**	−1.0%
−3.0	−0.1%	−0.3%	−0.4%	−0.6%	−0.8%	−1.0%	**−1.5%**

Although the electricity industry continues to go through a process of restructuring, whereby the industry is moving toward a more competitive framework (see Figure 5-5 for the status of restructuring by state),[2] in many states, electricity prices continue to be fully regulated by Public Service Commissions. As a result, the rules and processes outlined by these agencies would ultimately determine how these additional regulatory costs would be recovered by affected entities.

5.2.3 Partial Equilibrium Measures of Social Cost: Changes Consumer and Producer Surplus

In partial equilibrium analysis, the social costs are estimated by measuring the changes in consumer and producer surplus, and these values can be determined using the market supply and demand model (Figure 5-4). The change in consumer surplus is measured as follows:

$$\Delta CS = -[\Delta Q_1 \times \Delta p] + [0.5 \times \Delta Q \times \Delta p]. \tag{5.1}$$

Higher market prices and lower quantities lead to consumer welfare losses. Similarly, the change in producer surplus is measured as follows:

$$\Delta PS = [\Delta Q_1 \times \Delta p] - [\Delta Q_1 \times \mathrm{t}] - [0.5 \times \Delta Q \times (\Delta p - t)]. \tag{5.2}$$

Higher unit costs and lower production level reduce producer surplus because the net price change (Δp – t) is negative. However, these losses are mitigated because market prices tend to rise.

[2] http://tonto.eia.doe.gov/energy_in_brief/print_pages/electricity.pdf.

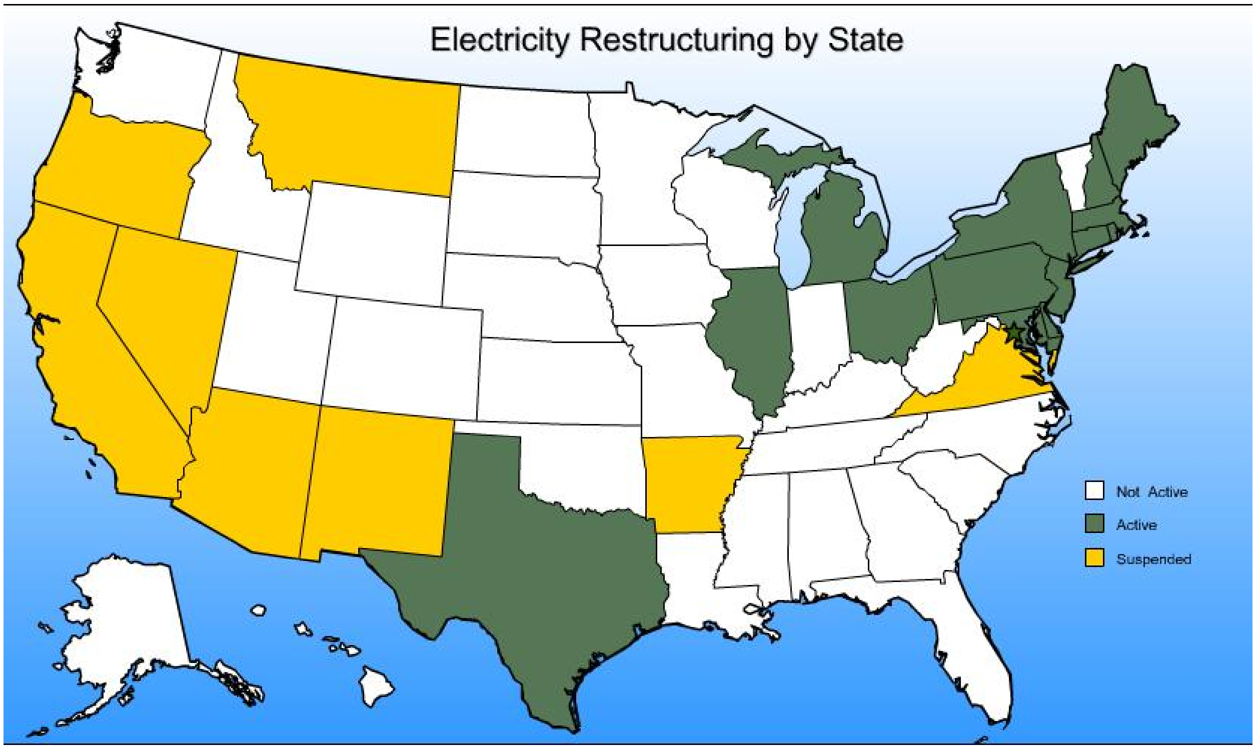


Figure 5-5. Electricity Restructuring by State

Source. U.S. Energy Information Administration. 2008a. <http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html>. Last updated September 2008.

5.3 Social Cost Estimate

Differences between social cost estimates derived from a perfect competition partial equilibrium models and engineering direct compliance cost methods are likely to be small. As shown in Table 5-1 the compliance costs are only a small fraction of the affected product value; this suggests that shift of the supply curve may also be small and result in small changes in market prices and consumption. As a result, EPA believes the national annualized compliance cost estimates provide a reasonable approximation of the social cost of this proposed rule.

5.4 Energy Impacts

Executive Order 13211 (66 FR 28355, May 22, 2001) provides that agencies will prepare and submit to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, a Statement of Energy Effects for certain actions identified as "significant energy actions." Section 4(b) of Executive Order 13211 defines "significant energy actions" as any action by an agency (normally published in the *Federal Register*) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking:

(1) (i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action.

This rule is not a significant energy action as designated by the Administrator of the Office of Information and Regulatory Affairs because it is not likely to have a significant adverse impact on the supply, distribution, or use of energy. EPA has prepared an analysis of energy impacts that explains this conclusion as follows below.

With respect to energy supply and prices, the analysis in Table 5-1 suggests at the industry level, the annualized costs represent a very small fraction of revenue (less than 0.7%). As a result, we can conclude supply and price impacts should be small.

To enhance understanding regarding the regulation's influence on energy consumption, we examined publicly available data describing energy consumption for the electric power sector that will be affected by this rule. The Annual Energy Outlook 2009 (EIA, 2008) provides energy consumption data. As shown in Table 5-4, this industry account for less than 0.5% of the U.S. total liquid fuels and less than 6.5% of natural gas. As a result, any energy consumption changes attributable to the regulatory program should not significantly influence the supply, distribution, or use of energy.

5.5 Unfunded Mandates

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), 2 U.S.C. 1531-1538, requires Federal agencies, unless otherwise prohibited by law, to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. This 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, EPA has prepared under section 202 of the UMRA a written statement which is summarized below in this section.

Table 5-4. U.S. Electric Power[a] Sector Energy Consumption (Quadrillion BTUs): 2013

	Quantity	Share of Total Energy Use
Distillate fuel oil	0.12	0.1%
Residual fuel oil	0.38	0.4%
Liquid fuels subtotal	0.50	0.5%
Natural gas	6.27	6.1%
Steam coal	21.55	21.0%
Nuclear power	8.53	8.3%
Renewable energy[b]	4.80	4.7%
Electricity Imports	0.08	0.1%
Total Electric Power Energy Consumption[c]	41.86	40.8%
Delivered Energy Use	74.05	72.2%
Total Energy Use	102.58	100.0%

[a]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.

[b]Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes net electricity imports.

[c]Includes non-biogenic municipal waste not included above.

Source: U.S. Energy Information Administration. 2008a. Supplemental Tables to the Annual Energy Outlook 2009. Table 10. Available at: <http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>.

5.5.1 Statutory Authority

As discussed previously in this RIA the statutory authority for the proposed rule is section 112 of the CAA. Section 112(b) lists the 189 chemicals, compounds, or groups of chemicals deemed by Congress to be HAP. These toxic air pollutants are to be regulated by NESHAP. Section 112(d) of the CAA directs us to develop NESHAP based on MACT, which require existing and new major sources to control emissions of HAP. These NESHAP apply to existing stationary RICE less than or equal to 500 HP located at major sources of HAP emissions, existing non-emergency stationary CI RICE greater than 300 HP, and existing stationary RICE located at area sources of HAP emissions, however, only certain existing stationary RICE have substantive regulatory requirements. EPA promulgated NESHAP for existing, new, and reconstructed stationary RICE greater than 500 HP located at major sources on June 15, 2004 (69 FR 33474). EPA promulgated NESHAP for new and reconstructed stationary RICE that are located at area sources of HAP emissions and for new and reconstructed stationary RICE that have a site rating of less than or equal to 500 HP that are located at major sources of HAP emissions on January 18, 2008 (73 FR 3568). EPA is required to address HAP emissions from stationary RICE located at area sources under section 112(k) of the CAA.

In compliance with section 205(a), we identified and considered a reasonable number of regulatory alternatives that are shown and discussed in Chapter 4 of this RIA. The regulatory alternative upon which the rule is based represents the MACT floor for stationary RICE less than or equal to 500 HP located at major sources and GACT for stationary RICE located at area sources and, as a result, it is the least costly and least burdensome alternative.

5.5.2 Social Costs and Benefits

The Agency's assessment of costs and benefits is detailed in this RIA. Based on estimated compliance costs on all sources associated with the proposed rule and the predicted change in prices and production in the affected industries, the estimated social costs of the proposed rule are $345 million (2007 dollars). It is estimated that by 2013, HAP will be reduced by 13,000 tpy due to reductions in formaldehyde, acetaldehyde, acrolein, methanol and other HAP from existing stationary RICE. Formaldehyde and acetaldehyde have been classified as "probable human carcinogens." Acrolein, methanol and the other HAP are not considered carcinogenic, but produce several other toxic effects. The proposed rule will also achieve reductions in 511,000 tons of CO, approximately 79,000 tons of NO_x per year, about 90,000 tons of VOC per year, and approximately 2,600 tons of PM per year, in the year 2013. Exposure to CO can affect the cardiovascular system and the central nervous system. Emissions of NO_x can transform into PM, which can result in fatalities and many respiratory problems (such as asthma or bronchitis); and NO_x can also transform into ozone causing several respiratory problems to affected populations.

The total monetized benefits of the proposed rule, as will be shown in more detail in Chapter 7, range from $0.9 to $2.0 billion (2007 dollars). The monetized benefits are comprised primarily of the benefits from reductions in directly emitted $PM_{2.5}$ and $PM_{2.5}$ created from transformation of NO_x and SO_2. We cannot provide a monetary estimate for the benefits associated with reductions of HAP and CO due to a lack of scientific knowledge of the links between the reductions in incidence of the health and environmental effects listed and a value that can be placed on them. EPA currently has research going on to provide such monetized estimates. We are also unable to quantify and monetize all categories of benefits of NO_x reductions (ecosystem and environmental effects), and to monetize reduction in premature mortalities associated with ozone reductions. The methodology for estimating monetized benefits is discussed in more detail in Chapter 7 of the RIA.

5.5.3 Future and Disproportionate Costs

The UMRA requires that we estimate, where accurate estimation is reasonably feasible, future compliance costs imposed by the rule and any disproportionate budgetary effects. Our estimates of the future compliance costs of the proposed rule are discussed previously in Chapter 4 of this RIA. We do not believe that there will be any disproportionate budgetary effects of the proposed rule on any particular areas of the country, State or local governments, types of communities (e.g., urban, rural), or particular industry segments.

5.5.4 Effects on the National Economy

The UMRA requires that we estimate the effect of the proposed rule on the national economy. To the extent feasible, we must estimate the effect on productivity, economic growth, full employment, creation of productive jobs, and international competitiveness of the U.S. goods and services if we determine that accurate estimates are reasonably feasible and that such effect is relevant and material. The nationwide economic impact of the proposed rule is presented earlier in this RIA chapter. This analysis provides estimates of the effect of the proposed rule on most of the categories mentioned above, and these estimates are presented earlier in this RIA chapter. In addition, we have determined that the proposed rule contains no regulatory requirements that might significantly or uniquely affect small governments. Therefore, today’s rule is not subject to the requirements of section 203 of the UMRA.

SECTION 6
SMALL ENTITY SCREENING ANALYSIS

The Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small governmental jurisdictions, and small not-for-profit enterprises.

After considering the economic impact of the proposed rule on small entities, the screening analysis indicates that this proposed rule will not have a significant economic impact on a substantial number of small entities (or “SISNOSE”).

6.1 Small Entity Data Set

The industry sectors covered by the proposed rule were identified during the development of the cost analysis (Nelson and Parise, 2008). The SUSB provides national information on the distribution of economic variables by industry and enterprise size (U.S. Census, 2008a, b).[1] The Census Bureau and the Office of Advocacy of the SBA supported and developed these files for use in a broad range of economic analyses.[2] Statistics include the total number of establishments and receipts for all entities in an industry; however, many of these entities may not necessarily be covered by the proposed rule. SUSB also provides statistics by enterprise employment and receipt size.

The Census Bureau’s definitions used in the SUSB are as follows:

- *Establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.
- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.
- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The

[1] The SUSB data do not provide establishment information for the national security NAICS code (92811) or irrigated farms. Since most national security installations are owned by the federal government (e.g., military bases), EPA assumes these entities would not be considered small. For irrigated farms, we relied on receipt data provided in the 2003 Farm and Irrigation Survey (USDA, 2004).

[2] See http://www.census.gov/csd/susb/ and http://www.sba.gov/advo/research/data.html for additional details.

> enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Because the SBA's business size definitions (SBA, 2008) apply to an establishment's "ultimate parent company," we assumed in this analysis that the "enterprise" definition above is consistent with the concept of ultimate parent company that is typically used for SBREFA screening analyses and the terms are used interchangeably.

6.1 Small Entity Economic Impact Measures

The analysis generated a set of establishment sales tests (represented as cost-to-receipt ratios)[3] for NAICS codes associated with sectors listed in Table 6-1. Although the appropriate SBA size definition should be applied at the parent company (enterprise) level, we can only compute and compare ratios for a model establishment owned by an enterprise within an SUSB size range (employment or receipts). Using the SUSB size range helps us account for receipt differences between establishments owned by large and small enterprises and also allows us to consider the variation in small business definitions across affected industries. Using establishment receipts is also a conservative approach, because an establishment's parent company (the "enterprise") may have other economic resources that could be used to cover the costs of the proposed rule.

6.1.1 Model Establishment Receipts and Annual Compliance Costs

The sales test compares a representative establishment's total annual engine costs to the average establishment receipts for enterprises in several size categories.[4] For industries with SBA employment size standards, we calculated average establishment receipts for each enterprise employment range (Table 6-2). For industries with SBA receipt size standards, we

[3]The following metrics for other small entity economic impact measures (if applicable) would potentially include

- small governments (if applicable): "revenue" test; annualized compliance cost as a percentage of annual government revenues and
- small nonprofits (if applicable): "expenditure" test; annualized compliance cost as a percentage of annual operating expenses,

[4]For the 1 to 20 employee category, we excluded SUSB data for enterprises with zero employees. These enterprises did not operate the entire year.

Table 6-1. Proposed NESHAP for Existing Stationary Reciprocating Internal Combustion Engines (RICE): Affected Sectors and SBA Small Business Size Standards

Industry Description	Corresponding NAICS	SBA Size Standard for Businesses (effective March 11, 2008)	Type of Small Entity
Electric power generation	2211	[a]	Business and government
General medical & surgical hospitals	622110	$34 million in annual receipts	Business and government
Natural gas transmission	48621	$7 million in annual receipts	Business
Crude petroleum and natural gas production	211111	500 employees	Business
Natural gas liquid producers	211112	500 employees	Business
National security	92811	NA	Government
Hydro power units	See NAICS 2211	1,000 employees	Business and government
Irrigation sets	Affects NAICS 111 and 112	Generally $750,000 or less in annual receipts	Business
Welders	Affects industries that use heavy equipment such as construction, mining, farming	Varies by 6-digit NAICS code; Example industry: NAICS 238 = $33.5 million in annual receipts	Business

[a]NAICS codes 221111, 221112, 221113, 221119, 221121, 221122: A firm is small if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.

calculated average establishment receipts for each enterprise receipt range (Table 6-3). We included the utility sector in the second group, although the SBA size standard for this industry is defined in terms of physical units (megawatt hours) versus receipts. Crop and animal production (NAICS 111 and 112) also have an SBA receipt size standard that defines a small business as receiving $750,000 or less in receipts per year. However, SUSB data were not available for these industries. Therefore, we conducted the sales test using the following range of establishment receipts: farms with annual receipts of $25,000 or less, farms with annual receipts of $100,000 or less, farms with annual receipts of $500,000 or less, and farms with annual receipts of $750,000 or less.

Table 6-2. Average Receipts for Affected Industry by Enterprise Employment Range: 2002 (millions of $2007 per establishment)

NAICS	NAICS Description	SBA Size Standard for Businesses (effective March 11, 2008)	All Enterprises	Owned by Enterprises with			
				1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees
211111	Crude petroleum & natural gas extraction	500 employees	$14.2	$0.5	$6.6	$9.3	NA
211112	Natural gas liquid extraction	500 employees	$168.8	$0.3	NA	$11.6	NA
335312	Motor & generator mfg	1,000 employees	$18	$1	$6	$16	$29
333992	Welding & soldering equipment mfg	500 employees	$18	$2	$6	$32	NA

NA = Not available.

Table 6-3. Average Receipts for Affected Industry by Enterprise Receipt Range: 2002 (millions of $2007 per establishment)

NAICS	NAICS Description	SBA Size Standard for Businesses (effective March 11, 2008)	Owned by Enterprises with Receipt Rang							
			All Enterprises	0–99	100–499.9	500–999.9	1,000–4,999.9	5,000,000–9,999,999	<10,000	10,0 49,
2211	Electric power generation, transmission, & distribution	[a]	$38.8	$0.0	$0.3	$0.8	$2.9	$6.5	$2.6	$1
48621	Pipeline transportation of natural gas	$7 million in annual receipts	$21.3	$0.1	$0.3	$0.9	$2.4	$6.7	$1.5	$1
622110	General medical & surgical hospitals	$34 million in annual receipts	$90.1	NA	NA	$0.8	$3.5	$8.0	$4.9	$2
234110	Highway & street construction	$33.5 million in annual receipts	$7.6	$0.1	$0.3	$0.8	$2.7	$7.9	$2.0	$2
234120	Bridge & tunnel construction	$33.5 million in annual receipts	$13.8	$0.1	$0.3	$0.9	$2.8	$7.9	$2.5	$2
234910	Water, sewer, & pipeline construction	$33.5 million in annual receipts	$3.8	$0.1	$0.3	$0.8	$2.7	$8.0	$1.8	$2
234920	Power & communication transmission line construction	$33.5 million in annual receipts	$3.3	$0.1	$0.3	$0.8	$2.5	$7.6	$1.3	$1
234930	Industrial nonbuilding structure construction	$33.5 million in annual receipts	$35.1	$0.1	$0.3	$0.8	$2.6	$8.2	$1.7	$2
234990	All other heavy construction	$33.5 million in annual receipts	$2.6	$0.1	$0.3	$0.8	$2.4	$7.6	$1.0	$1
92811	National security	NA	NA	NA	NA	NA	NA	NA	NA	N

[a] NAICS codes 221111, 221112, 221113, 221119, 221121, 221122: A firm in these industries is defined as small by SBA if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.

NA = Not available. SUSB did not report this data for disclosure or other reasons.

Annual entity compliance costs vary depending on the size of the diesel engines used at the affected establishment. Absent facility-specific information, we computed per-entity compliance costs based for three different cases based on representative establishments—Cases 1, 2, and 3 (see Table 6-4). Each representative establishment differs based on the size and number of diesel engines being used. Compliance costs are calculated by summing the total annualized compliance costs for the relevant engine categories, dividing the sum by the total existing population of those engines, and multiplying the average engine cost by the number of engines assumed to be at the establishment. Since NAICS 2211, 48621, and 622110 are fundamentally different than other industries considered in this analysis, we used different assumptions about what constitutes the representative establishment and report these assumptions separately.

- Case 1: The representative establishment for all industries uses three 750+ hp engines with an average compliance cost of $1,603 per engine, resulting in a total annualized compliance cost of approximately $4,810 for this representative establishment.
- Case 2: The representative establishment in NACIS 2211, 48621, and 622110 uses two 50 to 750+ hp engines with an average compliance cost of $352 per engine, resulting in a total annualized compliance cost of $704 for this representative establishment. For all other industries, the representative establishment uses two 50 to 300 hp engines with an average compliance cost of $141 per engine, resulting in a total compliance cost of $281 for this representative establishment.
- Case 3: The representative establishment for all industries uses two 50 to 100 hp engines with an average compliance cost of $58 per engine, resulting in a total compliance cost of $115 for this representative establishment.

EPA believes that small entities are most likely to face costs similar to Case 2 (columns shaded in gray in Table 6-4) because most of the engines to be affected by this proposal in NAICS 111, 112, 238, 211111, and 211112 are under 300 hp capacity, and most small entities in these industries will own engines of this size or smaller. However, it is difficult to make a similar claim for NAICS 2211, 48621, and 622110 based on the existing distribution of engines in these industries.

For the sales test, we divided the representative establishment compliance costs reported in Table 6-4 by the representative establishment receipts reported in Tables 6-2 and 6-3. This is known as the cost-to-receipt (i.e., sales) ratio, or the “sales test.” The “sales test” is the impact methodology EPA employs in analyzing small entity impacts as opposed to a “profits test,” in which annualized compliance costs are calculated as a share of profits.

Table 6-4. Representative Establishment Costs Used for Small Entity Analysis ($2007)

	Case 1		Case 2[a]		Case 3	
	NAICS 2211, 48621, 622110 (+750 hp only)	All Other NAICS (+750 hp only)	NAICS 2211, 48621, 622110 (50–750+ hp)	All Other NAICS (50–300 hp)	NAICS 2211, 48621, 622110 (50–100 hp only)	All Other NAICS (50–100 hp only)
Total annualized costs ($$10^3$)	$73,457	$4,127	$291,492	$41,514	$9,156	$6,382
Engine population	45,812	2,575	827,792	295,372	158,797	110,677
Average engine cost ($/engine)	$1,603	$1,603	$352	$141	$58	$58
Assumed engines per establishment	3	3	2	2	2	2
Total annualized costs per establishment	$4,810	$4,809	$704	$281	$115	$115

[a]Case 2 is the one used to determine the small entity impacts (and to provide the SISNOSE determination) for this proposed rule.

This is because revenues or sales data are commonly available data for entities normally impacted by EPA regulations and profits data normally made available are often not the true profit earned by firms because of accounting and tax considerations. Revenues as typically published are usually correct figures and are more reliably reported when compared to profit data. The use of a "sales test" for estimating small business impacts for a rulemaking such as this one is consistent with guidance offered by EPA on compliance with SBREFA[5] and is consistent with guidance published by the U.S. SBA's Office of Advocacy that suggests that cost as a percentage of total revenues is a metric for evaluating cost increases on small entities in relation to increases on large entities.[6]

If the cost-to-receipt ratio is less than 1%, then we consider the proposed rule to not have a significant impact on the establishment company in question. We summarize the industries with cost-to-receipt ratios exceeding 1% below:

Primary Analysis:

- *Case 2*: NAICS 2211 with receipts less than $100,000 per year

[5] The SBREFA compliance guidance to EPA rulewriters regarding the types of small business analysis that should be considered can be found at http://www.epa.gov/sbrefa/documents/rfafinalguidance06.pdf , pp. 24-25.

[6] U.S. SBA, Office of Advocacy. A Guide for Government Agencies, How to Comply with the Regulatory Flexibility Act, Implementing the President's Small Business Agenda and Executive Order 13272, May 2003.

- *Case 3*: No industries

Sensitivity Analysis (unlikely):

- *Case 1*: NAICS 211112 with less than 20 employees, NAICS 2211, 48621, and 238 with receipts less than $500,000 per year, and irrigated farms with receipts of $100,000 or less per year

In the Case 2 primary analysis, only establishments in NAICS 2211 with receipts less than $100,000 per year have cost-to-receipt ratios above 1%. However, establishments earning this level of receipts are likely to be using smaller engines than those assumed in Case 2, such as 50 to 100 hp engines. The results of our Case 3 analysis demonstrate that these establishments are not significantly impacted when taking this engine size into account.

6.2 Small Government Entities

The rule also covers sectors that include entities owned by small and large governments. However, given the uncertainty and data limitations associated with identifying and appropriately classifying these entities, we computed a "revenue" test for a model small government, where the annualized compliance cost is a percentage of annual government revenues (U.S. Census, 2005a, b). The use of a "revenue test" for estimating impacts to small governments for a rulemaking such as this one is consistent with guidance offered by EPA on compliance with SBREFA,[7] and is consistent with guidance published by the US SBA's Office of Advocacy.[8] For example, from the 2002 Census (in 2007 dollars), the average revenue for small governments (counties and municipalities) with populations fewer than 10,000 are $3 million per entity, and the average revenue for local governments with populations fewer than 50,000 is $7 million per entity. For the smallest group of local governments (<10,000 people), the cost-to-revenue ratio would be 0.2% or less under each case. For the larger group of governments (<50,000 people), the cost-to-revenue ratio is 0.1% or less under all cases.

[7] The SBREFA compliance guidance to EPA rulewriters regarding the types of small business analysis that should be considered can be found at http://www.epa.gov/sbrefa/documents/rfafinalguidance06.pdf , pp. 24-25.
[8] U.S. SBA, Office of Advocacy. A Guide for Government Agencies, How to Comply with the Regulatory Flexibility Act, Implementing the President's Small Business Agenda and Executive Order 13272, May 2003.

SECTION 7
HUMAN HEALTH BENEFITS OF EMISSIONS REDUCTIONS

7.1 Calculation of Human Health Benefits

To estimate the $PM_{2.5}$-related human health benefits of reducing emissions from the proposed NESHAP for Reciprocating Internal Combustion Engines (RICE), EPA used the benefits transfer approach it created for the regulatory impact analysis (RIA) accompanying the recent National Ambient Air Quality Standards (NAAQS) for Ozone.[1, 2] In that RIA, EPA developed and applied $PM_{2.5}$ benefit-per-ton coefficients to estimate the $PM_{2.5}$ co-benefits resulting from reductions in emissions of NO_X. EPA has followed that same approach to estimate the health benefits for the projected emission reductions of $PM_{2.5}$ precursor pollutants associated with this proposal.

EPA did not perform an air quality modeling assessment of the emission reductions resulting from installing controls on these RICE because of the time and resource constraints and the limited value of such an analysis for the purposes of developing the regulatory approach for this proposal. This lack of air quality modeling limited EPA's ability to perform a comprehensive benefits analysis for this proposal because our benefits model BenMAP requires either air quality modeling or monitoring data. In the absence of formal air quality modeling, we applied $PM_{2.5}$ benefit-per-ton (BPT) coefficients to estimate benefits. In addition to the 2008 Ozone NAAQS RIA, this benefit-per-ton approach has been used in RIAs prepared for a number of previous EPA rulemakings, e.g. the 2002 large industrial spark ignition engine and recreational vehicles rule, the 2004 Industrial Boilers and Process Heaters MACT, and the 2008 Petroleum Refineries NSPS.

The $PM_{2.5}$ precursor pollutant benefit per-ton estimates provide the total monetized human health benefits (the sum of premature mortality and morbidity related benefits) of reducing one ton of $PM_{2.5}$ or $PM_{2.5}$ precursor emissions from a specified source. We include

[1] U.S. EPA, 2008. *Technical Support Document: Calculating Benefit Per-Ton estimates,* Ozone NAAQS Docket #EPA-HQ-OAR-2007-0225-0284.

[2] U.S. EPA, 2008. *Regulatory Impact Analysis, 2008 National Ambient Air Quality Standards for Ground-level Ozone*, Chapter 6. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/RIAs/6-ozoneriachapter6.pdf.

direct $PM_{2.5}$ as $PM_{2.5}$ precursor emissions (SO_X, NO_X, and VOCs).[3] These PM benefits are actually co-benefits, which result from the installing controls to limit hazardous air pollutants (HAPs). Unfortunately, we are unable to quantify the human health benefits of reducing the 13,000 tons of HAPs, 510,000 tons of carbon monoxide (CO), or ozone precursor pollutants in this analysis because benefit-per-ton estimates are not available for these pollutants. The PM co-benefits estimates in this proposal analysis utilize the concentration-response functions as described in the PM NAAQS RIA analysis.[4] Specifically, we present two estimates reported in the epidemiology literature, as well as a set of 12 functions obtained in EPA's expert elicitation study. Each data source is described below:

- One estimate is based on the concentration-response (C-R) function developed from the study of the American Cancer Society (ACS) cohort reported in Pope et al. (2002), a study that EPA has previously used to generate its primary benefits estimate.

- One estimate is based on Laden et al.'s (2006) reporting of the extended Six Cities cohort study; this study is a more recent PM epidemiological study that was used as an alternative in the PM NAAQS RIA.

- The source for the other twelve estimates are based on the results of EPA's expert elicitation study[5,6] on the PM-mortality relationship and interpreted for benefits analysis in EPA's final RIA for the PM NAAQS, published in September 2006 (U.S. EPA, 2006). For that study, twelve experts (labeled A through L) provided independent estimates of the PM-mortality concentration-response function. EPA practice has been to develop independent estimates of PM-mortality estimates corresponding to the concentration-response function provided by each of the twelve experts, to better characterize the degree of variability in the expert responses.

[3] In this analysis, the monetized benefits of reducing VOCs only reflect their effects as a $PM_{2.5}$ precursor pollutant, not as a precursor to ozone. The benefit-per-ton estimate for VOCs includes more uncertainty than the other $PM_{2.5}$ precursor pollutants because the underlying photochemical modeling systematically underpredicts the secondary formation of organic carbon due to uncertainties in science of secondary organic carbon formation. EPA's modeling system has been peer reviewed, represents the state of science, and uses the best available and most comprehensive data sets to characterize meteorology and emissions. Because the relative effectiveness of VOC controls are underestimated in the modeling, the benefits of reducing VOCs as a $PM_{2.5}$ precursor may also be underestimated.

[4] U.S. EPA, 2006. *Regulatory Impact Analysis, 2006 National Ambient Air Quality Standards for Particulate Matter*, Chapter 5. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf.

[5] Industrial Economics, Inc., 2006. *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality*. Prepared for the U.S. EPA, Office of Air Quality Planning and Standards, September. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/Uncertainty/pm_ee_report.pdf.

[6] Roman et al, 2008. *Expert Judgment Assessment of the Mortality Impact of Changes in Ambient Fine Particulate Matter in the U.S.* Environ. Sci. Technol., 42, 7, 2268 – 2274.

EPA considers the benefit-per-ton estimates derived from the expert elicitation to be indicative of the range of uncertainty associated with the health functions, whereas the range of benefits represented by benefit-per-ton estimates generated using the Pope et al. and Laden et al. functions represent the best epidemiology based estimates of PM co-benefits.

To develop the estimate of benefits of reducing emissions from the proposal, we calculated the monetized benefits-per-ton of emission reductions estimates for direct $PM_{2.5}$ and each $PM_{2.5}$ precursor pollutant. Readers interested in the complete methodology for creating the benefit-per-ton estimates used in this analysis may consult the Technical Support Document (TSD) accompanying the final Ozone NAAQS RIA (U.S. EPA, 2008). In the TSD, we describe in detail how we generated the benefit-per-ton estimates. In summary, we used a model to convert emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors (i.e., SO_2, NO_X, and VOCs) into changes in $PM_{2.5}$ air quality. Next, we used the benefits model (BenMAP) to estimate the changes in human health based on the change in $PM_{2.5}$ air quality. Finally, the monetized health benefits were divided by the emission reductions to create the benefit-per-ton estimates. Even though all fine particles are assumed to have equivalent health effects, the benefit-per-ton estimates vary between precursors because each ton of precursor reduced has a different propensity to form $PM_{2.5}$. For example, NO_X has a lower benefit-per-ton estimate than direct $PM_{2.5}$ because it does not form as much $PM_{2.5}$, thus the exposure would be lower, and the monetized health benefits would be lower. For this analysis, we assumed that 40% of the emission reductions were from non-EGU point sources and 60% were from area sources for PM and SO_X, which are the only pollutants for which we have separate benefit-per-ton estimates for non-EGU sources and area sources.[7] After generating the benefit-per-ton estimate, we then multiply this estimate by the number of tons of each pollutant reduced to derive an overall monetary value of benefits.

It is important to note that the monetized benefit-per-ton estimates used here reflect specific geographic patterns of emissions reductions and specific air quality and benefits modeling assumptions. Use of these $/ton values to estimate benefits associated with different emission control programs (e.g., for reducing emissions from large stationary sources like EGUs) may lead to higher or lower benefit estimates than if benefits were calculated based on direct air quality modeling. Great care should be taken in applying these estimates to emission reductions occurring in any specific location, as these are all based on national or broad regional emission reduction programs and therefore represent average benefits-per-ton over the entire United

[7] These emission assumptions are taken from the compliance cost analysis memo prepared for the proposed rule entitled Impacts Associated with NESHAP for Existing Stationary RICE by Ec/R, Inc. on February 19, 2009.

States. The benefits- per-ton for emission reductions in specific locations may be very different from the national average.

7.2 Characterization of Uncertainty in the Benefits Estimates

In any complex analysis, there are likely to be many sources of uncertainty. Many inputs are used to derive the final estimate of economic benefits, including emission inventories, air quality models (with their associated parameters and inputs), epidemiological estimates of concentration-response (C-R) functions, estimates of values, population estimates, income estimates, and estimates of the future state of the world (i.e., regulations, technology, and human behavior). For some parameters or inputs, it may be possible to provide a statistical representation of the underlying uncertainty distribution. For other parameters or inputs, the necessary information is not available.

The annual benefit estimates presented in this analysis are also inherently variable due to the processes that govern pollutant emissions and ambient air quality in a given year. Factors such as hours of equipment use and weather are constantly variable, regardless of our ability to measure them accurately. As discussed in the $PM_{2.5}$ NAAQS RIA (Table 5.5), there is a variety of uncertainties associated with these PM benefits. Therefore, the estimates of annual benefits should be viewed as representative of the magnitude of benefits expected, rather than the actual benefits that would occur every year.

Below we present the estimates of the total benefits, based on our interpretation of the best available scientific literature and methods and supported by the SAB-HES and the NAS (NRC, 2002). The benefits estimates are subject to a number of assumptions and uncertainties. For example, for key assumptions underlying the estimates for premature mortality, which typically account for at least 90% of the total PM benefits, we were able to identify the following uncertainties:

1. Inhalation of fine particles is causally associated with premature death at concentrations near those experienced by most Americans on a daily basis. Although biological mechanisms for this effect have not been established definitively yet, the weight of the available epidemiological evidence supports an assumption of causality.

2. All fine particles, regardless of their chemical composition, are equally potent in causing premature mortality. This is an important assumption, because PM produced via transported precursors emitted from EGUs may differ significantly from direct PM released from diesel engines and other industrial sources, but no clear scientific grounds exist for supporting differential effects estimates by particle type.

3. The impact function for fine particles is approximately linear within the range of ambient concentrations under consideration. Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM, including both regions that are in attainment with fine particle standard and those that do not meet the standard.

4. The forecasts for future emissions and associated air quality modeling are valid. Although recognizing the difficulties, assumptions, and inherent uncertainties in the overall enterprise, these analyses are based on peer-reviewed scientific literature and up-to-date assessment tools, and we believe the results are highly useful in assessing this proposal.

5. Benefits estimated here reflect the application of a national dollar benefit-per-ton estimate of the benefits of reducing directly emitted fine particulates from point sources. Because they are based on national-level analysis, the benefit-per-ton estimates used here do not reflect local variability in population density, meteorology, exposure, baseline health incidence rates, or other local factors that might lead to an over-estimate or under-estimate of the actual benefits of controlling directly emitted fine particulates.

This RIA does not include the type of detailed uncertainty assessment found in the PM NAAQS RIA because we lack the necessary air quality input and monitoring data to run the benefits model (BenMAP). Moreover, it was not possible to develop benefit-per-ton metrics and associated estimates of uncertainty using the benefits estimates from the PM RIA because of the significant differences between the sources affected in that rule and those regulated here. However, the results of the Monte Carlo analyses of the health and welfare benefits presented in Chapter 5 of the PM RIA can provide some evidence of the uncertainty surrounding the benefits results presented in this analysis. In this analysis, we provide benefits estimates using concentration-response functions based on two epidemiology studies as well as twelve benefits estimates based on the concentration-response functions from the expert elicitation. While this captures only a fraction of the overall uncertainty, the magnitude of the mortality C-R function is a critical parameter in the analysis and the uncertainty in that parameter is likely to contribute a large fraction of the overall uncertainty in the benefits estimates.

7.3 Updating the Benefits Data Underlying the Benefit-per-Ton Estimates

As described above, the estimates provided are derived through a benefits transfer technique that adapts monetized benefits from reductions in $PM_{2.5}$ precursor pollutants that were estimated for the Ozone RIA utilizing nationally distributed emissions reductions. The benefit-per-ton estimates for this analysis have been updated since the Ozone RIA was completed. They have been updated to reflect a new population dataset, a more recent currency year.[8] EPA is currently in the process of generating localized benefit-per-ton estimates to better account for the spatial heterogeneity of benefits for a small number of urban areas. EPA believes that these estimates may better represent the localized benefits than estimates that use national averages. However, because the engines affected by this rule should be widely distributed nationally, we believe that the national estimates are most appropriate for this analysis.

In addition to generating local benefit-per-ton estimates, EPA is also exploring other updates to the national benefit-per-ton estimates. Technical updates would incorporate a new population dataset and expand the geographic scope of the national estimates. EPA is also exploring changing the assumption regarding thresholds in the health impact function. In previous RIAs, EPA has included sensitivity analyses for premature mortality, with alternative cutpoints at 0 $\mu g/m^3$, 7.5 $\mu g/m^3$, 12 $\mu g/m^3$, and 14 $\mu g/m^3$**.** As a sensitivity analysis for this analysis, EPA explored the implication of replacing the threshold assumption with log-linear no-threshold models similar to the authors of those original studies.[9] The health impact functions applied for our premature mortality benefits estimates are based on an assumed cutpoint at 10 $\mu g/m^3$ in the long-term mortality concentration-response function and short-term morbidity concentration-response functions. Removing the threshold assumption for this proposed rule increases the benefits based on Pope et al by 30% and increases the benefits based on Laden at al by 50% over the numbers presented in the tables below. Because this analysis uses benefit-per-ton estimates, we are unable to do a sensitivity analysis using the other alternative cutpoints analyzed previously.

EPA is considering this policy change in light of the results of the expert elicitation on PM mortality (Roman et al, 2008)**.** Specifically, of the 12 experts included in the expert elicitation, only one expert elected to specify a threshold, as the rest cited a lack of empirical and/or theoretical basis for a population threshold. Furthermore, that one expert only specified a 50% probability of a threshold (most likely at or below 5 µg/m3), which is below the cut-point that EPA has historically assumed.

---

[8] Previous RIAs reported the benefit-per-ton estimates using 2006$. However, to be consistent with the cost estimates, we also updated the benefits estimates in this analysis to 2007$. Updating the currency year does not affect the comparison of costs and benefits because each is adjusted consistently.

[9] For a synthesis of the epidemiology studies addressing the threshold issue, please consult EPA's *Integrated Science Assessment for Particulate Matter (External Review Draft)* (U.S. EPA, 2008*).* Available on the Internet at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805

7.4 Results of Benefits Analysis

Table 7-1 provides a general summary of the results by pollutant for the selected options, including the emissions reductions and monetized benefits-per-ton range using both a 3% discount rate and a 7% discount rate.[10] [11] Table 7-2 shows all 14 benefits estimates, including those based on the results of the expert elicitation at discount rates of 3% and 7%. Figure 7-1 provides a visual representation of the range of benefits estimates by pollutant at a 3% discount rate.[12] All benefits estimates are for the year of full implementation (2013). More details on the regulatory alternatives, emissions, and emission reductions can be found in Chapter 4 of this RIA.

Table 7-1. Summary of Health Benefits of the Proposed RICE NESHAP[a]

		3% Discount Rate			7% Discount Rate		
Pollutant	**Emissions Reductions (tons)**	**Benefit per ton (Pope)**	**Benefit per ton (Laden)**	**Total Monetized Benefits (millions 2007$)**	**Benefit per ton (Pope)**	**Benefit per ton (Laden)**	**Total Monetized Benefits (millions 2007$)**
Direct $PM_{2.5\ nonEGU}$	1,024	$160,000	$340,000	$160 to $350	$140,000	$310,000	$150 to $310
Direct $PM_{2.5\ area}$	1,536	$250,000	$500,000	$390 to $830	$230,000	$490,000	$350 to $750
$PM_{2.5}$ Precursors							
$SO_{2\ nonEGU}$	1,828	$16,000	$34,000	$29 to $63	$15,000	$31,000	$27 to $57
$SO_{2\ area}$	2,742	$14,000	$30,000	$39 to $83	$13,000	$27,000	$35 to $75
NO_X	90,106	$3,000	$6,500	$270 to $590	$2,800	$5,900	$250 to $530
VOC	89,860	$440	$940	$39 to $84	$400	$850	$36 to $76
Grand Total				$930 to $2,000			$850 to $1,800

[a]All estimates are for the analysis year (2013), and are rounded to two significant figures so numbers may not sum across columns. Emission reductions reflect the combination of both major and area sources. All fine particles are assumed to have equivalent health effects, but the benefit per ton estimates vary between precursors because each ton of precursor reduced has a different propensity to form $PM_{2.5}$. The monetized benefits incorporate the conversion from precursor emissions to ambient fine particles.

[10] Circular A-4 requires regulatory analyses to assess benefits using discount rates of 3% and 7%. Office of Management and Budget (OMB), 2003. *Circular A-4: Regulatory Analysis*. Washington, DC. Available on the internet at http://www.whitehouse.gov/omb/circulars/a004/a-4.html.

[11] The benefits are discounted to account for the cessation lag in $PM_{2.5}$ benefits from premature mortality and acute myocardial infarctions (AMIs), rather than a discounted stream of future benefits; whereas discounting the costs reflects the lifetime costs of the equipment. For this reason, it is appropriate in this context to use two different discount rates for the benefits and costs.

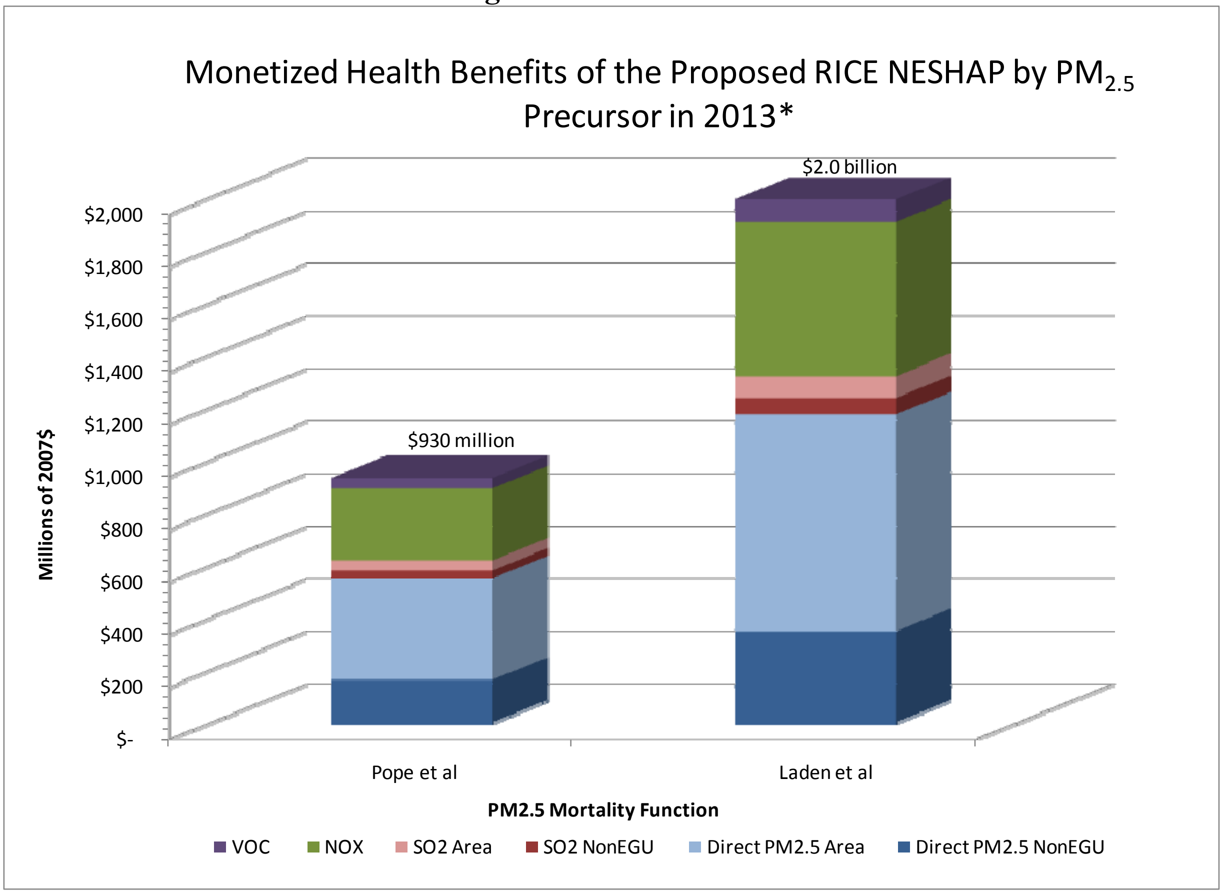
[12] The breakdown of benefits estimates by precursor using a 7% discount rate would be approximately the same.

Table 7-2. All Benefits Estimates for RICE NESHAP in 2013 (in millions of 2007$)[a]

	3% Discount Rate	7% Discount Rate
Benefit-per-ton Coefficients Derived from Epidemiology Literature		
Pope et al.	$3,900	$3,500
Laden et al.	$9,400	$8,500
Benefit-per-ton Coefficients Derived from Expert Elicitation		
Expert A	$10,000	$9,000
Expert B	$7,700	$7,000
Expert C	$7,600	$6,900
Expert D	$5,400	$4,900
Expert E	$12,000	$11,000
Expert F	$7,000	$6,300
Expert G	$4,600	$4,200
Expert H	$5,800	$5,200
Expert I	$7,500	$6,800
Expert J	$6,200	$5,600
Expert K	$1,600	$1,500
Expert L	$5,600	$5,100

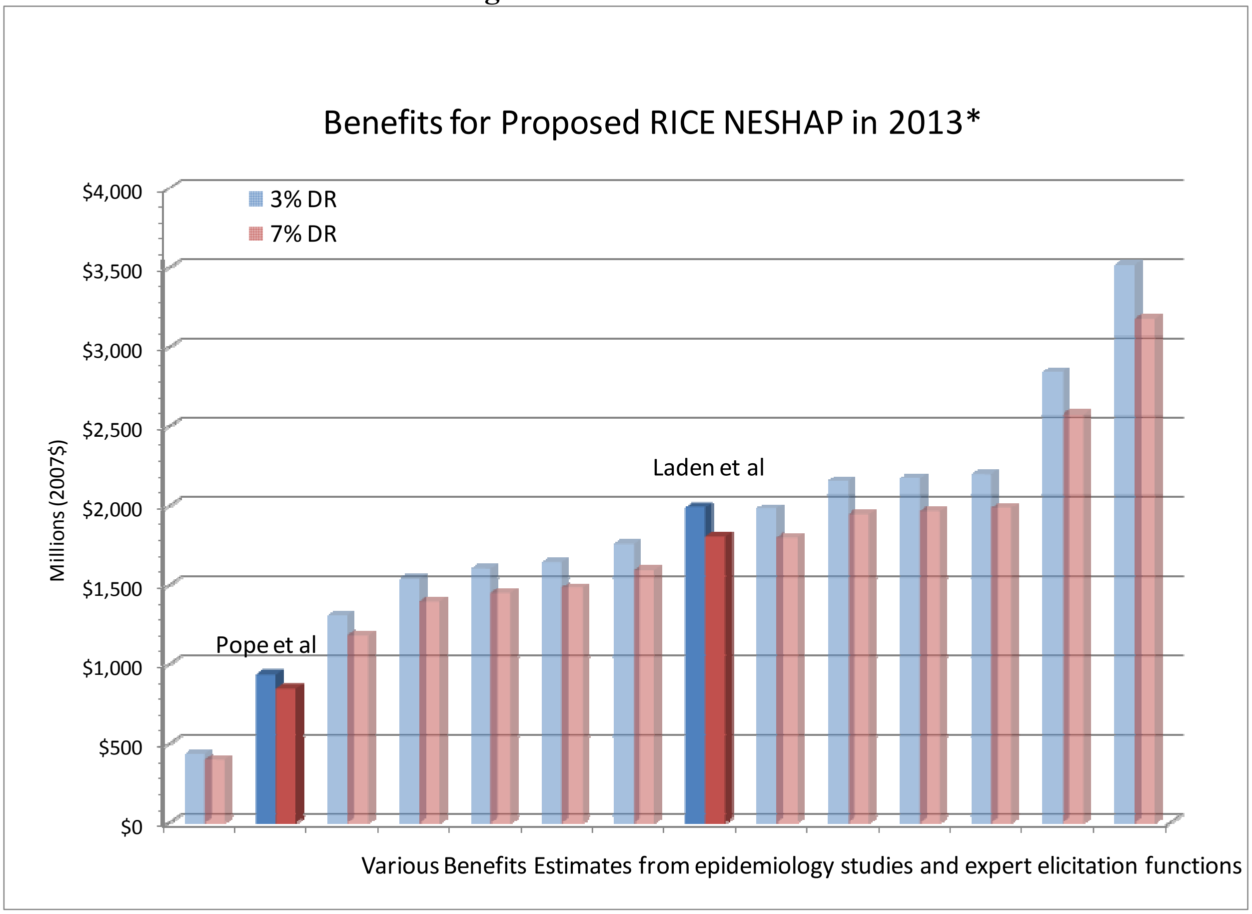
[a]All estimates are rounded to two significant figures. Estimates do not include confidence intervals because they were derived through the benefit-per-ton technique described above. The benefits estimates from the Expert Elicitation are provided as a reasonable characterization of the uncertainty in the mortality estimates associated with the concentration-response function.

Figure 7.1:



*** This graph shows the estimated benefits by precursor pollutant using effect coefficients derived from the Pope et al. study and the Laden et al, study at a 3% discount rate. All fine particles are assumed to have equivalent health effects, but the benefit-per-ton estimates vary because each ton of precursor reduced has a different propensity to become $PM_{2.5}$. The monetized benefits incorporate the conversion from precursor emissions to ambient fine particles.**

Figure 7.2:



*** This graph shows all of the benefits estimates, specifically identifying the estimates based on Pope et al and Laden et al with dark bars and the expert elicitation with translucent bars. Results using a 3% discount rate are shown in blue, and results using a 7% discount rate are shown in red.**

7.5 Comparison of Benefits and Costs

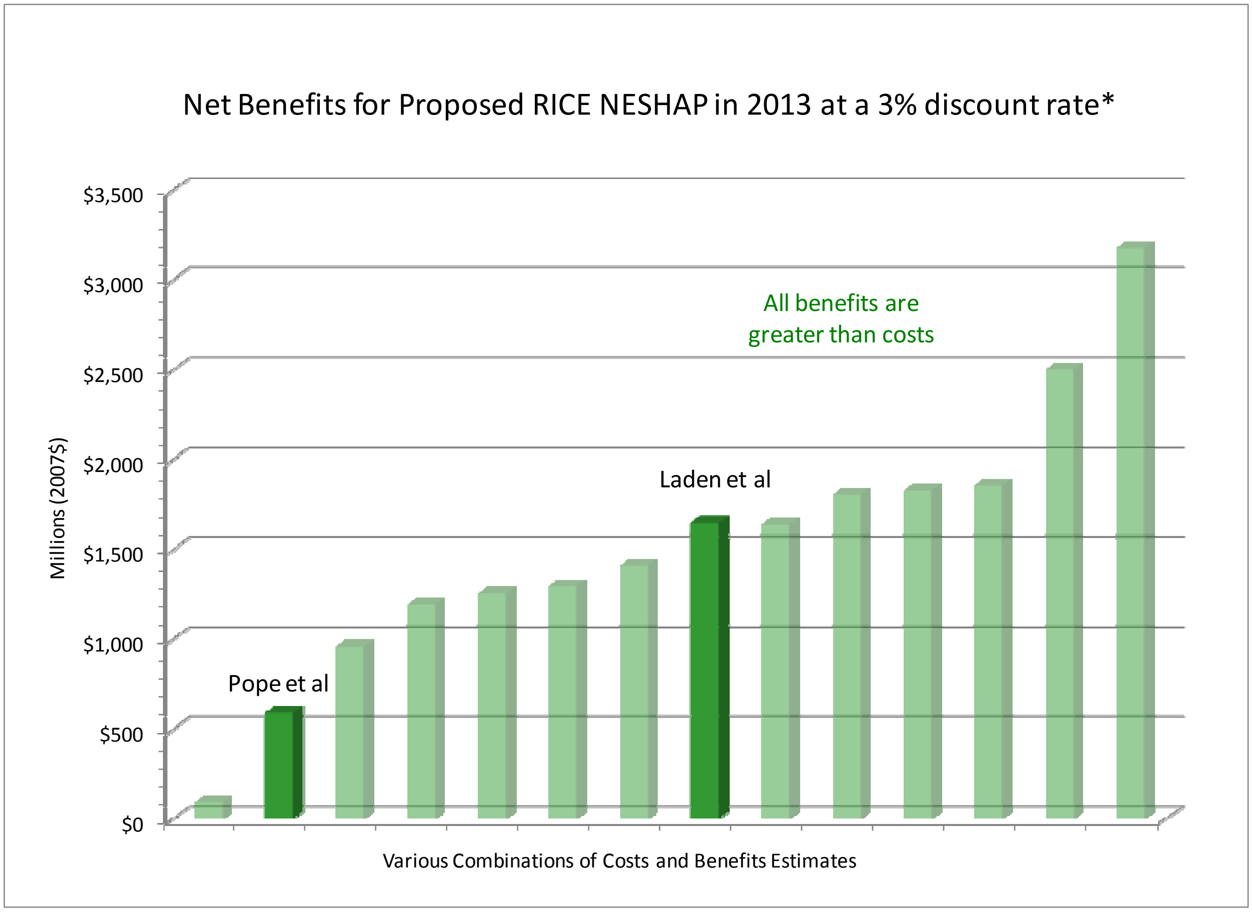
In the year of full implementation (2013), EPA estimates the range[13] of annualized benefits of this proposal to be $930 million to $2.0 billion ($2007) at a 3% discount rate[14] and $850 million to $1.8 billion ($2007) at a 7% discount rate with annualized costs of $345 million ($2007) at a 7% interest rate as mentioned in Chapter 4 of this RIA. Thus, the net benefits of the

[13] This range represents benefits estimates derived from the Pope et al. study to the Laden et al. study, not the entire range of the expert elicitation. This range captures most of the expert opinion, while preserving the empirical basis of our estimates. Uncertainty goes beyond the range shown here.

[14] The benefits are discounted to account for the cessation lag in $PM_{2.5}$ benefits from premature mortality and acute myocardial infarctions (AMIs), rather than a discounted stream of future benefits; whereas discounting the costs reflects the lifetime costs of the equipment. For this reason, it is appropriate in this context to use two different discount rates for the benefits and costs.

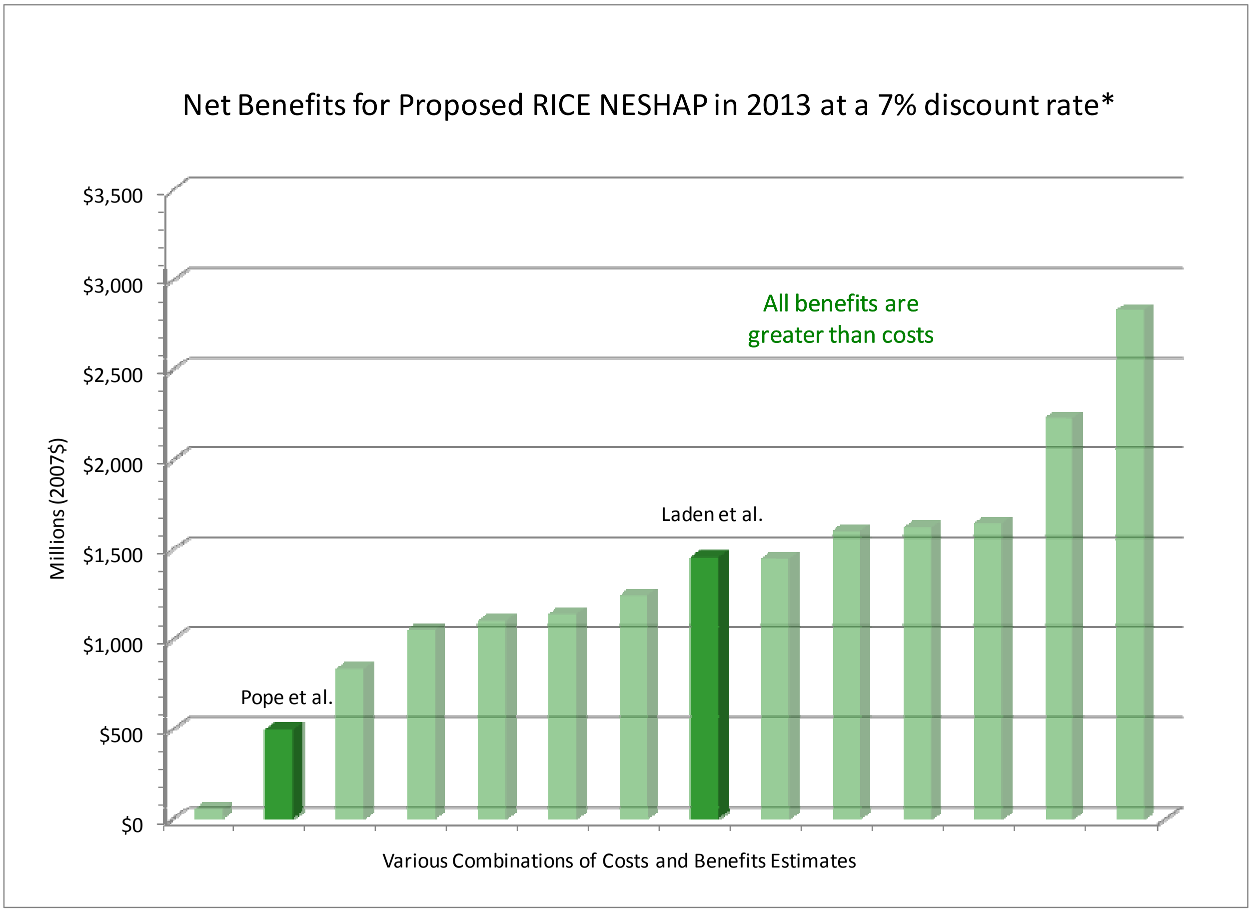
RICE NESHAP are $590 million to $1.6 billion at a 3% discount rate and $500 million to $1.5 billion at a 7% discount rate. Figures 7.2 and 7.3 show the all net benefits estimates (i.e., annual benefits in 2013 minus annualized costs) utilizing all 14 different $PM_{2.5}$ mortality functions. EPA believes that the benefits are likely to exceed the costs by a substantial margin under this proposal even when taking into account uncertainties in the cost and benefit estimates.

Figure 7.3:



***Net Benefits are quantified in terms of $PM_{2.5}$ benefits at a 3% discount. This graph shows all of the benefits estimates combined with the cost estimate, specifically identifying the estimates based on Pope et al and Laden et al with dark green bars and the expert elicitation with translucent green bars.**

Figure 7.4:



***Net Benefits are quantified in terms of $PM_{2.5}$ benefits at a 3% discount. This graph shows all of the benefits estimates combined with the cost estimate, specifically identifying the estimates based on Pope et al and Laden et al with dark green bars and the expert elicitation with translucent green bars.**

SECTION 8
REFERENCES

American Hospital Association. 2007. “AHA Hospital Statistics: 2008 Edition.” Health Forum.

Fullerton, D., and G. Metcalf. 2002. “Tax Incidence.” In A. Auerbach and M. Feldstein, eds., *Handbook of Public Economics*, Vol. 4, Amsterdam: Elsevier.

Industrial Economics, Inc., 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality. Prepared for the U.S. EPA, Office of Air Quality Planning and Standards, September. Available on the Internet at <http://www.epa.gov/ttn/ecas/regdata/Uncertainty/pm_ee_report.pdf>.

Interstate Oil & Gas Compact Commission. 2007. “Marginal Wells: Fuel for Economic Growth.” Table 3.B. <http://iogcc.myshopify.com/collections/frontpage/products/2007-marginal-well-report-2007>.

Laden, F., J. Schwartz, F.E. Speizer, and D.W. Dockery. 2006. Reduction in Fine Particulate Air Pollution and Mortality. American Journal of Respiratory and Critical Care Medicine. 173: 667-672.

Lincoln Electric Holdings. 2006. Form 10-K. Filed February 24, 2006.

National Research Council (NRC). 2002. Estimating the Public Health Benefits of Proposed Air Pollution Regulations. Washington, DC: The National Academies Press.

Nelson, B., EC/R Inc. and T. Parise, Alpha-Gamma Technologies, Inc. December 1, 2008. Memorandum to Jamie Pagan, U.S. Environmental Protection Agency. Impacts Associated with NESHAP for Existing Stationary RICE.

Nicholson, Walter. 1998. *Microeconomic Theory*. Orlando: The Dryden Press.

Office of Management and Budget (OMB), 2003. Circular A-4: Regulatory Analysis. Washington, DC. Available on the internet at <http://www.whitehouse.gov/omb/circulars/a004/a-4.html>.

Parise, T., Alpha-Gamma Technologies, Inc. 2008. Memorandum: “Impacts Associated with NESHAP for Existing Stationary RICE.”

Pope, C.A., III, R.T. Burnett, M.J. Thun, E.E. Calle, D. Krewski, K. Ito, and G.D. Thurston. 2002. “Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution.” Journal of the American Medical Association 287:1132-1141.

Roman, Henry A., Walker, Katherine D., Walsh, Tyra L., Conner, Lisa, Richmond, Harvey M., Hubbell, Bryan J., and Kinney, Patrick L., 2008. Expert Judgment Assessment of the Mortality Impact of Changes in Ambient Fine Particulate Matter in the U.S. Environ. Sci. Technol., 42, 7, 2268 – 2274.

The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G2211.S <http://www.federalreserve.gov/datadownload/>. (December 15, 2008)

Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

U.S. Bureau of Economic Analysis (BEA). 2002. 2002 and 1997 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5. <http://www.bea.gov/industry/index.htm#benchmark_io>.

U.S. Bureau of Economic Analysis (BEA). 2008. Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. Last revised November 25, 2008.

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: 2002 and 1997." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 22: Utilities: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Census Bureau. 2002a. "Industry Series." *Crude Petroleum & Natural Gas: 2002. EC02-21I-211111 (RV)*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002b. "Industry Series." *Electric Power Generation, Transmission, and Distribution: 2002. EC02-22I-03*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002c. "Industry Series." *Hospitals: 2002. EC02-62I-02*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002d. "Industry Series." *Natural Gas Liquid Extraction: 2002. EC02-21I-211112*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002e. "Industry Series." *Pipeline Transportation: 2002. EC02-48I-02*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2005a. *2002 Census of Governments, Volume 4, Number 3, Finances of County Governments: 2002 GC02(4)-3*. U.S. Government Printing Office, Washington, DC. Table 12.

U.S. Census Bureau. 2005b. *2002 Census of Governments, Volume 4, Number 4, Finances of Municipal and Township Governments: 2002 GC02(4)-4*. U.S. Government Printing Office, Washington, DC. Table 13.

U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed %20sizes_6digitnaics.txt>.

U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. <http://www2.census.gov/csd/susb/2002/ usalli_r02.xls>.

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002." <http://factfinder.census.gov>; (November 21, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years" <http://factfinder.census.gov>; (November 25, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Comparative Statistics for the United States (1997 NAICS Basis): 2002 and 1997" <http://factfinder.census.gov>; (December 12, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Geographic Distribution—Pipeline transportation of natural gas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Transportation and Warehousing: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 00: All sectors: Geographic Area Series: Economy-Wide Key Statistics: 2002" <http://factfinder.census.gov>; (December 17, 2008).

U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS.

U.S. Department of Agriculture (USDA). 2008. "Agricultural Projections to 2017." <http://www.ers.usda.gov/Publications/OCE081/OCE20081c.pdf>.

U.S. Department of Agriculture (USDA). 2008. "Agricultural Projections to 2017." <http://www.ers.usda.gov/Publications/OCE081/OCE20081c.pdf>.

U.S. Department of Energy, Energy Information Administration. 2007. "2006 EIA-906/920 Monthly Time Series."

U.S. Energy Information Administration. 2008a. <http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html>. Last updated September 2008.

U.S. Energy Information Administration. 2008b. Supplemental Tables to the Annual Energy Outlook 2009. Table 10. Available at: <http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>.

U.S. Environmental Protection Agency (EPA). September 2000. *Guidelines for Preparing Economic Analyses*. EPA 240-R-00-003. Washington, DC: EPA. <http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html>.

U.S. Environmental Protection Agency (EPA). May 2004. *Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines.* EPA420-R-04-007. Washington, DC: EPA. < http://www.epa.gov/nonroad-diesel/2004fr/420r04007.pdf>.

U.S. Environmental Protection Agency. 2006. Regulatory Impact Analysis, 2006 National Ambient Air Quality Standards for Particulate Matter, Chapter 5. Available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf >.

U.S. Environmental Protection Agency. 2008. Regulatory Impact Analysis, 2008 National Ambient Air Quality Standards for Ground-level Ozone, Chapter 6. Available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/6-ozoneriachapter6.pdf>.

U.S. Environmental Protection Agency. 2008. Technical Support Document: Calculating Benefit Per-Ton estimates, Ozone NAAQS Docket #EPA-HQ-OAR-2007-0225-0284.

U.S. Environmental Protection Agency. 2008. Integrated Science Assessment for Particulate Matter (External Review Draft). Washington, DC, EPA/600/R-08/139. Available on the Internet at <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805>

U.S. Small Business Administration (SBA). 2008. “Table of Small Business Size Standards Matched to North American Industry Classification System Codes.” Effective August 22, 2008. <http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf>.

U.S. Small Business Administration (SBA). 2008. Table of Small Business Size Standards Matched to North American Industry Classification System Codes. Effective March 11, 2008. <http://www.sba.gov/services/contractingopportunities/sizestandardstopics/size/index.html>.

Wade, S.H. 2003. “Price Responsiveness in the AEO2003 NEMS Residential and Commercial Buildings Sector Models.” <http://www.eia.doe.gov/oiaf/analysispaper/elasticity/pdf/buildings.pdf>.

February 2009

Regulatory Impact Analysis (RIA) for Existing Stationary Reciprocating Internal Combustion Engines (RICE) NESHAP

Final Report

Deleted: Draft

Prepared for

Larry Sorrels
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards (OAQPS)
Air Benefit and Cost Group (ABCG)
(MD-C439-02)
Research Triangle Park, NC 27711

Prepared by

RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709

RTI Project Number 0209897.003.061

RTI Project Number
0209897.003.061

Regulatory Impact Analysis (RIA) for Existing Stationary Reciprocating Internal Combustion Engines (RICE) NESHAP

Final Report

Deleted: Draft

February 2009

Prepared for

Larry Sorrels
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards (OAQPS)
Air Benefit and Cost Group (ABCG)
(MD-C439-02)
Research Triangle Park, NC 27711

Prepared by

RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709

RTI International is a trade name of Research Triangle Institute.

Deleted: *OMB Review Draft – February 23, 2009*

CONTENTS

Section **Page**

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Font: 12 pt

Formatted: Check spelling and grammar

Deleted: .1

Formatted: Check spelling and grammar

Formatted: Indent: Left: 0 pt, First line: 0 pt, Don't adjust space between Latin and Asian text

Formatted: Font: 12 pt

Deleted: 4.

Formatted: Indent: Left: 0 pt, First line: 0 pt, Don't adjust space between Latin and Asian text

Deleted: 2

Formatted: Font: 12 pt

Deleted: 5

Deleted: 5

Formatted: TOC 3, Tabs: 108 pt, Left

Formatted: Do not check spelling or grammar

Deleted:

Deleted: *OMB Review Draft – February 23, 2009*

LIST OF FIGURES

Number **Page**

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: *OMB Review Draft – February 23, 2009*

LIST OF TABLES

Number **Page**

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 1
EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA) has characterized the facilities and companies potentially affected by the proposed reciprocating internal combustion engines (RICE) National Emissions Standards for Hazardous Air Pollutants (NESHAP) by examining existing sources and the companies that own them.

EPA estimates that complying with the proposed RICE rule will have an annualized cost of approximately $345 million per year (2007 dollars) at a discount rate of 7 percent and $331 million per year at a discount rate of 3 percent (also 2007 dollars) in the year of full implementation of the rule (2013). Using these costs, EPA estimates in its economic impact analysis that the NESHAP will have limited impacts on the eight industries affected and their consumers. Using sales data obtained for affected small entities in an analysis of the impacts of this proposal on small entities, EPA expects that the proposed NESHAP will not result in a SISNOSE (a significant economic impacts for a substantial number of small entities). EPA also does not expect significant adverse energy impacts based on Executive Order 13211, an Executive Order that requires analysis of energy impacts for rules such as this one that are economically significant under Executive Order 12866.

The proposed RICE rule is also considered subject to the requirements of the Office of Management and Budget's (OMB's) Circular A-4 because EPA expects that either the benefits or the costs are potentially $1 billion or higher. EPA estimates the monetized benefits of this proposed NESHAP to be $930 million to $2.0 billion (2007$, at a 3 percent discount rate) in the year of full implementation (2013); higher or lower estimates are plausible according to alternate models identified by experts describing the relationship between $PM_{2.5}$ and premature mortality (Roman et al. 2008). The benefits at a 7 percent discount rate are $850 million to $1.8 billion (2007$). EPA believes that the benefits are likely to exceed the annualized costs of $345 million by a substantial margin under this rulemaking even when taking into account uncertainties in the cost and benefit estimates.

Deleted: EPA's estimate of the benefits of the NESHAP, based on information from the $PM_{2.5}$ expert elicitation study released in October, 2006 and other data, is a range from $0.9 billion to $2.0 billion (2007 dollars) in 2013.

Formatted: Font: (Default) Tms Rmn, Font color: Black

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 2
INTRODUCTION

The Environmental Protection Agency (EPA) is currently preparing a proposed National Emissions Standards for Hazardous Air Pollutants (NESHAP) to reduce hazardous air pollutants (HAP) emissions from existing reciprocating internal combustion engines (RICE). This rulemaking is on a court-ordered schedule to be proposed by February 25, 2009, and then promulgated by February 10, 2010. Regulations affecting new and reconstructed stationary diesel HAP and criteria pollutant emissions were issued in March 2004, July 2006, and December 2007. This latest rulemaking is meant to target those emissions sources (HAP, primarily) in the same industries that were not affected by these three different regulations. This rulemaking consists of a Maximum Achievable Control Technology (MACT) standard that will be applied to major sources of HAP emissions and a Generally Available Control Technology (GACT) standard that will be applied to area sources of HAP emissions. The proposed rule is economically significant according to Executive Order 12866. As part of the regulatory process of preparing these standards, EPA has prepared an economic impact analysis (RIA). This analysis includes an analysis of impacts to small entities as part of compliance with the Small Business Regulatory Enforcement Fairness Act (SBREFA) and an analysis of impacts on energy consumption and production to comply with Executive Order 13211 (Statement of Energy Effects).

2.1 Organization of this Report

Formatted: Bullets and Numbering

The remainder of this report supports and details the methodology and the results of the EIA:

- Section 3 presents a profile of the affected industries.
- Section 4 presents a summary of regulatory alternatives considered in the proposed rule, and provides the compliance costs of the rule.
- Section 5 describes the estimated costs of the regulation and describes the EIA methodology and reports market, welfare, and energy impacts.
- Section 6 presents estimated impacts on small entities.
- Section 7 presents the benefits estimates.

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 3
INDUSTRY PROFILE

This section provides an introduction to the industries affected by the proposed rule. The purpose is to give the reader a general understanding of the economic aspects of the industry; their relative size, relationships with other sectors in the economy, trends for the industries, and financial statistics. The sectors discussed are

- electric power generation, transmission, and distribution,
- oil and gas extraction (including marginal wells),
- pipeline transportation of natural gas,
- general medical and surgical hospitals, and
- irrigation sets and welding equipment.

3.1 Electric Power Generation, Transmission, and Distribution

Formatted: Bullets and Numbering

3.1.1 Overview

Electric power generation, transmission, and distribution (NAICS 2211) is an industry group within the utilities sector (NAICS 22). It includes establishments that produce electrical energy or facilitate its transmission to the final consumer.

From 1997 to 2002, revenues from electric power grew about 10% to over $373 billion ($2007) (Table 3-1). At the same time, payroll rose about 6.5% and the number of employees decreased by over 5%. The number of establishments rose by over 15%, resulting in a decrease in average establishment revenue of almost 7%. Industrial production within NAICS 2211 has increased 25% since 1997 (Figure 3-1).

Electric utility companies have traditionally been tightly regulated monopolies. Since 1978, several laws and orders have been passed to encourage competition within the electricity market. In the late 1990s, many states began the process of restructuring their utility regulatory framework to support a competitive market. Following market manipulation in the early 2000s, however, several states have suspended their restructuring efforts. The majority (58%) of diesel power generators controlled by combined heat and power (CHP) or independent power producers are located in states undergoing active restructuring (Figure 3-2).

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-1. Key Statistics: Electric Power Generation, Transmission, and Distribution (NAICS 2211) ($2007)

	1997	2002
Revenue ($$10^6$)	337,490	373,309
Payroll ($$10^6$)	38,176	40,842
Employees	564,525	535,675
Establishments	7,935	9,394

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

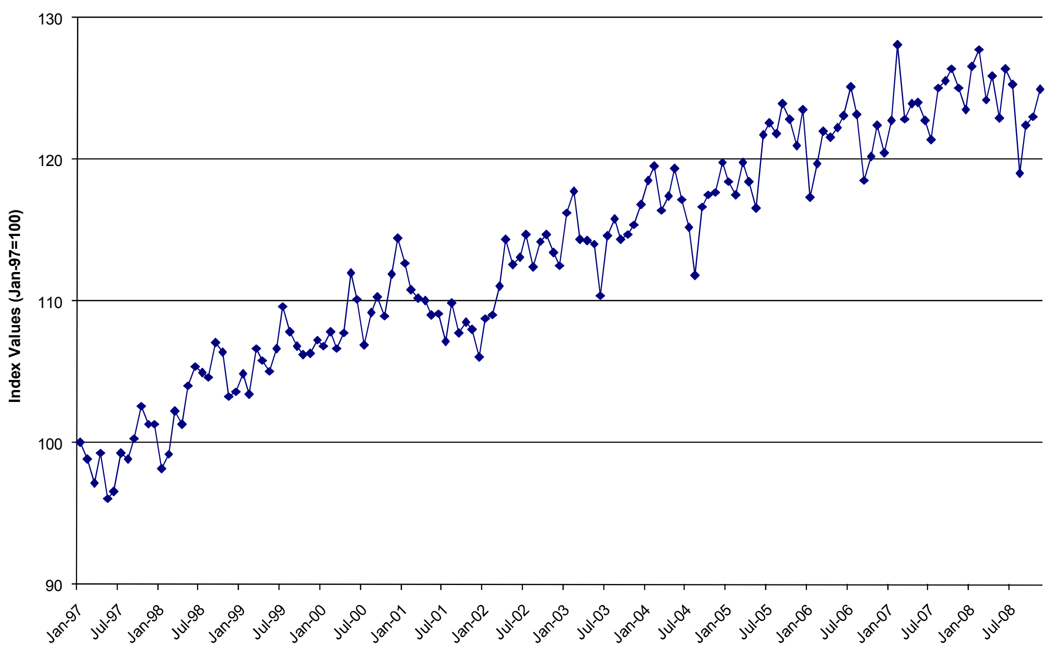


Figure 3-1. Industrial Production Index (NAICS 2211)

Source: The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G2211.S <http://www.federalreserve.gov/datadownload/>. (15 December, 2008)

3.1.2 Goods and Services Used

Formatted: Bullets and Numbering

In Table 3-2, we use the latest detailed benchmark input-output data report by the Bureau of Economic Analysis (BEA) (2002) to identify the goods and services used in electric power generation. As shown, labor and tax requirements represent a significant share of the value of

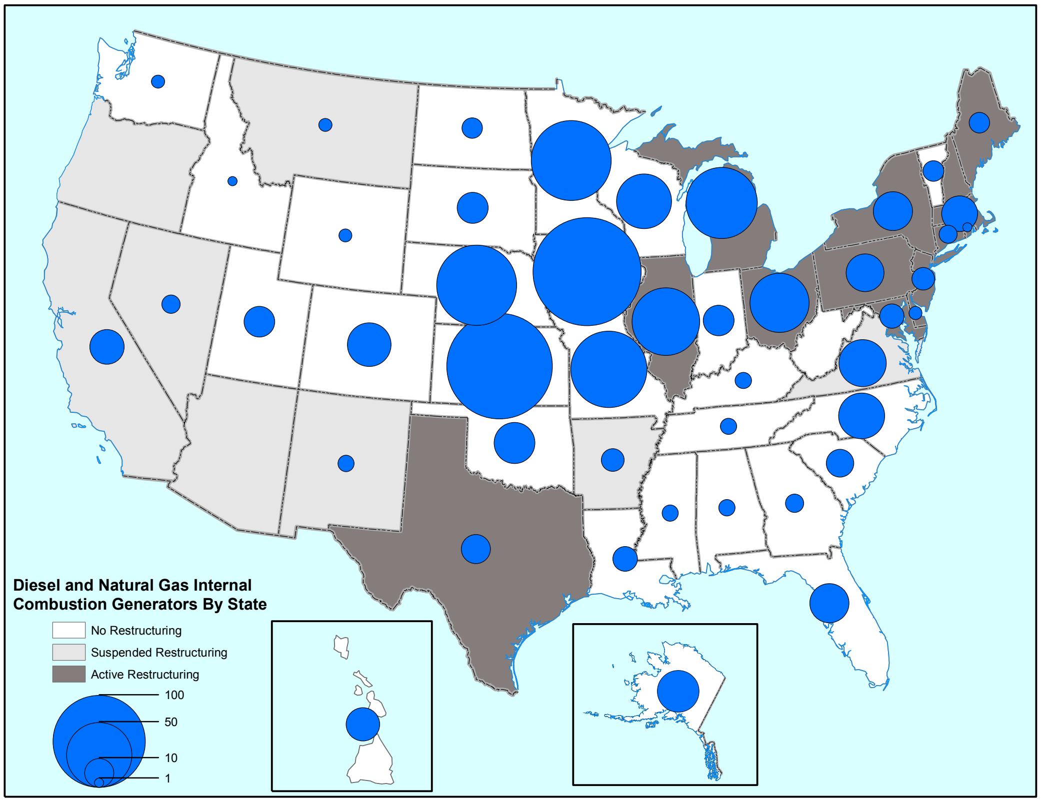


Figure 3-2. Internal Combustion Generators by State: 2006

Source: U.S. Department of Energy, Energy Information Administration. 2007. "2006 EIA-906/920 Monthly Time Series."

power generation. Extraction, transportation, refining, and equipment requirements potentially associated with reciprocating internal combustion engines (oil and gas extraction, pipeline transportation, petroleum refineries, and turbine manufacturing) represent around 10% of the value of services.

3.1.3 Business Statistics

Formatted: Bullets and Numbering

The U.S. Economic Census and Statistics of U.S. Businesses (SUSB) programs provide national information on the distribution of economic variables by industry, location, and size of business. Throughout this section and report, we use the following definitions:

- *Establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-2. Direct Requirements for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	20.52%
V00200	Taxes on production and imports, less subsidies	13.71%
211000	Oil and gas extraction	6.16%
212100	Coal mining	5.86%
482000	Rail transportation	3.01%
230301	Nonresidential maintenance and repair	2.83%
486000	Pipeline transportation	1.70%
722000	Food services and drinking places	1.40%
52A000	Monetary authorities and depository credit intermediation	1.39%
541100	Legal services	1.13%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.

- *Firm*: A firm is a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control. The firm and the establishment are the same for single-establishment firms. For each multiestablishment firm, establishments *in the same industry within a state* are counted as one firm; the firm employment and annual payroll are summed from the associated establishments.

- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise; the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

In 2002, Texas had almost 1,000 power establishments, while California, Georgia, and Ohio all had between 400 and 500 (Figure 3-3). Hawaii, Nebraska, and Rhode Island all had fewer than 20 establishments in their states.

Deleted: *OMB Review Draft – February 23, 2009*

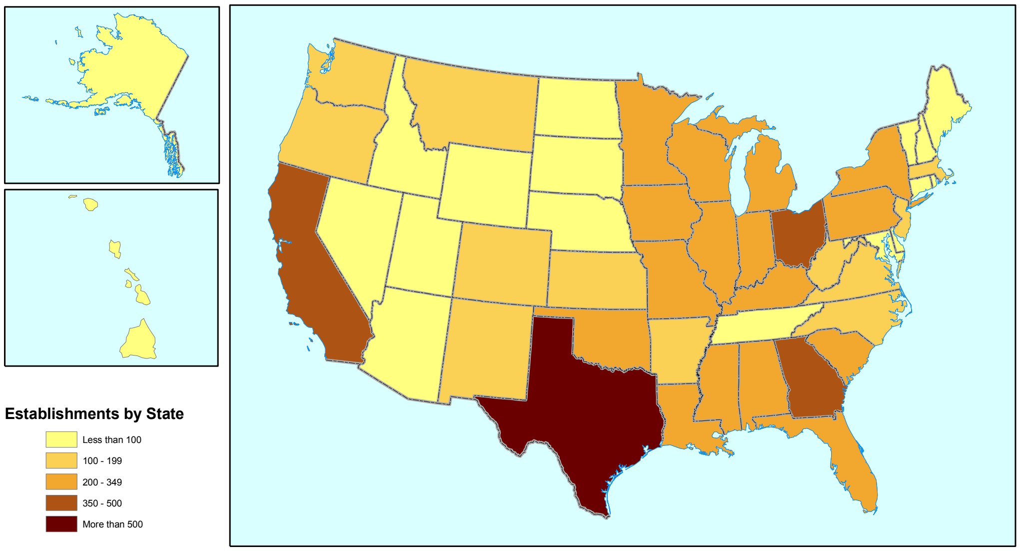


Figure 3-3. 2002 Regional Distribution of Establishments: Electric Power Generation, Transmission, and Distribution Industry (NAICS 2211)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002." <http://factfinder.census.gov>; (November 10, 2008).

As shown in Table 3-3, the four largest firms owned over 1,200 establishments and accounted for about 16% of total industry receipts/revenue. The 50 largest firms accounted for almost 6,000 establishments and about 78% of total receipts/revenue.

Investor-owned energy providers accounted for 67.5% of retail electricity sold in the United States in 2006 (Table 3-4). In 2007, less regulated investor-owned electric utility companies were on average more profitable than companies with greater regulation (Table 3-5). In 2006, enterprises within NAICS 2211 had a pre-tax profit margin of only 0.9% (Table 3-6).

In 2002, about 82% of firms generating, transmitting, or distributing electric power had receipts of under $50 million (Table 3-7). However, these firms accounted for only 11% of employment, with 89% of employees working for firms with revenues in excess of $100 million.

3.2 Oil and Gas Extraction

Formatted: Bullets and Numbering

3.2.1 Overview

Oil and gas extraction (NAICS 211) is an industry group within the mining sector (NAICS 21). It includes establishments that operate or develop oil and gas field properties

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-3. Firm Concentration for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

Commodity	Establishments	Receipts/Revenue Amount ($$10^6$)	Receipts/Revenue Percentage of Total	Number of Employees	Employees per Establishment
All firms	9,394	$325,028	100.0%	535,675	57
4 largest firms	1,260	$52,349	16.1%	68,432	54
8 largest firms	2,566	$95,223	29.3%	151,575	59
20 largest firms	3,942	$173,207	53.3%	271,393	69
50 largest firms	5,887	$253,015	77.8%	408,021	69

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002." <http://factfinder.census.gov>; (November 21, 2008).

through such activities as exploring for oil and gas, drilling and equipping wells, operating on-site equipment, and conducting other activities up to the point of shipment from the property.

Oil and gas extraction consists of two industries: crude petroleum and natural gas extraction (NAICS 211111) and natural gas liquid extraction (NAICS 211112). Crude petroleum and natural gas extraction is the larger industry; in 2002, it accounted for 93% of establishments and 75% of oil and gas extraction revenues.

Industrial production in this industry is particularly sensitive to hurricanes in the Gulf Coast. In September of both 2005 and 2008, production dropped 14% from the previous month. Production is currently 6% lower than it was in 1997 (Figure 3-4).

From 1997 to 2002, revenues from crude petroleum and natural gas extraction (NAICS 211111) grew less than 1% to almost $100 billion ($2007) (Table 3-8). At the same time, payroll dropped almost 8% and the number of employees dropped by almost 6%. The number of establishments dropped by over 8%; as a result, the average establishment revenue increased by 2.5%. Materials costs were approximately 25% of revenue over the period.

From 1997 to 2002, revenue from natural gas liquid extraction (NAICS 211112) grew over 7% to about $34 billion (Table 3-9). At the same time, payroll dropped 12% and the number of employees dropped by almost 9%. The number of establishments dropped by over 3%, resulting in an increase of revenue per establishment of about 10%.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-4. United States Retail Electricity Sales Statistics: 2006

	Full-Service Providers					Other Providers		
Item	**Investor-Owned**	**Public**	**Federal**	**Cooperative**	**Facility**	**Energy**	**Delivery**	**Total**
Number of entities	215	2,010	9	882	49	150	64	3,379
Number of retail customers	100,245,547	20,345,236	39,430	17,465,423	2,166	2,306,163	NA	140,403,965
Retail Sales (10^3 megawatthours)	2,476,445	549,124	42,359	370,410	12,397	219,185	NA	3,669,919
Percentage of retail sales	67.48	14.96	1.15	10.09	0.34	5.97	NA	100
Revenue from retail sales ($\$10^6$)	224,637	44,271	1,494	31,411	868	16,784	7,040	326,506
Percentage of revenue	68.8	13.56	0.46	9.62	0.27	5.14	2.16	100
Average retail price (cents/kWh)	9.06	8.06	3.53	8.48	7	7.66	3.21	8.9

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-5. FY 2007 Financial Data for 70 U.S. Shareholder-Owned Electric Utilities

	Profit Margin	Net Income	Operating Revenues
Investor-Owned Utilities	8.36%	$33,933	$405,938
Regulated[a]	7.12%	$12,078	$169,699
Mostly regulated[b]	8.89%	$13,776	$154,916
Diversified[c]	9.93%	$8,078	$81,323

[a]80%+ of total assets are regulated.
[b]50% to 80% of total assets are regulated.
[c]Less than 50% of total assets are regulated.

Source: Edison Electric Institute. "Income Statement: Q4 2007 Financial Update. Quarterly Report of the U.S. Shareholder-Owned Electric Utility Industry." <http://www.eei.org>.

Table 3-6. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 2211

Number of enterprises[a]	836
Total receipts (10^3)	$308,702,953
Net sales(10^3)	$289,887,930
Profit margin before tax	0.9%
Profit margin after tax	—

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

3.2.2 Goods and Services Used

Formatted: Bullets and Numbering

The oil and gas extraction industry has similar labor and tax requirements as the electric power generation sector. Extraction, support, power, and equipment requirements potentially associated with reciprocating internal combustion engines (oil and gas extraction, support activities, electric power generation, machinery and equipment rental and leasing, and pipeline transportation) represent around 8% of the value of services (Table 3-10).

3.2.3 Business Statistics

Formatted: Bullets and Numbering

The U.S. Economic Census and SUSB programs provide national information on the distribution of economic variables by industry, location, and size of business. Throughout this section and report, we use the following definitions:

- *Establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.

Table 3-7. Key Enterprise Statistics by Receipt Size for Electric Power Generation, Transmission, and Distribution (NAICS 2211): 2002

		Owned by Enterprises with									
Variable	**All Enterprises**	**0–99K Receipts**	**100–499.9K Receipts**	**500–999.9K Receipts**	**1,000–4,999.9K Receipts**	**5,000,000–9,999,999K Receipts**	**<10,000K Receipts**	**10,000–49,999K Receipts**	**50,000–99,999K Receipts**	**100,000K+ Receipts**
Firms	1,756	129	250	80	232	205	896	538	112	210
Establishments	9,493	129	250	85	245	262	971	978	403	7,141
Employment	515,769	429	834	3,139	2,712	5,620	12,734	31,573	14,858	456,604
Receipts ($\$10^3$)	\$320,502,670	\$5,596	\$63,339	\$57,363	\$627,414	\$1,472,405	\$2,226,117	\$12,171,098	\$7,607,166	\$298,498,289
Receipts/firm ($\$10^3$)	\$182,519	\$43	\$253	\$717	\$2,704	\$7,182	\$2,485	\$22,623	\$67,921	\$1,421,420
Receipts/establishment ($\$10^3$)	\$33,762	\$43	\$253	\$675	\$2,561	\$5,620	\$2,293	\$12,445	\$18,876	\$41,801
Receipts/employment (\$)	\$621,407	\$13,044	\$75,946	\$18,274	\$231,347	\$261,994	\$174,817	\$385,491	\$511,991	\$653,736

Source: U.S. Small Business Administration (SBA). 2008. “Firm Size Data from the Statistics of U.S. Businesses: U.S. All Industries Tabulated by Receipt Size: 2002.” <http://www.census.gov/csd/susb/susb02.htm>.

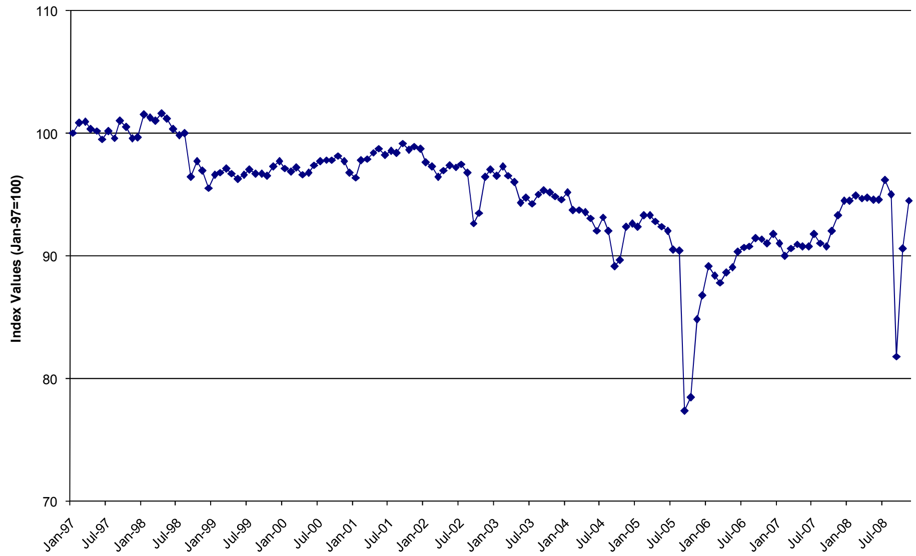


Figure 3-4. Industrial Production Index (NAICS 211)

Source: The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G211.S <http://www.federalreserve.gov/datadownload/>. (December 15, 2008).

Table 3-8. Key Statistics: Crude Petroleum and Natural Gas Extraction (NAICS 211111): ($2007)

	1997	2002
Revenue ($$10^6$)	97,832	98,667
Payroll ($$10^6$)	6,232	5,785
Employees	100,333	94,886
Establishments	7,784	7,178

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.

- *Firm*: A firm is a business organization consisting of one or more domestic establishments in the same state and industry that were specified under common ownership or control. The firm and the establishment are the same for single-

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-9. Key Statistics: Natural Gas Liquid Extraction (NAICS 211112) ($2007)

	1997	2002
Revenue ($$10^6$)	31,139	33,579
Payroll ($$10^6$)	679	607
Employees	10,548	9,693
Establishments	528	511

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

Table 3-10. Direct Requirements for Oil and Gas Extraction (NAICS 211): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00200	Taxes on production and imports, less subsidies	8.93%
V00100	Compensation of employees	6.67%
230301	Nonresidential maintenance and repair	6.36%
211000	Oil and gas extraction	1.91%
213112	Support activities for oil and gas operations	1.51%
221100	Electric power generation, transmission, and distribution	1.47%
541300	Architectural, engineering, and related services	1.24%
532400	Commercial and industrial machinery and equipment rental and leasing	1.20%
33291A	Valve and fittings other than plumbing	1.10%
541511	Custom computer programming services	0.99%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

establishment firms. For each multiestablishment firm, establishments *in the same industry within a state* are counted as one firm; the firm employment and annual payroll are summed from the associated establishments.

- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise; the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size

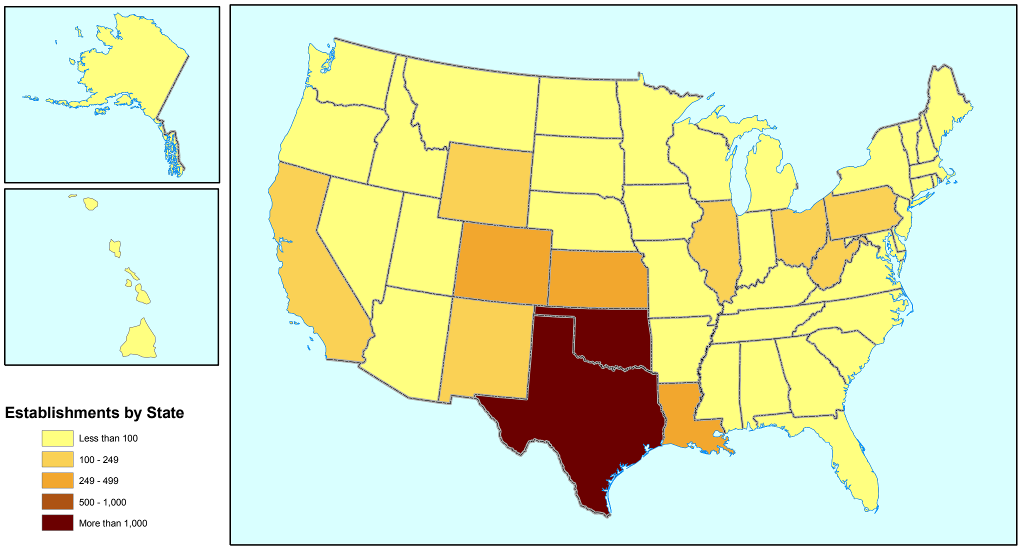


Figure 3-5. 2002 Regional Distribution of Establishments: Crude Petroleum and Natural Gas Extraction Industry (NAICS 211111)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Geographic Area Series: Industry Statistics for the State or Offshore Areas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

designations are determined by the summed employment of all associated establishments.

In 2002, Texas had almost 3,000 crude petroleum and natural gas extraction establishments, Oklahoma had about 1,000, and every other state had under 450 (Figure 3-5). Twenty states had fewer than 10 establishments. Similarly, Texas had 180 natural gas liquid extraction establishments, Louisiana had 76, and every other state had under 40 (Figure 3-6). Only nine states had 10 or more establishments, and 17 had no establishments.

According to the SUSB, 89% of crude petroleum and natural gas extraction firms had fewer than 500 employees in 2002 (Table 3-11). Sixty-three percent of natural gas liquid extraction firms had fewer than 500 employees in 2002 (Table 3-12).

Enterprises within this industry generated $165 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after-tax profit margin of 18.3% (Table 3-13).

Deleted: *OMB Review Draft – February 23, 2009*

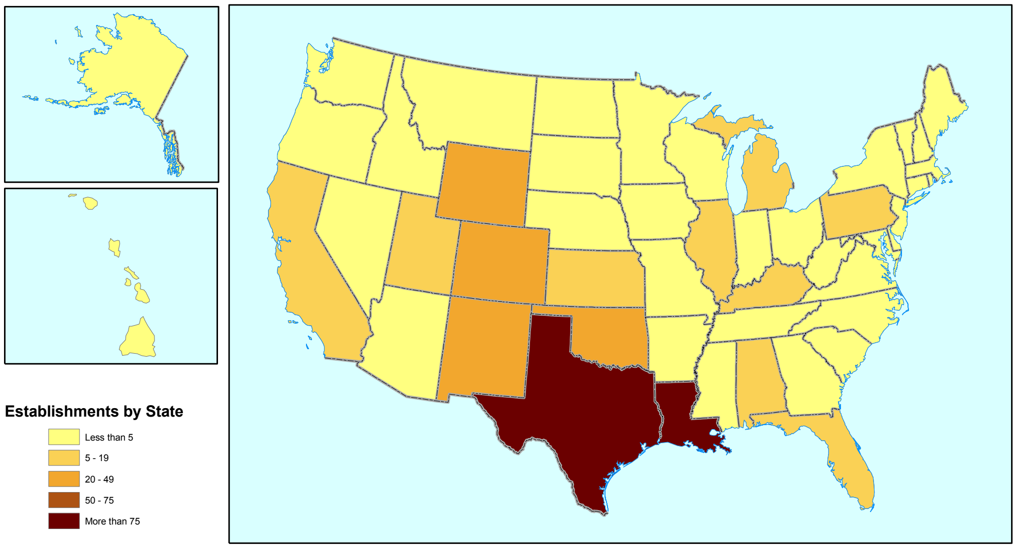


Figure 3-6. 2002 Regional Distribution of Establishments: Natural Gas Liquid Extraction Industry (NAICS 211112)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Geographic Area Series: Industry Statistics for the State or Offshore Areas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

Table 3-11. Key Enterprise Statistics by Employment Size for Crude Petroleum and Natural Gas Extraction (NAICS 211111): 2002

		Owned by Enterprises with					
Variable	All Enterprises	1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees	750–999 Employees	1,000–1,499 Employees
Firms	6,238	5,130	348	85	11	11	5
Establishments	7,135	5,185	449	254	37	63	25
Employment	76,794	5,825	5,171	2,757	Not disclosed	Not disclosed	Not disclosed
Receipts ($$10^3$)	$88,388,300	$2,353,181	$2,559,239	$2,051,860	Not disclosed	Not disclosed	Not disclosed
Receipts/firm ($$10^3$)	$14,169	$459	$7,354	$24,140	Not disclosed	Not disclosed	Not disclosed
Receipts/establishment ($$10^3$)	$12,388	$454	$5,700	$8,078	Not disclosed	Not disclosed	Not disclosed
Receipts/employment ($)	$1,150,979	$403,980	$494,921	$744,236	Not disclosed	Not disclosed	Not disclosed

Source: U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed%20sizes_6digitnaics.txt>.

3.2.4 Case Study: Marginal Wells

Formatted: Bullets and Numbering

To provide additional context for understanding energy sectors that use reciprocating internal combustion engines, we examine one segment of the oil and gas sector: marginal wells.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-12. Key Enterprise Statistics by Employment Size for Crude Natural Gas Liquid Extraction (NAICS 211112): 2002

		Owned by Enterprises with					
Variable	All Enterprises	1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees	750–999 Employees	1,000–1,499 Employees
Firms	113	54	7	10	2	1	2
Establishments	494	54	7	38	23	1	6
Employment	11,486	65	Not disclosed	241	Not disclosed	Not disclosed	Not disclosed
Receipts ($$10^3$)	$72,490,930	$13,862	Not disclosed	$383,496	Not disclosed	Not disclosed	Not disclosed
Receipts/firm ($$10^3$)	$641,513	$257	Not disclosed	$38,350	Not disclosed	Not disclosed	Not disclosed
Receipts/establishment ($$10^3$)	$146,743	$257	Not disclosed	$10,092	Not disclosed	Not disclosed	Not disclosed
Receipts/employment ($)	$6,311,242	$213,262	Not disclosed	$1,591,270	Not disclosed	Not disclosed	Not disclosed

Source: U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed%20sizes_6digitnaics.txt>.

Table 3-13. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 211

Number of enterprises[a]	17,097
Total receipts (10^3)	$164,841,432
Net sales(10^3)	$142,424,188
Profit margin before tax	24.6%
Profit margin after tax	18.3%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. “Almanac of Business and Industrial Financial Ratios: 2009 Edition.” CCH.

This industry includes small-volume wells that are mature in age, are more difficult to extract oil or natural gas from than other types of wells, and generally operate at very low levels of profitability. As a result, well operations can be quite responsive to small changes in the benefits and costs of their operation.

In 2006, there were approximately 420,000 marginal oil wells and 300,000 marginal gas wells (Interstate Oil and Gas Compact Commission [IOGCC], 2007). These wells provide the United States with 18% of oil and 9% of natural gas (IOGCC, 2007). Data for 2006 show that revenue from the over 700,000 wells was approximately $31.3 billion (Table 3-14).

Historical data show marginal oil production fluctuated between 1997 and 2006, reflecting the industry’s sensitivity to changes in economic conditions of fuel markets (see

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-14. Reported Gross Revenue Estimates from Marginal Wells: 2006

Well Type	Number of Wells	Production from Marginal Wells	Estimated Gross Revenue ($$10^9$)
Oil	422,255	335.312467 MMbbls	$20.1
Natural gas	296,721	1708.407584 MCF	$11.1
Total	718,976		$31.3

Source: Interstate Oil & Gas Compact Commission. 2007. "Marginal Wells: Fuel for Economic Growth." Table 3.B. Available at <http://iogcc.publishpath.com/Websites/iogcc/pdfs/2007-Marginal-Well-Report.pdf>.

Figure 3-7). In contrast, the number of marginal gas wells has continually increased during the past decade; the IOGCC estimates that daily production levels from these wells reached a 10-year high in 2005. Although we have been unable to find data on what fraction of these marginal wells are operated by small businesses, the IOGCC states that many are run by "mom and pop operators" (IOGCC, 2007).

3.3 Pipeline Transportation of Natural Gas

Formatted: Bullets and Numbering

3.3.1 Overview

Pipeline transportation of natural gas (NAICS 48621) is an industry group within the transportation and warehousing sector (NAICS 48-49), but more specifically in the pipeline transportation subsector (486). It includes the transmission of natural gas as well as the distribution of the gas through a local network to participating businesses.

From 1997 to 2002, natural gas transportation revenues fell by 7% to just under $23 billion ($2007) (Table 3-15). At the same time, payroll decreased by 7%, while the number of paid employees decreased by nearly 9%. However, the number of establishments increased by 17% from 1,450 establishments in 1997 to 1,701 in 2002.

3.3.2 Goods and Services Used

Formatted: Bullets and Numbering

The BEA reports pipeline transportation of natural gas only for total pipeline transportation (3-digit NAICS 486). In addition to pipeline transportation of natural gas (NAICS 4862), this industry includes pipeline transportation of crude oil (NAICS 4861) and other pipeline transportation (NAICS 4869. However, the BEA data are likely representative of the affected sector since pipeline transportation of natural gas accounts for 68% of NAICS 486 establishments and 72% of revenues (Figures 3-8 and 3-9).

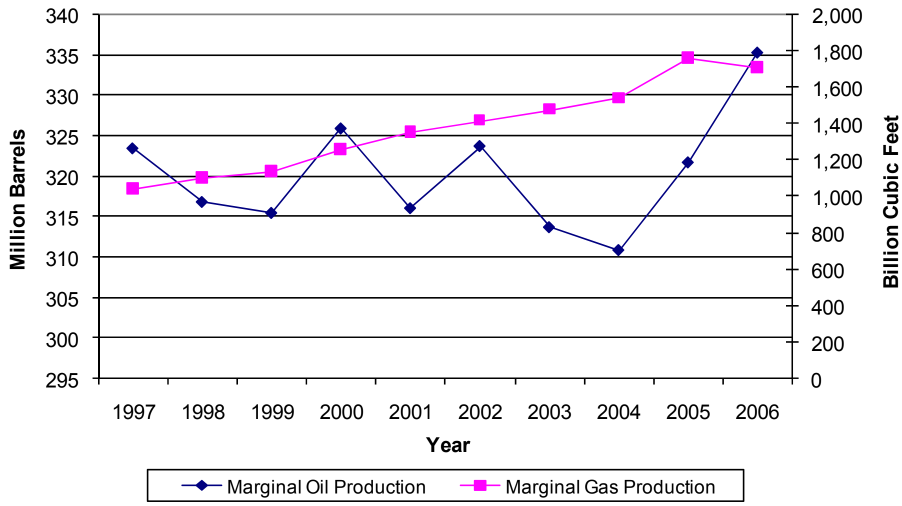


Figure 3-7. Trends in Marginal Oil and Gas Production: 1997 to 2006

Source: Interstate Oil & Gas Compact Commission. 2007. "Marginal Wells: Fuel for Economic Growth." Pages 3 and 11. Available at < http://iogcc.myshopify.com/collections/frontpage/products/2007-marginal-well-report-2007.pdf>.

Table 3-15. Key Statistics: Pipeline Transportation of Natural Gas (NAICS 48621) ($2007)

Year	1997	2002
Revenue ($$10^6$)	24,646	22,964
Payroll ($$10^6$)	2,662	2,438
Employees	35,789	32,542
Establishments	1,450	1,701

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Comparative Statistics for the United States (1997 NAICS Basis): 2002 and 1997" <http://factfinder.census.gov>; (December 12, 2008).

In Table 3-16, we use the latest detailed benchmark input-output data report by the BEA (2002) to identify the goods and services used by pipeline transportation (NAICS 486). As shown, labor, refineries, and maintenance requirements represent significant share of the cost associated with pipeline transportation. Power and equipment requirements potentially associated with reciprocating internal combustion engines (electric power generation and commercial and industrial machinery and equipment repair and maintenance) represent less than 2% of the value of services.

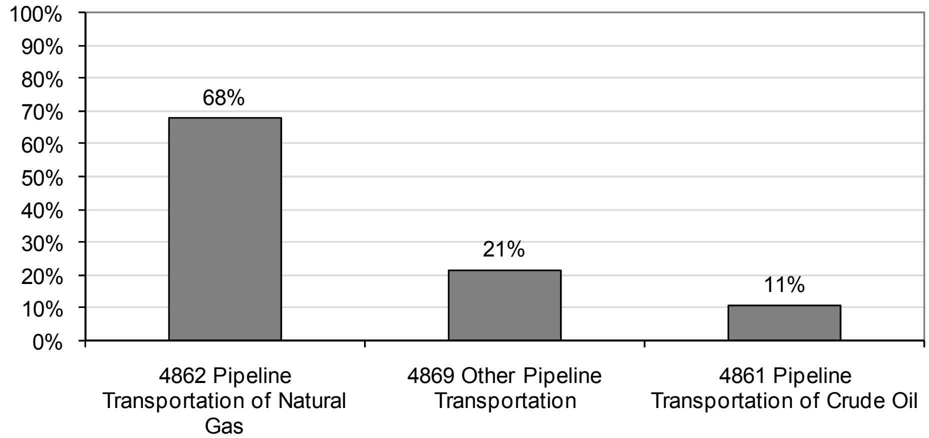


Figure 3-8. Distribution of Establishments within Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Summary Statistics for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

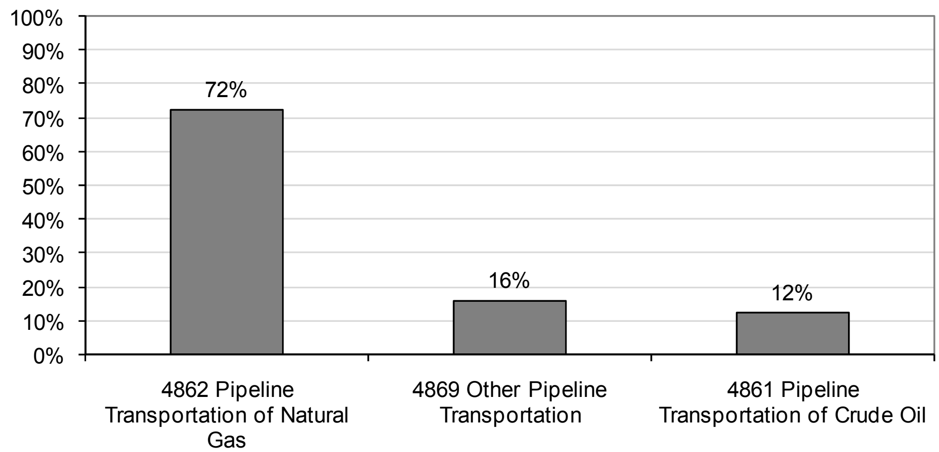


Figure 3-9. Distribution of Revenue within Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Summary Statistics for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-16. Direct Requirements for Pipeline Transportation (NAICS 486): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	14.78%
324110	Petroleum refineries	13.55%
230301	Nonresidential maintenance and repair	6.07%
211000	Oil and gas extraction	4.94%
333415	Air conditioning, refrigeration, and warm air heating equipment manufacturing	4.40%
561300	Employment services	4.26%
5416A0	Environmental and other technical consulting services	3.04%
541300	Architectural, engineering, and related services	3.04%
420000	Wholesale trade	2.79%
332310	Plate work and fabricated structural product manufacturing	2.72%
5419A0	All other miscellaneous professional, scientific, and technical services	2.48%
524100	Insurance carriers	2.38%
531000	Real estate	2.33%
52A000	Monetary authorities and depository credit intermediation	1.76%
V00200	Taxes on production and imports, less subsidies	1.41%
541100	Legal services	1.19%
221100	Electric power generation, transmission, and distribution	1.13%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

3.3.3 Business Statistics

Formatted: Bullets and Numbering

The pipeline transportation of natural gas is clearly concentrated in the two states closest to the refineries in the Gulf of Mexico. In 2002, Texas and Louisiana contributed to 31% of all pipeline transportation establishments in the United States (Figure 3-10) and 41% of all U.S. revenues. Other larger contributors with over 50 establishments in their states include Oklahoma, Pennsylvania, Kansas, Mississippi, and West Virginia.

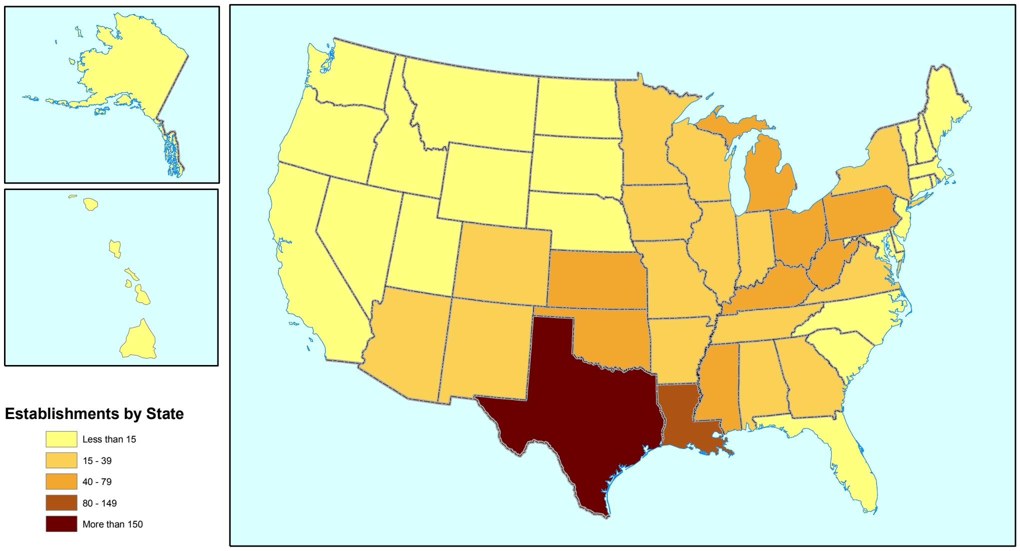


Figure 3-10. 2002 Regional Distribution of Establishments: Pipeline Transportation (NAICS 486)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Geographic Distribution—Pipeline transportation of natural gas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

According to 2002 U.S. Census data, about 86% of transportation of natural gas establishments were owned by corporations and about 8% were owned by individual proprietorships. About 6% were owned by partnerships (Figure 3-11). As shown in Table 3-17, the four largest firms accounted for nearly half of the establishments with 698, and just over half, 51%, of total revenue. The 50 largest firms accounted for over 1,354 establishments and about 99% of total revenue. The average number of employees per establishment was approximately 17 across all groups of firms.

Enterprises within pipeline transportation (NAICS 486) generated $6.6 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after-tax profit margin of 7.9% (Table 3-18).

The 2002 SUSB shows that 47% of all firms in this industry made under $5 million in revenue. Enterprises with revenue over $100 million provided an overwhelming share of employment in this industry (98%) (Table 3-19).

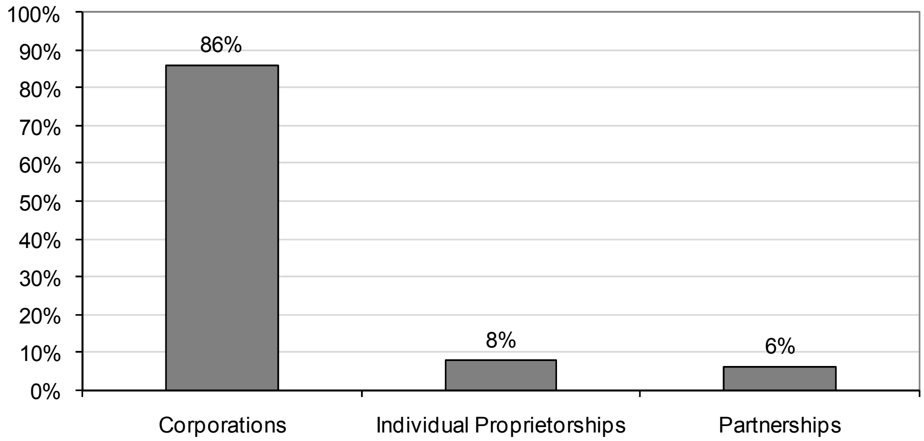


Figure 3-11. Share of Establishments by Legal Form of Organization in the Pipeline Transportation of Natural Gas Industry (NAICS 48621): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Transportation and Warehousing: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Table 3-17. Firm Concentration for Pipeline Transportation of Natural Gas (NAICS 48621): 2002

Commodity	Establishments	Receipts/Revenue: Amount ($$10^6$)	Receipts/Revenue: Percentage of Total	Number of Employees	Employees per Establishment
All firms	1,431	$14,797	100%	23,677	16.5
4 largest firms	698	$7,551	51%	11,814	16.9
8 largest firms	912	$10,059	68%	15,296	16.8
20 largest firms	1,283	$13,730	93%	21,792	17.0
50 largest firms	1,354	$14,718	99%	23,346	17.2

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-18. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 486

Number of enterprises[a]	410
Total receipts (10^3)	$6,606,472
Net sales(10^3)	$6,118,827
Profit margin before tax	12.9%
Profit margin after tax	7.8%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

3.4 General Medical and Surgical Hospitals

Formatted: Bullets and Numbering

3.4.1 *Overview*

General medical and surgical hospitals (NAICS 6221) is an industry group within the health care and social assistance sector (NAICS 62). It includes hospitals engaged in diagnostic and medical treatment (both surgical and nonsurgical) for inpatients with a broad range of medical conditions. They usually provide other services as well, including outpatient care, anatomical pathology, diagnostic X-rays, clinical laboratory work, and pharmacy services.

From 1997 to 2002, hospital revenues grew about 18% to over $500 billion ($2007) (Table 3-20). At the same time, payroll rose about 14%, while the number of employees increased by only 5%. The number of establishments declined during this period by almost 6%, resulting in an increase in revenue per establishment of almost 22%.

3.4.2 *Goods and Services Used*

Formatted: Bullets and Numbering

The BEA reports hospital expenditures only for hospitals (3-digit NAICS 622). In addition to general hospitals (NAICS 6221), this industry includes psychiatric and substance abuse hospitals (NAICS 6222) and specialty hospitals (NAICS 6223). However, these data should be representative of the affected sector since in 2002, general medical and surgical hospitals accounted for 92% of NAICS 622 establishments and 94% of revenues.

In Table 3-21, we use the latest detailed benchmark input-output data report by the BEA (2002) to identify the goods and services used by hospitals (NAICS 622). As shown, labor and land requirements represent a significant share of the value of hospital services. Power and equipment requirements potentially associated with reciprocating internal combustion engines (electric power generation and commercial and industrial machinery and equipment repair and maintenance) represent less than 2% of the value of services.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-19. Key Enterprise Statistics by Receipt Size for Pipeline Transportation of Natural Gas (NAICS 48621): 2002

		Owned by Enterprises with								
Variable	**All Enterprises**	**0–99K Receipts**	**100–499.9K Receipts**	**500–999.9K Receipts**	**1,000–4,999.9K Receipts**	**5,000,000–9,999,999K Receipts**	**<10,000K Receipts**	**10,000–49,999K Receipts**	**50,000–99,999K Receipts**	**100,000K+ Receipts**
Firms	154	8	32	10	22	6	78	11	4	61
Establishments	1,936	8	32	10	22	7	79	21	4	1,832
Employment	37,450	15	58	69	138	88	368	216	274	36,592
Receipts ($\$10^3$)	$35,896,535	$524	$8,681	$7,451	$46,429	$40,967	$104,052	$188,424	$154,384	$35,449,675
Receipts/firm ($\$10^3$)	$233,094	$66	$271	$745	$2,110	$6,828	$1,334	$17,129	$38,596	$581,142
Receipts/establishment ($\$10^3$)	$18,542	$66	$271	$745	$2,110	$5,852	$1,317	$8,973	$38,596	$19,350
Receipts/employment ($)	$958,519	$34,933	$149,672	$107,986	$336,442	$465,534	$282,750	$872,333	$563,445	$968,782

Source: U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-20. Key Statistics: General Medical and Surgical Hospitals (NAICS 6221) ($2007)

	1997	2002
Revenue ($$10^6$)	444,141	539,502
Payroll ($$10^6$)	178,874	209,063
Employees	4,526,591	4,772,422
Establishments	5,487	5,193

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: 2002 and 1997." <http://factfinder.census.gov>; (November 10, 2008).

Table 3-21. Direct Requirements for Hospitals (NAICS 622): 2002

Commodity	Commodity Description	Direct Requirements Coefficients[a]
V00100	Compensation of employees	51.90%
531000	Real estate	10.76%
550000	Management of companies and enterprises	4.02%
621B00	Medical and diagnostic labs and outpatient and other ambulatory care services	2.22%
561300	Employment services	1.90%
325412	Pharmaceutical preparation manufacturing	1.86%
325413	In-vitro diagnostic substance manufacturing	1.66%
524100	Insurance carriers	1.66%
420000	Wholesale trade	1.62%
221100	Electric power generation, transmission, and distribution	1.14%

[a] These values show the amount of the commodity required to produce $1.00 of the industry's output. The values are expressed in percentage terms (coefficient ×100).

Source: U.S. Bureau of Economic Analysis. 2002. 2002 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5.

3.4.3 Business Statistics

Formatted: Bullets and Numbering

In 2002, California and Texas each had around 400 hospitals, and New York, Pennsylvania, Florida, and Illinois all had more than 200 (Figure 3-12). Vermont, Rhode Island, Delaware, and the District of Columbia all had fewer than 20 hospital establishments in their states.

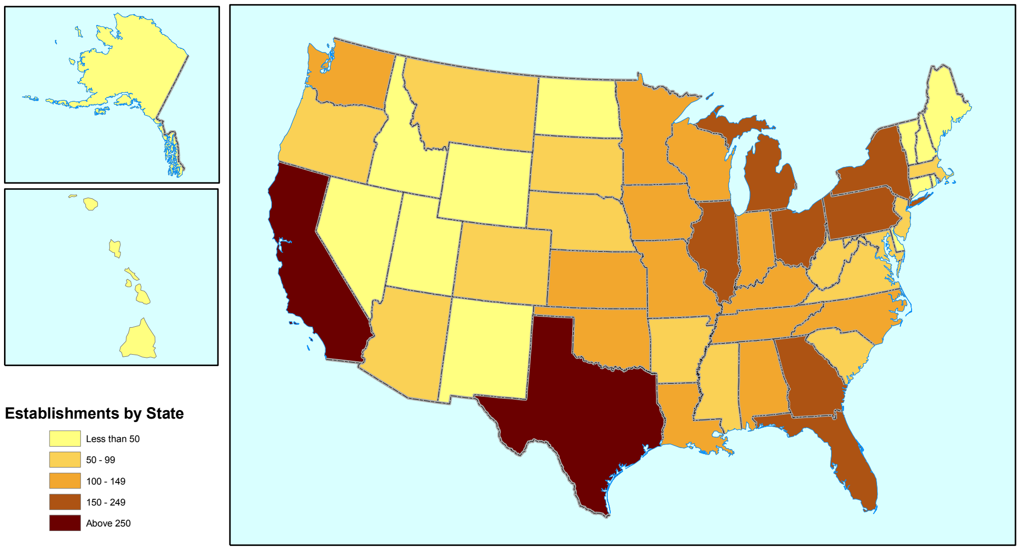


Figure 3-12. 2002 Regional Distribution of Establishments: General Medical and Surgical Hospital Industry (NAICS 6221)

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: Summary Statistics: 2002." <http://factfinder.census.gov>; (November 10, 2008).

According to 2002 Census data, 79.6% of general hospitals were owned by corporations, 19.5% were individual proprietorships, and about 0.7% were partnerships (Figure 3-13). As shown in Table 3-22, the four largest firms accounted for almost 400 establishments and about 10% of total revenue. The 50 largest firms accounted for over 1,100 establishments and about 30% of total revenue. In addition, about 27% of all general hospitals are owned or controlled by the government, with most of those at the local level (Table 3-23).

In 2006, the United States had 4,927 community hospitals (Table 3-24); nongovernmental not-for-profit hospitals accounted for 59% of these hospitals, and 75% of the expenses of all community hospitals.

Enterprises including hospitals, nursing and residential care facilities, and social assistance (NAICS 622-4) generated $108 billion in total receipts in 2006. Including those enterprises without net income, the industry averaged an after- tax profit margin of 3.1% (Table 3-25).

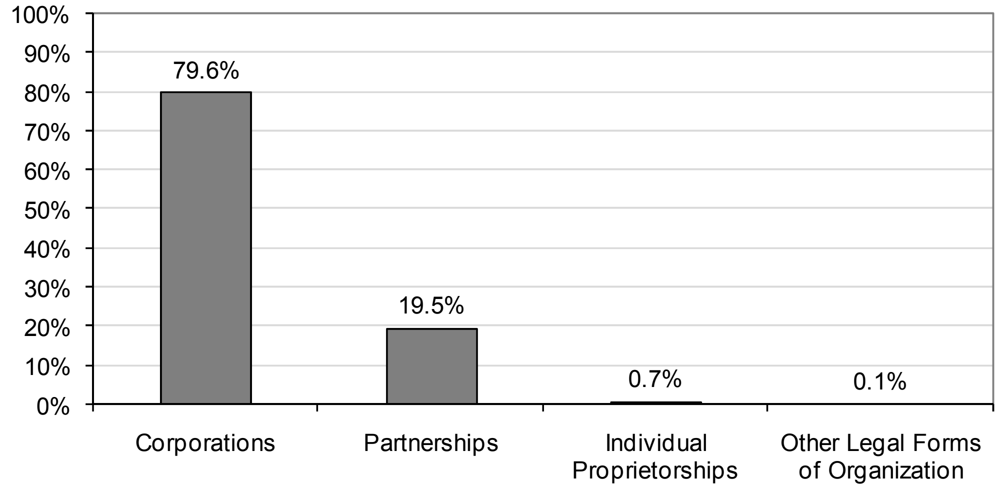


Figure 3-13. Share of Establishments by Legal Form of Organization in the General Medical and Surgical Hospitals Industry (NAICS 6221): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-22. Firm Concentration for General Medical and Surgical Hospitals (NAICS 6221): 2002

		Receipts/Revenue			
Commodity	Establishments	Amount ($\$10^6$)	Percentage of Total	Number of Employees	Employees per Establishment
All firms	5,193	$469,727	100.0%	4,772,422	919
4 largest firms	391	$44,124	9.4%	389,152	995
8 largest firms	507	$60,708	12.9%	537,695	1,061
20 largest firms	777	$92,466	19.7%	831,988	1,071
50 largest firms	1,138	$139,501	29.7%	1,279,444	1,124

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-23. Government Control and Ownership for General Medical and Surgical Hospitals (NAICS 6221): 2002

Commodity	Establishments	Percentage of Total	Receipts/Revenue Amount ($$10^6$)	Receipts/Revenue Percentage of Total	Number of Employees	Employees per Establishment
All firms	5,193	100.0%	$469,727	100.0%	4,772,422	919
All government owned and controlled hospitals	1,408	27.1%	$91,956	19.6%	962,772	684
Federal government	258	5.0%	$25,993	5.5%	257,766	999
State government	98	1.9%	$19,029	4.1%	176,754	1,804
Local government	1,052	20.3%	$46,934	10.0%	528,252	502

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

Table 3-24. Hospital Statistics: 2006

Community Hospitals	Number	Total Expenses (10^3)	Total Net Revenue (10^3)
Total	4,927	$551,835,328	$587,050,914
Nongovernment not-for-profit	2,919	$412,867,575	NA
Investor-owned	889	$54,994,199	NA
State and local government	1,119	$83,973,554	NA

NA = Not available

Source: American Hospital Association. 2007. "AHA Hospital Statistics: 2008 Edition." Health Forum.

Table 3-25. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 622-4

Number of enterprises[a]	18,263
Total receipts (10^3)	$108,074,793
Net sales(10^3)	$102,300,229
Profit margin before tax	4.4%
Profit margin after tax	3.1%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

The SUSB reports 27% of general hospitals have receipts of less than $10 million and 41% report receipts above $50 million (Table 3-26). Large hospitals employ a significant share of the people working in this industry.

3.5 Irrigation Sets and Welding Equipment

3.5.1 Overview

The U.S. Economic Census classifies irrigation equipment under the farm machinery and equipment manufacturing industry group (NAICS 333111). This U.S. industry comprises establishments primarily engaged in manufacturing agricultural and farm machinery and equipment and other turf and grounds care equipment, including planting, harvesting, and grass-mowing equipment (except lawn and garden type).

From 1997 to 2002, farm machinery and equipment manufacturing revenues fell by $3 billion from $18 billion to $15 billion (Table 3-27). At the same time, payroll decreased by 19% and the number of paid employees decreased by nearly 19%. The number of establishments dropped by 9% from 1,339 establishments in 1997 to 1,214 in 2002. Industrial production in the industry is currently 13% lower than in 1997 (Figure 3-14).

The U.S. Economic Census classifies welding equipment under the welding and soldering equipment manufacturing industry group (NAICS 333992). This U.S. industry comprises establishments primarily engaged in manufacturing welding and soldering equipment and accessories (except transformers), such as welding electrodes, welding wire, and soldering equipment (except handheld).

From 1997 to 2002 welding and soldering equipment manufacturing revenue fell by about 22% to $1 billion (Table 3-28). At the same time, payroll decreased by 21% and the number of paid employees decreased by nearly 28%. The number of establishments dropped by 8% from 250 establishments in 1997 to 231 in 2002.

3.5.2 Irrigation and Welding Services

The demand for equipment is derived from the demand for the services the equipment provides. We describe uses and industrial consumers of this equipment.

3.5.2.1 Irrigation

Demand for irrigation equipment is driven by farm operation decisions, optimal replacement considerations, and climate and weather conditions. The National Agriculture Statistics Service (NASS) 2003 Farm and Ranch Irrigation Survey (USDA-NASS, 2004) shows

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

Table 3-26. Key Enterprise Statistics by Receipt Size for General Medical and Surgical Hospitals (NAICS 6221): 2002 ($2007)

		Owned by Enterprises with								
Variable	**All Enterprises**	**0–99K Receipts**	**100–499.9K Receipts**	**500–999.9K Receipts**	**1,000–4,999.9K Receipts**	**5,000,000–9,999,999K Receipts**	**<10,000K Receipts**	**10,000–49,999K Receipts**	**50,000–99,999K Receipts**	**100,000K+ Receipts**
Firms	3,581	64	77	59	344	437	981	1,116	438	1,046
Establishments	5,971	64	77	59	356	454	1,010	1,203	519	3,239
Employment	4,713,450	2,500-4999	250-499	730	18,675	56,296	78,980	347,613	337,885	3,948,972
Receipts ($$10^3$)	$468,007,640	Not disclosed	Not disclosed	$42,017	$1,084,945	$3,165,513	$4,317,321	$26,036,570	$29,039,799	$408,613,950
Receipts/firm ($$10^3$)	$130,692	Not disclosed	Not disclosed	$712	$3,154	$7,244	$4,401	$23,330	$66,301	$390,644
Receipts/establishment ($$10^3$)	$78,380	Not disclosed	Not disclosed	$712	$3,048	$6,972	$4,275	$21,643	$55,953	$126,154
Receipts/employment ($)	$99,292	Not disclosed	Not disclosed	$57,558	$58,096	$56,230	$54,663	$74,901	$85,946	$103,473

Source: U.S. Small Business Administration (SBA). 2008. "Firm Size Data from the Statistics of U.S. Businesses: U.S. All Industries Tabulated by Receipt Size: 2002." <http://www.census.gov/csd/susb/susb02.htm>.

Table 3-27. Key Statistics: Farm Machinery and Equipment Manufacturing (NAICS 333111) ($2007)

	1997	2002
Revenue ($$10^6$)	$17,838	$15,006
Payroll ($$10^6$)	$2,644	$2,132
Employees	66,370	53,817
Establishments	1,339	1,214

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years" <http://factfinder.census.gov>; (November 25, 2008).

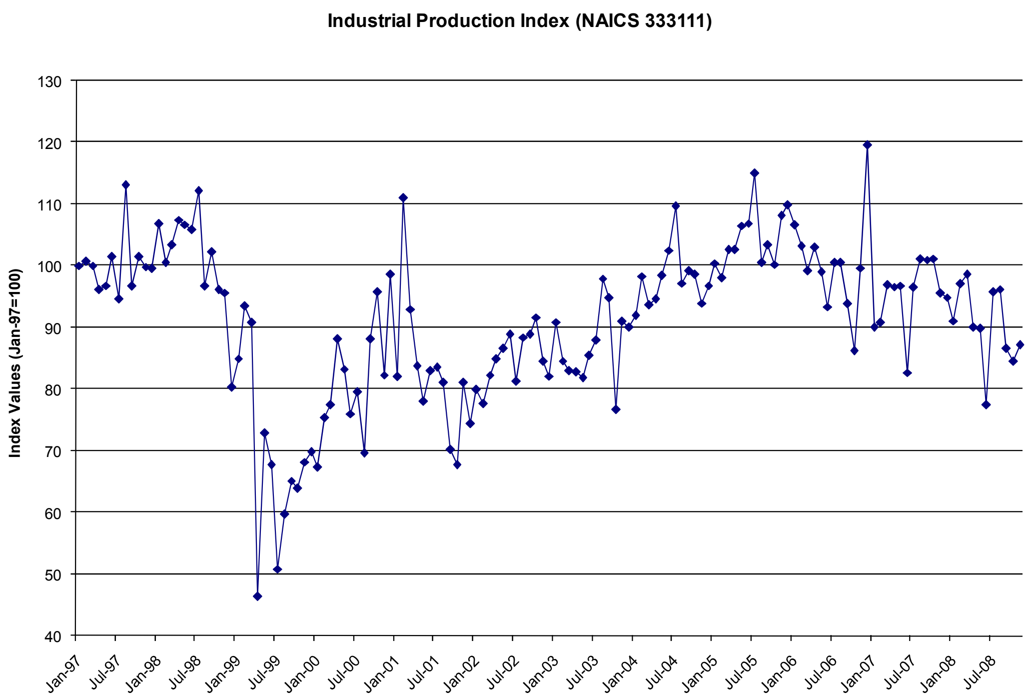


Figure 3-14. Industrial Production Index (NAICS 333111)

Table 3-28. Key Statistics: Welding and Soldering Equipment Manufacturing (NAICS 333992) ($2007)

	1997	2002
Revenue ($$10^6$)	$4,957	$3,880
Payroll ($$10^6$)	$1,024	$811
Employees	22,505	16,128
Establishments	250	231

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years." <http://factfinder.census.gov>; (November 25, 2008).

that the top five states ranked by total acres irrigated are California, Nebraska, Texas, Arkansas, and Idaho. Approximately 32 million of the 53 million, or 68%, of U.S. irrigated acres are used to support oilseed and grain farming and other crop farming (tobacco, cotton, sugar cane, and other).

The survey reported that approximately 500,000 pumps were used on U.S. farms in 2003 with energy expenses totaling $1.6 billion. Electricity is the dominant form of energy expense for irrigation pumps, accounting for 60% of total energy expenses. Diesel fuel is second (18%), followed by natural gas (18%) and other forms of energy such as gasoline (4%).

Per-acre operating costs for these irrigation systems vary by fuel type, and natural gas was the most expensive in 2003 ($57 per acre for well systems and $34 per acre for surface water systems) (Table 3-29). Systems using diesel fuel were operated at approximately half of these per-acre costs ($25 per acre for well systems and $16 per acre for surface water systems). Gasoline- and gasohol-powered systems offered the least expensive operating costs ($12 per acre for well systems and $18 per acre for surface water systems).

As shown in Table 3-30, the number of on-farm pumps fell from 508,727 to 497,443 (2%) between 1998 and 2003. However, the use of electric- and diesel-powered pumps increased during this period (3% and 4%, respectively), while other fuel sources such as gasoline declined significantly. Pumps powered by gasoline and gasohol, for example, declined from 8,965 to 6,178, a 31% change during this period. Pumps powered by natural gas, LP gas, propane, and butane also declined by 26% to 29%. Although 1998 operating cost data are not available, the change in relative costs of operation across fuels between 1998 and 2003 may partly explain

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-29. Expenses per Acre by Type of Energy: 2003

Fuel Type	Irrigated by Water from Wells	Irrigated by Surface Water
Electricity	$42.64	$29.84
Natural gas	$57.25	$33.67
LP gas, propane, butane	$27.21	$22.68
Diesel fuel	$25.09	$16.27
Gasoline and gasohol	$11.60	$18.05
Total	$39.50	$26.39

Source: U.S. Department of Agriculture, National Agricultural Statistics Service. 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 20.

Table 3-30. Number of On-Farm Pumps of Irrigation Water by Type of Energy: 1998 and 2003

Fuel Type	1998	2003	Percentage Change
Electricity	308,579	319,102	3%
Natural gas	58,880	41,771	–29%
LP gas, propane, butane	23,964	17,792	–26%
Diesel fuel	108,339	112,600	4%
Gasoline and gasohol	8,965	6,178	–31%
Total	508,727	497,443	–2%

Source: U.S. Department of Agriculture, National Agricultural Statistics Service. 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 20.

these patterns. Although no information is available on the use and construction of on-farm pumps specifically, their use is tied to the amount of agricultural land in production. USDA reports that planted acres of the eight major crops hit a 5-year high of 252 million acres in 2008 but will fall and level off to around 244 million acres over the next 2 to 4 years (USDA, 2008).

3.5.2.2 *Welding*

Formatted: Bullets and Numbering

Welding is used in a wide variety of applications. One of the biggest manufacturers of welding products identifies the following key end-user segments:

- general metal fabrication;
- infrastructure including oil and gas pipelines and platforms, buildings, bridges, and power generation;

Deleted: *OMB Review Draft – February 23, 2009*

- transportation and defense industries (automotive, trucks, rail, ships, and aerospace);
- equipment manufacturers in construction, farming, and mining;
- retail resellers; and
- rental market (Lincoln Electric Holdings, 2006).

Lincoln Electric further describes the following key applications: power generation and process industries, offshore production of oil and gas, pipelines/pipemills, and heavy fabrication (earthmoving and construction equipment and agricultural and farm equipment.

3.5.3 Business Statistics

Formatted: Bullets and Numbering

In 2003, California and Texas each had more than 5 million irrigated acres (Figure 3-15). Midwest states like Arkansas and Nebraska had more than 2.5 million irrigated acres. Heavy and civil engineering construction establishments are spread throughout the United States, particularly in areas such as California, Texas, North Carolina, and Florida (Figure 3-16). Each of these states has more than 2,000 establishments.

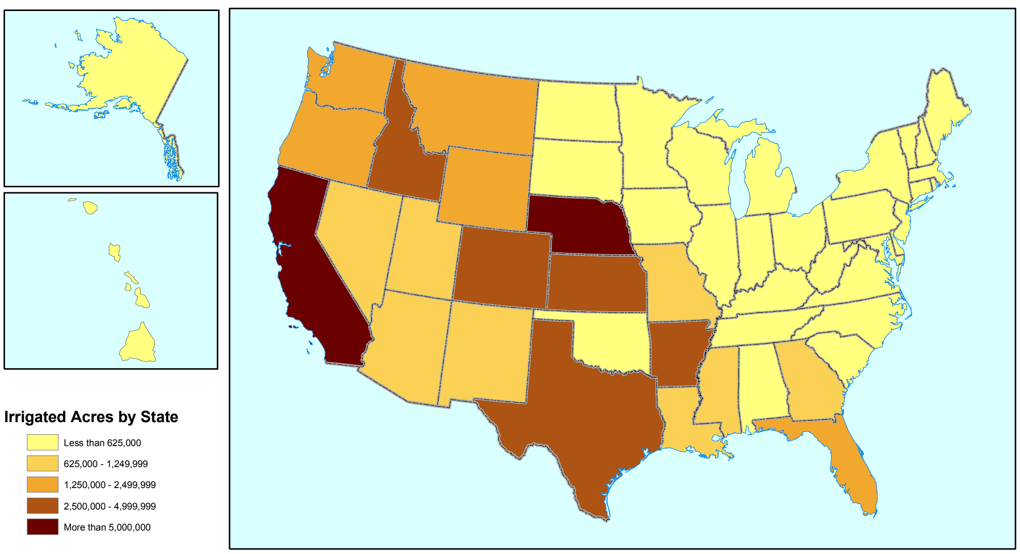


Figure 3-15. 2003 Regional Distribution of Irrigated Acres

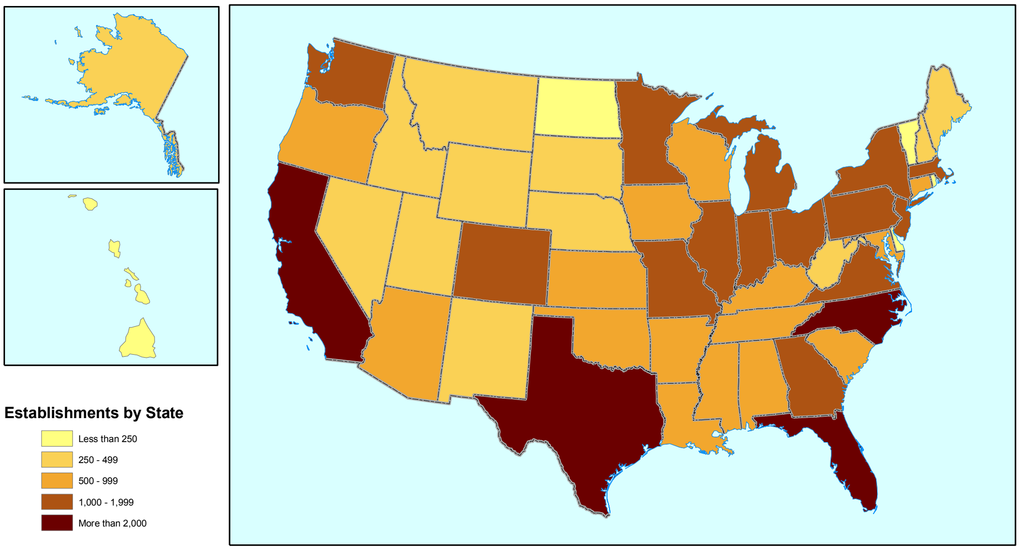


Figure 3-16. 2002 Regional Distribution of Establishments: Heavy and Civil Engineering Construction (NAICS 237)

As shown in Table 3-31, the market value of agriculture products sold was less than $25,000 per year on almost half the irrigated farms in the 2003 Farm and Ranch Irrigation Survey. Over 90% of the irrigated farms had agricultural product revenue below $750,000. It is not clear what fraction of these farms use stationary diesel engines or are owned by corporate farming operations. However, SUSB data also suggest 65% of firms in NAICS 11 have receipts less than $500,000 per year.

Table 3-31. Distribution of Farm Statistics by Market Value of Agricultural Products Sold: 2003

Variable	All Farms	<$25K	$25–$49K	$50–$99K	$100–$250K	$250–$500K	$500–$999K	$1,000K or More
Farms	220,163	48%	10%	11%	13%	8%	5%	4%
Land in farms (acres)	196,515,390	8%	6%	9%	21%	17%	16%	23%
Acres irrigated	52,583,431	5%	4%	7%	18%	18%	19%	29%
Irrigate cropland harvest (acres)	48,626,955	4%	3%	7%	18%	19%	20%	30%

Source: U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 2004. "2003 Farm and Ranch Irrigation Survey." Washington, DC: USDA-NASS. Table 34.

Deleted: *OMB Review Draft – February 23, 2009*

Enterprises within agriculture, construction, and mining machinery manufacturing (NAICS 3331) generated $118 billion of total receipts in 2006, while those in other general purpose machinery manufacturing (NAICS 3339) generated $69.8 billion. The average after-tax profit margin in these two industries was 6.9% and 4.7%, respectively (Table 3-32).

Table 3-32. Aggregate Tax Data for Accounting Period 7/05–6/06: NAICS 3331,9

	Agriculture, Construction, & Mining Machinery Manufacturing	Other General Purpose Machinery Manufacturing
Number of enterprises[a]	2,485	7,288
Total receipts (10^3)	$118,369,636	$69,813,244
Net sales(10^3)	$108,210,188	$65,256,901
Profit margin before tax	9.1%	6.1%
Profit Margin after tax	6.9%	4.7%

[a]Includes corporations with and without net income.

Source: Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

As noted earlier, welding equipment is used in heavy fabrication such as earthmoving and construction equipment. We focus on the size distribution for a representative sector in this section (NAICS 327, Heavy and Civil Engineering Construction); other subsections in Section 2 cover other sectors that potentially use equipment powered by diesel engines (e.g., power generation and offshore gas distribution). As shown in Table 3-33, SUSB data suggest 60% of firms in this industry have receipts less than $1 million per year; 90% are below the Small Business Administration (SBA) threshold on $50 million per year. However, it is not clear what fraction of these firms use stationary diesel engines.

Deleted: *OMB Review Draft – February 23, 2009*

Table 3-33. Key Enterprise Statistics by Receipt Size for Heavy Construction: 2002[a]

Variable	All Enterprises	Owned by Enterprises with 0–99K Receipts	100–499.9K Receipts	500–999.9K Receipts	1,000–4,999.9K Receipts	5,000,000–9,999,999K Receipts	<10,000K Receipts	10,000–49,999K Receipts	50,000–99,999K Receipts	100,000K+ Receipts
Firms	38,610	4,570	12,733	5,882	9,994	2,398	35,577	2,395	294	344
Establishments	39,949	4,570	12,733	5,883	10,025	2,427	35,638	2,561	405	1,345
Employment	856,312	5,219	35,592	37,498	156,941	87,858	323,108	199,532	64,681	268,991
Receipts ($$10^3$)	$174,384,008	$237,458	$3,346,936	$4,191,113	$22,641,664	$16,573,417	$46,990,588	$46,244,065	$16,728,737	$64,420,618
Receipts/firm ($$10^3$)	$4,517	$52	$263	$713	$2,266	$6,911	$1,321	$19,309	$56,900	$187,269
Receipts/establishment ($$10^3$)	$4,365	$52	$263	$712	$2,259	$6,829	$1,319	$18,057	$41,306	$47,896
Receipts/employment ($)	$203,645	$45,499	$94,036	$111,769	$144,269	$188,639	$145,433	$231,763	$258,634	$239,490

[a] 2002 SUSB NAICS 224. The most comparable 2002 NAICS code for this industry is 237.

Source: U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. http://www2.census.gov/csd/susb/2002/usalli_r02.xls.

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 4

REGULATORY ALTERNATIVES, COSTS, AND EMISSION IMPACTS

Formatted: Bullets and Numbering

Formatted: Indent: First line: 36 pt

4.1 Background

This action proposes national emission standards for hazardous air pollutants (NESHAP) from existing stationary reciprocating internal combustion engines (RICE) with a site rating of less than or equal to 500 hp located at major sources, and existing stationary RICE located at area sources. The final NESHAP for stationary RICE would be promulgated under 40 CFR part 63, subpart ZZZZ, which already contains standards applicable to new stationary RICE and existing stationary RICE with a site rating above 500 hp located at major sources. In addition, EPA is proposing national emission standards for hazardous air pollutants for existing stationary compression ignition engines greater than 500 brake horsepower that are located at major sources, based on a new review of these engines following the first RICE NESHAP rulemaking in 2004. Also, this action proposes NESHAP for existing stationary RICE of any power rating located at area sources. In addition, EPA is proposing to amend the previously promulgated regulations regarding operation of stationary reciprocating internal combustion engines during periods of startup, shutdown and malfunction. EPA is proposing these requirements to meet its statutory obligation to address hazardous air pollutants (HAP) emissions from these sources under sections 112(d) and 112(k) of the CAA.

EPA promulgated NESHAP (in this case, a MACT standard) for existing, new, and reconstructed stationary RICE greater than 500 hp located at major sources on June 15, 2004 (69 FR 33474). EPA promulgated NESHAP for new and reconstructed stationary RICE that are located at area sources of HAP emissions and for new and reconstructed stationary RICE that have a site rating of less than or equal to 500 hp that are located at major sources of HAP emissions on January 18, 2008 (73 FR 3568). At that time, EPA did not promulgate a final decision for existing stationary RICE that are located at area sources of HAP emissions or for existing stationary RICE that have a site rating of less than or equal to 500 hp that are located at major sources of HAP emissions due to comments received indicating that the proposed MACT determinations for existing sources were inappropriate and because of a U.S. Court of Appeals for the District of Columbia Circuit ruling on March 13, 2007, involving litigation on the "Brick MACT," which set emission standards for major sources in that source category (40 CFR part 63, subpart JJJJJ), that appeared to impact EPA's ability to finalize its proposed "no reduction" MACT standards for existing sources. *Sierra Club* v. *EPA*, 479 F.3d 875 (DC Cir 2007). Among other things, the D.C. Circuit found that EPA's no emission reduction MACT determination in the challenged rule was unlawful. Because in the proposed stationary RICE rule EPA used a MACT floor methodology similar to the methodology used in the Brick MACT, EPA decided to re-evaluate the MACT floors for existing major sources that have a site rating of less than or equal to 500 brake hp consistent with the Court's decision in the Brick MACT case. EPA has also re-evaluated the standards for existing area sources in light of the comments received on the proposed rule.

This proposal initiates a separate rulemaking process that focuses on existing sources. EPA has gathered further information on existing engines and has considered comments it received on the original proposed rule and the intervening court decision in creating this proposed rulemaking.

In addition, stakeholders have encouraged the Agency to review whether there are further ways to reduce emissions of pollutants from existing stationary diesel engines. In its comments on EPA's 2006 proposed rule for new stationary diesel engines,[1] Environmental Defense Fund suggested several possible avenues for the regulation of existing stationary diesel engines, including use of diesel oxidation catalysts or catalyzed diesel particulate filters (CDPF), as well as the use of ultra low sulfur diesel (ULSD) fuel. Environmental Defense Fund suggested that such controls can provide significant pollution reductions at reasonable cost. EPA issued an advance notice of proposed rulemaking (ANPRM) in January 2008, where it solicited comment on several issues concerning options to regulate emissions of pollutants from existing stationary diesel engines, generally, and specifically from larger, older stationary diesel engines. EPA solicited comment and collected information to aid decision-making related to the reduction of HAP emissions from existing stationary diesel engines and specifically from larger, older engines under Clean Air Act (CAA) section 112 authorities. The Agency sought comment on the larger, older engines because available data indicate that those engines emit the majority of particulate matter (PM) and toxic emissions from non-emergency stationary engines as a whole.

EPA has taken several actions over the past several years to reduce exhaust pollutants from stationary diesel engines, but believes that further reducing exhaust pollutants from stationary diesel engines, particularly existing stationary diesel engines that have not been subject to Federal standards, are justified. Therefore, EPA is proposing emissions reductions from existing stationary diesel engines.

[1] "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines and National Emission Standards for Hazardous Air Pollution for Reciprocating Internal Combustion Engines," 71 FR 33803–33855, www.epa.gov/ttn/atw/rice/ricepg.html, June 12, 2006.

4.2 Summary of the Proposed Rule

4.2.1 What Is the Source Category Regulated by this Proposed Rule?

This proposed rule addresses emissions from existing stationary engines less than or equal to 500 hp located at major sources and all stationary engines located at area sources. A major source of HAP emissions is a plant site that emits or has the potential to emit any single HAP at a rate of 10 tons (9.07 megagrams) or more per year or any combination of HAP at a rate of 25 tons (22.68 megagrams) or more per year, except that for oil and gas production facilities, a major source of HAP emissions is determined for each surface site. An area source of HAP emissions is a source that is not a major source. This proposed rule also addresses emissions from existing compression ignition (CI) engines greater than 500 hp located at major sources.

4.2.1.1 Stationary RICE ≤500 hp at Major Sources

This action proposes to revise 40 CFR part 63, subpart ZZZZ, to address HAP emissions from existing stationary RICE less than or equal to 500 hp located at major sources. For stationary engines less than or equal to 500 hp at major sources, EPA must determine what is the appropriate MACT for those engines under section 112(d)(3) of the CAA.

EPA has divided the source category into the following subcategories: stationary RICE less than 50 hp, landfill and digester gas stationary RICE greater than or equal to 50 hp, CI stationary RICE greater than or equal to 50 hp, and spark ignition (SI) stationary RICE greater than or equal to 50 hp. The CI stationary RICE greater than or equal to 50 hp subcategory was further subcategorized into emergency and non-emergency engines, as was the subcategory of SI stationary RICE greater than or equal to 50 hp. Spark ignition non-emergency stationary RICE greater than or equal to 50 hp were then subcategorized into 2-stroke lean burn (2SLB), 4-stroke lean burn (4SLB), and 4-stroke rich burn (4SRB) stationary RICE. The 2SLB and 4SLB stationary RICE greater than or equal to 50 hp subcategories were further subcategorized into below 250 hp and greater than or equal to 250 hp.

4.2.1.2 Stationary RICE at Area Sources

This action proposes to revise 40 CFR part 63, subpart ZZZZ, in order to address HAP emissions from existing stationary RICE located at area sources. For stationary engines located at area sources, EPA has the flexibility to promulgate standards based on generally available control technology or management practices (GACT) under CAA section 112(d)(5). EPA is required to address HAP emissions from stationary RICE located at area sources under section 112(k) of the CAA, based on criteria set forth by EPA in the Urban Air Toxics Strategy.

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

The subcategories for area sources are the same as those for major sources and are: stationary RICE less than 50 hp, landfill and digester gas stationary RICE greater than or equal to 50 hp, CI emergency stationary RICE greater than or equal to 50 hp, CI non-emergency stationary RICE greater than or equal to 50 hp, SI emergency stationary RICE greater than or equal to 50 hp, SI non-emergency 2SLB stationary RICE greater than or equal to 50 hp and less than 250 hp, SI non-emergency 2SLB greater than or equal to 250 hp, SI non-emergency 4SLB stationary RICE greater than or equal to 50 hp and less than 250 hp, SI non-emergency 4SLB greater than or equal to 250 hp, and SI non-emergency 4SRB stationary RICE greater than or equal to 50 hp.

4.2.1.3 Stationary CI RICE >500 hp at Major Sources

In addition, EPA is proposing emission standards for stationary CI engines greater than 500 hp at major sources under its authority to review and revise emission standards as necessary under section 112(d)(6) of the CAA.

4.2.2 What Are the Pollutants Regulated by this Proposed Rule?

The rule being proposed in this action would regulate emissions of HAP. Available emissions data show that several HAP, which are formed during the combustion process or which are contained within the fuel burned, are emitted from stationary engines. The HAP which have been measured in emission tests conducted on natural gas fired and diesel fired RICE include: 1,1,2,2-tetrachloroethane, 1,3-butadiene, 2,2,4-trimethylpentane, acetaldehyde, acrolein, benzene, chlorobenzene, chloroethane, ethylbenzene, formaldehyde, methanol, methylene chloride, n-hexane, naphthalene, polycyclic aromatic hydrocarbons, polycyclic organic matter, styrene, tetrachloroethane, toluene, and xylene. Metallic HAP from diesel fired stationary RICE that have been measured are: cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Although numerous HAP may be emitted from RICE, only a few account for essentially all of the mass of HAP emissions from stationary RICE. These HAP are: Formaldehyde, acrolein, methanol, and acetaldehyde.

EPA described the health effects of these HAP and other HAP emitted from the operation of stationary RICE in the preamble to 40 CFR part 63, subpart ZZZZ, published on June 15, 2004 (69 FR 33474). These HAP emissions are known to cause, or contribute significantly to air pollution, which may reasonably be anticipated to endanger public health or welfare.

EPA is proposing to limit emissions of HAP through emissions standards for formaldehyde for non-emergency 4SRB engines, emergency SI engines, and engines less than 50

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

Formatted: Font: (Default) Courier New

Deleted: ¶

Deleted: *OMB Review Draft – February 23, 2009*

HP, and through emission standards for carbon monoxide (CO) for all other engines. For the RICE NESHAP promulgated in 2004 (69 FR 33474) for engines greater than 500 HP located at major sources, EPA chose to select formaldehyde to serve as a surrogate for HAP emissions. Formaldehyde is the hazardous air pollutant present in the highest concentration in the exhaust from stationary engines. In addition, emissions data show that formaldehyde emission levels are related to other HAP emission levels.

For the NESHAP promulgated in 2004, EPA also found that there is a relationship between CO emissions reductions and HAP emissions reductions from 2SLB, 4SLB, and CI stationary engines. Therefore, because testing for CO emissions has many advantages over testing for formaldehyde, CO emissions were chosen as a surrogate for HAP emissions reductions for 2SLB, 4SLB, and CI stationary engines operating with oxidation catalyst systems for that rule. However, EPA could not confirm the same relationship between CO and formaldehyde for 4SRB engines, so emission standards for such engines were provided in terms of formaldehyde.

For the standards being proposed in this action, EPA believes that previous decisions regarding the appropriateness of using formaldehyde and CO both in concentration (ppm) levels as has been done for stationary sources before as surrogates for HAP are still valid.[2] Consequently, EPA is proposing emission standards for formaldehyde for 4SRB engines and emission standards for CO for lean burn and CI engines in order to regulate HAP emissions. Information EPA has received from stationary engine manufacturers indicate that most SI emergency engines and engines below 50 HP are and will be 4SRB engines. As discussed above, EPA could not confirm a relationship between CO and formaldehyde emissions for 4SRB engines. Therefore, EPA is proposing standards for formaldehyde for those engines. EPA is interested in receiving comments on the use of formaldehyde as a surrogate for HAP and information on any other surrogates that may be better indicators of total HAP emissions and their reductions.

We recognize that stationary diesel engines emit trace amounts of metal HAP that remain in the particle phase. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP. Although metal HAP emissions from existing diesel engines are very small – about 130

[2] In contrast, mobile source emission standards for diesel engines (both nonroad and on-highway) are promulgated on a mass basis rather than concentration.

Deleted: *OMB Review Draft – February 23, 2009*

tons per year – we are interested in receiving comments and data about more appropriate surrogates, if any, for the metallic HAP emissions.

In addition to reducing HAP and CO, the proposed rule would likely result in the reduction of PM emissions from existing diesel engines. The aftertreatment technologies expected to be used to reduce HAP and CO emissions also reduce emissions of PM from diesel engines. Furthermore, this proposed rule would also result in nitrogen oxides (NO_x) reductions from rich burn engines since these engines would likely need to install non-selective catalytic reduction (NSCR) technology that helps reduce NO_x in addition to CO and HAP emissions. Also, we propose the use of ultra-low sulfur diesel (ULSD) for stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder that use diesel fuel, which would result in lower emissions of sulfur oxides (SO_x) and sulfate particulate by reducing the sulfur content in the fuel. It should be noted that SO2 emission reduction estimates expected from the use of ultra-low sulfur diesel (ULSD) fuel and shown later in this RIA chapter assume that affected stationary diesel engines will switch from fuel containing 500 ppm sulfur to fuel containing 15 ppm sulfur. The compliance cost estimates for the proposed rule do not account for fuel price increases that may result from using ULSD.

Deleted: the proposed rule requires

4.2.3 What Are the Proposed Standards?

Formatted: Bullets and Numbering

4.2.3.1 Existing Stationary RICE at Major Sources

Formatted: Body Text Indent, Indent: First line: 36 pt, Line spacing: 1.5 lines

The emission standards proposed in this action for stationary RICE less than or equal to 500 hp located at major sources and stationary CI RICE greater than 300 hp located at major sources are shown in Table 4-1. Note that EPA is also co-proposing that the same standards apply during both normal operation and periods of startup and malfunctions.

Formatted: Font: (Default) Courier New

Table 4-1. Emission Standards for Stationary RICE Located at Major Sources

Subcategory	Emission Standards at 15% O_2 (ppm volume on a dry basis)	
	Except during periods of startup, shutdown, or malfunction	**During periods of startup, shutdown, or malfunction**
Non-Emergency 2SLB 50≥hp≤249	85 ppmvd CO	85 ppmvd CO
Non-Emergency 2SLB 250≥hp≤500	8 ppmvd CO or 90% CO reduction	85 ppmvd CO
Non-Emergency 4SLB 50≥hp≤249	95 ppmvd CO	95 ppmvd CO
Non-Emergency 4SLB	9 ppmvd CO	95 ppmvd CO

250≥hp≤500	or 90% CO reduction	
Non-Emergency 4SRB 50≥hp≤500	200 ppbvd formaldehyde or 90% formaldehyde reduction	2 ppmvd formaldehyde
All CI 50≥hp≤300	40 ppmvd CO	40 ppmvd CO
Emergency CI 300>hp≤500	40 ppmvd CO	40 ppmvd CO
Non-Emergency CI >300 hp	4 ppmvd CO or 90% CO reduction	40 ppmvd CO
<50 hp	2 ppmvd formaldehyde	2 ppmvd formaldehyde
Landfill/Digester 50≥hp≤500	177 ppmvd CO	177 ppmvd CO
Emergency SI 50≥hp≤500	2 ppmvd formaldehyde	2 ppmvd formaldehyde

In addition, certain existing stationary RICE located at major sources are subject to fuel requirements. Owners and operators of existing stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder located at major sources that use diesel fuel must use only diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 parts per million (ppm) and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

4.2.3.2 Stationary RICE at Area Sources

The emission standards and requirements proposed in this action for stationary RICE located at existing area sources are shown in Table 4-2. Note that EPA is also co-proposing that the same standards apply during both normal operation and periods of startup and malfunctions.

Deleted: OMB Review Draft – February 23, 2009

Formatted: Bullets and Numbering

Formatted: Body Text Indent, Indent: First line: 36 pt, Line spacing: 1.5 lines

Formatted: Font: (Default) Courier New

Deleted: ¶

Table 4-2. Emission Standards and Requirements for Stationary RICE Located at Area Sources

Subcategory	Emission Standards at 15 percent O_2, as applicable, or Management Practice: Except during periods of startup, shutdown, or malfunction	Emission Standards at 15 percent O_2, as applicable, or Management Practice: During periods of startup, shutdown, or malfunction

Deleted: *OMB Review Draft – February 23, 2009*

Non-Emergency 2SLB 50≥HP≤249	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency 2SLB HP≥250	8 ppmvd CO or 90% CO reduction	85 ppmvd CO
Non-Emergency 4SLB 50≥HP≤249	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency 4SLB HP≥250	9 ppmvd CO or 90% CO reduction	95 ppmvd CO
Non-Emergency 4SRB HP≥50	200 ppbvd formaldehyde or 90% formaldehyde reduction	2 ppmvd formaldehyde
Emergency CI 50≥HP≤500	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours, inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours, inspect all hoses and belts every 500 hours and replace as necessary
Emergency CI HP>500	40 ppmvd CO	40 ppmvd CO

(continued)

Deleted: *OMB Review Draft – February 23, 2009*

Table 4-2. Emission Standards and Requirements for Stationary RICE Located at Area Sources (continued)

Subcategory	Emission Standards at 15 percent O_2, as applicable, or Management Practice: Except during periods of startup, shutdown, or malfunction	Emission Standards at 15 percent O_2, as applicable, or Management Practice: During periods of startup, shutdown, or malfunction
Non-Emergency CI 50≥HP≤300	Change oil and filter every 500 hours; inspect air cleaner every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Non-Emergency CI HP>300	4 ppmvd CO or 90% CO reduction	40 ppmvd CO
HP<50	Change oil and filter every 200 hours; replace spark plugs every 500 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 200 hours; replace spark plugs every 500 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Landfill/Digester Gas 50≥HP≤500	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Landfill/Digester Gas HP>500	177 ppmvd CO	177 ppmvd CO
Emergency SI 50≥HP≤500	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary	Change oil and filter every 500 hours; replace spark plugs every 1000 hours; and inspect all hoses and belts every 500 hours and replace as necessary
Emergency SI HP>500	2 ppmvd formaldehyde	2 ppmvd formaldehyde

4.2.3.3 Operating Limitations

Formatted: Bullets and Numbering

The EPA is proposing operating limitations for stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source. Owners and operators of engines that are equipped with oxidation catalyst or NSCR must maintain the

Deleted: *OMB Review Draft – February 23, 2009*

catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water from the pressure drop across the catalyst that was measured during the initial performance test. Owners and operators of these engines must also maintain the temperature of the stationary RICE exhaust so that the catalyst inlet temperature is between 450 and 1,350°F for engines with an oxidation catalyst and 750 to 1,250°F for engines with NSCR. Owners and operators of engines that are not using oxidation catalyst or NSCR must comply with any operating limitations approved by the Administrator.

4.2.3.4 Fuel Requirements

Formatted: Bullets and Numbering

In addition to emission standards and management practices, certain stationary CI RICE located at existing area sources are subject to fuel requirements. These fuel requirements are proposed in order to reduce the potential formation of sulfate compounds that are emitted when high sulfur diesel fuel is used in combination with oxidation catalysts and to assist in the efficient operation of the oxidation catalysts. Owners and operators of stationary non-emergency CI engines greater than 300 hp with a displacement of less than 30 liters per cylinder located at existing area sources that use diesel fuel must only use diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

Formatted: Font: (Default) Courier New

4.2.3.5 New or Reconstructed Stationary RICE >500 HP at Major Sources, New or Reconstructed 4SLB Stationary RICE ≥ 250 HP at Major Sources and Existing 4SRB Stationary RICE >500 HP at Major Sources

The EPA is co-proposing, in the alternative, as explained below, to amend the existing regulations for new and reconstructed non-emergency 2SLB and CI stationary RICE >500 HP at major sources, new and reconstructed non-emergency 4SLB stationary RICE ≥ 250 HP at major sources, and existing 4SRB stationary RICE >500 HP at major sources, in order to set limits during periods of startup and malfunction. These emission limitations are shown in Table 4-3. Note that EPA is also co-proposing that the same standards apply during both normal operation and periods of startup and malfunctions.

4.2.3.6 Operating Limitations and Management Practices

The EPA is proposing operating limitations for existing stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 HP and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 HP and are located at a major source. These are large sources that are subject to proposed standards that would require the use of aftertreatment. Owners and operators of engines that are equipped with oxidation catalyst or NSCR must maintain the catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water from the pressure drop across the catalyst that was measured during the initial performance test.

Table 4-3. Emission Standards for New or Reconstructed Non-Emergency Stationary RICE >500 HP at Major Sources and Existing Non-Emergency 4SRB Stationary RICE >500 HP at Major Sources During Periods of Startup, Shutdown or Malfunction

Subcategory	Emission Standards at 15 percent O_2
New or reconstructed non-emergency 2SLB >500 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 259 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
New or reconstructed non-emergency 4SLB >250 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 420 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
Existing non-emergency 4SRB >500 HP located at a major source of HAP emissions; or New or reconstructed non-emergency 4SRB >500 HP located at a major source of HAP emissions	Limit concentration of formaldehyde in the stationary RICE exhaust to 2 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.
New or reconstructed non-emergency CI >500 HP located at a major source of HAP emissions	Limit concentration of CO in the stationary RICE exhaust to 77 ppmvd or less at 15 percent O_2 during periods of startup, shutdown, or malfunction.

Owners and operators of these engines must also maintain the temperature of the stationary RICE exhaust so that the catalyst inlet temperature is between 450 and 1350 degrees Fahrenheit (°F) for engines with an oxidation catalyst and 750 to 1250°F for engines with NSCR. Owners and operators of engines that are not using oxidation catalyst or NSCR must comply with any operating limitations approved by the Administrator.

As shown in Table 4-2 above, the EPA is also proposing management practices for several subcategories of engines located at area sources. Such management practices include maintenance requirements that are expected to ensure that emission control systems are working properly. EPA asks for comments on these management practices and requests suggestions of additional maintenance requirements that may be needed for some of these engine subcategories.

Deleted: *OMB Review Draft – February 23, 2009*

4.2.4 What Are the Requirements for Demonstrating Compliance?

The following sections describe the requirements for demonstrating compliance under the proposed rule.

4.2.4.1 Stationary RICE at Major Sources

Formatted: No bullets or numbering

Owners and operators of stationary non-emergency RICE located at major sources that are less than 100 hp and stationary emergency RICE located at major sources must operate and maintain their stationary RICE and aftertreatment control device (if any) according to the manufacturer's emission-related written instructions or develop their own maintenance plan. Owners and operators of stationary non-emergency RICE located at major sources that are less than 100 hp and stationary emergency RICE located at major sources do not have to conduct any performance testing.

Owners and operators of stationary non-emergency RICE located at major sources that are greater than or equal to 100 hp and less than or equal to 500 hp must conduct an initial performance test to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency RICE located at major sources that are greater than 500 hp must conduct an initial performance test and must test every 8,760 hours of operation or 3 years, whichever comes first, to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source must continuously monitor and record the catalyst inlet temperature if an oxidation catalyst is being used on the engine. The pressure drop across the catalyst must also be measured monthly. If an oxidation catalyst is not being used on the engine, the owner or operator must continuously monitor and record the operating parameters (if any) approved by the Administrator.

4.2.4.2 Stationary RICE at Area Sources

Formatted: No bullets or numbering

Owners and operators of stationary emergency RICE located at existing area sources and stationary RICE that are located at existing area sources that are not subject to any numerical emission standards, as shown in Table 4-2, must operate and maintain their stationary RICE and after-treatment control device (if any) according to the manufacturer's emission-related written instructions or develop their own maintenance plan. Owners and operators of stationary RICE that are located at existing area sources that are not subject to any numerical emission standards do not have to conduct any performance testing.

Deleted: *OMB Review Draft – February 23, 2009*

Owners and operators of stationary RICE that are located at existing area sources subject to numerical emission standards, as shown in Table 4-2, must conduct an initial performance test to demonstrate that they are achieving the required emission standards.

Owners and operators of stationary non-emergency RICE located at existing area sources that are greater than 500 hp must conduct an initial performance test and must test every 8,760 hours of operation or 3 years, whichever comes first, to demonstrate that they are achieving the required emission standards.

In addition to emission standards and management practices, certain stationary CI RICE located at existing area sources are subject to fuel requirements. These fuel requirements are proposed in order to reduce the potential formation of sulfate compounds that are emitted when high sulfur diesel fuel is used in combination with oxidation catalysts and to assist in the efficient operation of the oxidation catalysts. Thus, owners and operators of stationary non-emergency diesel-fueled CI engines greater than 300 HP with a displacement of less than 30 liters per cylinder located at existing area sources must only use diesel fuel meeting the requirements of 40 CFR 80.510(b), which requires that diesel fuel have a maximum sulfur content of 15 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

Owners and operators of stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source must continuously monitor and record the catalyst inlet temperature if an oxidation catalyst or NSCR is being used on the engine. The pressure drop across the catalyst must also be measured monthly. If an oxidation catalyst or NSCR is not being used on the engine, the owner or operator must continuously monitor and record the operating parameters (if any) approved by the Administrator.

4.2.5 What Are the Reporting and Recordkeeping Requirements?

The following sections describe the reporting and recordkeeping requirements that are required under the proposed rule.

Owners and operators of stationary emergency RICE that do not meet the requirements for non-emergency engines are required to keep records of their hours of operation. Owners and operators of stationary emergency RICE must install a non-resettable hour meter on their engines to record the necessary information. Emergency stationary RICE may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the Federal, State or local government, the manufacturer, the vendor, or the insurance

Deleted: *OMB Review Draft – February 23, 2009*

company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. Owners and operators can petition the Administrator for additional hours, beyond the allowed 100 hours per year, if such additional hours should prove to be necessary for maintenance and testing reasons. A petition is not required if the hours beyond 100 hours per year for maintenance and testing purposes are mandated by regulation such as State or local requirements. There is no time limit on the use of emergency stationary engines in emergency situations, however, the owner or operator is required to record the length of operation and the reason the engine was in operation during that time. Records must be maintained documenting why the engine was operating to ensure the 100 hours per year limit for maintenance and testing operation is not exceeded. In addition, owners and operators are allowed to operate their stationary emergency RICE for non-emergency purposes for 50 hours per year, but those 50 hours are counted towards the total 100 hours provided for operation other than for true emergencies and owners and operators may not engage in income-generating activities during those 50 hours. The 50 hours per year for non-emergency purposes cannot be used to generate income for a facility, for example, to supply power to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

Owners and operators of existing stationary RICE located at area sources, that are subject to management practices as shown in Table 4-2, are required to keep records that show that management practices that are required are being met. Such records are to be kept on-site by owners and operators. These records must include, but may not be limited to: oil and filter change dates, oil amounts added and corresponding hour on the hour meter, fuel consumption rates, air filter change dates, records of repairs and other maintenance performed.

In terms of reporting requirements, owners and operators of existing stationary RICE, except stationary RICE that are less than 100 hp, existing emergency stationary RICE, and existing stationary RICE that are not subject to any numerical emission standards, must submit all of the applicable notifications as listed in the NESHAP General Provisions (40 CFR part 63, subpart A), including initial an initial notification, notification of performance test, and a notification of compliance for each stationary RICE which must comply with the specified emission limitations.

4.3 Rationale for Proposed Rule

4.3.1 Which Control Technologies Apply to Stationary RICE?

Formatted: Indent: Left: -3 pt, No bullets or numbering

EPA reviewed various control technologies applicable to stationary engines. For detailed information on the control technology review that EPA conducted, refer to information in the docket for this proposed rule. The following sections provide general descriptions of currently available controls that can be used to reduce emissions from stationary engines.

Non-selective catalytic reduction (NSCR) has been commercially available for many years and has been widely used on stationary engines. The technology can be applied to rich burn stationary engines and is capable of significantly reducing HAP emissions from stationary RICE. The technology is also capable of considerably reducing CO and NO_x emissions from rich burn stationary RICE. Based on available information, NSCR appears to be technically feasible for rich burn engines down to 25 hp.

Oxidation catalyst is another type of aftertreatment that can be applied to stationary engines and is typically used with lean burn engines. The technology can be applied to either diesel or gas fired lean burn engines. Significant reductions in HAP and CO are achieved with oxidation catalyst and applying the technology to diesel fired engines also yields PM emissions reductions. Oxidation catalyst control has been widely used and has been available for decades for use with lean burn stationary engines. While oxidation catalysts are very effective at reducing HAP and CO emissions, there is some concern about increasing NO_2 emissions as a result of using highly catalyzed devices. Thus, EPA requests comments and information on the potential increase in NO_2 emissions and any strategies to help reduce their formation.

Catalyzed diesel particulate filters (CDPF) are applicable to CI engines using diesel fuel and are primarily used to reduce PM emissions. Applying CDPF can significantly reduce PM emissions, while also limiting emissions of HAP and CO. Catalyzed diesel particulate filters are the basis for the Tier 4 emission standards for PM for most nonroad CI engines regulated by 40 CFR part 1039 and also for most new non-emergency stationary CI engines regulated under 40 CFR part 60, subpart IIII. Recently finalized standards for stationary CI engines in California are also based on the use of particulate filters in some cases.

4.3.2 How Did EPA Determine the Basis and Level of the Proposed Standards?

4.3.2.1 Stationary RICE at Major Sources

Section 112 of the CAA requires that EPA establish NESHAP for the control of HAP from new and existing sources in regulated source categories. The CAA requires the NESHAP for major sources to reflect the maximum degree of reduction in emissions of HAP that is achievable. This level of control is commonly referred to as the MACT.

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: The technology is a newer technology than other aftertreatment control devices, but is becoming increasingly widespread

Formatted: Indent: Left: -3 pt, No bullets or numbering

Formatted: No bullets or numbering

Deleted: *OMB Review Draft – February 23, 2009*

The MACT floor is the minimum control level allowed for NESHAP and is defined under section 112(d)(3) of the CAA. In essence, the MACT floor ensures that the standards are set at a level that assures that all major sources achieve the level of control at least as stringent as that already achieved by the better controlled and lower emitting sources in each source category or subcategory.

The MACT floor standards for existing sources must be no less stringent than the average emission limitation achieved by the best performing 12% of existing sources in the category or subcategory (or the best performing 5 sources for categories or subcategories with fewer than 30 sources). The MACT standard must be no less stringent than the MACT floor.

In developing MACT, EPA also considers control options that are more stringent than the floor. EPA may establish standards more stringent than the floor (or, “beyond-the-floor”) based on the consideration of cost of achieving the emissions reductions, any non-air quality health and environmental impacts, and energy requirements. Section 112 of the CAA allows EPA to establish subcategories among a group of sources, based on criteria that differentiate such sources. The subcategories that have been developed for stationary RICE were previously listed and are necessary in order to capture the distinct differences, which could affect the emissions of HAP from these engines. The complete rationale explaining the development of these subcategories is provided in the memorandum titled “Subcategorization and MACT Floor Determination for Stationary Reciprocating Internal Combustion Engines ≤500 hp at Major Sources” and is available from the docket.

For the MACT floor determination, EPA reviewed the data in its Office of Air Quality Planning and Standards’ RICE Population Database (hereafter referred to as the “Population Database”) and RICE Emissions Database (hereafter referred to as the “Emissions Database”). The Population and Emissions Databases represent the best information available to EPA. Information in the Population and Emissions Database was obtained from several sources and is further described in the notice of proposed rulemaking for the RICE NESHAP for engines greater than 500 hp at major sources (67 FR 77830, December 19, 2002) and in the docket for the RICE NESHAP rulemaking (EPA-HQ-OAR-2002-0059). EPA queried the Population Database to determine how many stationary RICE less than or equal to 500 hp in each subcategory have catalyst type controls to determine the relevant technology for the MACT floor. In order to establish the emission standard for each subcategory of stationary existing RICE, EPA referred to the Emissions Database. The following sections describe the MACT floor review and proposed MACT determinations for each subcategory of stationary RICE.

Deleted: *OMB Review Draft – February 23, 2009*

a. Stationary RICE <50 hp. According to the Population Database there are no existing stationary RICE less than 50 hp using catalyst type controls. Therefore, EPA determined that the MACT floor is the emission level that is achievable by existing engines of this size operating without add-on controls. EPA is not expecting any stationary CI engines less than 50 hp since such engines are typically considered nonroad mobile engines. Also, EPA does not expect any lean burn engines in this subcategory as lean burn engines tend to be found in larger engine size segments. Therefore, EPA believes that engines less than 50 hp would be 4SRB engines. Subsequently, EPA reviewed formaldehyde emissions from 4SRB engines and averaged the best performing 12% without add-on controls. As a result, the MACT floor for engines below 50 hp is 2 parts per million by volume, dry basis (ppmvd) of formaldehyde at 15% oxygen (O_2).

Deleted: it is assumed

EPA considered regulatory options more stringent than the MACT floor, specifically NSCR. However, the cost per ton of HAP reduced for engines less than 50 hp equipped with NSCR is substantial, particularly when considered the potential HAP reductions that would be expected. Therefore, MACT is equivalent to the MACT floor. For details on the cost per ton analysis, refer to the memorandum entitled "Above-the-Floor Determination for Stationary RICE," included in the docket.

Deleted: high and outweighs

Deleted: reduction benefit.

b. Stationary Landfill/Digester Gas ≥50 hp. According to the Population Database there are no existing landfill or digester gas engines using catalyst type controls. Therefore, EPA determined that the MACT floor for this subcategory is the level achievable by existing landfill and digester gas engines operating without add-on controls. EPA consulted several sources, including the Emissions Database, in order to determine the level being achieved by the best performing 12 percent of landfill and digester gas engines.

Based on reviewing recently obtained test reports for landfill and digester gas engines, EPA concluded that the latest information obtained on the current levels being achieved by landfill gas engines is the most appropriate and representative information and therefore was used to determine the MACT floor limit. EPA analyzed the CO emissions from landfill and digester gas test reports. EPA has previously discussed the appropriateness of using CO emissions as a surrogate for HAP emissions and therefore reviewed CO emissions from landfill and digester gas engines without add-on controls. EPA selected the best performing 12% and averaged those 12% to determine the MACT floor. As a result, the MACT floor for landfill and digester gas stationary RICE greater than or equal to 50 hp is 177 ppmvd of CO at 15% O_2.

Currently, there are no viable above-the-floor options for engines that combust landfill or digester gas. Aftertreatment controls could theoretically be applied to engines burning waste gas;

however, numerous studies have shown that a family of silicon-based compounds named siloxanes can foul add-on catalyst controls. Such fouling can render the catalyst inoperable within short periods of time. Pre-treatment systems could be applied to clean the fuel prior to combustion theoretically allowing catalysts to be used, but has not shown to be a reliable technology at this time. Therefore, MACT is equivalent to the MACT floor.

c. Stationary Emergency CI 50≥hp≤500. EPA reviewed CO emissions from CI engines without add-on controls and selected the best performing 12% without add-on controls. As a result, the MACT floor for CI emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 40 ppmvd of CO at 15% O_2.

As part of the analysis to consider beyond-the-floor options, EPA considered add-on controls for emergency engines. However, due to the limited operation of emergency engines (about 50 hours per year on average), the cost per ton of HAP removed by such controls is high. The estimated cost of oxidation catalyst per ton of HAP reduced ranges from $1 million to $2.8 million for emergency CI engines in this size range. For CDPF, the estimated cost per ton of HAP reduced for emergency CI engines between 50 and 500 HP ranges from $3.7 million to $8.7 million. In addition, the total reductions achieved by applying aftertreatment controls would be minimal since stationary emergency engines are operated only an average of about 50 hours per year. Therefore, MACT is equivalent to the MACT floor. EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

d. Stationary Non-Emergency CI 50≥hp≤500. As a result of our review of the Emissions Database , the MACT floor for CI non-emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 40 ppmvd of CO at 15% O_2.

As part of analysis of going beyond the MACT floor, EPA considered add-on controls for this subcategory of engines. The applicable add-on controls that yield significant HAP reductions are oxidation catalyst and CDPF. Diesel oxidation catalysts are capable of reducing HAP emissions by significant amounts in excess of 90% in some cases. Diesel oxidation catalysts also reduce emissions of CO as well as PM emissions. Achievable reductions of PM are on the order of 30% for oxidation catalyst. Catalyzed diesel particulate filters are capable of reducing HAP and CO emissions by similar amounts, but are more efficient in reducing PM. Achievable PM reductions are on the order of 90% or more with CDPF. However, CDPF is considerably more expensive than diesel oxidation catalysts.

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: No existing CI emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp were found to have catalyst type controls in the Population Database. For that reason, the MACT floor is the level achievable by existing CI engines operating without add-on controls.

Deleted: -effectiveness of

Deleted: poor.

Deleted: . Other relevant concerns include technical feasibility and the need for emergency engines to start quickly and operate without problems.

Deleted: . No existing CI non-emergency stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp were found to have catalyst type controls, according the Population Database. For that reason, the MACT floor for this subcategory is the level achievable by existing CI engines operating without add-on controls. In terms of non-cumulative emissions, there is no difference between emissions from non-emergency and emergency CI engines. Therefore, the MACT floor for non-emergency CI engines between 50 and 500 hp engines is equivalent to the MACT floor for emergency CI engines between 50 and 500 hp and EPA analyzed the same data in order to determine the MACT floor limit.

Deleted: again

Deleted: *OMB Review Draft – February 23, 2009*

EPA estimated the cost per ton of HAP removal by potentially applying oxidation catalysts and CDPF to existing non-emergency CI engines. The specific costs associated with add-on controls can be found in memoranda available from the rulemaking docket. The cost per ton of HAP removed for CDPF is in general significantly higher than the cost per ton of HAP removed for oxidation catalyst, but the cost per ton for both options dramatically increases as the size of the engine decreases and is more favorable towards larger size engines. EPA requests data and other information on the ability of oxidation catalysts to remove HAP compared to CDPF. In addition, we request comment on the performance capability of these control devices to remove metallic HAP.

Deleted: drastically

Considering the HAP emission reductions capable from oxidation catalysts, the cost of oxidation catalyst control compared to CDPF, and the low capital costs associated with oxidation catalyst make oxidation catalysts a favorable option for reduction of HAP emissions from larger existing non-emergency stationary diesel engines. However, going above-the-floor and requiring oxidation catalyst on all non-emergency stationary CI engines would require significant total capital investment and total annual control costs. For the greater than 300 hp segment the cost per ton removed, which includes a mixture of organic and metallic HAP, is estimated to be $51,973. This cost is almost a third less than the estimated cost per ton of $140,395 for stationary engines 50 to 100 hp.

Deleted:

Stationary existing diesel engines were largely uncontrolled at the Federal level prior to the promulgation of EPA's emission standards for stationary diesel engines in 2004, which affected engines constructed beginning in 2002. Non-emergency diesel engines are estimated to emit 90% of total combined PM and NO_x emissions from all existing stationary diesel engines, with emergency engines emitting the remaining 10%. Of the non-emergency diesel engines, about 50,000 non-emergency engines rated 300 hp or higher were built prior to 2002, which is about 29% of the existing population of non-emergency stationary diesel engines. These 50,000 non-emergency diesel engines emit approximately 72% of the total HAP emissions, 66% of the total PM emissions, and 62% of the total NO_x emissions from existing non-emergency stationary diesel engines. This information is based on data from the Power Systems Research Database that was presented in Tables 1-4 of EPA's January 24, 2008 ANPRM for stationary diesel engines emission standards (73 FR 4136).

For these reasons, EPA concluded that it can achieve the highest level of emission reduction relative to cost, while requiring controls where appropriate, by requiring more stringent emission standards on non-emergency stationary diesel engines with a power rating greater than 300 hp. For these reasons and considering the higher level of HAP reductions achievable from engines greater than 300 hp and the reduced annual cost of control, EPA believes that requiring above-the-floor levels that rely on oxidation catalyst control is appropriate for engines greater than 300 hp. EPA solicits comments and data on whether 300 hp is the appropriate size division for setting beyond-the-floor MACT standards requiring the use of add-on controls. Specifically, EPA is soliciting comment on whether it would be appropriate to extend the more stringent standards to engines that are less than 300 hp.

Of further consideration are the co-benefits that would be achieved by the use of oxidation catalyst as it will reduce other pollutants such as CO and PM. Taking into account the reductions in CO and PM associated with applying oxidation catalyst to non-emergency CI engines, the cost per ton of pollutants reduced if one sums the reductions together decreases. The total co-benefits of this proposed regulation are presented in a separate memorandum titled "“Impacts Associated with NESHAP for Existing Stationary RICE,” which provides the costs and emissions impacts of this regulation. These emission estimates are also summarized later in this RIA chapter.

EPA believes that the emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified under section 112(d). Therefore, EPA is proposing MACT to be the level that is achieved by applying oxidation catalyst to non-emergency CI engines greater than 300 HP, which is 4 ppmvd of CO at 15 percent O_2, or 90 percent CO efficiency. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

While these proposed HAP emission standards would not require the use of CDPFs, EPA notes that when compared to oxidation catalysts, CDPFs provide significantly greater reductions in levels of PM from diesel engines, which are a significant health concern. PM emissions from these engines contain several constituents, including black carbon and trace amounts of metallic HAP. EPA estimates that the range of PM2.5 emission reductions would increase from 2,600 tons to 7,600 tons if CDPFs are used rather than oxidation catalysts.

The contribution of black carbon emissions to global climate is being evaluated in a number of scientific forums.[5],[6] EPA is interested in comments and information on other

[5] Intergovernmental Panel on Climate Change (IPCC). 2007. Changes in Atmospheric Constituents and in Radiative Forcing, in Climate Change 2007, Cambridge University Press, New York, Cambridge University Press.

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Normal, Indent: First line: 36 pt, Line spacing: 1.5 lines

Deleted: , which is of significant health concern.

Deleted: discussing

Formatted: Font: (Default) Courier New

Formatted: Font: (Default) Courier New

Deleted: (including black carbon)

Deleted: ¶

Deleted:

Deleted: Black carbon emissions contribute to climate warming by absorbing incoming and reflected sunlight in the atmosphere and by darkening clouds, snow and ice. The Fourth Assessment Report (2007) of the Intergovernmental Panel on Climate Change (IPCC) estimated that the global mean radiative forcing (or heating) effect of black carbon ranged from roughly 10 to 50% of the radiative forcing due to carbon dioxide (CO_2). A more recent study estimates an even higher global mean heating effect for black carbon.

Deleted: [3] The National Academy of Sciences states "Regulations targeting black carbon emissions or ozone precursors would have combined benefits for public health and climate."

Deleted: [4] While mobile diesel engines have been the largest black carbon source in the U.S., these emissions are expected to be reduced significantly over the next several decades based on CDPFs for new vehicles.

Formatted: Font: (Default) Times New Roman

Deleted: *OMB Review Draft – February 23, 2009*

regulatory and non-regulatory approaches that could help address black carbon emissions from existing stationary diesel engines.

Sources may wish to review whether it is appropriate for some existing CI engines to use CDPFs to meet the requirements of this rule, given the considerable co-benefits of using CDPF. For example, the cost effectiveness associated with reducing PM2.5 with oxidation catalysts on a 300 HP diesel engine is $27,000 per ton, while using a CDPF improves the cost effectiveness to about $9,000 per ton. These cost effectiveness numbers include any potential reductions of metallic HAP which would be emitted in the particle phase. EPA notes, however, that some have suggested that the use of CDPF on older uncontrolled engines may be more problematic than for newer engines that already have some level of engine control.

One of the potential problems raised by industry are the difficulties with retrofitting CDPFs on mechanically-controlled engines versus those that use electronic controls. Furthermore, the diesel PM levels from older engines are, according to some, too high for efficient operation of a CDPF. EPA is requesting comment on the use of CDPF to meet the HAP standards for this rule and on the benefits generally of using CDPFs on older stationary CI engines. EPA also asks for comment on technical feasibility issues that might preclude the use of such devices on older diesel engines.

Stationary diesel engines also emit trace amounts of metallic HAP. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP, including these very small trace emissions of metals. Nonetheless, EPA is taking comment on whether there are more appropriate surrogates for metallic HAP from stationary diesel engines. EPA does not have data regarding the use of other surrogates for these emissions from stationary diesel engines, so EPA is soliciting data on any other such surrogates.

The proposed rule requires the use of ULSD for existing non-emergency stationary diesel engines greater than 300 hp with a displacement of less than 30 liters per cylinder. The use of ULSD is necessary due to concerns about oxidation catalysts simultaneously oxidizing SO_2 to form sulfate particulate. A limit on the diesel fuel sulfur level of 15 ppm will reduce the potential for increased sulfate emissions from diesel engines equipped with oxidation catalysts and will improve the efficiency of the catalyst. The use of ULSD will also enable stationary diesel

[6] Atmospheric Aerosol Properties and Climate Impacts. 2009. U.S. Climate Change Science Program Synthesis and Assessment Product 2.3, January 2009.

engines to utilize CDPF if desired. EPA has already promulgated similar diesel fuel sulfur standards for highway and nonroad diesel engines and for new stationary diesel engines.

e. Stationary Non-Emergency CI >500 hp. A regulation covering existing stationary diesel engines was promulgated in 2004. However, based on the MACT floor analysis conducted at that time, the regulation subjected diesel engines greater than 500 hp at major sources to emission standards of no further emission control.

However, due to the availability of technically feasible and reasonably cost-effective technologies to control emissions from these existing large stationary CI engines, and the potential of reducing exhaust HAP (as well as PM), EPA is proposing to address HAP emissions from these existing diesel engines > 500 HP pursuant to its authority under CAA section 112(d).

As a result of our review of the Emissions Database, the MACT floor for CI non-emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 40 ppmvd of CO at 15 percent O_2.

As part of our analysis of going beyond the MACT floor, EPA considered the emissions associated with the use of oxidation catalysts. Similar to EPA's analysis of the emission reductions and costs associated with the use of oxidation catalysts for diesel engines from 300-500 HP, EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified under section 112(d). A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

EPA is proposing to address emissions from existing non-emergency CI engines greater than 500 HP located at major sources by limiting the CO to 4 ppmvd at 15 percent O_2 or by reducing CO by 90 percent or more. The proposed standards are based on what is achieved by applying oxidation catalyst controls. Oxidation catalyst controls reduce HAP, CO, and PM from diesel engines. The proposed emission standard is in terms of CO, which has been shown to be an appropriate surrogate for HAP. Stationary diesel engines also emit trace amounts of metallic HAP. EPA believes that formaldehyde and CO are reasonable surrogates for total HAP, including these very small trace emissions of metals. Nonetheless, EPA is taking comment on whether there are more appropriate surrogates for metallic HAP from stationary diesel engines. EPA does not have data regarding the use of other surrogates for these emissions from stationary diesel engines, so EPA is soliciting data on any other such surrogates.

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: EPA is proposing to address emissions from existing non-emergency CI engines greater than 500 hp located at major sources by limiting the CO to 4 ppmvd at 15% O_2 or by reducing CO by 90% or more. The proposed standards are based on what is achievable by applying oxidation catalyst.

Deleted:

Deleted: *OMB Review Draft – February 23, 2009*

For the same reasons provided above for non-emergency diesel engines between 300-500 HP, EPA is requiring the use of ULSD for non-emergency diesel engines above 500 HP.

f. Stationary Emergency SI 50≥hp≤500. As a result of our review of the Emissions Database and industry estimates, EPA determined the MACT floor for SI emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 2 ppmvd of formaldehyde at 15 percent O2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered add-on controls for this subcategory. However, the same issues apply to emergency SI engines as to emergency CI engines; in particular, the cost-effectiveness of such controls on emergency engines and questions about the feasibility of such controls on emergency engines. According to the Population Database there are no SI emergency stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP using catalyst type controls. Therefore, it is not appropriate to require add-on controls on emergency SI engines. EPA also found no other techniques appropriate to go beyond the MACT floor. MACT is therefore equivalent to the MACT floor.

g. Stationary Non-Emergency 2SLB 50≥HP≤500. EPA selected the best performing 12 percent of engines for formaldehyde, identified the corresponding CO tests, and averaged the CO emissions from the corresponding tests. As a result, the MACT floor for non-emergency 2SLB stationary RICE greater than or equal to 50 HP and less than or equal to 500 HP is 85 ppmvd of CO at 15 percent O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst controls to this subcategory and estimated the cost per ton of HAP removed. EPA believes the costs to be reasonable for engines 250 HP and above equipped with oxidation catalyst and can be justified in light of the significant reductions of HAP that would be achieved. For example, the cost effectiveness of reducing HAP from 2SLB engines in the 300 to 500 HP size range is about $2,900 per ton. Oxidation catalysts can reduce HAP and CO from stationary spark-ignition engines by approximately 90 percent. The Emissions Database did not indicate any other proven and cost-effective control technologies or other methods that can reduce HAP emissions from 2SLB engines to levels lower than those achieved by oxidation catalysts. The proposed emission limit is in terms of CO, which has been shown to be an appropriate surrogate for HAP. EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified. Therefore, MACT for engines 250 HP and above is the level that is achievable by applying oxidation

Formatted: Font: (Default) Courier New

Deleted: *OMB Review Draft – February 23, 2009*

catalyst and is 8 ppmvd of CO at 15 percent O_2 or 90 percent CO efficiency. MACT for engines below 250 HP is equivalent to the MACT floor.

g. Non-Emergency 2SLB 50≥hp≤500. According to the Population Database, there are no non-emergency 4SLB stationary RICE greater than or equal to 50 HP and less than or equal to 249 HP using catalyst type controls.

EPA reviewed formaldehyde emissions tests from 4SLB engines. EPA selected the best performing 12 percent of engines for formaldehyde and identified the corresponding CO values from the top 12 tests for formaldehyde. The corresponding CO values were then averaged. As a result, the MACT floor for 4SLB stationary RICE greater than or equal to 50 HP and less than or equal to 249 HP is 95 ppmvd of CO at 15 percent O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst controls to this subcategory. However the cost per ton of HAP removed was determined to be too significant and to outweigh the expected HAP reductions from these stationary engines. Therefore, MACT is equivalent to the MACT floor.

h. Non-Emergency 4SLB 50≥hp≤249. According to the Population Database, there are no non-emergency 4SLB stationary RICE greater than or equal to 50 hp and less than or equal to 249 hp using catalyst type controls. Therefore, the MACT floor for this subcategory is the level achieved by 4SLB engines 50 to 249 hp operating without add-on controls.

EPA reviewed formaldehyde emissions tests from 4SLB engines without add-on controls. EPA selected the best performing 12% of engines for formaldehyde and identified the corresponding CO values from the top 12 tests for formaldehyde. The corresponding CO values were then averaged. As a result, the MACT floor for 4SLB stationary RICE greater than or equal to 50 hp and less than or equal to 249 hp is 95 ppmvd of CO at 15% O_2.

EPA considered applying oxidation catalyst controls to this subcategory as part of the beyond-the-floor analysis. However, the cost per ton of HAP removed was determined to outweigh the potential reductions. Therefore, MACT is equivalent to the MACT floor.

Deleted: the level achievable without add-on control and is

i. Non-Emergency 4SLB 250≥hp≤500. For non-emergency 4SLB engines between 250 and 500 hp, EPA found that 5.7% of the population is controlled with aftertreatment that yields HAP reductions, particularly oxidation catalysts. EPA analyzed formaldehyde emissions from 4SLB tests for engines without add-on controls. EPA took the average of the best performing 12% of engines for formaldehyde and identified the corresponding CO values from the best

Deleted: *OMB Review Draft – February 23, 2009*

performing 12% of tests. The corresponding CO values were then averaged. The result for 4SLB stationary RICE greater than or equal to 250 hp and less than or equal to 500 hp is 95 ppmvd of CO at 15% O_2.

As part of EPA's beyond-the-floor MACT analysis, EPA considered applying oxidation catalyst and estimated the cost per ton of HAP removed. The use of oxidation catalysts on these engines can achieve 90 percent HAP reductions. EPA concluded that the control costs associated with installing oxidation catalysts are reasonable for this type of stationary engine, and thus can be justified considering the significant reductions of HAP that would be achieved by using oxidation catalysts. Oxidation catalysts can reduce HAP and CO from stationary spark-ignition engines. The proposed emission limit is in terms of CO, which has been shown to be an appropriate surrogate for HAP. EPA believes the HAP emission reductions associated with use of oxidation catalysts, taking into account the costs of such controls, are justified. The Emissions Database did not indicate any other proven and cost-effective control technologies or other methods that can reduce HAP emissions from 4SLB engines to levels lower than those achieved by oxidation catalysts.

EPA determined that the appropriate numerical MACT level could be determined by analyzing uncontrolled levels of HAP and reducing the levels by the expected reductions from oxidation catalysts. EPA analyzed formaldehyde emissions from 4SLB tests for engines without add-on controls. EPA took the average of the best performing 12 percent of engines for formaldehyde and identified the corresponding CO values from the best performing 12 percent of tests. The corresponding CO values were then averaged. The result for 4SLB stationary RICE greater than or equal to 250 HP and less than or equal to 500 HP is 95 ppmvd of CO at 15 percent O_2.

Given an expected 90 percent reduction from the use of oxidation catalysts, MACT is 9 ppmvd of CO at 15 percent O_2 or 90 percent CO efficiency. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

j. Non-Emergency 4SRB 50≥hp≤500. For SI non-emergency stationary 4SRB engines greater than or equal to 50 hp and less than or equal to 500 hp, EPA found that 5.6% of the population are using catalyst type controls, according to the Population Database. The add-on controls that apply to this subcategory of engines is NSCR.

As part of the beyond-the-floor analysis, EPA considered the application of NSCR to this engine subcategory. The Emissions Database provided no other proven and cost effective emission control methods currently available which can reduce HAP emissions from 4SRB engines to levels lower than that achieved through NSCR control.

The technology is proven, has been applied to thousands of rich burn engines, and is efficient at reducing HAP emissions. EPA considered applying NSCR and estimated the cost per ton of HAP removed. EPA believes the costs are reasonable and appropriate and can be justified considering the significant reductions of HAP that would be achieved by using NSCR on this subcategory of engines. For example, the cost effectiveness of reducing HAP from stationary 4SRB engines in the 300 to 500 HP size range is about $5,000 per ton.

Other pollutants are also reduced through the use of NSCR including significant reductions in NO_x and CO emissions. Taking into consideration the emission reductions achieved by applying NSCR to 4SRB engines greater than 50 hp, the cost per ton of emissions reduced is favorable for this type of stationary engines. A fuller discussion of EPA's analysis of regulatory alternatives above-the-floor is presented in the memorandum entitled "Above-the-Floor Determination for Stationary RICE."

EPA determined that the appropriate numerical MACT level could be determined by analyzing uncontrolled levels of HAP and reducing the levels by the expected reductions from NSCR. EPA analyzed formaldehyde emissions from 4SRB engines without add-on controls and averaged the emissions from the best performing 12% of engines. The result for 4SRB stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 2 ppmvd of formaldehyde at 15% O_2.

Therefore, MACT is the level that is achievable by applying NSCR and is 200 ppbvd of formaldehyde at 15% O_2 or 90% formaldehyde efficiency.

Deleted: *OMB Review Draft – February 23, 2009*

Deleted: EPA determined that the appropriate numerical MACT level could be determined by analyzing uncontrolled levels of HAP and reducing the levels by the expected reductions from NSCR. EPA analyzed formaldehyde emissions from 4SRB engines without add-on controls and averaged the emissions from the best performing 12% of engines. The result for 4SRB stationary RICE greater than or equal to 50 hp and less than or equal to 500 hp is 2 ppmvd of formaldehyde at 15% O_2.¶

Deleted: *OMB Review Draft – February 23, 2009*

4.4 Engines at Area Sources

Under section 112(k) of the CAA, EPA developed a national strategy to address air toxic pollution from area sources. The strategy is part of EPA's overall national effort to reduce toxics, but focuses on the particular needs of urban areas. Section 112(k) requires EPA to list area source categories and to ensure 90% of the emissions from area sources are subject to standards pursuant to section 112(d) of the CAA. Under section 112(k), the CAA specifically mandated that EPA develop a strategy to address public health risks posed by air toxics from area sources in urban areas. Section 112(k) also mandates that the strategy achieve a 75% reduction in cancer incidence attributable to HAP emitted by stationary sources. As mentioned, stationary RICE are listed as a source category under the Urban Air Toxics Strategy developed under the authority of sections 112(k) and 112(c)(3) of the CAA. These area sources are subject to standards under section 112(d).

Section 112(d)(5) of the CAA indicates that EPA may elect to promulgate standards or requirements to area sources "which provide for the use of generally available control technologies or management practices by such sources to reduce emissions of hazardous air pollutants." For determining emission limitations, GACT standards can be more flexible requirements than MACT standards. For example, the CAA provisions for setting GACT do not require setting a control baseline or "floor" that is equal to the average emission levels achieved by the best performing 12% of a type of facility, for existing sources, or the emission control achieved in practice by the best controlled similar source, for new sources. EPA is permitted to consider costs and other factors during each phase of the GACT analysis. Control technology options available to stationary RICE located at area sources are the same as those discussed for engines located at major sources.

Deleted: to set

The requirements being proposed in this action are applicable to stationary RICE located at area sources of HAP emissions. EPA has chosen to propose national requirements, which not only focus on urban areas, but address emissions from area sources in all areas (urban and rural).

For stationary RICE, it would not be practical or appropriate to limit the applicability to urban areas and EPA has determined that national standards are appropriate. Stationary RICE are located in both urban and rural areas. In fact, there are some rural areas with high concentrations of stationary RICE. Stationary RICE are employed in various industries used for both the private and public sector for a wide range of applications such as generator sets, irrigation sets, air and gas compressors, pumps, welders, and hydro power units. Stationary RICE may be used by private entities for agricultural purposes and be located in a rural area, or it may be used as a standby generator for an office building located in an urban area. Other stationary RICE may operate at large sources for electric power generation, transmission, or distribution purposes.

In previous rulemakings, EPA had determined that stationary RICE are located all over the U.S., and EPA cannot say that these sources are more prevalent in certain areas of the country. Therefore, for the source category of stationary RICE, EPA is proposing national requirements without a distinction between urban and non-urban areas. However, EPA would like to ask for comment on this approach, which does not distinguish between urban and rural areas, in order to determine whether it continues to be valid for today's population of stationary RICE.

For subcategories of larger engines, particularly those above 500 hp and those for which EPA has based MACT on the use of add-on controls, the proposed GACT requirement for area sources is equal to MACT for similar engines at major sources. The control technologies that create the basis for the emission standards for engines located at major sources are readily available and feasible for all engines. Further, for those cases where EPA is basing the MACT emission standards on add-on controls, EPA determined that costs associated with implementing HAP-reducing technologies are reasonable and justified. Hence, there is no reason why GACT should be any different than MACT for larger engines located at area sources. Consequently, EPA has determined that for area sources that are non-emergency 2SLB engines greater than or equal to 250 hp, non-emergency 4SLB engines greater than or equal to 250 hp, non-emergency 4SRB greater than or equal to 50 hp, emergency CI engines greater than 500 hp, non-emergency CI engines greater than 300 hp, landfill and digester gas engines greater than 500 hp, and emergency SI engines greater than 500 hp, GACT is equal to MACT.

As discussed, GACT provides EPA more flexibility in setting requirements than MACT and can include available control technologies or management practices to reduce HAP emissions. EPA has determined that for area sources that are non-emergency 2SLB engines greater than or equal to 50 hp and less than 250 hp, non-emergency 4SLB engines greater than or equal to 50 hp and less than 250 hp, emergency CI engines greater than or equal to 50 hp and less than or equal to 500 hp, non-emergency CI engines greater than or equal to 50 hp and less than or equal to 300 hp, engines less than 50 hp, landfill and digester gas engines greater than or equal to 50 hp and less than or equal to 500 hp, and emergency SI engines greater than or equal to 50 hp and less than or equal to 500 hp, EPA proposes that GACT is management practices.

Management practices include requiring owners and operators to operate and maintain their stationary RICE and aftertreatment control device (if any) according to the manufacturer's

Deleted: *OMB Review Draft – February 23, 2009*

emission-related written instructions. Alternatively, owners and operators may develop their own maintenance plans to follow. Owners and operators using such maintenance plans must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. Add-on controls are feasible for some engines located at area sources, but control costs are high and EPA believes that it is possible to achieve reasonable controls using management practices. For example, capital costs associated with installing an oxidation catalyst on a 200 HP diesel engine are about $2,100 with annual costs of $700. Such costs are significant particularly when one considers that the cost per ton of this option is on the order of $72,000 per ton of HAP reduced. Considering the high cost per ton of HAP reduced, it is difficult to justify requiring add-on controls on these engines.

EPA is also attempting to minimize the burden of the proposed rule, specifically on small businesses and individual owners and operators. EPA does not believe that management practices would be a substantial burden on owners and operators such as private owners and small entities.

Deleted: Therefore, EPA is proposing management practices for smaller engines located at area sources, particularly those where the MACT standard was not determined to be based on add-on technology.

4.5. Startup, Shutdown, and Malfunction Limits

With respect to the exemption from emission standards during periods of Startup, Shutdown and Malfunction in the General Provisions (see, e.g., 40 CFR 63.6(f)(1)(exemption from non-opacity emission standards) and (h)(1)(exemption from opacity and visible emission standards)), we note that on December 19, 2008, in a decision addressing a challenge to the 2002, 2004 and 2006 amendments to those provisions, the Court of Appeals for the District of Columbia Circuit vacated the SSM exemption. Sierra Club v. EPA 2008 U.S. App. LEXIS 25578 (D.C. Cir. Dec. 19, 2008). We are still evaluating the recent court decision, and the time for appeal of that decision has not yet run. However, in light of the court decision, EPA is proposing not to apply the SSM exemption for non-opacity standards set forth in 40 CFR § 63.6(f)(1) to this NESHAP. The SSM exemption for opacity and visible emissions standards in 40 CFR § 63.6(h)(1) is not relevant here because the standards proposed in this action do not constitute opacity or visible emission standards.

EPA recognizes that there are different modes of operation for any stationary source, and those modes generally include start-up, normal operations, shut-down, and malfunctions. EPA does not believe that emissions should be different during periods of shutdown compared to

Deleted: *OMB Review Draft – February 23, 2009*

normal operations, but EPA does believe that emissions will likely be different during periods of startup and malfunction, particularly for engines relying on catalytic controls.

EPA is proposing two options in this action for subcategories where the proposed emission standard is based on the use of catalytic controls. The first option is to have the same standards apply during both normal operation and periods of startup and malfunctions. While EPA is aware of the general properties of engine catalytic controls, our Emissions Database has no specific data showing that emissions during periods of startup and malfunction are different than during normal operation. Furthermore, EPA does not have substantial information regarding the specific parameters (e.g. timing, temperature) of such differences in emissions.

Although we lack specific data on emissions during start-up and malfunction, EPA recognizes that emissions are likely to differ during these periods for engines relying on catalytic controls. Accordingly, for subcategories where the proposed emission standard is based on the use of catalytic controls, EPA is also co-proposing emission limitations that would apply to stationary RICE during periods of startup and malfunction in order to account for the different emissions characteristics of stationary internal combustion engines during startup and malfunction periods, compared to other periods of operation.

During startup operation with an OC, engine exhaust temperatures must reach about 250 to 300 degrees C in order to work effectively. In the case of NSCR, exhaust gas temperatures must reach between 425 to 650 degrees C in order to work effectively. It can take about 15 to 30 minutes of operation – depending on engine size – for exhaust temperatures to reach those temperature levels. Thus, for the subcategories of stationary RICE discussed above where the proposed emission standard is based on the use of catalytic controls, EPA is co-proposing that the standards during periods of startup and malfunction will be based on emissions expected from the best controlled sources prior to the full warm-up of the catalytic control.

Under either co-proposal, for the subcategories of stationary RICE discussed above where the proposed emission limitations during normal operation are not based on the use of oxidation catalyst or NSCR, we are proposing the same emission limitations during startup and malfunction as during periods of normal operation.

For more information on these startup, shutdown, and malfunction options, please refer to the preamble.

4.6 How Did EPA Determine the Compliance Requirements?

EPA discussed the specific compliance requirements that are being proposed earlier in this chapter. In general, EPA has attempted to reduce the burden on affected owners and operators. The following presents the rationale for the proposed compliance requirements.

Stationary non-emergency RICE located at major sources that are less than 100 hp, stationary RICE located at area sources that are not subject to numerical emission standards, and all stationary emergency RICE are only subject to minimal compliance requirements in the form of management practices to minimize emissions and are not subject to performance testing. EPA does not believe that following the manufacturer's instructions is a burdensome requirement, and it is expected that most owners and operators are already doing so. It is in the owner's best interest to operate and maintain the engine and aftertreatment device (if one is installed) properly. This proposed requirement minimizes the burden on individual owners and operators and small entities, while ensuring that the engine and aftertreatment device is operated and maintained correctly. Further, EPA does not believe that it is reasonable to subject small stationary RICE and stationary emergency RICE to performance testing. Subjecting the engines to maintenance requirements will assist in minimizing and maintaining emissions below the emission standards. The cost of requiring performance testing on these engines would be too significant when compared to the cost of the unit itself and to the benefits of such testing. Subjecting stationary RICE located at area sources that are not subject to numerical emission standards to performance testing would not serve a meaningful purpose.

For stationary non-emergency RICE located at major sources that are greater than or equal to 100 hp and stationary RICE located at area sources that are subject to numerical emission standards, EPA determined that performance testing is necessary to confirm that the emission standards are being met. Again, EPA has attempted to reduce compliance requirements and is proposing a level of performance testing commensurate with ensuring that the emission standards are being met. Therefore, for non-emergency stationary RICE located at major sources that are greater than or equal to 100 hp and less than or equal to 500 hp and stationary RICE located at area sources that are subject to numerical emission standards, EPA chose to require an initial performance test only. However, if the engine is rebuilt or overhauled, the engine must be re-tested to demonstrate that it meets the emission standards.

For non-emergency stationary RICE greater than 500 hp, testing every 8,760 hours of operation of 3 years, whichever comes first, is also required. EPA believes such a requirement is appropriate for these size engines, but does not believe that further testing is necessary for

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: Indent: Left: -3 pt, No bullets or numbering

Formatted: Font: Not Italic

smaller engines, i.e., those less than or equal to 500 hp. Subsequent performance testing is appropriate for engines greater than 500 hp due to their size and frequency of operation. Plus, many States mandate more stringent compliance requirements for large engines. Finally, the RICE NESHAP for engines greater than 500 hp located at major sources also required further performance testing following the initial compliance demonstration.

Owners and operators of stationary non-emergency 2SLB, 4SLB, 4SRB, and CI RICE that are greater than 500 hp and are located at an area source, and stationary non-emergency CI RICE that are greater than 500 hp and are located at a major source must continuously monitor pressure drop across the catalyst and catalyst inlet temperature if the engine is equipped with oxidation catalyst or NSCR. These parameters serve as surrogates of the catalyst performance. The pressure drop across the catalyst can indicate if the catalyst is damaged or fouled, in which case, catalyst performance would decrease. If the pressure drop across the catalyst deviates by more than two inches of water from the pressure drop across the catalyst measured during the initial performance test, the catalyst might be damaged or fouled. If the catalyst is changed, the pressure drop across the catalyst must be reestablished. The catalyst inlet temperature is a requirement for proper performance of the catalyst. In general, the catalyst performance will decrease as the catalyst inlet temperature decreases. In addition, if the catalyst inlet temperature is too high, it might be an indication of ignition misfiring, poisoning, or fouling, which would decrease catalyst performance. In addition, the catalyst requires inlet temperatures to be greater than or equal to the specified temperature for the reduction of HAP emissions.

4.7 How Did EPA Determine the Reporting and Recordkeeping Requirements?

Formatted: Indent: Left: -3 pt, No bullets or numbering

Formatted: Font: Not Italic

EPA discussed the specific reporting and recordkeeping requirements that are being proposed earlier in this report. In general, EPA has attempted to reduce the reporting and recordkeeping burden on affected owners and operators. The following presents the rationale for the proposed reporting and recordkeeping requirements.

Owners and operators of emergency engines are required to keep records of their hours of operation (emergency and non-emergency). Owners and operators must install a non-resettable hour meter on their engines to record the necessary information. The owner and operators are required to record the time of operation and the reason the engine was in operation during that time. EPA believes these requirements are appropriate for emergency engines. The requirement to maintain records documenting why the engine was operating will ensure that regulatory agencies have the necessary information to determine if the engine was in compliance with the maintenance and testing hour limitation of 100 hours per year.

Deleted: *OMB Review Draft – February 23, 2009*

EPA does not believe the recordkeeping requirements being placed upon owners and operators of stationary emergency engines are onerous. Emergency engines are often equipped with the equipment necessary to record hours of operation and operators may already be recording the information. Even as a brand new requirement, recording the time and reason of operation should take minimal time and effort. Further, recording the hours and reason for operation is necessary to assure that the engine is in compliance. Finally, these requirements are consistent with previously promulgated requirements affecting the same or similar engines, namely under the CI and SI NSPS.

The reporting requirements being proposed in this rule are consistent with those required for engines subject to the 2004 rule, i.e., stationary RICE greater than 500 hp located at major sources and are based on the General Provisions. Owners and operators of existing emergency stationary RICE, existing stationary RICE that are less than 100 hp and existing stationary RICE that are not subject to any numerical emission standards, do not have to submit the notifications listed in the NESHAP General Provisions (40 CFR part 63, subpart A). Owners and operators of all other engines must submit an initial notification, notification of performance test, and a notification of compliance for each stationary RICE which must comply with the specified emission limitations.

4.8 How Cost Estimates Are Derived

Formatted: No bullets or numbering

4.8.1 Introduction

The cost impacts associated with the proposed rule consist of different types of costs, which include the annual and capital costs of controls, costs associated with keeping records of information necessary to demonstrate compliance, costs associated with reporting requirements under the General Provisions of 40 CFR part 63, subpart A, costs of purchasing and operating equipment associated with continuous parametric monitoring, and the cost of conducting performance testing to demonstrate compliance with the emission standards. The costs presented in this section are calculated based on the control cost methodology presented in the EPA (2002) Air Pollution Control Cost Manual prepared by the U.S. Environmental Protection Agency.[7] This methodology sets out a procedure by which capital and annualized costs are defined and estimated, and this procedure is often used to estimate the costs of rulemakings such as this one. The capital costs presented in this section are annualized using a 7% interest rate, a rate that is consistent with the guidance provided in the Office of Management and Budget's (OMB's)

[7] Available on the Internet at http://epa.gov/ttn/catc/products.html#cccinfo.

(2003) Circular A-4.[8] The following sections describe how the various cost elements were estimated.

4.8.2 Control Costs

For engines that will need to add control technology to meet the emission standards, the following equations were used to estimate capital and annual control costs:

Cost Equations for RICE Add-on Control Technologies

Technology	Capital Cost	Annual Cost
NSCR	\$19.7 x hp + \$1,799	\$2.65 x hp + \$657
Oxidation catalyst	\$11.3 x hp - \$170	\$1.52 x hp + \$393
CDPF	\$7.48 x hp + \$1,304	\$6.27 x hp + \$1,094

The control costs were obtained from a memorandum of information developed for previous engine rulemakings and is available from Docket ID EPA-HQ-OAR-2005-0030.[9]

4.8.3 Recordkeeping

No costs were attributed to the requirement of following the manufacturer's emission-related operation and maintenance (O&M) requirements or the owner or operator's own maintenance plan. It is expected that the majority of owners and operators are already following some type of O&M requirements and minimal to no additional burden is expected. Costs associated with recording the hours of operation of emergency engines are based on labor rates obtained from the Bureau of Labor Statistics web site (http://www.bls.gov/news.release/ecec.toc.htm) and is \$68 per hour for technical labor. The final total wage rate was based on the 2005 compensation rates for professional staff and adjusted by an overhead and profit rate of 167%. The year 2005 was used for consistency in order to have the same basis for all costs. All costs were later converted to 2007 dollars for purposes of presenting costs associated with the rule in present day terms. One hour per year is expected to be sufficient to records hours of operating for stationary emergency engines. No cost is attributed to purchasing and installing an hour-meter since most stationary engines already come equipped with such equipment.

[8] Available on the Internet at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.
[9] Memorandum from Bradley Nelson, Alpha-Gamma Technologies, Inc. to Jaime Pagán, EPA Energy Strategies Group, Control Costs for Reciprocating Internal Combustion Engines at Major and Area Sources, April 28, 2006.

Deleted: *OMB Review Draft – February 23, 2009*

Formatted: No bullets or numbering

Formatted Table

Formatted: No bullets or numbering

Deleted: *OMB Review Draft – February 23, 2009*

4.8.4 *Reporting*

Formatted: No bullets or numbering

Most engines affected by this rule will be subject to reporting requirements such as reading instructions, training personnel, submitting an initial notification, submitting a notification of performance test(s), and submitting a compliance report. Owners and operators of engines less than 100 hp, emergency engines, and engines that are not subject to any numerical emission standards (e.g., 2SLB less than or equal to 249 hp located at area sources) are not subject to any reporting requirements. The reporting requirements are based on $68 per hour for technical labor to comply with the reporting requirements. It is estimated that a total of 14 hours will be needed.

4.8.5 *Monitoring*

Formatted: No bullets or numbering

The cost of monitoring includes the purchase of a continuous parametric monitoring system (CPMS). Non-emergency engines greater than 500 hp that have add-on controls are required to use a CPMS to monitor the catalyst inlet temperature and pressure drop across the catalyst to ensure those parameters do not exceed the operating limitations. The cost of purchasing and operating a CPMS was obtained from vendor quotes received for previous rulemaking and adjusted to 2007 dollars.[10] The capital cost of a CPMS for a large engine facility is $531. It is estimated that 30 hours per year is necessary to operate and maintain the CPMS and that 6 hours per year (or 0.5 hours per month) is needed to record information from the CPMS. It is assumed that all engines subject to continuous monitoring would be located at large engine facilities.

4.8.6 *Performance Testing*

Formatted: No bullets or numbering

The cost of conducting performance testing is based on the cost of portable analyzer testing and is $1,000 per engine. Since in most cases only an initial performance test is required, it is expected that a testing firm will be conducting the performance test. The cost of testing is based on testing two engines where facilities have engines less than 500 hp for a reduction in cost of testing per engine. The testing cost is based on testing three engines where facilities have engines larger than 500 hp. The testing costs are based on information previously obtained from engine testing firms[11] and recently obtained information summarized in the memorandum "Portable Analyzer Testing Costs."

---

[10] Part A of the Supporting Statement for Standard Form 83 Stationary Reciprocating Internal Combustion Engines, November 17, 2003.

[11] Memorandum from Bradley Nelson, Alpha-Gamma Technologies, Inc. to Sims Roy, EPA/OAQPS/ESD/Combustion Group, Portable Emissions Analyzer Cost Information, August 31, 2005.

Deleted: *OMB Review Draft – February 23, 2009*

Summary of Cost Impacts. A summary of the total capital and annualized costs associated with the rule and a breakdown of the costs by NAICS codes are presented in Tables 4-4 through 4-7. Costs are presented by type of cost (i.e., control device, or administrative), industry, and engine size category, and they are also listed with the number of affected engines by size category. These cost estimates do not account for fuel price increases that may result from affected RICE switching to ULSD fuel as part of compliance with this proposed rule. In addition, these costs are not adjusted for retirement of existing RICE that may occur between the current year and 2013. All of these estimates are taken from the memo "Impacts Associated with NESHAP for Existing Stationary RICE" that is found in the docket for this rulemaking.

The total national capital cost for the proposed rule is estimated to be $528 million, and the total national annualized cost is $345 million (2007 dollars) in 2013. The total national capital costs for area sources are about four times higher than those for major sources, and the total national annualized costs for area sources are about twice that for major sources. The electric power generation and natural gas transmission industries are each expected to receive 43% of the capital costs and 44 and 33% of the annualized costs, respectively.

Deleted:).

Summary of Emission Reductions. The proposed rule is expected to reduce total HAP emissions from stationary RICE by approximately 13,000 tons per year (tpy) beginning in the year 2013 or the first year the rule will become effective. EPA estimates that approximately 290,000 stationary SI engines will be subject to the rule and nearly 1 million stationary CI engines will be subject to the rule. These estimates include stationary engines located at major and area sources; however, not all stationary engines are subject to numerical emission standards. As with the costs, these estimates are not adjusted for retirement of existing RICE that may occur between the current year and 2013. Further information regarding the estimated reductions of the proposed rule can be found in the memorandum entitled "Impacts Associated with NESHAP for Existing Stationary RICE," which is available in the docket.

In addition to HAP emissions reductions, the proposed rule will reduce other pollutants such as CO, NO_x, PM, SOx, and VOC. The proposed rule is expected to reduce emissions of CO by more than 511,000 tpy in the year 2013. Emissions of NO_x are expected to be reduced by 79,000 tpy in the year 2013. Reductions of PM are estimated at close to 2,600 tpy in the year 2013, and all of the PM is in the $PM_{2.5}$ fraction. SO_x reductions are expected to be more than 4,600 tpy in the year 2013. Emissions of volatile organic compounds (VOC) are estimated to be reduced by 90,000 tpy in the year 2013. Table 4-8 provides a listing of these pollutant reductions.

Table 4-4. Summary of Major Source and Area Source Costs for the RICE NESHAP[a]

Size Range (hp)	Non-Emergency 4SRB Capital Control Cost	Non-Emergency 4SRB Annual Control Cost	Non-Emergency 4SLB Capital Control Cost	Non-Emergency 4SLB Annual Control Cost	Non-Emergency 2SLB Capital Control Cost	Non-Emergency 2SLB Annual Control Cost	Non-Emergency CI Capital Control Cost	Non-Emergency CI Annual Control Cost
Major Sources								
50-100	$4,480,916	$1,170,317	$0	$0	$0	$0	$0	$0
100-175	$11,282,481	$2,556,407	$0	$0	$0	$0	$0	$0
175-300	$4,508,605	$895,335	$3,692,584	$1,107,592	$916,460	$274,892	$0	$0
300-500	$3,735,882	$662,724	$8,858,948	$2,038,576	$2,198,696	$505,953	$46,543,747	$10,710,412
500-600	$0	$0	$0	$0	$0	$0	$5,734,073	$1,165,786
600-750	$0	$0	$0	$0	$0	$0	$3,620,899	$688,978
>750	$0	$0	$0	$0	$0	$0	$11,920,816	$2,048,924
Total	$24,007,884	$5,284,784	$12,551,531	$3,146,168	$3,115,156	$780,845	$67,819,535	$14,614,100
Area Sources								
50-100	$6,721,523	$1,755,515	$0	$0	$0	$0	$0	$0
100-175	$16,923,926	$3,834,657	$0	$0	$0	$0	$0	$0
175-300	$6,762,908	$1,343,003	$5,538,876	$1,661,387	$1,374,690	$412,339	$0	$0
300-600	$9,259,947	$1,605,989	$22,518,639	$4,934,400	$5,588,886	$1,224,665	$118,325,168	$25,928,017
600-750	$1,468,729	$237,945	$3,828,149	$728,414	$950,106	$180,784	$30,094,612	$5,726,350
>750	$21,757,967	$3,346,835	$59,432,703	$10,215,163	$14,750,564	$2,535,295	$79,569,541	$13,676,238
Total	$62,894,999	$12,123,944	$91,318,367	$17,539,363	$22,664,246	$4,353,083	$227,989,320	$45,330,605
Total	**$86,902,882**	**$17,408,727**	**$103,869,898**	**$20,685,531**	**$25,779,402**	**$5,133,928**	**$295,808,855**	**$59,944,705**

[a]Costs are presented in 2007 dollars.

Table 4-4. **Summary of Major Source and Area Source Costs for the RICE NESHAP (continued)**[a]

Size Range (hp)	Initial Test	Recordkeeping	Reporting	Monitoring - Capital Cost	Monitoring - Annual Cost	Total Annual Costs	Total Capital Costs
Major Sources							
50-100	$0	$5,044,730	$0	$0	$0	$6,215,047	$4,480,916
100-175	$25,927,200	$6,609,981	$12,341,347	$0	$0	$47,434,935	$11,282,481
175-300	$13,045,400	$5,012,634	$6,209,610	$0	$0	$26,545,463	$9,117,649
300-500	$6,972,600	$2,637,366	$3,318,958	$0	$0	$26,846,589	$61,337,272
500-600	$214,900	$0	$204,585	$456,501	$2,104,301	$3,689,572	$6,190,574
600-750	$110,000	$0	$104,720	$233,667	$1,077,120	$1,980,818	$3,854,567
>750	$242,650	$0	$231,003	$515,449	$2,376,029	$4,898,605	$12,436,265
Total	$46,512,750	$19,304,710	$22,410,223	$1,205,618	$5,557,450	$117,611,029	$108,699,724
Area Sources							
50-100	$0	$7,567,094	$0	$0	$0	$9,322,609	$6,721,523
100-175	$8,505,714	$9,914,944	$4,048,720	$0	$0	$26,304,035	$16,923,926
175-300	$3,423,995	$7,518,950	$1,629,821	$0	$0	$15,989,495	$13,676,474
300-600	$12,733,739	$5,934,061	$7,176,595	$4,918,641	$22,673,106	$82,210,572	$160,611,280
600-750	$1,182,000	$994,704	$1,092,688	$2,297,271	$10,589,565	$20,732,451	$38,638,867
>750	$4,404,900	$1,762,179	$3,854,596	$7,135,234	$32,890,773	$72,685,978	$182,646,009
Total	$30,250,347	$33,691,933	$17,802,420	$14,351,147	$66,153,444	$227,245,140	$419,218,078
Total	**$76,763,097**	**$52,996,643**	**$40,212,643**	**$15,556,764**	**$71,710,894**	**$344,856,169**	**$527,917,802**

[a]Costs are presented in 2007 dollars.

Table 4-5. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP[a]

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Electric Power Generation (2211)	$50,442,105	$57,897,442	$174,944,005	$225,386,110	$156,540,989
Hospitals (622110)	$6,305,263	$7,237,180	$21,868,001	$28,173,264	$19,567,624
Natural Gas Transmission (48621)	$39,276,661	$25,297,242	$189,817,689	$229,094,350	$115,382,960
Crude Petroleum & NG Production (211111)	$1,274,843	$4,242,990	$2,494,602	$3,769,445	$7,232,675
Natural Gas Liquid Producers (211112)	$1,274,843	$4,242,990	$2,494,602	$3,769,445	$7,232,675
National Security (92811)	$6,305,263	$7,237,180	$21,868,001	$28,173,264	$19,567,624
Hydro Power Units (335312)	$10,447	$14,489	$15,670	$26,117	$36,224
Irrigation Sets (335312)	$2,912,018	$10,056,184	$4,368,057	$7,280,075	$16,028,767
Welders (333992)	$898,282	$1,385,331	$1,347,452	$2,245,733	$3,266,633
Total	**$108,699,724**	**$117,611,029**	**$419,218,078**	**$527,917,802**	**$344,856,169**

[a]Costs are presented in 2007 dollars.

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a]

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Electric Power Generation (2211)					
50–100 hp	$2,205,292	$3,058,748	$3,308,012	$5,513,304	$7,646,890
100–175 hp	$6,018,272	$25,302,623	$9,027,518	$15,045,790	$39,333,655
175–300 hp	$4,328,077	$12,600,924	$6,492,115	$10,820,192	$20,191,012
300–600 hp	$32,088,690	$14,510,538	$76,321,189	$108,409,878	$53,576,340
600–750 hp	$1,160,986	$596,617	$11,637,927	$12,798,913	$6,841,178
>750 hp	$4,640,789	$1,827,992	$68,157,244	$72,798,033	$28,951,913
Total Electric Power Generation 2211	**$50,442,105**	**$57,897,442**	**$174,944,005**	**$225,386,110**	**$156,540,989**
Hospitals (622110)					
50–100 hp	$275,662	$382,344	$413,501	$689,163	$955,861
100–175 hp	$752,284	$3,162,828	$1,128,440	$1,880,724	$4,916,707
175–300 hp	$541,010	$1,575,115	$811,514	$1,352,524	$2,523,876
300–600 hp	$4,011,086	$1,813,817	$9,540,149	$13,551,235	$6,697,043
600–750 hp	$145,123	$74,577	$1,454,741	$1,599,864	$855,147
>750 hp	$580,099	$228,499	$8,519,656	$9,099,754	$3,618,989
Total Hospitals (622110)	**$6,305,263**	**$7,237,180**	**$21,868,001**	**$28,173,264**	**$19,567,624**
Natural Gas Transmission (48621)					
50–100 hp	$159,582	$221,341	$239,379	$398,961	$553,355
100–175 hp	$482,532	$2,028,709	$723,807	$1,206,339	$3,153,686
175–300 hp	$2,362,712	$6,878,887	$3,544,068	$5,906,779	$11,022,342
300–600 hp	$27,314,729	$12,351,748	$64,966,584	$92,281,312	$45,605,577
600–750 hp	$2,403,335	$1,235,047	$24,091,458	$26,494,793	$14,161,796
>750 hp	$6,553,772	$2,581,510	$96,252,394	$102,806,166	$40,886,204
Total Natural Gas Transmission (48621)	**$39,276,661**	**$25,297,242**	**$189,817,689**	**$229,094,350**	**$115,382,960**

(continued)

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a] (continued)

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Crude Petroleum & NG Production (211111)					
50–100 hp	$273,040	$378,708	$409,570	$682,610	$946,772
100–175 hp	$909,557	$3,824,050	$1,364,352	$2,273,908	$5,944,595
175–300 hp	$364	$1,060	$546	$910	$1,698
300–600 hp	$51,128	$23,120	$121,605	$172,733	$85,365
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$40,754	$16,053	$598,530	$639,283	$254,244
Total Crude Petroleum & NG Production (211111)	**$1,274,843**	**$4,242,990**	**$2,494,602**	**$3,769,445**	**$7,232,675**
Natural Gas Liquid Producers (211112)					
50–100 hp	$273,040	$378,708	$409,570	$682,610	$946,772
100–175 hp	$909,557	$3,824,050	$1,364,352	$2,273,908	$5,944,595
175–300 hp	$364	$1,060	$546	$910	$1,698
300–600 hp	$51,128	$23,120	$121,605	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	$40,754	$16,053	$598,530	$639,283	$254,244
Total Natural Gas Liquid Producers (211112)	**$1,274,843**	**$4,242,990**	**$2,494,602**	**$3,769,445**	**$7,232,675**
National Security (92811)					
50–100 hp	$275,662	$382,344	$413,501	$689,163	$955,861
100–175 hp	$752,284	$3,162,828	$1,128,440	$1,880,724	$4,916,707
175–300 hp	$541,010	$1,575,115	$811,514	$1,352,524	$2,523,876
300–600 hp	$4,011,086	$1,813,817	$9,540,149	$13,551,235	$6,697,043
600–750 hp	$145,123	$74,577	$1,454,741	$1,599,864	$855,147
>750 hp	$580,099	$228,499	$8,519,656	$9,099,754	$3,618,989
Total Natural Gas Liquid Producers (211112)	**$6,305,263**	**$7,237,180**	**$21,868,001**	**$28,173,264**	**$19,567,624**

(continued)

Table 4-6. Summary of Major Source and Area Source Costs by NAICS for the RICE NESHAP by Size[a] (continued)

NAICS	Major Source		Area Source	Total (Major + Area)	
	Capital Cost	Annual Cost	Capital Cost	Capital Cost	Annual Cost
Hydro Power Units (335312)					
50–100 hp	$10,447	$14,489	$15,670	$26,117	$36,224
100–175 hp	$0	$0	$0	$0	$0
175–300 hp	$0	$0	$0	$0	$0
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Hydro Power Units (335312)	**$10,447**	**$14,489**	**$15,670**	**$26,117**	**$36,224**
Irrigation Sets (335312)					
50–100 hp	$159,393	$221,079	$239,095	$398,488	$552,699
100–175 hp	$1,408,511	$5,921,803	$2,112,792	$3,521,303	$9,205,613
175–300 hp	$1,344,113	$3,913,302	$2,016,170	$3,360,283	$6,270,455
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Irrigation Sets (335312)	**$2,912,018**	**$10,056,184**	**$4,368,057**	**$7,280,075**	**$16,028,767**
Welders (333992)					
50–100 hp	$848,798	$1,177,286	$1,273,225	$2,122,023	$2,943,221
100–175 hp	$49,484	$208,045	$74,227	$123,711	$323,412
175–300 hp	$0	$0	$0	$0	$0
300–600 hp	$0	$0	$0	$0	$0
600–750 hp	$0	$0	$0	$0	$0
>750 hp	$0	$0	$0	$0	$0
Total Welders (333992)	**$898,282**	**$1,385,331**	**$1,347,452**	**$2,245,733**	**$3,266,633**
Total	**$108,699,724**	**$117,611,029**	**$419,218,078**	**$527,917,802**	**$344,856,169**

[a] Costs are presented in 2007 dollars

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a]

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Electric Power Generation (2211)					
50–100 hp	53,049	79,573	132,622	$5,513,304	$7,646,890
100–175 hp	79,511	119,267	198,778	$15,045,790	$39,333,655
175–300 hp	47,377	71,066	118,443	$10,820,192	$20,191,012
300–600 hp	27,099	56,377	83,476	$108,409,878	$53,576,340
600–750 hp	663	5,830	6,493	$12,798,913	$6,841,178
>750 hp	1,811	16,245	18,056	$72,798,033	$28,951,913
Total Electric Power Generation 2211	**209,510**	**348,358**	**557,868**	**$225,386,110**	**$156,540,989**
Hospitals (622110)					
50–100 hp	6,631	9,947	16,578	$689,163	$955,861
100–175 hp	9,939	14,908	24,847	$1,880,724	$4,916,707
175–300 hp	5,922	8,883	14,805	$1,352,524	$2,523,876
300–600 hp	3,387	7,047	10,435	$13,551,235	$6,697,043
600–750 hp	83	729	812	$1,599,864	$855,147
>750 hp	226	2,031	2,257	$9,099,754	$3,618,989
Total Hospitals (622110)	**26,189**	**43,545**	**69,734**	**$28,173,264**	**$19,567,624**
Natural Gas Transmission (48621)					
50–100 hp	3,839	5,758	9,597	$398,961	$553,355
100–175 hp	6,375	9,563	15,938	$1,206,339	$3,153,686
175–300 hp	25,863	38,795	64,658	$5,906,779	$11,022,342
300–600 hp	23,068	47,990	71,057	$92,281,312	$45,605,577
600–750 hp	1,372	12,069	13,440	$26,494,793	$14,161,796
>750 hp	2,557	22,942	25,499	$102,806,166	$40,886,204
Total Natural Gas Transmission (48621)	**63,074**	**137,116**	**200,190**	**$229,094,350**	**$115,382,960**

(continued)

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a] (continued)

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Crude Petroleum & NG Production (211111)					
50–100 hp	6,568	9,852	16,420	$682,610	$946,772
100–175 hp	12,017	18,025	30,042	$2,273,908	$5,944,595
175–300 hp	4	6	10	$910	$1,698
300–600 hp	43	90	133	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	16	143	159	$639,283	$254,244
Total Crude Petroleum & NG Production (211111)	**18,648**	**28,116**	**46,763**	**$3,769,445**	**$7,232,675**
Natural Gas Liquid Producers (211112)					
50–100 hp	6,568	9,852	16,420	$682,610	$946,772
100–175 hp	12,017	18,025	30,042	$2,273,908	$5,944,595
175–300 hp	4	6	10	$910	$1,698
300–600 hp	43	90	133	$172,733	$85,365
600–750 hp	0	0	0	$0	$0
>750 hp	16	143	159	$639,283	$254,244
Total Natural Gas Liquid Producers (211112)	**18,648**	**28,116**	**46,763**	**$3,769,445**	**$7,232,675**
National Security (92811)					
50–100 hp	6,631	9,947	16,578	$689,163	$955,861
100–175 hp	9,939	14,908	24,847	$1,880,724	$4,916,707
175–300 hp	5,922	8,883	14,805	$1,352,524	$2,523,876
300–600 hp	3,387	7,047	10,435	$13,551,235	$6,697,043
600–750 hp	83	729	812	$1,599,864	$855,147
>750 hp	226	2,031	2,257	$9,099,754	$3,618,989
Total Natural Gas Liquid Producers (211112)	**26,189**	**43,545**	**69,734**	**$28,173,264**	**$19,567,624**

(continued)

Table 4-7. Summary of Major Source and Area Source NAICS Costs for the RICE NESHAP by Number of Engines[a] (continued)

NAICS	Number of Engines			Total (Major + Area)	
	Major	Area	Total	Capital Cost	Annual Cost
Hydro Power Units (335312)					
50–100 hp	251	377	628	$26,117	$36,224
100–175 hp	0	0	0	$0	$0
175–300 hp	0	0	0	$0	$0
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Hydro Power Units (335312)	**251**	**377**	**628**	**$26,117**	**$36,224**
Irrigation Sets (335312)					
50–100 hp	3,834	5,751	9,586	$398,488	$552,699
100–175 hp	18,609	27,913	46,522	$3,521,303	$9,205,613
175–300 hp	14,713	22,070	36,783	$3,360,283	$6,270,455
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Irrigation Sets (335312)	**37,156**	**55,734**	**92,891**	**$7,280,075**	**$16,028,767**
Welders (333992)					
50–100 hp	20,418	30,627	51,045	$2,122,023	$2,943,221
100–175 hp	654	981	1,634	$123,711	$323,412
175–300 hp	0	0	0	$0	$0
300–600 hp	0	0	0	$0	$0
600–750 hp	0	0	0	$0	$0
>750 hp	0	0	0	$0	$0
Total Welders (333992)	**21,072**	**31,608**	**52,679**	**$2,245,733**	**$3,266,633**
Total	**420,736**	**716,514**	**1,137,250**	**$527,917,802**	**$344,856,169**

[a]Costs are presented in 2007 dollars.

4.9 Baseline Emissions and Emission Reductions

Deleted: 6

Formatted: Line spacing: 1.5 lines

Tables 4-8 through 4-10 present the baseline emissions by pollutant, engine type (CI and SI, non-emergency and emergency), and engine size. Tables 4-8 and 4-9 present this information for the CI engines; Table 4-10 presents this information for the SI engines. As shown in these tables, there are no emission reductions from emergency CI engines. Table 4-11 presents the emission reductions by pollutant, engine type and engine size, and Table 4-12 presents a summary of the emission reductions across all pollutants, engine types and sizes. All emission estimates are for the year in which full implementation of this proposal is required (2013). More information on these emissions, emission reductions, and how these estimates are generated can be found in the memo "Impacts Associated with NESHAP for Existing Stationary RICE" that is available in the public docket for this rulemaking.

Table 4-8. Baseline Emissions for Major and Area Sources (tons per year) – Non-Emergency CI Engines

	HAP - Non-Emergency CI	NO_x - Non-Emergency CI	PM - Non-Emergency CI*	SO_2 - Non-Emergency CI	VOC - Non-Emergency CI	CO - Non-Emergency CI
Major Sources (hp)						
50-100	74	15,301	487	281	2,010	6,454
100-175	179	36,756	1,170	676	4,828	8,457
175-300	234	48,145	1,532	885	6,324	6,413
300-500	207	42,663	1,357	784	5,604	3,374
500-600	25	5,201	165	96	683	299
600-750	16	3,267	104	60	429	153
>750	52	10,677	340	196	1,402	338
Total	788	162,010	5,155	2,979	21,281	25,489
Area Sources (hp)						
50-100	112	22,952	730	422	3,015	9,681
100-175	268	55,134	1,754	1,014	7,242	12,685
175-300	351	72,218	2,298	1,328	9,486	9,620
300-600	525	107,991	3,436	1,765	14,186	7,592
600-750	132	27,153	864	499	3,567	1,273
>750	347	71,265	2,268	1,310	9,361	2,255
Total	1,735	356,712	11,350	6,338	46,857	43,106
Total	**2,523**	**518,722**	**16,505**	**9,317**	**68,139**	**68,595**

* All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Deleted: *OMB Review Draft – February 23, 2009*

Table 4-9. Summary of Major Source and Area Source Baseline Emissions (tons per year) – Emergency CI Engines

	HAP - Emergency CI	*NO_x - Emergency CI*	*PM - Emergency CI***	*SO_2 - Emergency CI*	*VOC - Emergency CI*	*CO - Emergency CI*
Major Sources (hp)						
50-100	15	3,060	97	56	402	1,291
100-175	36	7,351	234	135	966	1,691
175-300	47	9,629	306	177	1,265	1,283
300-500	41	8,533	271	157	1,121	675
500-600	N/A	N/A	33	19	N/A	N/A
600-750	N/A	N/A	21	12	N/A	N/A
>750	N/A	N/A	68	39	N/A	N/A
Total	139	28,573	1,031	596	3,753	4,940
Area Sources (hp)						
50-100	22	4,590	146	84	603	1,936
100-175	54	11,027	351	203	1,448	2,537
175-300	70	14,444	460	266	1,897	1,924
300-600	105	21,598	687	353	2,837	1,518
600-750	26	5,431	173	100	713	255
>750	69	14,253	454	262	1,872	451
Total	347	71,342	2,270	1,268	9,371	8,621
Total	**486**	**99,916**	**3,301**	**1,863**	**13,125**	**13,561**

** All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Deleted: *OMB Review Draft – February 23, 2009*

Table 4-10. Summary of Major Source and Area Source Baseline Emissions (tons per year) – SI Engines

Deleted:

	HAP - SI	*NO_x - SI*	*VOC - SI*	*CO - SI*
Major Sources (hp)				
50-100	765	34,777	3,937	285,964
100-175	2,568	116,687	13,208	523,359
175-300	1,217	56,048	6,259	145,537
300-500	1,113	52,348	5,726	80,708
500-600	N/A	N/A	N/A	N/A
600-750	N/A	N/A	N/A	N/A
>750	N/A	N/A	N/A	N/A
Total	5,663	259,859	29,130	1,035,568
Area Sources (hp)				
50-100	1,148	52,167	5,905	428,955
100-175	3,852	175,033	19,813	785,048
175-300	1,825	84,071	9,389	218,305
300-600	2,817	132,488	14,493	181,570
600-750	474	22,266	2,436	20,343
>750	7,297	343,143	37,538	211,619
Total	17,413	809,167	89,573	1,845,840
Total	**23,076**	**1,069,026**	**118,703**	**2,881,408**

Table 4-11. Summary of Major Source and Area Source Emission Reductions (tons per year) – by Pollutant and Engine Type*

	HAP - SI	*HAP - CI*	*CO - SI*	*CO - CI*	*NO_x - SI*	*NO_x - CI*	*PM - CI*	*SO_2 - CI*	*VOC - SI*	*VOC - CI*
Major Sources (hp)										
50-100	81	N/A	39,195	N/A	2,577	N/A	0	0	414	0
100-175	270	N/A	71,733	N/A	8,645	N/A	0	0	1,391	0
175-300	472	N/A	29,290	N/A	4,152	N/A	0	0	2,428	0
300-500	920	187	24,014	3,037	3,878	N/A	407	761	4,733	5,044
500-600	N/A	23	N/A	269	N/A	N/A	50	93	N/A	23
600-750	N/A	14	N/A	138	N/A	N/A	31	58	N/A	14
>750	N/A	47	N/A	304	N/A	N/A	102	190	N/A	47
Total	1,743	271	164,232	3,748	19,252	0	590	1,102	8,966	5,128
Area Sources (hp)										
50-100	121	0	58,794	N/A	3,865	N/A	0	0	622	0
100-175	406	0	107,601	N/A	12,968	N/A	0	0	2,086	0
175-300	708	0	43,935	N/A	6,229	N/A	0	0	3,642	0
300-600	2,329	473	54,025	6,833	9,816	N/A	1,031	1,712	11,978	12,767
600-750	391	119	6,053	1,145	1,650	N/A	259	484	2,013	3,210
>750	6,031	312	62,966	2,029	25,423	N/A	680	1,271	31,024	8,425
Total	9,985	904	333,375	10,007	59,950	0	1,970	3,467	51,365	24,402
Total	**11,728**	**1,174**	**497,607**	**13,755**	**79,202**	**0**	**2,560**	**4,570**	**60,330**	**29,530**

* There are no emission reductions from either CI or SI emergency engines. Thus, all of these emission reductions are from non-emergency engines.
** All PM emissions affected by this proposed rule are in the fine particulate ($PM_{2.5}$) mass fraction.

Deleted: *OMB Review Draft – February 23, 2009*

Table 4-12. Summary of Major Source and Area Source Emissions Reductions for the RICE NESHAP, 2013

	Emission Reductions (tons per year)					
Size Range (hp)	**HAP**	**CO**	**NO_x**	**PM[a]**	**SO_2**	**VOC**
Major Sources						
50–100	81	39,195	2,577	0	0	414
100–175	270	71,733	8,645	0	0	1,391
175–300	472	29,290	4,152	0	0	2,428
300–500	1,107	27,051	3,878	407	761	9,777
500–600	23	269	NA	50	93	23
600–750	14	138	NA	31	58	14
>750	47	304	NA	102	190	47
Total	2,013	167,980	19,252	590	1,102	14,093
Area Sources						
50–100	121	58,794	3,865	0	0	622
100–175	406	107,601	12,968	0	0	2,086
175–300	708	43,935	6,229	0	0	3,642
300–600	2,801	60,858	9,816	1,031	1,712	24,745
600–750	510	7,198	1,650	259	484	5,223
>750	6,343	64,996	25,423	680	1,271	39449
Total	10,889	343,382	59,950	1,970	3,467	75,767
Total	**12,902**	**511,362**	**79,202**	**2,560**	**4,570**	**89,860**

[a]All of the PM emissions from the affected RICE sources are in the $PM_{2.5}$ fraction.

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 5
ECONOMIC IMPACT ANALYSIS, ENERGY IMPACTS, AND SOCIAL COSTS

The EIA provides decision makers with social cost estimates and enhances understanding of how the costs may be distributed across stakeholders (EPA, 2000). Although several economic frameworks can be used to estimate social costs for regulations of this size and sector scope, OAQPS has typically used partial equilibrium market models. However, the current data do not provide sufficient details to develop a market model; the data that are available have little or no sector/firm detail and are reported at the national level. In addition, some sectors have unique market characteristics (e.g., hospitals) that make developing partial equilibrium models difficult. Given these constraints, we used the direct compliance costs as a measure of total social costs. In addition, we also provide a qualitative analysis of the proposed rule's impact on stakeholder decisions, a qualitative discussion on if unfunded mandates occur as a result of this proposed rule, and the potential distribution of social costs between consumers and producers.

5.1 Compliance Costs of the Proposed Rule

For the year 2013, EPA's engineering cost analysis estimates the total annualized costs of the proposed rule are $345 million (in 2007 dollars) as found in the memo "Impacts Associated with Existing Stationary NESHAP," which can be found in the docket for this rulemaking.

Deleted: (Nelson and Paries, 2008)

As shown in Figure 5-1, the majority of the costs fall on the electric power sector (46%), followed by the natural gas transmission sector (31%). The remaining industries each account for less than 10% of the total annualized cost.

The proposed rule will affect approximately 1.3 million existing stationary diesel engines. As shown in Figure 5-2, most of the affected engines fall within the 100 to 175 hp category (31%). The next highest categories are 50 to 100 hp (23%) and 175 to 300 hp (21%). The remaining engines are concentrated in the 300 to 600 hp category (16%).

The annualized compliance costs per engine vary by the engine size (see Figure 5-3). For 300 hp engines or less, the annualized per-engine costs are below $200 per engine. Per-engine costs for higher horsepower (hp) engines range between $600 and $1,600.

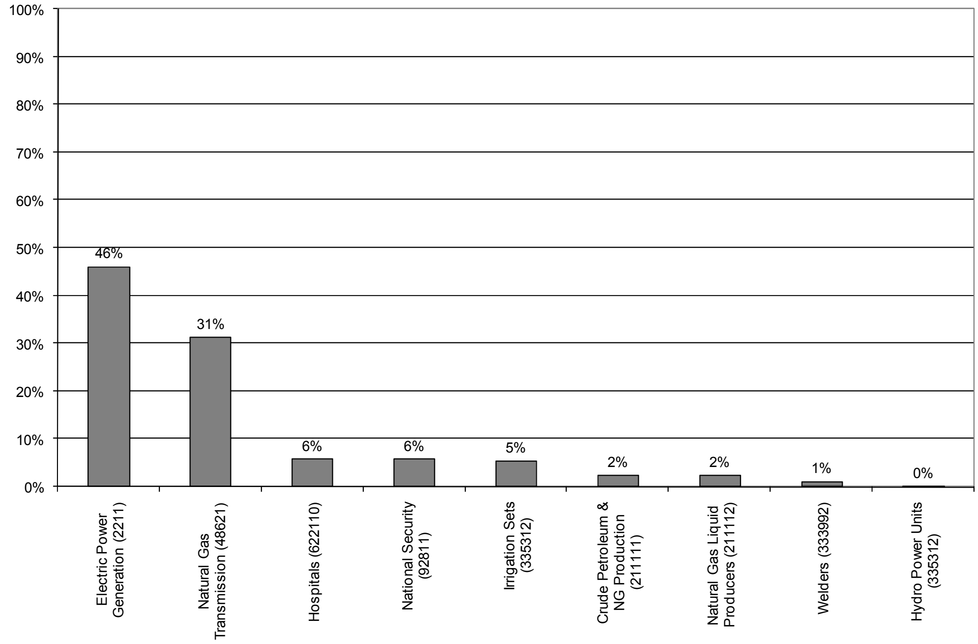


Figure 5-1. Distribution of Annualized Direct Compliance Costs by Industry: 2013 ($2007)

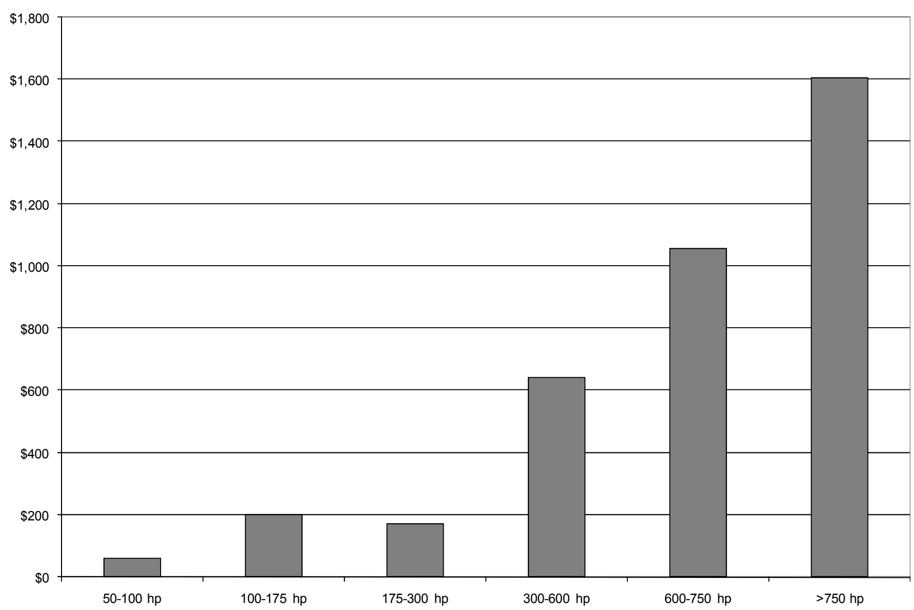


Figure 5-2. Distribution of Engine Population by Horsepower Group: 2013

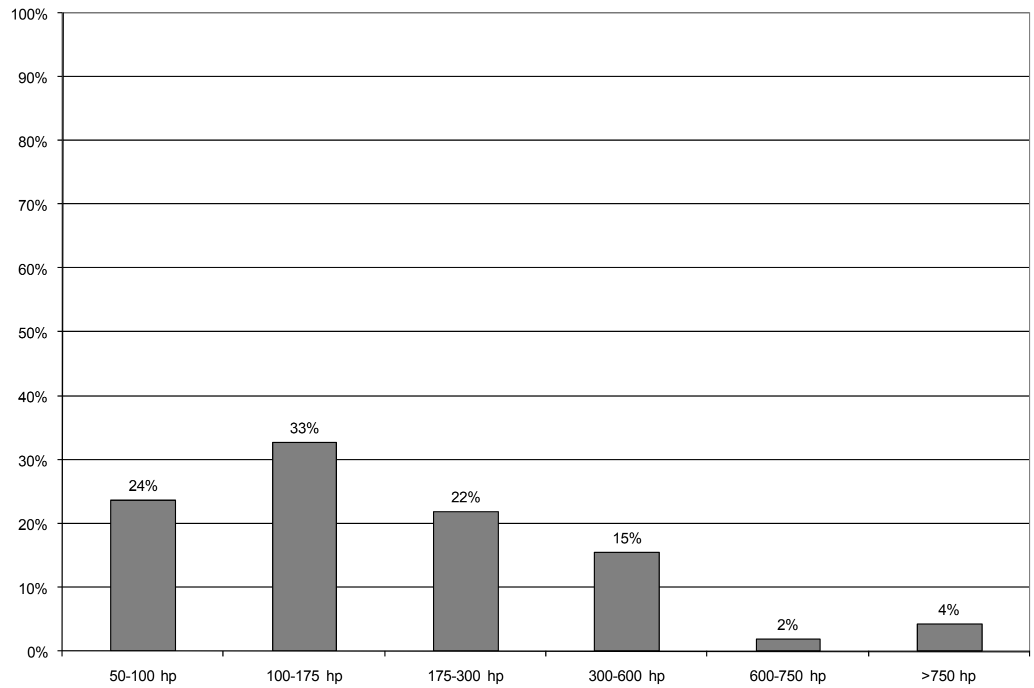


Figure 5-3. Average Annualized Cost per Engine by Horsepower Group: 2013 ($2007)

To assess the size of the compliance relative to the value of the goods and services for industries using affected engines, we collected census data for selected industries. At the industry level, the annualized costs represent a very small fraction of revenue (less than 0.7%) (Table 5-1). These industry level cost-to-sales ratios can be interpreted as an average impact on potentially affected firms in these industries. Based on the cost-to-sales ratios, we can conclude that the annualized cost of this rule should be no higher than 1% of the sales for a firm in each of these industries.

5.2 How Might People and Firms Respond? A Partial Equilibrium Analysis

Markets are composed of people as consumers and producers trying to do the best they can given their economic circumstances. One way economists illustrate behavioral responses to pollution control costs is by using market supply and demand diagrams. The market supply curve describes how much of a good or service firms are willing and able to sell to people at a particular price; we often draw this curve as upward sloping because some production resources are fixed. As a result, the cost of producing an additional unit typically rises as more units are made. The market demand curve describes how much of a good or service consumers are willing

Deleted: *OMB Review Draft – February 23, 2009*

Table 5-1. Selected Industry-Level Annualized Compliance Costs as a Fraction of Total Industry Revenue: 2002

Industry (NAICS)	Industry Name	Total Annual Costs ($\$10^{6}$)	Revenue ($\$2002\ 10^{9}$)	Revenue ($\$2007\ 10^{9}$)	Cost-to-Sales Ratio
2211	Electric Power Generation, Transmission and Distribution	$156.5	$325.0	$373.8	0.04%
48621	Pipeline transportation of natural gas	$115.4	$14.8	$17.0	0.68%
622110	General medical & surgical hospitals	$19.6	$469.7	$540.2	<0.01%
111 and 112	Agriculture using irrigation	$16.0	$20.7 (estimate)[a]	$23.9	0.07%
211111	Crude Petroleum & Natural Gas	$7.2	$85.9	$98.8	0.01%
211112	Natural Gas Liquid Extraction	$7.2	$29.2	$33.6	0.02%

[a]Assumes 10 percent of U.S. agricultural revenue is associated with farms with irrigation.

Sources: Nelson, B., EC/R Inc. and T. Parise, Alpha-Gamma Technologies, Inc. February 19, 2009. Impacts Associated with NESHAP for Existing Stationary RICE.

Deleted: December 1, 2008. Memorandum to Jamie Pagan, U.S. Environmental Protection Agency.

Deleted: associated

Deleted: existing stationary

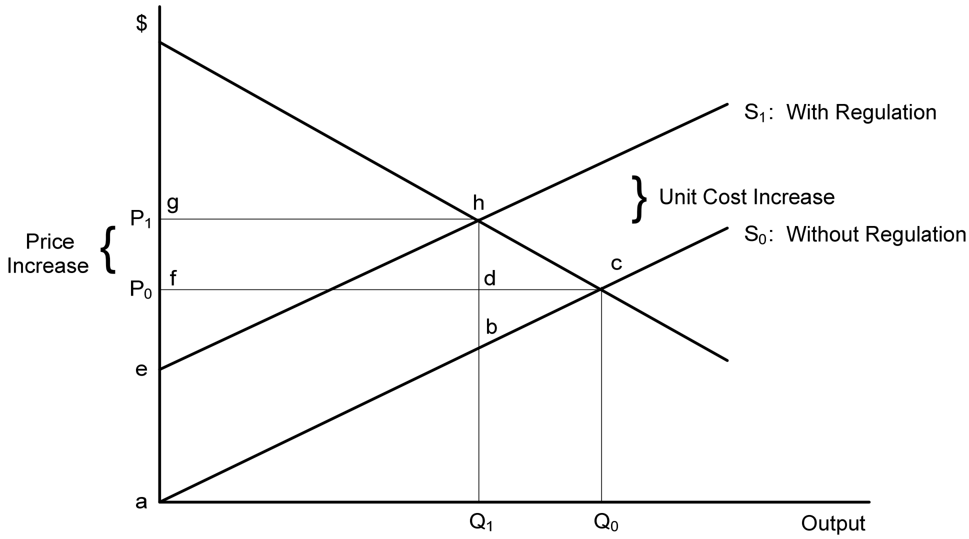
U.S. Census Bureau; generated by RTI International; using American FactFinder; “Sector 00: All sectors: Geographic Area Series: Economy-Wide Key Statistics: 2002” <http://factfinder.census.gov>; (December 17, 2008).

and able to buy at some price. Holding other factors constant, the quantity demand is assumed to fall when prices rise. In a perfectly competitive market, equilibrium price (P_0) and quantity (Q_0) is determined by the intersection of the supply and demand curves (see Figure 5-4).

5.2.1 Changes in Market Prices and Quantities

To qualitatively assess how the regulation may influence the equilibrium price and quantity in the affected markets, we assumed the market supply function shifts up by the additional cost of producing the good or service; the unit cost increase is typically calculated by dividing the annual compliance cost estimate by the baseline quantity (Q_0) (see Figure 5-4). As shown, this model makes two predictions: the price of the affected goods and services are likely to rise and the consumption/production levels are likely to fall.

Deleted: *OMB Review Draft – February 23, 2009*



consumer surplus = –[fghd + dhc]

producer surplus = [fghd – aehb] – bdc

total surplus = consumer surplus + producer surplus =

–[aehb + dhc + bdc]

Figure 5-4. Market Demand and Supply Model: With and Without Regulation

The size of these changes depends on two factors: the size of the unit cost increase (supply shift) and differences in how each side of the market (supply and demand) responds to changes in price. Economists measure responses using the concept of price elasticity, which represents the percentage change in quantity divided by the percentage change in price. This dependence has been expressed in the following formula:[1]

$$\text{Share of per-unit cost} = \frac{\text{Price Elasticity of Supply}}{(\text{Price Elasticity of Supply - Price Elasticity of Demand})}$$

As a general rule, a higher share of the per-unit cost increases will be passed on to consumers in markets where

- goods and services are necessities and people do not have good substitutes that they can switch to easily (demand is inelastic) and

[1] For examples of similar mathematical models in the public finance literature, see Nicholson (1998), pages 444–447, or Fullerton and Metcalf (2002).

Deleted: *OMB Review Draft – February 23, 2009*

- suppliers have excess capacity and can easily adjust production levels at minimal costs, or the time period of analysis is long enough that suppliers can change their fixed resources; supply is more elastic over longer periods.

Short-run demand elasticities for energy goods (electricity and natural gas), agricultural products, and construction are often inelastic. Specific estimates of short-run demand elasticities for these products can be obtained from existing literature. For the short-run demand of energy products, the National Energy Modeling System (NEMS) buildings module uses values between 0.1 and 0.3; a 1% increase in price leads to a 0.1 to 0.3% decrease in energy demand (Wade, 2003). For the short-run demand of agriculture and construction, the EPA has estimated elasticities to be 0.2 for agriculture and approximately 1 for construction (EPA, 2004). As a result, a 1% increase in the prices of agriculture products would lead to a 0.2% decrease in demand for those products, while a 1% increase in construction prices would lead to approximately a 1% decrease in demand for construction. Given these demand elasticity scenarios (shaded in gray), approximately a 1% increase unit costs would result in a price increase of 0.1 to 1% (Table 5-2). As a result, 10 to 100% of the unit cost increase could be passed on to consumers in the form of higher goods/services prices. This price increase would correspond to a 0.1 to 0.8% decline in consumption in these markets (Table 5-3).

Table 5-2. Hypothetical Price Increases for a 1% Increase in Unit Costs

Market Demand Elasticity	Market Supply Elasticity						
	0.1	**0.3**	**0.5**	**0.7**	**1**	**1.5**	**3**
−0.1	**0.5%**	0.8%	0.8%	0.9%	0.9%	0.9%	1.0%
−0.3	0.3%	**0.5%**	0.6%	0.7%	0.8%	0.8%	0.9%
−0.5	0.2%	0.4%	**0.5%**	0.6%	0.7%	0.8%	0.9%
−0.7	0.1%	0.3%	0.4%	**0.5%**	0.6%	0.7%	0.8%
−1.0	0.1%	0.2%	0.3%	0.4%	**0.5%**	0.6%	0.8%
−1.5	0.1%	0.2%	0.3%	0.3%	0.4%	**0.5%**	0.7%
−3.0	0.0%	0.1%	0.1%	0.2%	0.3%	0.3%	**0.5%**

5.2.2 Regulated Markets: The Electric Power Generation, Transmission, and Distribution Sector

Formatted: No bullets or numbering, Tabs: Not at 67.5 pt

Given that the electric power sector bears close to half of the estimated compliance costs (Figure 5-1) and the industry is also among the last major regulated energy industries in the United States (EIA, 2000), the competitive model is not necessarily applicable for this industry.

Deleted: *OMB Review Draft – February 23, 2009*

Table 5-3. Hypothetical Consumption Decreases for a 1% Increase in Unit Costs

Market Demand Elasticity	Market Supply Elasticity						
	0.1	0.3	0.5	0.7	1	1.5	3
−0.1	**−0.1%**	−0.1%	−0.1%	−0.1%	−0.1%	−0.1%	−0.1%
−0.3	−0.1%	**−0.2%**	−0.2%	−0.2%	−0.2%	−0.3%	−0.3%
−0.5	−0.1%	−0.2%	**−0.3%**	−0.3%	−0.3%	−0.4%	−0.4%
−0.7	−0.1%	−0.2%	−0.3%	**−0.4%**	−0.4%	−0.5%	−0.6%
−1.0	−0.1%	−0.2%	−0.3%	−0.4%	**−0.5%**	−0.6%	−0.8%
−1.5	−0.1%	−0.3%	−0.4%	−0.5%	−0.6%	**−0.8%**	−1.0%
−3.0	−0.1%	−0.3%	−0.4%	−0.6%	−0.8%	−1.0%	**−1.5%**

Although the electricity industry continues to go through a process of restructuring, whereby the industry is moving toward a more competitive framework (see Figure 5-5 for the status of restructuring by state),[2] in many states, electricity prices continue to be fully regulated by Public Service Commissions. As a result, the rules and processes outlined by these agencies would ultimately determine how these additional regulatory costs would be recovered by affected entities.

5.2.3. *Partial Equilibrium Measures of Social Cost: Changes Consumer and Producer Surplus*

Formatted: Indent: Left: 18 pt, No bullets or numbering, Tabs: Not at 67.5 pt

In partial equilibrium analysis, the social costs are estimated by measuring the changes in consumer and producer surplus, and these values can be determined using the market supply and demand model (Figure 5-4). The change in consumer surplus is measured as follows:

$$\Delta CS = -[\Delta Q_1 \times \Delta p] + [0.5 \times \Delta Q \times \Delta p]. \qquad (5.1)$$

Higher market prices and lower quantities lead to consumer welfare losses. Similarly, the change in producer surplus is measured as follows:

$$\Delta PS = [\Delta Q_1 \times \Delta p] - [\Delta Q_1 \times \mathrm{t}] - [0.5 \times \Delta Q \times (\Delta p - t)]. \qquad (5.2)$$

Higher unit costs and lower production level reduce producer surplus because the net price change (Δp – t) is negative. However, these losses are mitigated because market prices tend to rise.

[2] http://tonto.eia.doe.gov/energy_in_brief/print_pages/electricity.pdf.

Deleted: *OMB Review Draft – February 23, 2009*

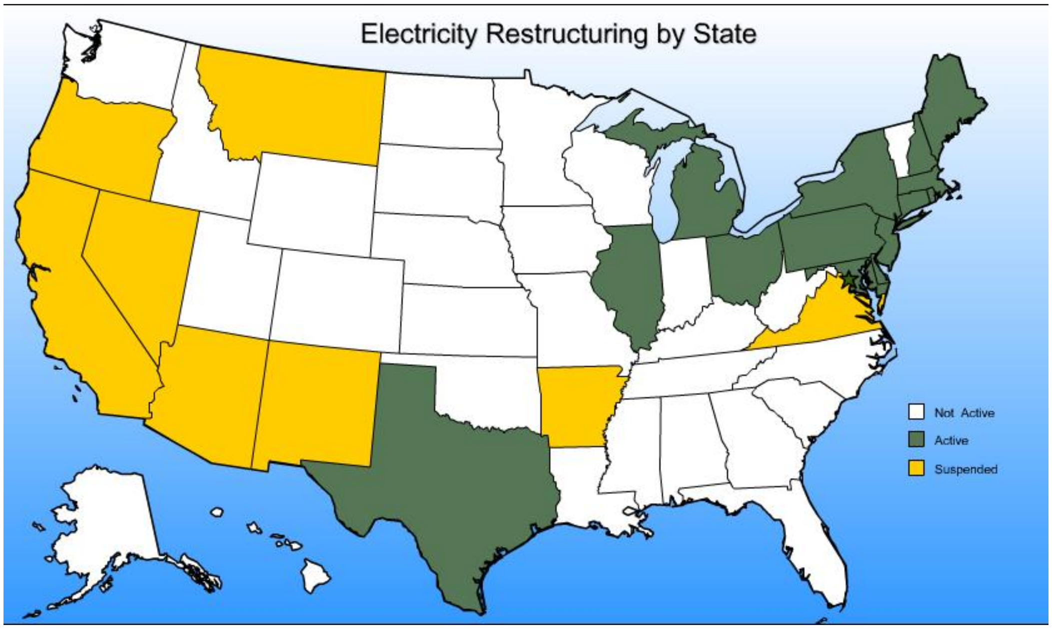


Figure 5-5. Electricity Restructuring by State

Source. U.S. Energy Information Administration. 2008a. <http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html>. Last updated September 2008.

5.3 Social Cost Estimate

Differences between social cost estimates derived from a perfect competition partial equilibrium models and engineering direct compliance cost methods may be small. As shown in Table 5-1 the compliance costs are only a small fraction of the affected product value; this suggests that, assuming a relatively inelastic change of supply in response to the compliance costs, the shift of the supply curve may also be small and result in small changes in market prices and consumption. Based on the assumption of relatively inelastic supply and the small size of compliance cost compared to affected product value, EPA believes the national annualized compliance cost estimates provide a reasonable approximation of the social cost of this proposed rule.

Deleted: are likely to

Deleted: As a result

5.4 Energy Impacts

Executive Order 13211 (66 FR 28355, May 22, 2001) provides that agencies will prepare and submit to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, a Statement of Energy Effects for certain actions identified as “significant energy actions.” Section 4(b) of Executive Order 13211 defines “significant energy

Deleted: *OMB Review Draft – February 23, 2009*

actions" as any action by an agency (normally published in the *Federal Register*) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking: (1) (i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action.

This rule is not a significant energy action as designated by the Administrator of the Office of Information and Regulatory Affairs because it is not likely to have a significant adverse impact on the supply, distribution, or use of energy. EPA has prepared an analysis of energy impacts that explains this conclusion as follows below.

With respect to energy supply and prices, the analysis in Table 5-1 suggests at the industry level, the annualized costs represent a very small fraction of revenue (less than 0.7%). As a result, we can conclude supply and price impacts should be small.

To enhance understanding regarding the regulation's influence on energy consumption, we examined publicly available data describing energy consumption for the electric power sector that will be affected by this rule. The Annual Energy Outlook 2009 (EIA, 2008) provides energy consumption data. As shown in Table 5-4, this industry account for less than 0.5% of the U.S. total liquid fuels and less than 6.5% of natural gas. As a result, any energy consumption changes attributable to the regulatory program should not significantly influence the supply, distribution, or use of energy.

5.5 Unfunded Mandates

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), 2 U.S.C. 1531-1538, requires Federal agencies, unless otherwise prohibited by law, to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. This 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, EPA has prepared under section 202 of the UMRA a written statement which is summarized below in this section.

Deleted: *OMB Review Draft – February 23, 2009*

Table 5-4. U.S. Electric Power[a] Sector Energy Consumption (Quadrillion BTUs): 2013

	Quantity	Share of Total Energy Use
Distillate fuel oil	0.12	0.1%
Residual fuel oil	0.38	0.4%
Liquid fuels subtotal	0.50	0.5%
Natural gas	6.27	6.1%
Steam coal	21.55	21.0%
Nuclear power	8.53	8.3%
Renewable energy[b]	4.80	4.7%
Electricity Imports	0.08	0.1%
Total Electric Power Energy Consumption[c]	41.86	40.8%
Delivered Energy Use	74.05	72.2%
Total Energy Use	102.58	100.0%

[a]Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.

[b]Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes net electricity imports.

[c]Includes non-biogenic municipal waste not included above.

Source: U.S. Energy Information Administration. 2008a. Supplemental Tables to the Annual Energy Outlook 2009. Table 10. Available at: <http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>.

5.5.1 Statutory Authority

As discussed previously in this RIA the statutory authority for the proposed rule is section 112 of the CAA. Section 112(b) lists the 189 chemicals, compounds, or groups of chemicals deemed by Congress to be HAP. These toxic air pollutants are to be regulated by NESHAP. Section 112(d) of the CAA directs us to develop NESHAP based on MACT, which require existing and new major sources to control emissions of HAP. These NESHAP apply to existing stationary RICE less than or equal to 500 HP located at major sources of HAP emissions, existing non-emergency stationary CI RICE greater than 300 HP, and existing stationary RICE located at area sources of HAP emissions, however, only certain existing stationary RICE have substantive regulatory requirements. EPA promulgated NESHAP for existing, new, and reconstructed stationary RICE greater than 500 HP located at major sources on June 15, 2004 (69 FR 33474). EPA promulgated NESHAP for new and reconstructed stationary RICE that are located at area sources of HAP emissions and for new and reconstructed stationary RICE that have a site rating of less than or equal to 500 HP that are located at major sources of HAP emissions on January 18, 2008 (73 FR 3568). EPA is required to address HAP emissions from stationary RICE located at area sources under section 112(k) of the CAA.

Deleted: *OMB Review Draft – February 23, 2009*

In compliance with section 205(a), we identified and considered a reasonable number of regulatory alternatives that are shown and discussed in Chapter 4 of this RIA. The regulatory alternative upon which the rule is based represents the MACT floor for stationary RICE less than or equal to 500 HP located at major sources and GACT for stationary RICE located at area sources and, as a result, it is the least costly and least burdensome alternative.

5.5.2 Social Costs and Benefits

The Agency's assessment of costs and benefits is detailed in this RIA. Based on estimated compliance costs on all sources associated with the proposed rule and the predicted change in prices and production in the affected industries, the estimated social costs of the proposed rule are $345 million (2007 dollars). It is estimated that by 2013, HAP will be reduced by 13,000 tpy due to reductions in formaldehyde, acetaldehyde, acrolein, methanol and other HAP from existing stationary RICE. Formaldehyde and acetaldehyde have been classified as "probable human carcinogens." Acrolein, methanol and the other HAP are not considered carcinogenic, but produce several other toxic effects. The proposed rule will also achieve reductions in 511,000 tons of CO, approximately 79,000 tons of NO_x per year, about 90,000 tons of VOC per year, about 4,600 tons per year of SO_2, and approximately 2,600 tons of PM per year, in the year 2013. Exposure to CO can affect the cardiovascular system and the central nervous system. Emissions of NO_x and SO_2 can transform into PM, which can result in fatalities and many respiratory problems (such as asthma or bronchitis); and NO_x can also transform into ozone causing several respiratory problems to affected populations.

The total monetized benefits of the proposed rule, as will be shown in more detail in Chapter 7, range from $0.9 to $2.0 billion (2007 dollars). The monetized benefits are comprised primarily of the benefits from reductions in directly emitted $PM_{2.5}$ and $PM_{2.5}$ created from transformation of NO_x and SO_2. We cannot provide a monetary estimate for the benefits associated with reductions of HAP and CO due to a lack of scientific knowledge of the links between the reductions in incidence of the health and environmental effects listed and a value that can be placed on them. EPA currently has research going on to provide such monetized estimates. We are also unable to quantify and monetize all categories of benefits of NO_x reductions (ecosystem and environmental effects), and to monetize reduction in premature mortalities associated with ozone reductions. The methodology for estimating monetized benefits is discussed in more detail in Chapter 7 of the RIA.

Deleted: *OMB Review Draft – February 23, 2009*

5.5.3 Future and Disproportionate Costs

The UMRA requires that we estimate, where accurate estimation is reasonably feasible, future compliance costs imposed by the rule and any disproportionate budgetary effects. Our estimates of the future compliance costs of the proposed rule are discussed previously in Chapter 4 of this RIA. We do not believe that there will be any disproportionate budgetary effects of the proposed rule on any particular areas of the country, State or local governments, types of communities (e.g., urban, rural), or particular industry segments.

5.5.4 Effects on the National Economy

The UMRA requires that we estimate the effect of the proposed rule on the national economy. To the extent feasible, we must estimate the effect on productivity, economic growth, full employment, creation of productive jobs, and international competitiveness of the U.S. goods and services if we determine that accurate estimates are reasonably feasible and that such effect is relevant and material. The nationwide economic impact of the proposed rule is presented earlier in this RIA chapter. This analysis provides estimates of the effect of the proposed rule on most of the categories mentioned above, and these estimates are presented earlier in this RIA chapter. In addition, we have determined that the proposed rule contains no regulatory requirements that might significantly or uniquely affect small governments. Therefore, today's rule is not subject to the requirements of section 203 of the UMRA.

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 6
SMALL ENTITY SCREENING ANALYSIS

The Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small governmental jurisdictions, and small not-for-profit enterprises.

After considering the economic impact of the proposed rule on small entities, the screening analysis indicates that this proposed rule will not have a significant economic impact on a substantial number of small entities (or "SISNOSE").

6.1 Small Entity Data Set

The industry sectors covered by the proposed rule were identified during the development of the cost analysis found in the memorandum "Impacts Associated with NESHAP for Existing Stationary RICE." The SUSB provides national information on the distribution of economic variables by industry and enterprise size (U.S. Census, 2008a, b).[1] The Census Bureau and the Office of Advocacy of the SBA supported and developed these files for use in a broad range of economic analyses.[2] Statistics include the total number of establishments and receipts for all entities in an industry; however, many of these entities may not necessarily be covered by the proposed rule. SUSB also provides statistics by enterprise employment and receipt size.

Deleted: (Nelson and Parise, 2008

The Census Bureau's definitions used in the SUSB are as follows:

- *Establishment*: An establishment is a single physical location where business is conducted or where services or industrial operations are performed.
- *Receipts*: Receipts (net of taxes) are defined as the revenue for goods produced, distributed, or services provided, including revenue earned from premiums, commissions and fees, rents, interest, dividends, and royalties. Receipts exclude all revenue collected for local, state, and federal taxes.
- *Enterprise*: An enterprise is a business organization consisting of one or more domestic establishments that were specified under common ownership or control. The

[1] The SUSB data do not provide establishment information for the national security NAICS code (92811) or irrigated farms. Since most national security installations are owned by the federal government (e.g., military bases), EPA assumes these entities would not be considered small. For irrigated farms, we relied on receipt data provided in the 2003 Farm and Irrigation Survey (USDA, 2004).

[2] See http://www.census.gov/csd/susb/ and http://www.sba.gov/advo/research/data.html for additional details.

> enterprise and the establishment are the same for single-establishment firms. Each multiestablishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the summed employment of all associated establishments.

Because the SBA's business size definitions (SBA, 2008) apply to an establishment's "ultimate parent company," we assumed in this analysis that the "enterprise" definition above is consistent with the concept of ultimate parent company that is typically used for SBREFA screening analyses and the terms are used interchangeably.

6.1 Small Entity Economic Impact Measures

The analysis generated a set of establishment sales tests (represented as cost-to-receipt ratios)[3] for NAICS codes associated with sectors listed in Table 6-1. Although the appropriate SBA size definition should be applied at the parent company (enterprise) level, we can only compute and compare ratios for a model establishment owned by an enterprise within an SUSB size range (employment or receipts). Using the SUSB size range helps us account for receipt differences between establishments owned by large and small enterprises and also allows us to consider the variation in small business definitions across affected industries. Using establishment receipts is also a conservative approach, because an establishment's parent company (the "enterprise") may have other economic resources that could be used to cover the costs of the proposed rule.

6.1.1 Model Establishment Receipts and Annual Compliance Costs

The sales test compares a representative establishment's total annual engine costs to the average establishment receipts for enterprises in several size categories.[4] For industries with SBA employment size standards, we calculated average establishment receipts for each enterprise employment range (Table 6-2). For industries with SBA receipt size standards, we

[3]The following metrics for other small entity economic impact measures (if applicable) would potentially include

- small governments (if applicable): "revenue" test; annualized compliance cost as a percentage of annual government revenues and
- small nonprofits (if applicable): "expenditure" test; annualized compliance cost as a percentage of annual operating expenses,

[4]For the 1 to 20 employee category, we excluded SUSB data for enterprises with zero employees. These enterprises did not operate the entire year.

Table 6-1. Proposed NESHAP for Existing Stationary Reciprocating Internal Combustion Engines (RICE): Affected Sectors and SBA Small Business Size Standards

Industry Description	Corresponding NAICS	SBA Size Standard for Businesses (effective March 11, 2008)	Type of Small Entity
Electric power generation	2211	[a]	Business and government
General medical & surgical hospitals	622110	$34 million in annual receipts	Business and government
Natural gas transmission	48621	$7 million in annual receipts	Business
Crude petroleum and natural gas production	211111	500 employees	Business
Natural gas liquid producers	211112	500 employees	Business
National security	92811	NA	Government
Hydro power units	See NAICS 2211	1,000 employees	Business and government
Irrigation sets	Affects NAICS 111 and 112	Generally $750,000 or less in annual receipts	Business
Welders	Affects industries that use heavy equipment such as construction, mining, farming	Varies by 6-digit NAICS code; Example industry: NAICS 238 = $33.5 million in annual receipts	Business

[a]NAICS codes 221111, 221112, 221113, 221119, 221121, 221122: A firm is small if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.

calculated average establishment receipts for each enterprise receipt range (Table 6-3). We included the utility sector in the second group, although the SBA size standard for this industry is defined in terms of physical units (megawatt hours) versus receipts. Crop and animal production (NAICS 111 and 112) also have an SBA receipt size standard that defines a small business as receiving $750,000 or less in receipts per year. However, SUSB data were not available for these industries. Therefore, we conducted the sales test using the following range of establishment receipts: farms with annual receipts of $25,000 or less, farms with annual receipts of $100,000 or less, farms with annual receipts of $500,000 or less, and farms with annual receipts of $750,000 or less.

Table 6-2. Average Receipts for Affected Industry by Enterprise Employment Range: 2002 (millions of $2007 per establishment)

NAICS	NAICS Description	SBA Size Standard for Businesses (effective March 11, 2008)	All Enterprises	Owned by Enterprises with 1–20 Employees	20–99 Employees	100–499 Employees	500–749 Employees	750–999 Employees	1,000–1,499 Employees
211111	Crude petroleum & natural gas extraction	500 employees	$14.2	$0.5	$6.6	$9.3	NA	NA	NA
211112	Natural gas liquid extraction	500 employees	$168.8	$0.3	NA	$11.6	NA	NA	NA
335312	Motor & generator mfg	1,000 employees	$18	$1	$6	$16	$29	NA	NA
333992	Welding & soldering equipment mfg	500 employees	$18	$2	$6	$32	NA	NA	$112

NA = Not available.

Formatted: Width: 792 pt, Height: 612 pt

Table 6-3. Average Receipts for Affected Industry by Enterprise Receipt Range: 2002 (millions of $2007 per establishment)

NAICS	NAICS Description	SBA Size Standard for Businesses (effective March 11, 2008)	Owned by Enterprises with Receipt Range ($10^3^)									
			All Enterprises	0–99	100–499.9	500–999.9	1,000–4,999.9	5,000,000–9,999,999	<10,000	10,000–49,999	50,000–99,999	100,000+
2211	Electric power generation, transmission, & distribution	[a]	$38.8	$0.0	$0.3	$0.8	$2.9	$6.5	$2.6	$14.3	$21.7	$48.1
48621	Pipeline transportation of natural gas	$7 million in annual receipts	$21.3	$0.1	$0.3	$0.9	$2.4	$6.7	$1.5	$10.3	$44.4	$22.3
622110	General medical & surgical hospitals	$34 million in annual receipts	$90.1	NA	NA	$0.8	$3.5	$8.0	$4.9	$24.9	$64.3	$145.1
234110	Highway & street construction	$33.5 million in annual receipts	$7.6	$0.1	$0.3	$0.8	$2.7	$7.9	$2.0	$22.1	$55.2	$55.5
234120	Bridge & tunnel construction	$33.5 million in annual receipts	$13.8	$0.1	$0.3	$0.9	$2.8	$7.9	$2.5	$24.7	$55.7	$77.8
234910	Water, sewer, & pipeline construction	$33.5 million in annual receipts	$3.8	$0.1	$0.3	$0.8	$2.7	$8.0	$1.8	$20.1	$44.0	$46.2
234920	Power & communication transmission line construction	$33.5 million in annual receipts	$3.3	$0.1	$0.3	$0.8	$2.5	$7.6	$1.3	$16.4	$33.7	$23.3
234930	Industrial nonbuilding structure construction	$33.5 million in annual receipts	$35.1	$0.1	$0.3	$0.8	$2.6	$8.2	$1.7	$21.8	$30.2	$170.3
234990	All other heavy construction	$33.5 million in annual receipts	$2.6	$0.1	$0.3	$0.8	$2.4	$7.6	$1.0	$18.3	$39.6	$41.4
92811	National security	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] NAICS codes 221111, 221112, 221113, 221119, 221121, 221122: A firm in these industries is defined as small by SBA if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.

NA = Not available. SUSB did not report this data for disclosure or other reasons.

Deleted: *OMB Review Draft – February 23, 2009*

Annual entity compliance costs vary depending on the size of the diesel engines used at the affected establishment. Absent facility-specific information, we computed per-entity compliance costs based for three different cases based on representative establishments—Cases 1, 2, and 3 (see Table 6-4). Each representative establishment differs based on the size and number of diesel engines being used. Compliance costs are calculated by summing the total annualized compliance costs for the relevant engine categories, dividing the sum by the total existing population of those engines, and multiplying the average engine cost by the number of engines assumed to be at the establishment. Since NAICS 2211, 48621, and 622110 are fundamentally different than other industries considered in this analysis, we used different assumptions about what constitutes the representative establishment and report these assumptions separately.

- Case 1: The representative establishment for all industries uses three 750+ hp engines with an average compliance cost of $1,603 per engine, resulting in a total annualized compliance cost of approximately $4,810 for this representative establishment.
- Case 2: The representative establishment in NACIS 2211, 48621, and 622110 uses two 50 to 750+ hp engines with an average compliance cost of $352 per engine, resulting in a total annualized compliance cost of $704 for this representative establishment. For all other industries, the representative establishment uses two 50 to 300 hp engines with an average compliance cost of $141 per engine, resulting in a total compliance cost of $281 for this representative establishment.
- Case 3: The representative establishment for all industries uses two 50 to 100 hp engines with an average compliance cost of $58 per engine, resulting in a total compliance cost of $115 for this representative establishment.

EPA believes that small entities are most likely to face costs similar to Case 2 (columns shaded in gray in Table 6-4) because most of the engines to be affected by this proposal in NAICS 111, 112, 238, 211111, and 211112 are under 300 hp capacity, and most small entities in these industries will own engines of this size or smaller. However, it is difficult to make a similar claim for NAICS 2211, 48621, and 622110 based on the existing distribution of engines in these industries.

For the sales test, we divided the representative establishment compliance costs reported in Table 6-4 by the representative establishment receipts reported in Tables 6-2 and 6-3. This is known as the cost-to-receipt (i.e., sales) ratio, or the "sales test." The "sales test" is the impact methodology EPA employs in analyzing small entity impacts as opposed to a "profits test," in which annualized compliance costs are calculated as a share of profits.

Deleted: *OMB Review Draft – February 23, 2009*

Table 6-4. Representative Establishment Costs Used for Small Entity Analysis ($2007)

	Case 1		Case 2[a]		Case 3	
	NAICS 2211, 48621, 622110 (+750 hp only)	All Other NAICS (+750 hp only)	NAICS 2211, 48621, 622110 (50–750+ hp)	All Other NAICS (50–300 hp)	NAICS 2211, 48621, 622110 (50–100 hp only)	All Other NAICS (50–100 hp only)
Total annualized costs ($$10^3$)	$73,457	$4,127	$291,492	$41,514	$9,156	$6,382
Engine population	45,812	2,575	827,792	295,372	158,797	110,677
Average engine cost ($/engine)	$1,603	$1,603	$352	$141	$58	$58
Assumed engines per establishment	3	3	2	2	2	2
Total annualized costs per establishment	$4,810	$4,809	$704	$281	$115	$115

[a]Case 2 is the one used to determine the small entity impacts (and to provide the SISNOSE determination) for this proposed rule.

This is because revenues or sales data are commonly available data for entities normally impacted by EPA regulations and profits data normally made available are often not the true profit earned by firms because of accounting and tax considerations. Revenues as typically published are usually correct figures and are more reliably reported when compared to profit data. The use of a “sales test” for estimating small business impacts for a rulemaking such as this one is consistent with guidance offered by EPA on compliance with SBREFA[5] and is consistent with guidance published by the U.S. SBA’s Office of Advocacy that suggests that cost as a percentage of total revenues is a metric for evaluating cost increases on small entities in relation to increases on large entities.[6]

If the cost-to-receipt ratio is less than 1%, then we consider the proposed rule to not have a significant impact on the establishment company in question. We summarize the industries with cost-to-receipt ratios exceeding 1% below:

Primary Analysis:

- *Case 2*: NAICS 2211 with receipts less than $100,000 per year

[5] The SBREFA compliance guidance to EPA rulewriters regarding the types of small business analysis that should be considered can be found at http://www.epa.gov/sbrefa/documents/rfafinalguidance06.pdf , pp. 24-25.
[6] U.S. SBA, Office of Advocacy. A Guide for Government Agencies, How to Comply with the Regulatory Flexibility Act, Implementing the President’s Small Business Agenda and Executive Order 13272, May 2003.

Deleted: *OMB Review Draft – February 23, 2009*

- *Case 3*: No industries

Sensitivity Analysis (unlikely):

- *Case 1*: NAICS 211112 with less than 20 employees, NAICS 2211, 48621, and 238 with receipts less than $500,000 per year, and irrigated farms with receipts of $100,000 or less per year

In the Case 2 primary analysis, only establishments in NAICS 2211 with receipts less than $100,000 per year have cost-to-receipt ratios above 1%. However, establishments earning this level of receipts are likely to be using smaller engines than those assumed in Case 2, such as 50 to 100 hp engines. The results of our Case 3 analysis demonstrate that these establishments are not significantly impacted when taking this engine size into account.

6.2 Small Government Entities

The rule also covers sectors that include entities owned by small and large governments. However, given the uncertainty and data limitations associated with identifying and appropriately classifying these entities, we computed a "revenue" test for a model small government, where the annualized compliance cost is a percentage of annual government revenues (U.S. Census, 2005a, b). The use of a "revenue test" for estimating impacts to small governments for a rulemaking such as this one is consistent with guidance offered by EPA on compliance with SBREFA,[7] and is consistent with guidance published by the US SBA's Office of Advocacy.[8] For example, from the 2002 Census (in 2007 dollars), the average revenue for small governments (counties and municipalities) with populations fewer than 10,000 are $3 million per entity, and the average revenue for local governments with populations fewer than 50,000 is $7 million per entity. For the smallest group of local governments (<10,000 people), the cost-to-revenue ratio would be 0.2% or less under each case. For the larger group of governments (<50,000 people), the cost-to-revenue ratio is 0.1% or less under all cases.

[7] The SBREFA compliance guidance to EPA rulewriters regarding the types of small business analysis that should be considered can be found at http://www.epa.gov/sbrefa/documents/rfafinalguidance06.pdf , pp. 24-25.

[8] U.S. SBA, Office of Advocacy. A Guide for Government Agencies, How to Comply with the Regulatory Flexibility Act, Implementing the President's Small Business Agenda and Executive Order 13272, May 2003.

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 7
HUMAN HEALTH BENEFITS OF EMISSIONS REDUCTIONS

7.1 Calculation of Human Health Benefits

To estimate the $PM_{2.5}$-related human health benefits of reducing emissions from the proposed NESHAP for Reciprocating Internal Combustion Engines (RICE), EPA used the benefits transfer approach it created for the regulatory impact analysis (RIA) accompanying the recent National Ambient Air Quality Standards (NAAQS) for Ozone.[1, 2] In that RIA, EPA developed and applied $PM_{2.5}$ benefit-per-ton coefficients to estimate the $PM_{2.5}$ co-benefits resulting from reductions in emissions of NO_X. EPA has followed that same approach to estimate the health benefits for the projected emission reductions of $PM_{2.5}$ precursor pollutants associated with this proposal.

EPA did not perform an air quality modeling assessment of the emission reductions resulting from installing controls on these RICE because of the time and resource constraints and the limited value of such an analysis for the purposes of developing the regulatory approach for this proposal. This lack of air quality modeling limited EPA's ability to perform a comprehensive benefits analysis for this proposal because our benefits model BenMAP requires either air quality modeling or monitoring data. In the absence of formal air quality modeling, we applied $PM_{2.5}$ benefit-per-ton (BPT) coefficients to estimate benefits. In addition to the 2008 Ozone NAAQS RIA, this benefit-per-ton approach has been used in RIAs prepared for a number of previous EPA rulemakings, e.g. the 2002 large industrial spark ignition engine and recreational vehicles rule, the 2004 Industrial Boilers and Process Heaters MACT, and the 2008 Petroleum Refineries NSPS.

The $PM_{2.5}$ precursor pollutant benefit per-ton estimates provide the total monetized human health benefits (the sum of premature mortality and morbidity related benefits) of reducing one ton of $PM_{2.5}$ or $PM_{2.5}$ precursor emissions from a specified source. We include

[1] U.S. EPA, 2008. *Technical Support Document: Calculating Benefit Per-Ton estimates,* Ozone NAAQS Docket #EPA-HQ-OAR-2007-0225-0284.

[2] U.S. EPA, 2008. *Regulatory Impact Analysis, 2008 National Ambient Air Quality Standards for Ground-level Ozone*, Chapter 6. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/RIAs/6-ozoneriachapter6.pdf.

Deleted: *OMB Review Draft – February 23, 2009*

direct $PM_{2.5}$ as $PM_{2.5}$ precursor emissions (SO_X, NO_X, and VOCs).[3] These PM benefits are actually co-benefits, which result from the installing controls to limit hazardous air pollutants (HAPs). Unfortunately, we are unable to quantify the human health benefits of reducing the 13,000 tons of HAPs, 510,000 tons of carbon monoxide (CO), or ozone precursor pollutants in this analysis because benefit-per-ton estimates are not available for these pollutants. The PM co-benefits estimates in this proposal analysis utilize the concentration-response functions as described in the PM NAAQS RIA analysis.[4] Specifically, we present two estimates reported in the epidemiology literature, as well as a set of 12 functions obtained in EPA's expert elicitation study. Each data source is described below:

- One estimate is based on the concentration-response (C-R) function developed from the study of the American Cancer Society (ACS) cohort reported in Pope et al. (2002), a study that EPA has previously used to generate its primary benefits estimate.

- One estimate is based on Laden et al.'s (2006) reporting of the extended Six Cities cohort study; this study is a more recent PM epidemiological study that was used as an alternative in the PM NAAQS RIA.

- The source for the other twelve estimates are based on the results of EPA's expert elicitation study[5,6] on the PM-mortality relationship and interpreted for benefits analysis in EPA's final RIA for the PM NAAQS, published in September 2006 (U.S. EPA, 2006). For that study, twelve experts (labeled A through L) provided independent estimates of the PM-mortality concentration-response function. EPA practice has been to develop independent estimates of PM-mortality estimates corresponding to the concentration-response function provided by each of the twelve experts, to better characterize the degree of variability in the expert responses.

---

[3] In this analysis, the monetized benefits of reducing VOCs only reflect their effects as a $PM_{2.5}$ precursor pollutant, not as a precursor to ozone. The benefit-per-ton estimate for VOCs includes more uncertainty than the other $PM_{2.5}$ precursor pollutants because the underlying photochemical modeling systematically underpredicts the secondary formation of organic carbon due to uncertainties in science of secondary organic carbon formation. EPA's modeling system has been peer reviewed, represents the state of science, and uses the best available and most comprehensive data sets to characterize meteorology and emissions. Because the relative effectiveness of VOC controls are underestimated in the modeling, the benefits of reducing VOCs as a $PM_{2.5}$ precursor may also be underestimated.

[4] U.S. EPA, 2006. *Regulatory Impact Analysis, 2006 National Ambient Air Quality Standards for Particulate Matter*, Chapter 5. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf.

[5] Industrial Economics, Inc., 2006. *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality*. Prepared for the U.S. EPA, Office of Air Quality Planning and Standards, September. Available on the Internet at http://www.epa.gov/ttn/ecas/regdata/Uncertainty/pm_ee_report.pdf.

[6] Roman et al, 2008. *Expert Judgment Assessment of the Mortality Impact of Changes in Ambient Fine Particulate Matter in the U.S.* Environ. Sci. Technol., 42, 7, 2268 – 2274.

Deleted: *OMB Review Draft – February 23, 2009*

EPA considers the benefit-per-ton estimates derived from the expert elicitation to be indicative of the range of uncertainty associated with the health functions, whereas the range of benefits represented by benefit-per-ton estimates generated using the Pope et al. and Laden et al. functions represent the best epidemiology based estimates of PM co-benefits.

To develop the estimate of benefits of reducing emissions from the proposal, we calculated the monetized benefits-per-ton of emission reductions estimates for direct $PM_{2.5}$ and each $PM_{2.5}$ precursor pollutant. Readers interested in the complete methodology for creating the benefit-per-ton estimates used in this analysis may consult the Technical Support Document (TSD) accompanying the final Ozone NAAQS RIA (U.S. EPA, 2008). In the TSD, we describe in detail how we generated the benefit-per-ton estimates. In summary, we used a model to convert emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors (i.e., SO_2, NO_X, and VOCs) into changes in $PM_{2.5}$ air quality. Next, we used the benefits model (BenMAP) to estimate the changes in human health based on the change in $PM_{2.5}$ air quality. Finally, the monetized health benefits were divided by the emission reductions to create the benefit-per-ton estimates. Even though all fine particles are assumed to have equivalent health effects, the benefit-per-ton estimates vary between precursors because each ton of precursor reduced has a different propensity to form $PM_{2.5}$. For example, NO_X has a lower benefit-per-ton estimate than direct $PM_{2.5}$ because it does not form as much $PM_{2.5}$, thus the exposure would be lower, and the monetized health benefits would be lower. For this analysis, we assumed that 40% of the emission reductions were from non-EGU point sources and 60% were from area sources for PM and SO_X, which are the only pollutants for which we have separate benefit-per-ton estimates for non-EGU sources and area sources.[7] After generating the benefit-per-ton estimate, we then multiply this estimate by the number of tons of each pollutant reduced to derive an overall monetary value of benefits.

It is important to note that the monetized benefit-per-ton estimates used here reflect specific geographic patterns of emissions reductions and specific air quality and benefits modeling assumptions. Use of these $/ton values to estimate benefits associated with different emission control programs (e.g., for reducing emissions from large stationary sources like EGUs) may lead to higher or lower benefit estimates than if benefits were calculated based on direct air quality modeling. Great care should be taken in applying these estimates to emission reductions occurring in any specific location, as these are all based on national or broad regional emission reduction programs and therefore represent average benefits-per-ton over the entire United

[7] These emission assumptions are taken from the compliance cost analysis memo prepared for the proposed rule entitled Impacts Associated with NESHAP for Existing Stationary RICE by Ec/R, Inc. on February 19, 2009.

Deleted: *OMB Review Draft – February 23, 2009*

States. The benefits- per-ton for emission reductions in specific locations may be very different from the national average.

7.2 Characterization of Uncertainty in the Benefits Estimates

In any complex analysis, there are likely to be many sources of uncertainty. Many inputs are used to derive the final estimate of economic benefits, including emission inventories, air quality models (with their associated parameters and inputs), epidemiological estimates of concentration-response (C-R) functions, estimates of values, population estimates, income estimates, and estimates of the future state of the world (i.e., regulations, technology, and human behavior). For some parameters or inputs, it may be possible to provide a statistical representation of the underlying uncertainty distribution. For other parameters or inputs, the necessary information is not available.

The annual benefit estimates presented in this analysis are also inherently variable due to the processes that govern pollutant emissions and ambient air quality in a given year. Factors such as hours of equipment use and weather are constantly variable, regardless of our ability to measure them accurately. As discussed in the $PM_{2.5}$ NAAQS RIA (Table 5.5), there is a variety of uncertainties associated with these PM benefits. Therefore, the estimates of annual benefits should be viewed as representative of the magnitude of benefits expected, rather than the actual benefits that would occur every year.

Below we present the estimates of the total benefits, based on our interpretation of the best available scientific literature and methods and supported by the SAB-HES and the NAS (NRC, 2002). The benefits estimates are subject to a number of assumptions and uncertainties. For example, for key assumptions underlying the estimates for premature mortality, which typically account for at least 90% of the total PM benefits, we were able to identify the following uncertainties:

Formatted: Line spacing: 1.5 lines

1. Inhalation of fine particles is causally associated with premature death at concentrations near those experienced by most Americans on a daily basis. Although biological mechanisms for this effect have not been established definitively yet, the weight of the available epidemiological evidence supports an assumption of causality.

2. All fine particles, regardless of their chemical composition, are equally potent in causing premature mortality. This is an important assumption, because PM produced via transported precursors emitted from EGUs may differ significantly from direct PM released from diesel engines and other industrial sources, but no clear scientific grounds exist for supporting differential effects estimates by particle type.

Deleted: *OMB Review Draft – February 23, 2009*

3. The impact function for fine particles is approximately linear within the range of ambient concentrations under consideration. Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM, including both regions that are in attainment with fine particle standard and those that do not meet the standard.

4. The forecasts for future emissions and associated air quality modeling are valid. Although recognizing the difficulties, assumptions, and inherent uncertainties in the overall enterprise, these analyses are based on peer-reviewed scientific literature and up-to-date assessment tools, and we believe the results are highly useful in assessing this proposal.

5. Benefits estimated here reflect the application of a national dollar benefit-per-ton estimate of the benefits of reducing directly emitted fine particulates from point sources. Because they are based on national-level analysis, the benefit-per-ton estimates used here do not reflect local variability in population density, meteorology, exposure, baseline health incidence rates, or other local factors that might lead to an over-estimate or under-estimate of the actual benefits of controlling directly emitted fine particulates.

This RIA does not include the type of detailed uncertainty assessment found in the PM NAAQS RIA because we lack the necessary air quality input and monitoring data to run the benefits model (BenMAP). Moreover, it was not possible to develop benefit-per-ton metrics and associated estimates of uncertainty using the benefits estimates from the PM RIA because of the significant differences between the sources affected in that rule and those regulated here. However, the results of the Monte Carlo analyses of the health and welfare benefits presented in Chapter 5 of the PM RIA can provide some evidence of the uncertainty surrounding the benefits results presented in this analysis. In this analysis, we provide benefits estimates using concentration-response functions based on two epidemiology studies as well as twelve benefits estimates based on the concentration-response functions from the expert elicitation. While this captures only a fraction of the overall uncertainty, the magnitude of the mortality C-R function is a critical parameter in the analysis and the uncertainty in that parameter is likely to contribute a large fraction of the overall uncertainty in the benefits estimates.

7.3 Updating the Benefits Data Underlying the Benefit-per-Ton Estimates

As described above, the estimates provided are derived through a benefits transfer technique that adapts monetized benefits from reductions in $PM_{2.5}$ precursor pollutants that were estimated for the Ozone RIA utilizing nationally distributed emissions reductions. The benefit-per-ton estimates for this analysis have been updated since the Ozone RIA was completed. They

Deleted: *OMB Review Draft – February 23, 2009*

have been updated to reflect a new population dataset, a more recent currency year.[8] EPA is currently in the process of generating localized benefit-per-ton estimates to better account for the spatial heterogeneity of benefits for a small number of urban areas. EPA believes that these estimates may better represent the localized benefits than estimates that use national averages. However, because the engines affected by this rule should be widely distributed nationally, we believe that the national estimates are most appropriate for this analysis.

In addition to generating local benefit-per-ton estimates, EPA is also exploring other updates to the national benefit-per-ton estimates. Technical updates would incorporate a new population dataset and expand the geographic scope of the national estimates. EPA is also exploring changing the assumption regarding thresholds in the health impact function. In previous RIAs, EPA has included sensitivity analyses for premature mortality, with alternative cutpoints at 0 $\mu g/m^3$, 7.5 $\mu g/m^3$, 12 $\mu g/m^3$, and 14 $\mu g/m^3$. As a sensitivity analysis for this analysis, EPA explored the implication of replacing the threshold assumption with log-linear no-threshold models similar to the authors of those original studies.[9] The health impact functions applied for our premature mortality benefits estimates are based on an assumed cutpoint at 10 $\mu g/m^3$ in the long-term mortality concentration-response function and short-term morbidity concentration-response functions. We estimate that incorporating this suite of updates for this proposed rule would increase the benefits presented in Table 7.1 by 30% to 50%. Because this analysis uses benefit-per-ton estimates, we are unable to do a sensitivity analysis using the other alternative cutpoints analyzed previously.

Deleted: Removing the threshold assumption for this proposed rule increases the benefits based on Pope et al by 30% and increases the benefits based on Laden at al by 50% over the numbers presented in the tables below.

EPA is considering this policy change in light of the results of the expert elicitation on PM mortality (Roman et al, 2008). Specifically, of the 12 experts included in the expert elicitation, only one expert elected to specify a threshold, as the rest cited a lack of empirical and/or theoretical basis for a population threshold. Furthermore, that one expert only specified a 50% probability of a threshold (most likely at or below 5 µg/m3), which is below the cut-point that EPA has historically assumed.

[8] Previous RIAs reported the benefit-per-ton estimates using 2006$. However, to be consistent with the cost estimates, we also updated the benefits estimates in this analysis to 2007$. Updating the currency year does not affect the comparison of costs and benefits because each is adjusted consistently.

[9] For a synthesis of the epidemiology studies addressing the threshold issue, please consult EPA's *Integrated Science Assessment for Particulate Matter (External Review Draft)* (U.S. EPA, 2008). Available on the Internet at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805

Deleted: *OMB Review Draft – February 23, 2009*

7.4 Results of Benefits Analysis

Table 7-1 provides a general summary of the results by pollutant for the selected options, including the emissions reductions and monetized benefits-per-ton range using both a 3% discount rate and a 7% discount rate.[10] [11] Table 7-2 shows all 14 benefits estimates, including those based on the results of the expert elicitation at discount rates of 3% and 7%. Figure 7-1 provides a visual representation of the range of benefits estimates by pollutant at a 3% discount rate.[12] All benefits estimates are for the year of full implementation (2013). More details on the regulatory alternatives, emissions, and emission reductions can be found in Chapter 4 of this RIA.

Table 7-1. Summary of Health Benefits of the Proposed RICE NESHAP[a]

Pollutant	Emissions Reductions (tons)	3% Discount Rate: Benefit per ton (Pope)	3% Discount Rate: Benefit per ton (Laden)	3% Discount Rate: Total Monetized Benefits (millions 2007$)	7% Discount Rate: Benefit per ton (Pope)	7% Discount Rate: Benefit per ton (Laden)	7% Discount Rate: Total Monetized Benefits (millions 2007$)
Direct $PM_{2.5\ nonEGU}$	1,024	$160,000	$340,000	$160 to $350	$140,000	$310,000	$150 to $310
Direct $PM_{2.5\ area}$	1,536	$250,000	$500,000	$390 to $830	$230,000	$490,000	$350 to $750
$PM_{2.5}$ Precursors							
$SO_{2\ nonEGU}$	1,828	$16,000	$34,000	$29 to $63	$15,000	$31,000	$27 to $57
$SO_{2\ area}$	2,742	$14,000	$30,000	$39 to $83	$13,000	$27,000	$35 to $75
NO_X	90,106	$3,000	$6,500	$270 to $590	$2,800	$5,900	$250 to $530
VOC	89,860	$440	$940	$39 to $84	$400	$850	$36 to $76
Grand Total				$930 to $2,000			$850 to $1,800

[a]All estimates are for the analysis year (2013), and are rounded to two significant figures so numbers may not sum across columns. Emission reductions reflect the combination of both major and area sources. All fine particles are assumed to have equivalent health effects, but the benefit per ton estimates vary between precursors because each ton of precursor reduced has a different propensity to form $PM_{2.5}$. The monetized benefits incorporate the conversion from precursor emissions to ambient fine particles.

[10] Circular A-4 requires regulatory analyses to assess benefits using discount rates of 3% and 7%. Office of Management and Budget (OMB), 2003. *Circular A-4: Regulatory Analysis*. Washington, DC. Available on the internet at http://www.whitehouse.gov/omb/circulars/a004/a-4.html.

[11] The benefits are discounted to account for the cessation lag in $PM_{2.5}$ benefits from premature mortality and acute myocardial infarctions (AMIs), rather than a discounted stream of future benefits; whereas discounting the costs reflects the lifetime costs of the equipment. For this reason, it is appropriate in this context to use two different discount rates for the benefits and costs.

[12] The breakdown of benefits estimates by precursor using a 7% discount rate would be approximately the same.

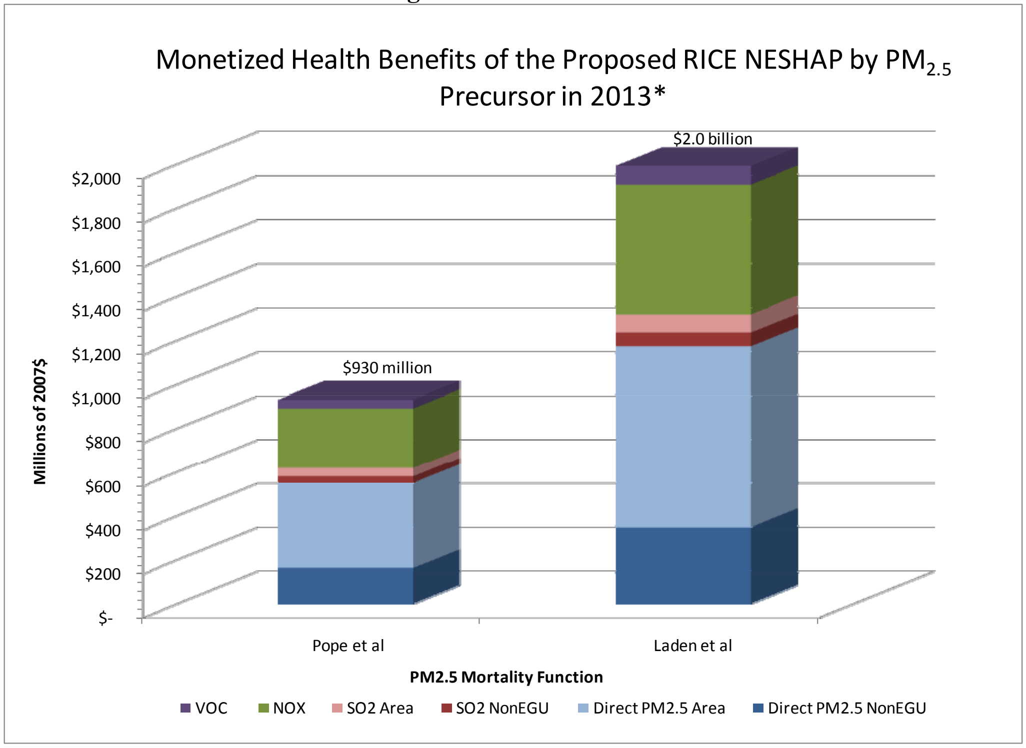
Deleted: *OMB Review Draft – February 23, 2009*

Table 7-2. All Benefits Estimates for RICE NESHAP in 2013 (in millions of 2007$)[a]

	3% Discount Rate	7% Discount Rate
Benefit-per-ton Coefficients Derived from Epidemiology Literature		
Pope et al.	$3,900	$3,500
Laden et al.	$9,400	$8,500
Benefit-per-ton Coefficients Derived from Expert Elicitation		
Expert A	$10,000	$9,000
Expert B	$7,700	$7,000
Expert C	$7,600	$6,900
Expert D	$5,400	$4,900
Expert E	$12,000	$11,000
Expert F	$7,000	$6,300
Expert G	$4,600	$4,200
Expert H	$5,800	$5,200
Expert I	$7,500	$6,800
Expert J	$6,200	$5,600
Expert K	$1,600	$1,500
Expert L	$5,600	$5,100

[a]All estimates are rounded to two significant figures. Estimates do not include confidence intervals because they were derived through the benefit-per-ton technique described above. The benefits estimates from the Expert Elicitation are provided as a reasonable characterization of the uncertainty in the mortality estimates associated with the concentration-response function.

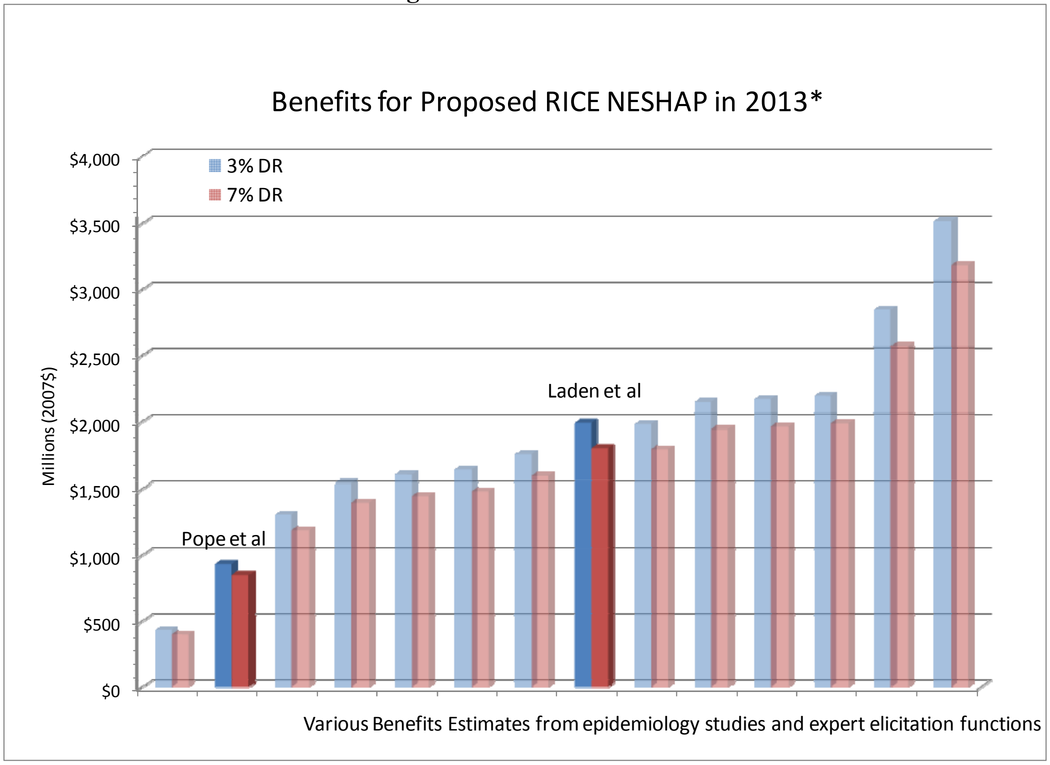
Figure 7.1:



*** This graph shows the estimated benefits by precursor pollutant using effect coefficients derived from the Pope et al. study and the Laden et al, study at a 3% discount rate. All fine particles are assumed to have equivalent health effects, but the benefit-per-ton estimates vary because each ton of precursor reduced has a different propensity to become $PM_{2.5}$. The monetized benefits incorporate the conversion from precursor emissions to ambient fine particles.**

Deleted: *OMB Review Draft – February 23, 2009*

Figure 7.2:



*** This graph shows all of the benefits estimates, specifically identifying the estimates based on Pope et al and Laden et al with dark bars and the expert elicitation with translucent bars. Results using a 3% discount rate are shown in blue, and results using a 7% discount rate are shown in red.**

Formatted: Bullets and Numbering

7.5 Comparison of Benefits and Costs

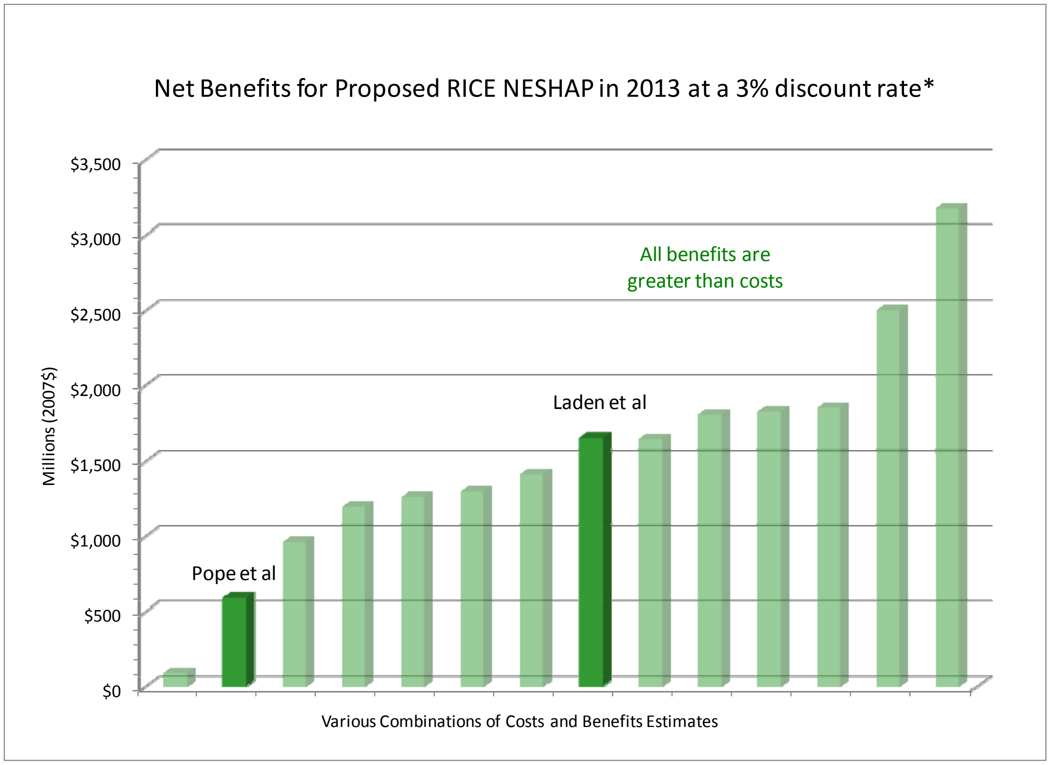
In the year of full implementation (2013), EPA estimates the range[13] of annualized benefits of this proposal to be $930 million to $2.0 billion ($2007) at a 3% discount rate[14] and $850 million to $1.8 billion ($2007) at a 7% discount rate with annualized costs of $345 million ($2007) at a 7% interest rate as mentioned in Chapter 4 of this RIA. Thus, the net benefits of the

[13] This range represents benefits estimates derived from the Pope et al. study to the Laden et al. study, not the entire range of the expert elicitation. This range captures most of the expert opinion, while preserving the empirical basis of our estimates. Uncertainty goes beyond the range shown here.

[14] The benefits are discounted to account for the cessation lag in $PM_{2.5}$ benefits from premature mortality and acute myocardial infarctions (AMIs), rather than a discounted stream of future benefits; whereas discounting the costs reflects the lifetime costs of the equipment. For this reason, it is appropriate in this context to use two different discount rates for the benefits and costs.

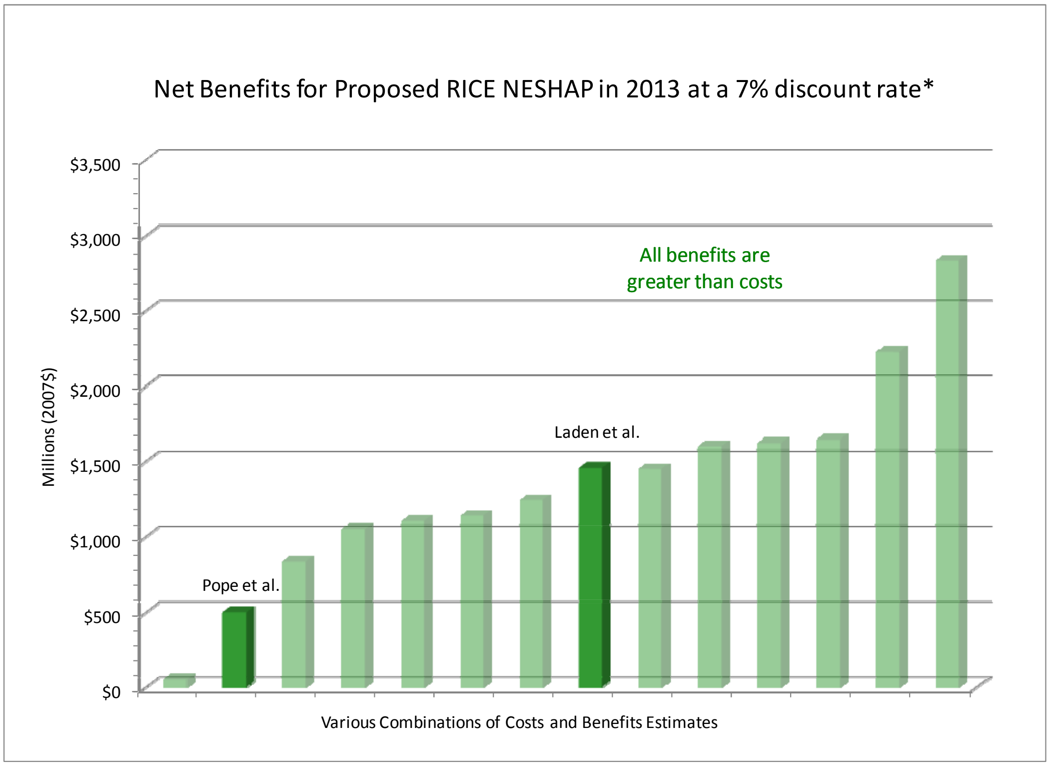
RICE NESHAP are $590 million to $1.6 billion at a 3% discount rate and $500 million to $1.5 billion at a 7% discount rate. Figures 7.2 and 7.3 show the all net benefits estimates (i.e., annual benefits in 2013 minus annualized costs) utilizing all 14 different $PM_{2.5}$ mortality functions. EPA believes that the benefits are likely to exceed the costs by a substantial margin under this proposal even when taking into account uncertainties in the cost and benefit estimates.

Figure 7.3:



***Net Benefits are quantified in terms of $PM_{2.5}$ benefits at a 3% discount. This graph shows all of the benefits estimates combined with the cost estimate, specifically identifying the estimates based on Pope et al and Laden et al with dark green bars and the expert elicitation with translucent green bars.**

Figure 7.4:



***Net Benefits are quantified in terms of $PM_{2.5}$ benefits at a 3% discount. This graph shows all of the benefits estimates combined with the cost estimate, specifically identifying the estimates based on Pope et al and Laden et al with dark green bars and the expert elicitation with translucent green bars.**

Deleted: *OMB Review Draft – February 23, 2009*

SECTION 8
REFERENCES

American Hospital Association. 2007. “AHA Hospital Statistics: 2008 Edition.” Health Forum.

Fullerton, D., and G. Metcalf. 2002. “Tax Incidence.” In A. Auerbach and M. Feldstein, eds., *Handbook of Public Economics*, Vol. 4, Amsterdam: Elsevier.

Industrial Economics, Inc., 2006. Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality. Prepared for the U.S. EPA, Office of Air Quality Planning and Standards, September. Available on the Internet at <http://www.epa.gov/ttn/ecas/regdata/Uncertainty/pm_ee_report.pdf>.

Interstate Oil & Gas Compact Commission. 2007. “Marginal Wells: Fuel for Economic Growth.” Table 3.B. <http://iogcc.myshopify.com/collections/frontpage/products/2007-marginal-well-report-2007>.

Laden, F., J. Schwartz, F.E. Speizer, and D.W. Dockery. 2006. Reduction in Fine Particulate Air Pollution and Mortality. American Journal of Respiratory and Critical Care Medicine. 173: 667-672.

Lincoln Electric Holdings. 2006. Form 10-K. Filed February 24, 2006.

National Research Council (NRC). 2002. Estimating the Public Health Benefits of Proposed Air Pollution Regulations. Washington, DC: The National Academies Press.

Nelson, B., EC/R Inc. and T. Parise, Alpha-Gamma Technologies, Inc. December 1, 2008. Memorandum to Jamie Pagan, U.S. Environmental Protection Agency. Impacts Associated with NESHAP for Existing Stationary RICE.

Nicholson, Walter. 1998. *Microeconomic Theory*. Orlando: The Dryden Press.

Office of Management and Budget (OMB), 2003. Circular A-4: Regulatory Analysis. Washington, DC. Available on the internet at <http://www.whitehouse.gov/omb/circulars/a004/a-4.html>.

Parise, T., Alpha-Gamma Technologies, Inc. 2008. Memorandum: “Impacts Associated with NESHAP for Existing Stationary RICE.”

Pope, C.A., III, R.T. Burnett, M.J. Thun, E.E. Calle, D. Krewski, K. Ito, and G.D. Thurston. 2002. “Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution.” Journal of the American Medical Association 287:1132-1141.

Roman, Henry A., Walker, Katherine D., Walsh, Tyra L., Conner, Lisa, Richmond, Harvey M., Hubbell, Bryan J., and Kinney, Patrick L., 2008. Expert Judgment Assessment of the Mortality Impact of Changes in Ambient Fine Particulate Matter in the U.S. Environ. Sci. Technol., 42, 7, 2268 – 2274.

The Federal Reserve Board. "Industrial Production and Capacity Utilization: Industrial Production" Series ID: G17/IP_MINING_AND_UTILITY_DETAIL/IP.G2211.S <http://www.federalreserve.gov/datadownload/>. (December 15, 2008)

Troy, Leo. 2008. "Almanac of Business and Industrial Financial Ratios: 2009 Edition." CCH.

U.S. Bureau of Economic Analysis (BEA). 2002. 2002 and 1997 Benchmark Input-Output Accounts: Detailed Make Table, Use Table and Direct Requirements Table. Tables 4 and 5. <http://www.bea.gov/industry/index.htm#benchmark_io>.

U.S. Bureau of Economic Analysis (BEA). 2008. Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. Last revised November 25, 2008.

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: 2002 and 1997." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 22: Utilities: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Bureau of the Census. 2002; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Geographic Area Series: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Census Bureau. 2002a. "Industry Series." *Crude Petroleum & Natural Gas: 2002. EC02-21I-211111 (RV)*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002b. "Industry Series." *Electric Power Generation, Transmission, and Distribution: 2002. EC02-22I-03*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002c. "Industry Series." *Hospitals: 2002. EC02-62I-02*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002d. "Industry Series." *Natural Gas Liquid Extraction: 2002. EC02-21I-211112*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2002e. "Industry Series." *Pipeline Transportation: 2002. EC02-48I-02*. Washington, DC: U.S. Bureau of the Census. Table 1.

U.S. Census Bureau. 2005a. *2002 Census of Governments, Volume 4, Number 3, Finances of County Governments: 2002 GC02(4)-3*. U.S. Government Printing Office, Washington, DC. Table 12.

U.S. Census Bureau. 2005b. *2002 Census of Governments, Volume 4, Number 4, Finances of Municipal and Township Governments: 2002 GC02(4)-4*. U.S. Government Printing Office, Washington, DC. Table 13.

U.S. Census Bureau. 2008a. Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002. <http://www2.census.gov/csd/susb/2002/02us_detailed %20sizes_6digitnaics.txt>.

U.S. Census Bureau. 2008b. Firm Size Data from the Statistics of U.S. Businesses, U.S. All Industries Tabulated by Receipt Size: 2002. <http://www2.census.gov/csd/susb/2002/ usalli_r02.xls>.

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 21: Mining: Industry Series: Historical Statistics for the Industry: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002." <http://factfinder.census.gov>; (November 21, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 22: Utilities: Geographic Area Series: Summary Statistics: 2002 and 1997." <http://factfinder.census.gov>; (November 26, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 62: Health Care and Social Assistance: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (November 21, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Industry Series: Historical Statistics for the Industry: 2002 and Earlier Years" <http://factfinder.census.gov>; (November 25, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Industry Series: Comparative Statistics for the United States (1997 NAICS Basis): 2002 and 1997" <http://factfinder.census.gov>; (December 12, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48: Transportation and Warehousing: Subject Series—Estab & Firm Size: Concentration by Largest Firms for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Geographic Distribution—Pipeline transportation of natural gas: 2002." <http://factfinder.census.gov>; (November 10, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 48-49: Transportation and Warehousing: Subject Series—Estab & Firm Size: Legal Form of Organization for the United States: 2002" <http://factfinder.census.gov>; (December 12, 2008).

Deleted: *OMB Review Draft – February 23, 2009*

U.S. Census Bureau; generated by RTI International; using American FactFinder; “Sector 00: All sectors: Geographic Area Series: Economy-Wide Key Statistics: 2002” <http://factfinder.census.gov>; (December 17, 2008).

U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). 2004. “2003 Farm and Ranch Irrigation Survey.” Washington, DC: USDA-NASS.

U.S. Department of Agriculture (USDA). 2008. “Agricultural Projections to 2017.” <http://www.ers.usda.gov/Publications/OCE081/OCE20081c.pdf>.

U.S. Department of Agriculture (USDA). 2008. “Agricultural Projections to 2017.” <http://www.ers.usda.gov/Publications/OCE081/OCE20081c.pdf>.

U.S. Department of Energy, Energy Information Administration. 2007. “2006 EIA-906/920 Monthly Time Series.”

U.S. Energy Information Administration. 2008a. <http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html>. Last updated September 2008.

U.S. Energy Information Administration. 2008b. Supplemental Tables to the Annual Energy Outlook 2009. Table 10. Available at: <http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>.

U.S. Environmental Protection Agency (EPA). September 2000. *Guidelines for Preparing Economic Analyses*. EPA 240-R-00-003. Washington, DC: EPA. <http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html>.

U.S. Environmental Protection Agency (EPA). May 2004. *Final Regulatory Analysis: Control of Emissions from Nonroad Diesel Engines.* EPA420-R-04-007. Washington, DC: EPA. < http://www.epa.gov/nonroad-diesel/2004fr/420r04007.pdf>.

U.S. Environmental Protection Agency. 2006. Regulatory Impact Analysis, 2006 National Ambient Air Quality Standards for Particulate Matter, Chapter 5. Available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf >.

U.S. Environmental Protection Agency. 2008. Regulatory Impact Analysis, 2008 National Ambient Air Quality Standards for Ground-level Ozone, Chapter 6. Available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/6-ozoneriachapter6.pdf>.

U.S. Environmental Protection Agency. 2008. Technical Support Document: Calculating Benefit Per-Ton estimates, Ozone NAAQS Docket #EPA-HQ-OAR-2007-0225-0284.

U.S. Environmental Protection Agency. 2008. Integrated Science Assessment for Particulate Matter (External Review Draft). Washington, DC, EPA/600/R-08/139. Available on the Internet at <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805>

U.S. Small Business Administration (SBA). 2008. "Table of Small Business Size Standards Matched to North American Industry Classification System Codes." Effective August 22, 2008. <http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf>.

U.S. Small Business Administration (SBA). 2008. Table of Small Business Size Standards Matched to North American Industry Classification System Codes. Effective March 11, 2008. <http://www.sba.gov/services/contractingopportunities/sizestandardstopics/size/index.html>.

Wade, S.H. 2003. "Price Responsiveness in the AEO2003 NEMS Residential and Commercial Buildings Sector Models." <http://www.eia.doe.gov/oiaf/analysispaper/elasticity/pdf/buildings.pdf>.