Economic Impact Analysis

Proposed Revisions to the National Emission Standards for Hazardous Air Pollutants Subpart S (MACT I and MACT III) for the Pulp and Paper Industry

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U.S. Environmental Protection Agency
Office of Air and Radiation
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ACKNOWLEDGEMENTS

In addition to EPA staff from the Office of Air Quality Planning and Standards, personnel from RTI International contributed data and analysis to this document. Specific sections where RTI International made contributions include the industry profile and sections describing emissions, pollution control options, the engineering cost analysis, and potential employment impacts.

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1 EXECUTIVE SUMMARY

1.1 Introduction

EPA is performing a Risk and Technology Review (RTR) that focuses on the National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart S. Subpart S controls hazardous air pollutant (HAP) emissions from the pulp and paper production areas of mills using the kraft, sulfite, semi-chemical, and soda pulp processes (MACT I) and HAP emissions from pulp and paper production areas of mills using mechanical, secondary fiber, and non-wood pulping, and papermaking systems at all mills (MACT III). As of this review, a total of 171 pulp and paper major sources are subject to MACT I and III.

Under this proposal, affected pulp and paper facilities will be required to implement control measures and absorb regulatory costs. As part of the regulatory process, EPA is required to develop an economic impact analysis (EIA) and small entity impacts analysis for the potentially affected industries. This report documents the methods and results of this EIA.

1.2 Results

EPA estimates the program will result in very small increases in market prices and very small reductions in output of paper and paperboard products produced by the affected industries. The economic approach and engineering cost approach yield approximately the same estimate of the total change in surplus under the regulatory program. However, the economic approach identifies important distributional impacts among stakeholders. The key results of the EIA are as follows:

- **Engineering Cost Analysis:** Total annualized engineering costs measure the costs incurred by affected industries annually. The annualized engineering costs for the proposed regulatory alternative are estimated to be $6.2 million in 2010 dollars.
- **Market Analysis:** The proposed option induces minimal changes in the average national price of paper and paperboard products. Paper and paperboard product prices increase less than 0.01% on average, while production levels decrease less that 0.01% on average, as a result of the proposed option.
- **Economic Welfare Analysis:** The economic analysis identifies important transitory impacts across stakeholders as paper and paperboard product markets adjust to higher production costs. Consumers see reductions in economic welfare of about $3.3 million as the result of higher prices and reduced consumption. Although producers' welfare losses

are mitigated to some degree by higher prices, market conditions limit their ability to pass on all of the compliance costs. As a result, they also experience a loss in economic welfare of about $2.9 million.

- **Small Business Analysis:** EPA performed a screening analysis for impacts on small businesses by comparing estimated annualized engineering compliance costs at the company-level to company sales. The screening analysis found that the ratio of compliance cost to company revenue falls below 1% for the three small companies that are likely to be affected by the proposed option. Based upon this analysis, we conclude there is no significant impact on a substantial number of small entities (SISNOSE) arising from the proposed NESHAP amendments.
- **Employment Impact Analysis:** EPA estimated the annual labor required to comply with the requirements of the proposal. To do this, EPA first estimated the labor required for emission control equipment operation and maintenance, as well as reporting and recordkeeping, then converted this number to full-time equivalents (FTEs) by dividing by 2,080 (40 hours per week multiplied by 52 weeks). The upfront (one-time) and ongoing, annual labor required for complying with the proposed option is estimated at about 2.5 and 9.1 FTEs, respectively. EPA notes that this type of FTE estimate cannot be used to make assumptions about the specific number of people involved or whether new jobs are created for new employees.

1.3 Organization of this Report

The remainder of this report details the methodology and the results of the EIA. Section 2 presents the industry profile of the papermaking industry. Section 3 describes the emissions points, controls, regulatory options evaluated in the EIA, emissions reduction estimates, and engineering costs analysis. Section 4 presents the economic, small business, and employment impacts analyses. Section 5 lists references cited throughout the EIA.

2 INDUSTRY PROFILE

2.1 Introduction

The paper manufacturing subsector is an essential component of all business operations worldwide. Broadly speaking, paper and paperboard are manufactured by converting timber or other recycled material into products such as printing and writing papers, newsprint, tissue, and containerboard (Benwart 2006). The subsector has been experiencing a decline in shipments as of late. From 1997 to 2007, shipments in the industry declined 7%, and employment declined by 27% (Table 2-1). While total payroll dropped 26% over this time, annual payroll per employee rose 2% from 1997 to 2007 because of the decline in the number of employees (Table 2-2). Shipments per employee grew 28% from 1997 to 2007, with much of that growth taking place between 2002 and 2006 (Table 2-2).

Table 2-1 Key Statistics: Paper Manufacturing (NAICS 322)

	1997	2002	2006	2007
Shipments ($2007, millions)	$188,496	$175,983	$174,887	$175,806
Payroll ($2007, millions)	$27,983	$24,561	$21,188	$20,804
Employees	574,274	489,367	414,049	416,886
Establishments	5,868	5,495	NA	4,803

NA = Not available.

Sources: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Annual Survey of Manufactures: General Statistics: Statistics for Industry Groups and Industries: 2006 and 2005." <http://factfinder.census.gov>; (July 8, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 00: All Sectors: Core Business Statistics Series: Comparative Statistics for the United States and the States (1997 NAICS Basis): 2002 and 1997." <http://factfinder.census.gov>; (July 8, 2008).

U.S. Census Bureau; generated by Kapur Energy and Environment; using American FactFinder; "Sector 00: EC0700A1: All Sectors: Geographic Area Series: Economy-Wide Key Statistics: 2007." Accessed on December 28, 2009. [Source for 2007 numbers]

Table 2-2 Industry Data: Paper Manufacturing (NAICS 322)

Industry Data	1997	2002	2006	2007
Total shipments ($2007, millions)	$188,496	$175,983	$174,887	$175,806
Shipments per establishment ($2007, thousands)	$32,123	$32,026	NA	$36,603
Average Shipments per employee ($2007)	$328,233	$359,614	$422,381	$421,712
Average Shipments per $ of payroll ($2007)	$6.74	$7.17	$8.25	$8.45
Average Annual payroll per employee ($2007)	$48,727	$50,189	$51,174	$49,904
Average Employees per establishment	98	89	NA	87

NA = Not available.

Sources: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Annual Survey of Manufactures: General Statistics: Statistics for Industry Groups and Industries: 2006 and 2005." <http://factfinder.census.gov>; (July 8, 2008).

U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 00: All Sectors: Core Business Statistics Series: Comparative Statistics for the United States and the States (1997 NAICS Basis): 2002 and 1997." <http://factfinder.census.gov>; (July 8, 2008).

U.S. Census Bureau; generated by Kapur Energy and Environment; using American FactFinder; "Sector 00: EC0700A1: All Sectors: Geographic Area Series: Economy-Wide Key Statistics: 2007." <http://factfinder.census.gov>. Accessed on December 28, 2009. [Source for 2007 numbers]

The U.S. Census Bureau categorizes this industry's facilities into two categories: pulp, paper, and paperboard manufacturing and converted paper product manufacturing. These are further divided into the following types of facilities as defined by the U.S. Census Bureau (2001):

- **Pulp, Paper, and Paperboard:**
  - Pulp Mills (NAICS 32211): This industry comprises establishments primarily engaged in manufacturing pulp without manufacturing paper or paperboard. The pulp is made by separating the cellulose fibers from the other impurities in wood or other materials, such as used or recycled rags, linters, scrap paper, and straw.
  - Paper Mills (NAICS 32212): This industry comprises establishments primarily engaged in manufacturing paper from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may convert the paper they make. The activity of making paper classifies an establishment into this industry regardless of the output.
  - Paperboard Mills (NAICS 32213): This industry comprises establishments primarily engaged in manufacturing paperboard from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paperboard they make.

- **Converted Paper Products:**
  - Paperboard Containers Manufacturing (NAICS 32221): This industry comprises establishments primarily engaged in converting paperboard into containers without manufacturing paperboard. These establishments use corrugating, cutting, and shaping machinery to form paperboard into containers. Products made by these establishments include boxes; corrugated sheets, pads, and pallets; paper dishes; and fiber drums and reels.
  - Paper Bag and Coated and Treated Paper Manufacturing (NAICS 32222): This industry comprises establishments primarily engaged in one or more of the following manufacturing activities: cutting and coating paper and paperboard; cutting and laminating paper and paperboard and other flexible materials (except plastics film to plastics film); bags or multiwall bags or sacks of paper, metal foil, coated paper, or laminates or coated combinations of paper and foil with plastics film; laminated aluminum and other converted metal foils from purchased foils; and surface coating paper or paperboard.
  - Stationary Product Manufacturing (NAICS 32223): This industry comprises establishments primarily engaged in converting paper or paperboard into products used for writing, filing, art work, and similar applications.
  - Other Converted Paper Products (NAICS 32229): This industry comprises establishments primarily engaged in one of the following manufacturing activities:
    - converting paper and paperboard into products (except containers, bags, coated and treated paper and paperboard, and stationery products), or
    - converting pulp into pulp products, such as disposable diapers, or molded pulp egg cartons, food trays, and dishes.

Figure 2-1 shows that the value of shipments for converted paper products was 54% of the value of all paper products in 2007, while the value of shipments for pulp, paper, and paperboard products was 46%. Figure 2-2 indicates that 70% of industry employees worked in the converted paper product category of the industry due to the labor intensive aspects of those facilities.

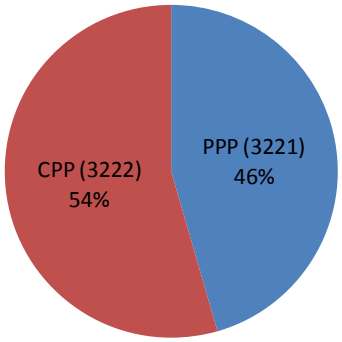

Figure 2-1 Distribution of Value of Shipments within Paper Manufacturing (NAICS 322): 2007

Source: U.S. Census Bureau; generated by Kapur Energy and Environment; using American FactFinder: "Sector 31: EC0731I1: Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007." Accessed on December 28, 2009.

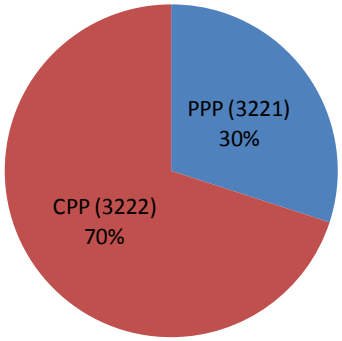

Figure 2-2 Distribution of Employment within Paper Manufacturing (NAICS 322): 2007

Source: U.S. Census Bureau; generated by Kapur Energy and Environment; using American FactFinder; "Sector 31: EC0731I1: Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007." <http://factfinder.census.gov>. Accessed on December 28, 2009.

2.2 Supply and Demand Characteristics

Next, we provide a broad overview of the supply and demand sides of the paper manufacturing industry. We emphasize the economic interactions this industry has with other industries, identify the key goods and services used by the industry, and identify the major uses and consumers of paper manufacturing products.

2.2.1 Goods and Services Used in Paper Manufacturing

In 2007, the cost of materials made up 53% of the total shipment value of goods in the paper manufacturing industry Table 2-3. Total compensation of employees represented 15% of

the total value in 2007, down from 17% in 2005. The total number of employees decreased by 2% between 2005 and 2007. Meanwhile shipments increased by 3% over the same period.

The top 10 industry groups supplying inputs to the paper manufacturing subsector accounted for 70% of the total intermediate inputs according to 2008 Bureau of Economic Analysis (BEA) data (Table 2-4). Inputs for pulp, paper, and paperboard products are notably different from inputs for converted paper products because the NAICS 3221 group represents the initial step in the paper manufacturing process; thus, its inputs include more raw resources such as wood products, forestry and logging products, natural gas, and electricity. This becomes evident when observing inputs for converted paper products: 49% of the cost of inputs comes from pulp, paper, and paperboard products.

2.3.2.1.1 Energy. The Department of Energy (DOE) categorizes paper manufacturing (NAICS 322) as an energy-intensive subsector. The 2008 Annual Energy Outlook predicts that the paper-producing subsector will be one of four subsectors experiencing positive average growth of delivered energy consumption between 2006 and 2030 (U.S. Energy Information Administration 2008)

Energy generation from the recovery boiler is often insufficient for total plant needs, so facilities augment recovery boilers with fossil fuel–fired and wood waste–fired boilers (hogged fuel) to generate steam and often electricity. Industry wide, the use of pulp wastes, bark, and other papermaking residues supplies 58% of the energy requirements of pulp and paper companies (U.S. Environmental Protection Agency 2002).

Likewise, Table 2-5 shows that total energy use decreased between 1998 and 2006 by 14%. Figure 2-3 indicates that total electrical power use changed sporadically between 2002 and 2004 but decreased consistently and rapidly after 2004.

Table 2-3 Costs of Goods and Services Used in the Paper Manufacturing Industry (NAICS 322)

Variable	2005	Share	2006	Share	2007	Share
Total shipments ($2007, millions)	$171,477	100%	$174,887	100%	$176,018	100%
Total compensation ($2007, millions)	$28,846	17%	$27,791	16%	$27,150	15%
Annual payroll	$21,792	13%	$21,188	12%	$20,804	12%
Fringe benefits	$7,054	4%	$6,603	4%	$6,346	4%
Total employees	426,748		414,049		417,367	
Average compensation per employee	$67,596		$67,121		$65,051	
Total production workers wages ($2007, millions)	$14,965	9%	$14,689	8%	$14,190	8%
Total production workers	331,228		321,684		321,937	
Total production hours (thousands)	716,963		691,134		680,732	
Average production wages per hour	$21		$21		$21	
Total cost of materials ($2007, thousands)	$91,897	54%	$92,452	53%	$94,029	53%
Materials, parts, packaging	$77,494	45%	$78,202	45%	$79,984	45%
Purchase electricity	$3,788	2%	$3,841	2%	$3,780	2%
Purchased fuel ($2007)	$5,537	3%	$5,509	3%	$5,511	3%
Other	$5,078	3%	$4,901	3%	$4,755	3%

Sources: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Annual Survey of Manufactures: General Statistics: Statistics for Industry Groups and Industries: 2006 and 2005." <http://factfinder.census.gov>; (July 8, 2008).

U.S. Census Bureau; generated by Kapur Energy and Environment; using American FactFinder; "Sector 31: EC0731I1: Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007." <http://factfinder.census.gov>. Accessed on December 28, 2009. [Source for 2007 numbers]

Table 2-4 Key Goods and Services Used in the Paper Manufacturing Industry (NAICS 322) ($millions, $2007)

Description	BEA Code	NAICS 3221 Pulp, Paper, and Paperboard	NAICS 3222 Converted Paper Products	Total
Pulp, paper, and paperboard	3221	$4,155	$30,448	$34,603
Wholesale trade	4200	$3,916	$6,356	$10,273
Management of companies and enterprises	5500	$3,154	$3,838	$6,993
Forestry and logging products	1130	$5,389	$0	$5,389
Basic chemicals	3251	$3,734	$263	$3,997
Electric power generation, transmission, and distribution	2211	$2,690	$913	$3,603
Wood products	3210	$3,450	$33	$3,484
Converted paper products	3222	$1,415	$1,745	$3,159
Natural gas distribution	2212	$2,680	$345	$3,026
Truck transportation	4840	$1,428	$1,571	$2,999
Total intermediate inputs	T005	$47,835	$62,690	$110,525

Source: U.S. Bureau of Economic Analysis (BEA). 2008. "2002 Benchmark Input-Output Accounts: 2002 Standard Make and Use Tables at the Summary Level." Table 2. Washington, DC: BEA.

Table 2-5 Energy Used in Paper Manufacturing (NAICS 322)

Fuel Type	1998	2002	2006
Net electricity[a] (million kWh)	70,364	65,503	72,518
Residual fuel oil (million bbl)	24	16	15
Distillate fuel oil[b] (million bbl)	2	2	2
Natural gas[c] (billion cu ft)	570	490	461
LPG and NGL[d] (million bbl)	1	2	1
Coal (million short tons)	12	11	10
Coke and breeze (million short tons)	—	*	—
Other[e] (trillion BTU)	1,476	1,276	1,303
Total (trillion BTU)	2,744	2,361	2,354

[a] Net electricity is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from on-site cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

[b] Distillate fuel oil includes Nos. 1, 2, and 4 fuel oils and Nos. 1, 2, and 4 diesel fuels.

[c] Natural gas includes natural gas obtained from utilities, local distribution companies, and any other supplier(s), such as independent gas producers, gas brokers, marketers, and any marketing subsidiaries of utilities.

[d] Examples of liquefied petroleum gases (LPG) are ethane, ethylene, propane, propylene, normal butane, butylene, ethane-propane mixtures, propane-butane mixtures, and isobutene produced at refineries or natural gas processing plants, including plants that fractionate raw natural gas liquids (NGLs).

[e] Other includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power.

* Estimate less than 0.5.

Sources: U.S. Department of Energy, Energy Information Administration. 2007. "2002 Energy Consumption by Manufacturers—Data Tables." Tables 3.2 and N3.2. <http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/shelltables.html>. Washington, DC: DOE.

U.S. Department of Energy, Energy Information Administration. 2007b. "2006 Energy Consumption by Manufacturers—Data Tables." Table 3.1. <http://www.eia.doe.gov/emeu/mecs/mecs2006/2006tables.html>. Accessed on December 27, 2009. [Source for 2006 numbers]

Over the last 25 years, the pulp and paper subsector has changed its energy generation methods from fossil fuels to a greater use of processes such as increases in the use of wood wastes in place of fuel (Table 2-6). During the 1972–1999 period, the proportion of total industry power generated from the combination of wood wastes, spent liquor solids, and other self-generated methods increased from about 41% to about 56%, while coal, fuel oil, and natural gas use decreased from about 54% to about 36% (U.S. Environmental Protection Agency 2002).

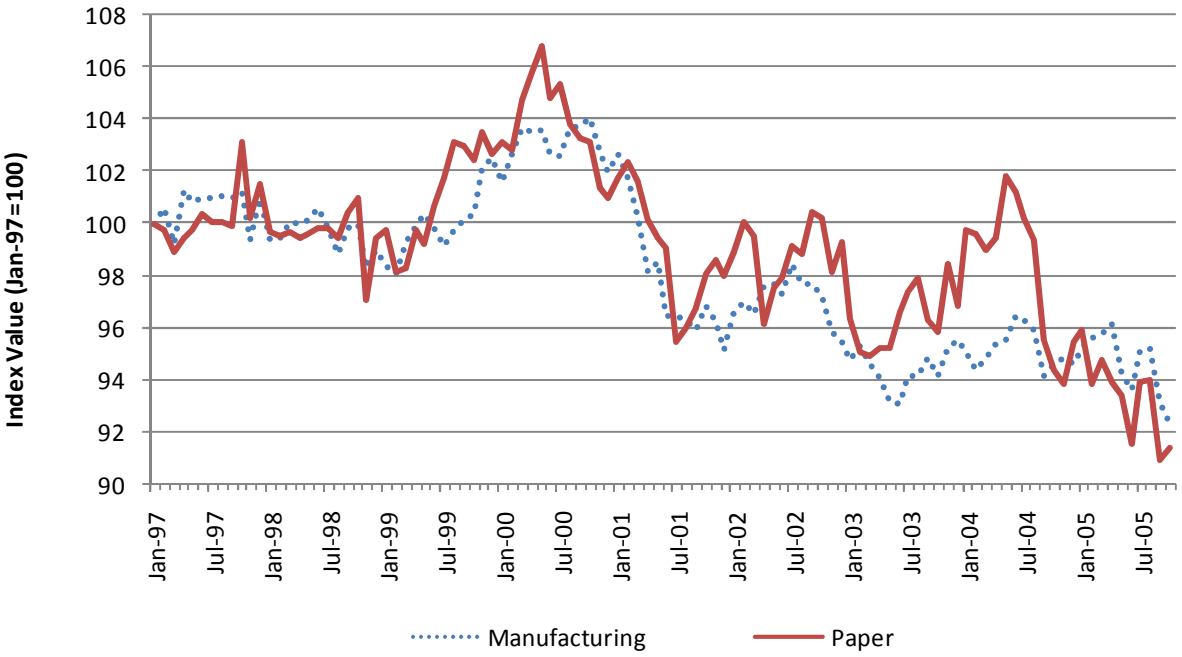

Figure 2-3 Electrical Power Use Trends in the Paper Manufacturing Industry: 1997–2005

Source: Federal Reserve Board. 2009. "Industrial Production and Capacity Utilization: Electric Power Use: Manufacturing and Mining." Series ID: G17/KW/KW.GMF.S & G17/KW/KW.G322.S. <http://www.federalreserve.gov/datadownload/>.

Table 2-6 Estimated Energy Sources for the U.S. Pulp and Paper Industry

Energy Source	1972	1979	1990	1999
Purchased steam	5.4%	6.7%	7.3%	1.5%
Coal	9.8%	9.1%	13.7%	12.5%
Fuel oil	22.3%	19.1%	6.4%	6.3%
Natural gas	21.5%	17.8%	16.4%	17.6%
Other purchased energy	—	—	—	6.7%
Waste wood and wood chips (hogged fuel) and bark	6.6%	9.2%	15.4%	13.5%
Spent liquor solids	33.7%	37.3%	39.4%	40.3%
Other self-generated power	0.6%	0.8%	1.2%	1.6%

Source: U.S. Environmental Protection Agency. 2002. "Profile of the Pulp and Paper Industry." Sector Notebook Project. <http://www.epa.gov/Compliance/resources/publications/assistance/sectors/notebooks/index.html>.

2.2.2 Uses and Consumers

Products manufactured in the NAICS groups 3221 and 3222 have different, but complementary, consumer profiles. NAICS 3221 supplies a significant portion of NAICS 3222 demand (37% of total commodity output). Both industries specialize in products with intermediate uses, with an average of 92% of sales between the two going toward this purpose. NAICS 3222 has a very diverse assortment of subsector groups from which it receives demand. Food manufacturing makes up 21% of the demand, making members of this industry the largest consumer of converted paper products (Table 2-7). Pulp, paper, and paperboard products have a large trade deficit, while converted paper products have a very small trade surplus.

Table 2-7 Demand by Sector: Paper Manufacturing Industry (NAICS 322) ($millions, $2007)

Sector	BEA Code	3221 Pulp, Paper, and Paperboard	3222 Converted Paper Products	Total
Converted paper product manufacturing	3222	$30,448	$1,745	$32,193
Food manufacturing	3110	$638	$18,782	$19,421
Printing and related support activities	3230	$13,320	$3,874	$17,194
General state and local government services	S007	$6,065	$7,792	$13,857
Pulp, paper, and paperboard mills	3221	$4,155	$1,415	$5,569
Newspaper, periodical, book, and directory publishers	5111	$4,851	$168	$5,018
Plastics and rubber products manufacturing	3260	$1,249	$3,403	$4,651
Wholesale trade	4200	$990	$2,619	$3,609
Food services and drinking places	7220	$1,510	$2,597	$4,107
Total intermediate use	T001	$76,729	$80,862	$157,591
Personal consumption expenditures	F010	$11,882	$9,295	$21,177
Exports of goods and services	F040	$7,724	$5,799	$13,523
Imports of goods and services	F050	−$15,284	−$5,720	−$21,005
Total final uses (GDP)	T004	$4,996	$9,607	$14,604
Total commodity output	T007	$81,725	$90,469	$172,195

Source: U.S. Bureau of Economic Analysis (BEA). 2008. "2002 Benchmark Input-Output Accounts: 2002 Standard Make and Use Tables at the Summary Level." Table 2. Washington, DC: BEA.

2.3 Firm and Market Characteristics

This section describes geographic, production, and market data. These data provide the basis for further analysis, and depict recent historical trends of production and pricing.

2.3.1 Location

As Figure 2-4 illustrates, as of 2002, California was home to the most paper manufacturing establishments in the United States, followed by Illinois and some bordering northeastern states. The location of establishments in the paper manufacturing industry varies a great deal by subsector. Wisconsin and New York had the most pulp, paper, and paperboard establishments, while California dominated with over 500 converted paper product establishments. Overall, as of 2002, the United States had 561 pulp, paper, and paperboard establishments and 4,956 converted paper product establishments.

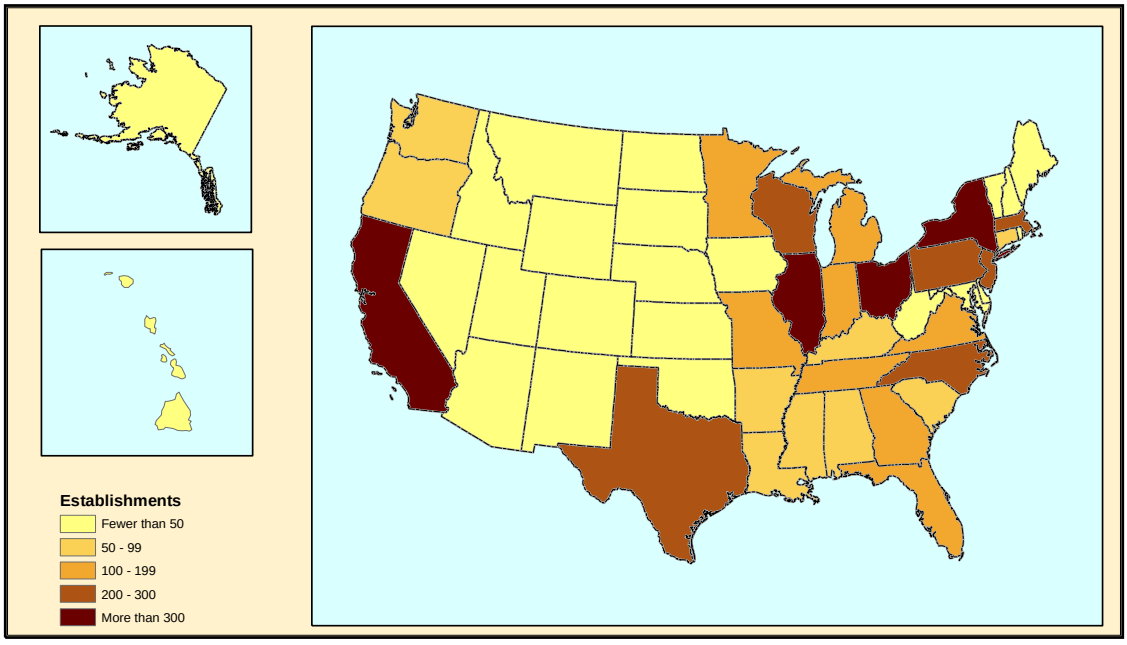

Figure 2-4 Establishment Concentration in Paper Manufacturing Industry (NAICS 322): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Geographic Area Series: Industry Statistics for the States, Metropolitan and Micropolitan Statistical Areas, Counties, and Places: 2002." <http://factfinder.census.gov>; (July 23, 2008).

2.3.2 Production Capacity and Utilization

Capacity utilization of the paper manufacturing subsector has been experiencing a steady decline, similar to the decline of the total manufacturing sector. However, paper manufacturing has managed to use its capacity at a consistently higher rate than the average for manufacturing industries (Figure 2-5).

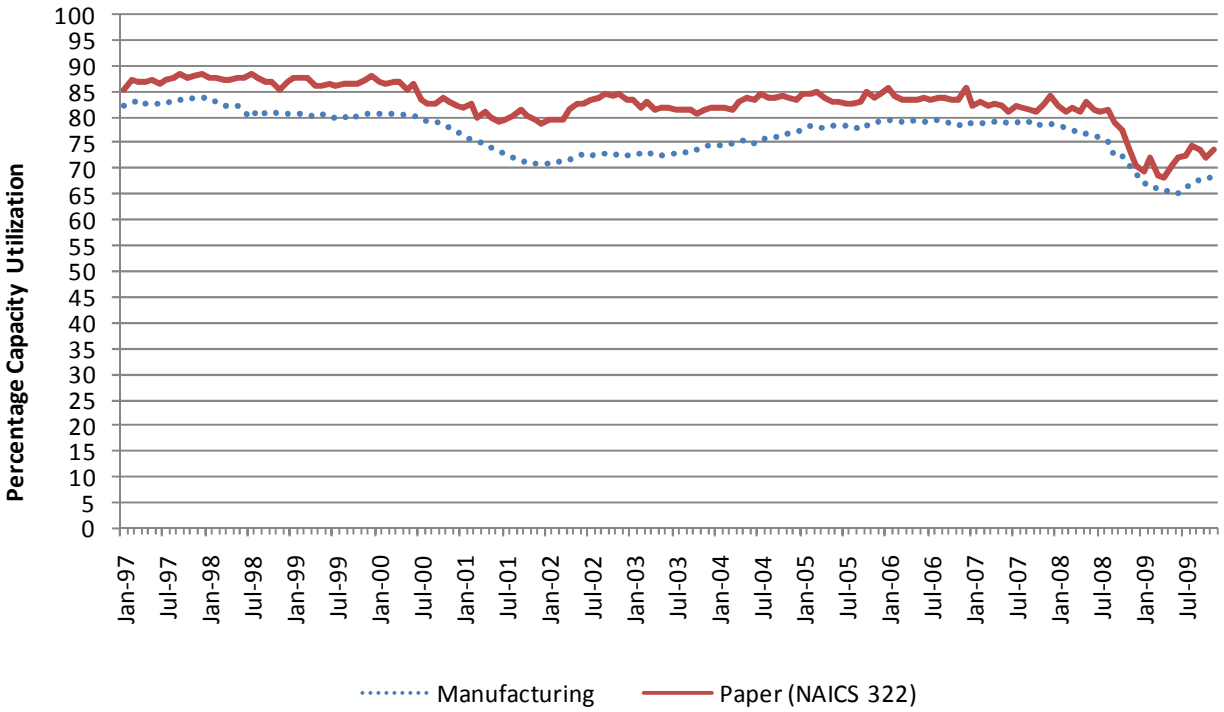

Figure 2-5 Capacity Utilization Trends in the Paper Manufacturing Industry (NAICS 322)

Source: Source: Federal Reserve Board. 2009. "Industrial Production and Capacity Utilization: Capacity Utilization." Series ID: G17/CAPUTL/CAPUTL.GMF.S & G17/CAPUTL/CAPUTL.G322.S. <http://www.federalreserve.gov/datadownload/>.

2.3.3 Employment

Wisconsin has the largest number of employees in the paper manufacturing subsector with over 38,008 reported in the 2002 census followed by 29,379 in California (Figure 2-6). The converted paper products group has more employees per establishment, 283, than the pulp, paper, and paperboard group, 67.

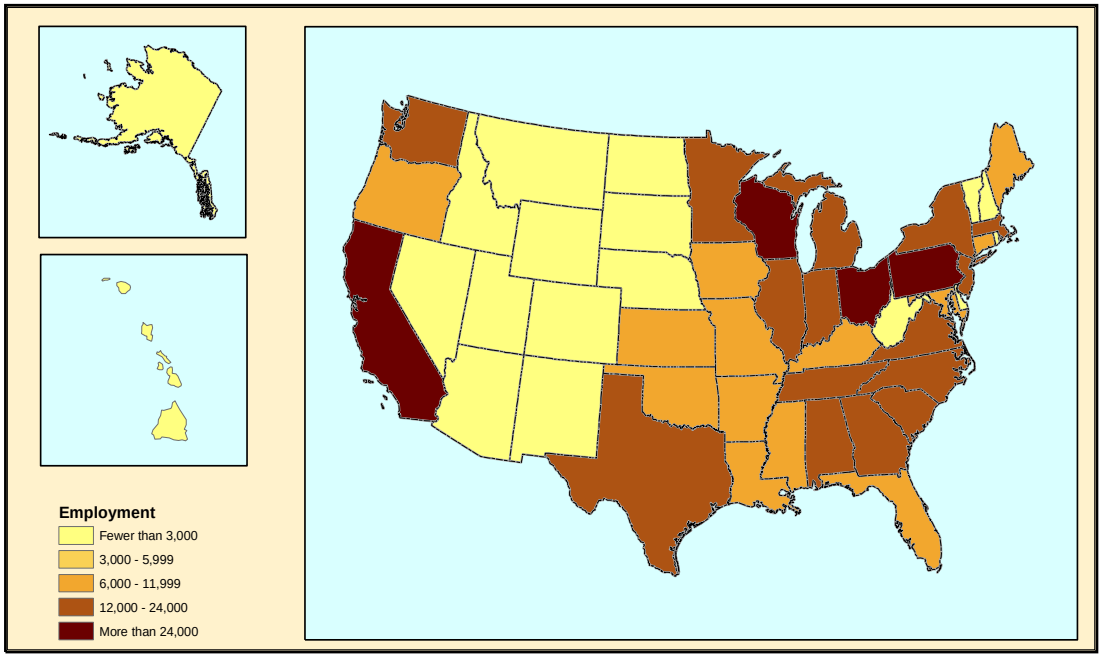

Figure 2-6 Employment Concentration in the Paper Manufacturing Industry (NAICS 322): 2002

Source: U.S. Census Bureau; generated by RTI International; using American FactFinder; "Sector 31: Manufacturing: Geographic Area Series: Industry Statistics for the States, Metropolitan and Micropolitan Statistical Areas, Counties, and Places: 2002." <http://factfinder.census.gov>; (July 23, 2008).

2.3.4 Plants and Capacity

While the manufacturing sector has been growing consistently since 1997, the paper manufacturing sector has not experienced the same amount of success in the same period. Despite a small amount of growth in capacity between 1997 and 2001, the paper manufacturing subsector's capacity has declined to as much as 7% below 1997 capacity levels (Figure 2-7).

2.3.5 Firm Characteristics

In 2006, the top 10 paper and forest product companies produced over $75 billion in sales, with the top two companies—International Paper and Weyerhaeuser—generating nearly $22 billion each (Figure 2-8). The top two companies' revenue consists of 58% of the revenue of the top 10 companies in Standard & Poor's (S&P's) list (Benwart 2006). Although these numbers do not exclusively reflect paper products, they do convey the market environment in which firms in this sector compete.

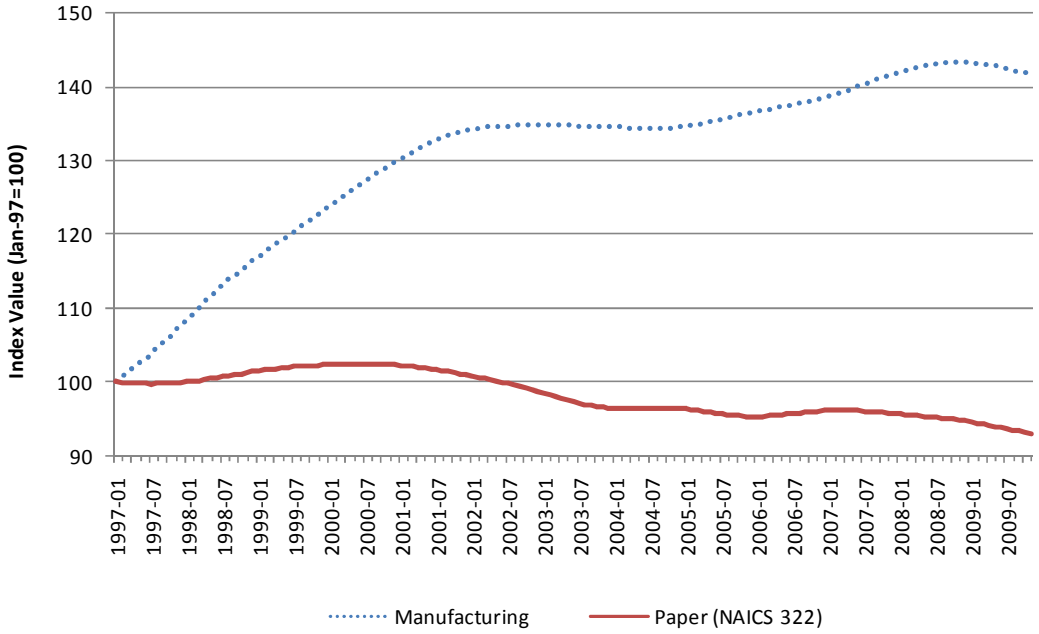

Figure 2-7 Capacity Trends in the Paper Manufacturing Industry (NAICS 322)

Source: Federal Reserve Board. 2009. "Industrial Production and Capacity Utilization: Industrial Capacity." Series ID: G17/CAP/CAP.GMF.S & G17/CAP/CAP.G322.S. <http://www.federalreserve.gov/datadownload/>.

Table 2-8 Largest U.S. Paper and Forest Products Companies: 2006

Company	Revenues ($millions)[a]
International Paper	21,995
Weyerhaeuser	21,896
Smurfit-Stone	7,157
MeadWestvaco	6,530
Temple-Inland	5,558
Bowater	3,530
Grief Inc.	2,628
Louisiana-Pacific	2,235
Packaging Corp.	2,187
Plum Creek	1,627

[a] Includes revenues from operations other than paper and forest products in certain cases.

Sources: Benwart, S.J. 2006. "Paper & Forest Products. Standard and Poor's Industry Surveys." 176(28). U.S. and international sales data from company reports.

2.3.6 Size Distribution

The primary criterion for categorizing a business as small is the number of employees, using definitions by the SBA for regulatory flexibility analyses. According to SUSB reports for 2002, large companies dominated revenue-generating transactions in the paper manufacturing subsector; 80% of receipts were generated by companies with 500 employees or more (Table 2-9). This was especially true in the pulp, paper, and paperboard group, in which large companies generated 92% of receipts. The number of employees in the small business cutoff varies according to six-digit NAICS codes (Table 2-10). The cutoff for all subsectors in the pulp, paper, and paperboard group is 750 employees, while the cutoff for most converted paper product groups is 500 employees.

Table 2-9 Distribution of Economic Data by Enterprise Size: Paper Manufacturing (NAICS 322)

		Enterprises with					
Variable	**Total**	**1 to 20 Employees[a]**	**20 to 99 Employees**	**100 to 499 Employees**	**500 to 749 Employees**	**750 to 999 Employees**	**1,000 to 1,499 Employees**
Firms	3,538	1,482	1,200	476	43	22	33
Establishments	5,546	1,488	1,271	755	83	69	138
Employment	495,990	11,325	52,334	78,402	13,293	12,496	23,283
Receipts ($millions)	$154,746	$2,218	$9,483	$17,620	$3,034	$3,951	$6,798
Receipts/firm ($thousands)	$43,738	$1,497	$7,903	$37,017	$70,561	$179,577	$206,001
Receipts/establishment ($thousands)	$27,902	$1,491	$7,461	$23,338	$36,556	$57,256	$49,261
Receipts/employment ($)	$311,994	$195,850	$181,203	$224,742	$228,250	$316,157	$291,974

[a] Excludes SUSB employment category for zero employees. These entities only operated for a fraction of the year.

Source: U.S. Census Bureau. 2008. "Firm Size Data from the Statistics of U.S. Businesses: U.S. Detail Employment Sizes: 2002." <http://www.census.gov/csd/susb/download_susb02.htm>.

Table 2-10 Small Business Size Standards: Paper Manufacturing (NAICS 322)

NAICS	NAICS Description	Employees
322110	Pulp Mills	750
322121	Paper (except Newsprint) Mills	750
322122	Newsprint Mills	750
322130	Paperboard Mills	750
322211	Corrugated and Solid Fiber Box Manufacturing	500
322212	Folding Paperboard Box Manufacturing	750
322213	Setup Paperboard Box Manufacturing	500
322214	Fiber Can, Tube, Drum, and Similar Products Manufacturing	500
322215	Non-Folding Sanitary Food Container Manufacturing	750
322221	Coated and Laminated Packaging Paper Manufacturing	500
322222	Coated and Laminated Paper Manufacturing	500
322223	Coated Paper Bag and Pouch Manufacturing	500
322224	Uncoated Paper and Multiwall Bag Manufacturing	500
322225	Laminated Aluminum Foil Manufacturing for Flexible, Packaging Uses	500
322226	Surface-Coated Paperboard Manufacturing	500
322231	Die-Cut Paper and Paperboard Office Supplies, Manufacturing	500
322232	Envelope Manufacturing	500
322233	Stationery, Tablet, and Related Product Manufacturing	500
322291	Sanitary Paper Product Manufacturing	500
322299	All Other Converted Paper Product Manufacturing	500

Source: 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/services/contractingopportunities/sizestandardstopics/size/index.html>.

2.3.7 Domestic Production

Similar to industry capacity rates, subsector production rates for paper manufacturing have witnessed a decreasing rate of production compared to the steady increase in production for the manufacturing sector since 1997 (Figure 2-8). It seems that the paper manufacturing sector was not able to return to its former levels of growth following the 2001 recession; it has experienced a downward production trend since then.

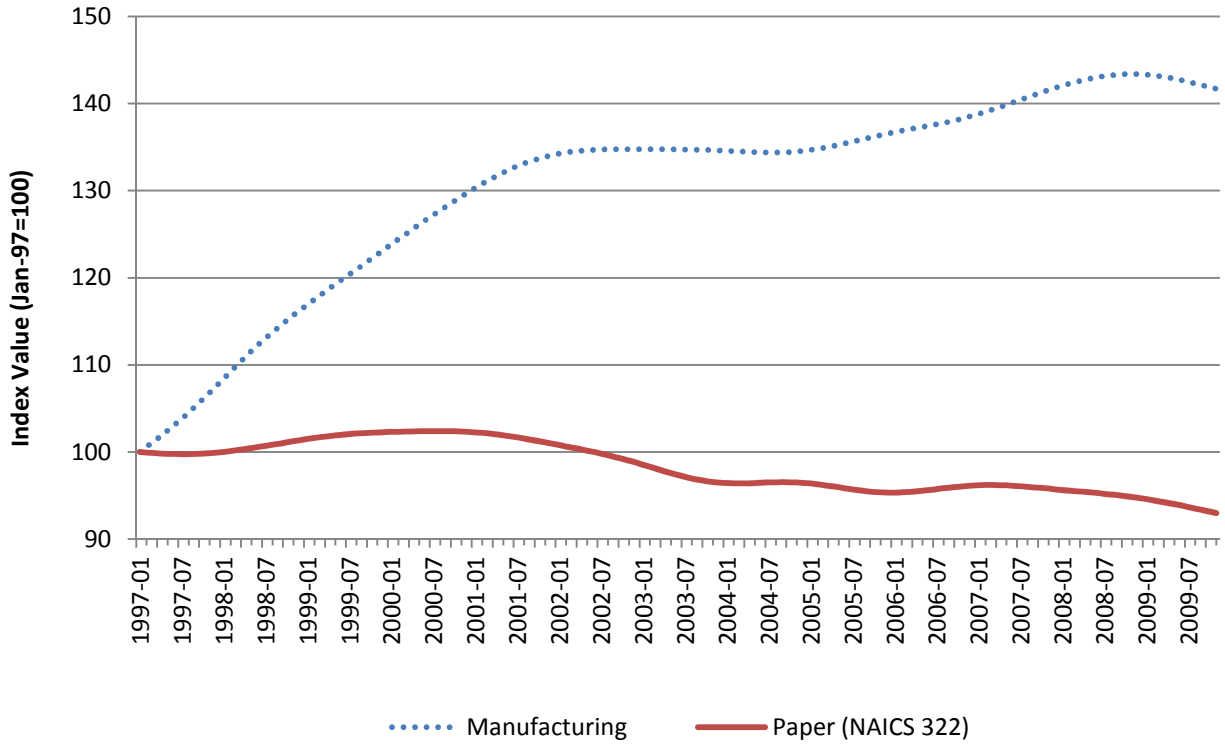

Figure 2-8 Industrial Production Trends in the Paper Manufacturing Industry (NAICS 322): 1997–2009

Source: Federal Reserve Board. 2009. "Industrial Production and Capacity Utilization: Industrial Production." Series ID: G17/IP_MAJOR_INDUSTRY_GROUPS/IP.GMF.S & G17/IP_MAJOR_INDUSTRY_GROUPS/IP.G322.S. <http://www.federalreserve.gov/datadownload/>.

2.3.8 International Trade

Since 1997, paper manufacturing products, both pulp, paper, and paperboard products and converted paper products, have contributed to an increasing trade surplus in this sector (Figure 2-9). Imports and exports have been changing at similar rates since 1999.

2.3.9 Market Prices

Prices of goods in paper manufacturing have been increasing at a rate consistent with all manufacturing products (Figure 2-10). Producer price indices (PPIs) show that producer prices for paper in 2007 increased by 20% since 1997, while producer prices for all manufacturing goods increased by roughly 27%.

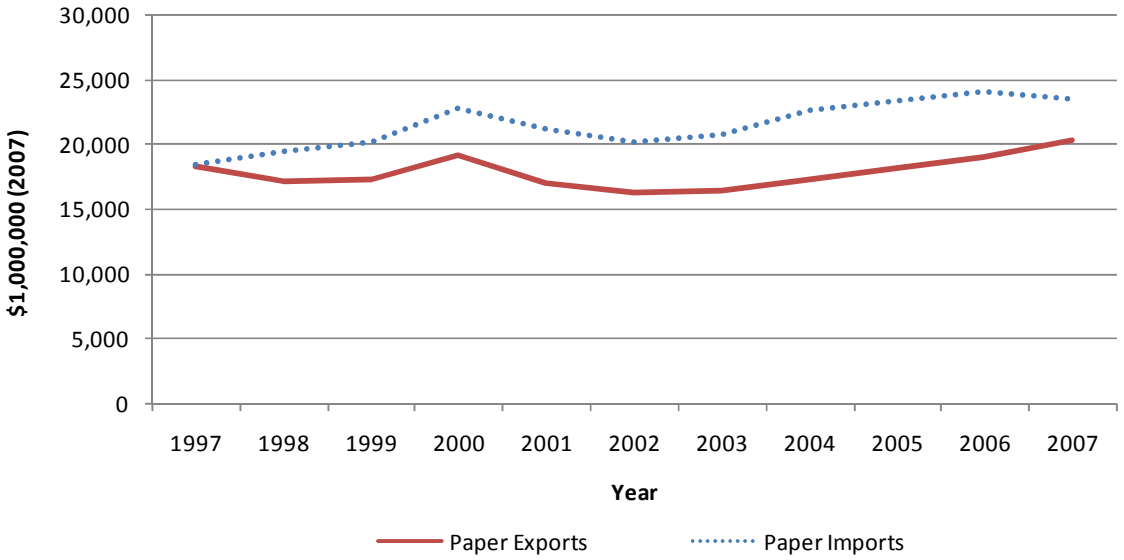

Figure 2-9 International Trade Trends in the Paper Manufacturing Industry (NAICS 322)

Source: U.S. International Trade Commission. 2008b. "U.S. Total Exports" & "U.S. Imports for Consumption." <http://dataweb.usitc.gov/scripts/user_set.asp>.

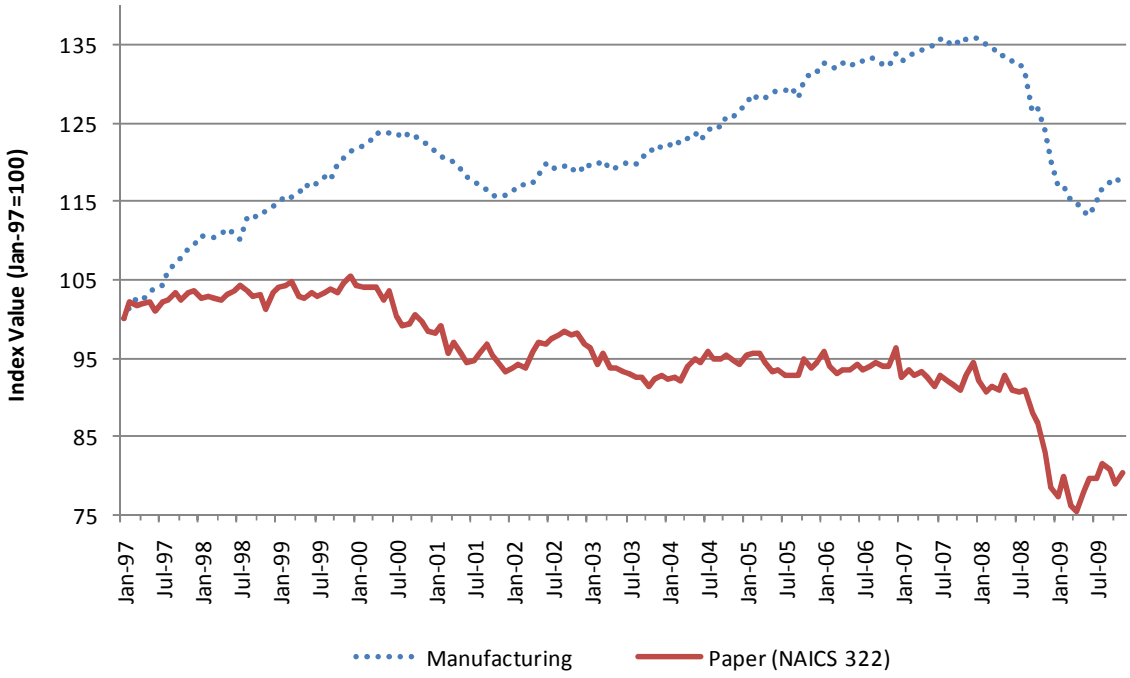

Figure 2-10 Producer Price Trends in the Paper Manufacturing Industry (NAICS 222)

Source: U.S. Bureau of Labor Statistics (BLS). 2009. "Producer Price Index." Series ID: PCU322–322– & PCUOMFG–OMFG–. <http://www.bls.gov/ppi/home.htm>.

3 REGULATORY PROGRAM COST AND EMISSIONS REDUCTIONS

3.1 Introduction

This Risk and Technology Review (RTR) focuses on the National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart S. Subpart S controls hazardous air pollutant (HAP) emissions from the pulp and paper production areas of mills using the kraft, sulfite, semi-chemical, and soda pulp processes (MACT I) and HAP emissions from pulp and paper production areas of mills using mechanical, secondary fiber, and non-wood pulping, and papermaking systems at all mills (MACT III). As of this review, a total of 171 pulp and paper major sources are subject to MACT I and III.

Under this proposal, affected pulp and paper facilities will be required to implement control measures and absorb regulatory costs. This section presents the emission and emission points addressed in this RTR proposal, as well as the controls, regulatory options evaluated in the EIA, estimated emission reductions, and the engineering cost analysis associated with each regulatory option.

3.2 Emissions, Emissions Points, Emissions Controls, and Regulatory Options

Even though MACT I and MACT III controls HAP emissions from a wide variety of pulp and paper processes, the proposed RTR standards will primarily affect HAP emissions from kraft condensates at kraft mills. Kraft mills are those that use an alkaline cooking liquor of sodium hydroxide (NaOH) and sodium sulfide (Na_2S) to digest wood. Kraft pulping condensates are HAP-containing liquids that condense from pulping system vent streams. These HAP-containing liquids result from the contact of organic compounds in the pulping process with water or steam that condenses. HAP emissions from kraft condensates are primarily organic HAPs like methanol, acetaldehyde, and formaldehyde. Limiting HAP emissions from these kraft condensates will also reduce HAP emissions from the handling and reuse of these liquids and from wastewater treatment. Of the 171 major sources subject to Subpart S, 97 mills are currently operating as kraft pulping facilities and currently subject to the kraft condensates standards under Subpart S.

The current kraft condensate standard under Subpart S and Effluent Guideline standards require facilities to either 1) recycle the condensates back through systems controlled under low-volume, high-concentration (LVHC) or high volume, low concentration (HVLC) requirements in the pulp mill or 2) remove 92% by weight of the condensates through steam stripping and incineration or biological control in a Wastewater Treatment System (hardpiping option). Because of other process considerations, kraft mills generally chose the 92% control option for compliance demonstration for kraft condensates rather than recycling.

For this EIA, we analyze three regulatory options for the Subpart S RTR:

Option 1: repeat air emission performance testing and retain current kraft condensate standards of 92% control

Option 2 (proposed option): tightening the kraft condensate standards from 92% control option to 94% and repeat air emission performance testing

Option 3: tightening the kraft condensate standards from 92% control option to 98% and repeat air emission performance testing.

Option 1, the repeat air emissions performance testing option, would require air emission performance testing once every five years for facilities complying with the standards for kraft, soda, and semichemical pulping vent gases, sulfite processes, and bleaching systems. Under this testing option, repeat air emissions testing would be required for mills complying with the kraft condensate standards using a steam stripper (or other equipment serving the same function) since such equipment is, by definition, part of the low-volume, high-concentration (LVHC) gas collection system. The EPA is not considering additional repeat testing for biological treatment systems to comply with the kraft pulping condensate standards because more frequent quarterly sampling is already required for biological treatment systems. The EPA is also not considering additional repeat testing for facilities complying with the clean condensate alternative (CCA) standards due to the complexity of this compliance approach.

Options 2 and 3 would require repeat air emissions performance testing as in Option 1, but would additionally require kraft mills to further reduce total HAP emissions from the kraft condensates. Option 2 would require 94% total HAP control, while Option 3 would require 98% total HAP control from kraft condensates. Various treatment methods are currently used to reduce total HAP emissions from kraft condensates to 92% or more. Reducing total HAPs

emissions from 92% to 94% or 98% will require some facilities to upgrade or replace their existing control equipment. Table 3-1 presents the various condensate treatment methods currently used by kraft mills.

Table 3-1 Number of Mills Using Various Condensate Treatment Methods

Treatment Method	No. of Facilities
Biotreatment	39
Recycle	5
Stripping or stripping/recycle	43
Stripping and biotreatment	9
Thermal incinerator	1
Total	**97**

3.3 Estimated Emissions Reductions and Engineering Cost Analysis

Table 3-2 presents the regulatory options under analysis in the EIA and the number of affected facilities and the associated emission reductions under each regulatory option.

Table 3-2 Regulatory Options, Affected Facilities, and Associated HAP Emission Reductions

Option	Regulatory Control Option	No. of Facilities Affected	Nation-wide HAP Reduction (ton/yr)
Option 1	Repeat air emission testing	114	0
Option 2 (proposed)	Tightening the kraft condensate standards from 92% to 94% and repeat air emission testing	Kraft condensate 15 Repeat Testing 114	4,090
Option 3	Tightening the kraft condensate standards from 92% to 98% and repeat air emission testing	Kraft condensate 66 Repeat Testing 114	12,300

Each regulatory option requires repeat emission testing. No emission reductions are expected from this repeat testing requirement. However, it stands to reason that repeat testing would provide incentive for facilities to maintain their control systems and make periodic adjustments to ensure peak performance, thereby reducing emissions and the potential for periodic episodes of acute risk. A total of 114 facilities will be affected by this requirement based on the number of chemical pulp mills and mills that bleach with chlorinated compounds.

Nationwide capital cost for repeat emission testing is estimated to be $5.4 million while the annualized cost is estimated to be $1.3 million per year.

Under Options 2 and 3, some kraft facilities would need to upgrade or replace existing control equipment. Option 2 would require 15 facilities to reduce their total HAP from kraft condensates from 92 to 94%. Per the Pulp and Paper survey data, 82 kraft mills are currently achieving 94% emissions control. Option 3 will require 66 facilities to reduce their total HAP from kraft condensates from 92 to 98%. Per the Pulp and Paper survey data, 31 kraft mills are currently achieving 98% emissions control.

Table 3-3 presents the estimated emission reductions from kraft condensates across regulatory options. The estimated emission reductions for Options 2 and 3 includes incremental emission reductions already achieved in practice from mills exceeding the current standard since these emission reductions would now be *required* through a change in the existing regulatory limit.

Table 3-3 Kraft Condensate Options: Estimated Costs, Emissions Reductions, and Cost Effectiveness (costs in 2010 dollars)

	No. of Facilities Affected	Engineering Capital Costs (millions)	Engineering Annualized Costs (millions)	HAP Reductions (tons per year)
Option 1	0	0	0	0
Option 2 (proposed)	15	$36.2	$4.1	4,090
Option 3	66	$297.0	$33.7	12,300

Table 3-4 summarizes estimated total engineering costs, emissions, reductions, and HAP reduction cost-effectiveness across the three regulatory options. This table includes additional reporting and recordkeeping expenses estimated to be required of affected firms. Capital costs and annualized cists for reporting and recordkeeping are estimated at $4,344 and $6,516 per affected facility, respectively. For the 114 affected firms, total national capital and annualized reporting and recordkeeping costs are estimated at $0.5 million and $0.7 million, respectively.

Table 3-4 Summary Nationwide Costs Emissions Reductions, and Cost Effectiveness (costs in 2010 dollars)

	Engineering Capital Costs (millions)	Engineering Annualized Costs (millions)	Estimated HAP Emissions Reductions	Cost Effectiveness ($/ton)
Option 1	$5.9	$2.1	0	N/A
Option 2 (proposed)	$42.1	$6.2	4,090	1,516
Option 3	$302.9	$35.7	12,300	2,906

4 ECONOMIC IMPACT ANALYSIS

4.1 Introduction

The EIA is designed to inform decision makers about the potential economic consequences of a regulatory action. For the current proposed rulemaking, EPA performed a partial-equilibrium analysis of national pulp and paper product markets to estimate potential paper product market and consumer and producer welfare impacts of the regulatory alternatives. This section also presents the analysis used to support the conclusion that EPA anticipates there will be no Significant Impact on a Substantial Number of Small Entities (SISNOSE) arising from the proposed NESHAP amendments. The section concludes with estimates of the initial and annual labor required to comply with the regulatory alternatives.

4.2 Market Analysis

EPA performed a series of single-market partial-equilibrium analyses of national pulp and paper product markets to measure the economic consequences of the regulatory options. With the basic conceptual model described below, we estimated how the regulatory program affects prices and quantities for ten paper and paperboard products that, aggregated, constitute the production of the industry. We also conducted an economic welfare analysis that estimates the consumer and producer surplus changes associated with the regulatory program. The welfare analysis identifies how the regulatory costs are distributed across two broad classes of stakeholders: consumers and producers.

While a series of partial equilibrium models was used to analyze the economic impacts of this proposal, EPA notes that it is currently developing the Industrial Sectors Integrated Solution Model (ISIS) for the U.S. pulp and paper industry. When completed, the ISIS model for the pulp and paper industry will be a dynamic engineering-economic model that facilitates analysis of emission reduction strategies for multiple pollutants, while taking into account plant-level economic and technical factors such as the type of mill, associated capacity, location, cost of production, applicable controls, and costs. By considering various emission reduction strategies,

the model when completed will provide information on optimal industry operation and determine the most cost-effective controls to meet the demand for pulp and paper products and the emission reduction requirements for a given time period of interest.

4.2.1 Market Analysis Methods

The models use a common analytic expression to analyze supply and demand in a single market (Berck and Hoffmann 2002; Fullerton and Metcalf 2002) and follows EPA guidelines for conducting an EIA (U.S. Environmental Protection Agency 2010). We illustrate our approach for estimating market-level impacts using a simple, single partial equilibrium model. The method involves specifying a set of nonlinear supply and demand relationships for the affected market, simplifying the equations by transforming them into a set of linear equations, and then solving the equilibrium system of equations (see Fullerton and Metcalfe (2002) for an example).

First, we consider the formal definition of the elasticity of supply, q_s, with respect to changes in own price, p, where ε_s represents the market elasticity of supply:

$$\varepsilon_s = \frac{dq_s / q_s}{dp / p} \tag{4.1}$$

Next, we can use "hat" notation to transform Eq. 1 to proportional changes and rearrange terms:

$$\hat{q}_s = \varepsilon_s \hat{p} \tag{4.1a}$$

where $\hat{q}_s$ equals the percentage change in the quantity of market supply, and $\hat{p}$ equals the percentage change in market price. As Fullerton and Metcalfe (2002) note, we have taken the elasticity definition and turned it into a linear behavioral equation for the market we are analyzing.

To introduce the direct impact of the regulatory program, we assume the per-unit cost associated with the regulatory program, c, leads to a proportional shift in the marginal cost of production $\left(\widehat{mc}\right)$. The per-unit costs are estimated by dividing the total estimated annualized engineering costs accruing to producers within a given product market by the baseline national

production in that market. Under the assumption of perfect competition (e.g. price equaling marginal cost), we can approximate this shift at the initial equilibrium point as follows:

$$\widehat{mc} = \frac{c}{mc_0} = \frac{c}{p_0}. \tag{4.1b}$$

The with-regulation supply equation can now be written as

$$\hat{q}_s = \varepsilon_s(\hat{p} - \widehat{mc}) \ . \tag{4.1c}$$

Next, we can specify a demand equation as follows:

$$\hat{q}_d = \eta_d \hat{p} \tag{4.2}$$

where

$\hat{q}_d$ = percentage change in the quantity of market demand,
η_d = market elasticity of demand, and
$\hat{p}$ = percentage change in market price.

Finally, we specify the market equilibrium conditions in the affected market. In response to the exogenous increase in production costs, producer and consumer behaviors are represented in Eq. 4-1a and Eq. 4-2, and the new equilibrium satisfies the condition that the change in supply equals the change in demand:

$$\hat{q}_s = \hat{q}_d \ . \tag{4.3}$$

We now have three linear equations in three unknowns ($\hat{p}$, $\hat{q}_d$, and $\hat{q}_s$), and we can solve for the proportional price change in terms of the elasticity parameters (ε_s and η_d) and the proportional change in marginal cost:

$$\begin{aligned} \varepsilon_s\left(\hat{p} - \widehat{mc}\right) &= \eta_d \hat{p} \\ \varepsilon_s \hat{p} - \varepsilon_s \widehat{mc} &= \eta_d \hat{p} \\ \varepsilon_s \hat{p} - \eta_d \hat{p} &= \varepsilon_s \widehat{mc} \end{aligned} \tag{4.4}$$

Given this solution, we can solve for the proportional change in market quantity using Eq. 4-2.

The change in consumer surplus in the affected market can be estimated using the following linear approximation method:

$$\Delta cs = -\left(q_1 \times p\right) + \left(0.5 \times \Delta q \times \Delta p\right) \tag{4.5}$$

where q_1 equals with-regulation quantities produced. As shown, higher market prices and reduced consumption lead to welfare losses for consumers.

For affected supply, the change in producer surplus can be estimated with the following equation:

$$\Delta ps = \left(q_1 \times \Delta p\right) - \left(q_1 \times c\right) - \left(0.5 \times \Delta q \times \left(\Delta p - c\right)\right). \tag{4.6}$$

Increased regulatory costs and output declines have a negative effect on producer surplus, because the net price change $\left(\Delta p - c\right)$ is negative. However, these losses are mitigated, to some degree, as a result of higher market prices.

4.2.2 Model Baseline

Standard EIA practice compares and contrasts the state of a market with and without the regulatory policy. EPA selected 2010 as the baseline year for the analysis and collected pulp and paper production and price data for this year from the American Forest Products Association and RISI, Inc., respectively. The figures cited were obtained from RISI Inc.'s *PPI Pulp and Paper Week.* Baseline data are reported in Table 4-1.

Table 4-1 Baseline Paper Market Data, 2010 (in 2010 dollars)

Products	Price[1] ($/ton)	Quantity[2] (tons/year)	% of Total Production
Paper			
Newsprint	$ 580	3,429,000	4%
Uncoated mechanical	$ 740	2,002,000	2%
Coated paper	$ 960	7,903,000	10%
Uncoated freesheet	$ 930	9,500,000	12%
Tissue[3]	$ 1,765	7,302,000	9%
Other printing/writing	$ 1,305	4,917,000	6%
Total Paper[4]	**$1,118**	**35,053,000**	**43%**
Paperboard			
Unbleached Kraft paperboard	$ 640	21,579,000	26%
Semichemical paperboard	$ 610	5,443,000	7%
Bleached paperboard	$ 1,290	5,499,000	7%
Recycled paperboard	$ 855	14,896,000	18%
Total Paperboard[4]	**$779**	**47,417,000**	**57%**
Total Paper and Paperboard[4]	**$923**	**82,470,000**	**100%**

[1] Source: RISI Inc. (2011a)
[2] Source: American Forest Products Association; cited in RISI Inc. (2011b)
[3] EPA was unable to obtain national price averages for tissue paper. For this analysis, EPA relied upon the average of the prices reported by two major tissue producers in corporate earnings statements. We will seek to obtain a better tissue price estimate for the EIA for promulgation of this rule. The price used in this table is derived from prices reported by Cellu Tissue in 2009 and Clearwater Paper (2010).
[4] Weighted average of individual product prices.

Because the paper and paperboard products listed in Table 4-2 are aggregates of many relatively distinct types of products, EPA had to choose one product per aggregated product for price information. Ideally, the analyst would use weighted averaged of all products within the aggregate product category, but this information is not available to EPA as of the signature date for this proposal. With the exception of tissue papers (note footnote in Table 4-2), all product prices were drawn from a RISI, Inc. publication. Table 4-2 lists the aggregate product category and product selected for pricing purposes as representative of the aggregate product. For the promulgation version of this EIA, EPA will further investigate appropriate price information.

Table 4-2 Products Used for Price Information

Products	Source	Product Used for Price Information
Paper		
Newsprint	RISI Inc.	30-lb (East)
Uncoated mechanical	RISI Inc.	22.1-lb White directory (mid-point min./max.[1])
Coated paper	RISI Inc.	Economy 8-lb sheets (mid-point min./max.)
Uncoated freesheet	RISI Inc.	50-lb offset, rolls (mid-point min./max.)
Other printing/writing	RISI Inc.	Bleached bristols, 10-pt C1S, rolls (mid-point min./max.)
Paperboard		
Unbleached Kraft paperboard	RISI Inc.	Unbleached kraft (East, mid-point min./max.)
Semichemical paperboard	RISI Inc.	Corrugating Medium, Semichemical (East, mid-point min./max.)
Bleached paperboard	RISI Inc.	Grocery bag, 30-lb (mid-point min./max.)
Recycled paperboard	RISI Inc.	20-pt clay coated news (mid-point min./max.)

[1] For many products, RISI Inc. lists price ranges, based on minimum and maximum prices. We chose to use the midpoint of this range as the price used in the analyses.

4.2.3 Model Parameters

Demand elasticity is calculated as the percentage change in the quantity of a product demanded divided by the percentage change in price. An increase in price causes a decrease in the quantity demanded, hence the negative values seen in Table 4-3, which presents the demand elasticities used in this analysis. Demand is considered elastic if demand elasticity exceeds 1.0 in absolute value (i.e., the percentage change in quantity exceeds the percentage change in price). The quantity demanded, then, is very sensitive to price increases. Demand is considered inelastic if demand elasticity is less than 1.0 in absolute value (i.e., the percentage change in quantity is less than the percentage change in price). Inelastic demand implies that the quantity demanded changes very little in response to price changes.

As shown in Table 4-3, we draw demand elasticities from the North American Pulp and Paper (NAPAP) model, a dynamic model used by the U.S. Forest Service to analyze the paper and paperboard industry (Ince and Buongiorno 2007). The table presents the elasticity estimates, as well as the NAPAP product from which the elasticity estimate is drawn.

Table 4-3 Demand Elasticity Estimates

Products	Elasticity	Source	Source Product
Paper			
Newsprint	-0.22	NAPAP	Newsprint
Uncoated mechanical	-0.40	NAPAP	Uncoated groundwood
Coated paper	-0.40	NAPAP	Coated freesheet
Uncoated freesheet	-0.47	NAPAP	Uncoated freesheet
Tissue	-0.26	NAPAP	Tissue
Other printing/writing	-0.23	NAPAP	Specialty packaging
Paperboard			
Unbleached Kraft paperboard	-0.54	NAPAP	Kraft packaging paper
Semichemical paperboard	-0.43	NAPAP	Corrugating medium
Bleached paperboard	-0.29	NAPAP	Solid bleached board
Recycled paperboard	-0.40	NAPAP	Recycled board

Source: The North American Pulp and Paper (NAPAP) model (Ince and Buongiorno 2007)

Supply elasticity is calculated as the percentage change in quantity supplied divided by the percentage change in price. An upward sloping supply curve has a positive elasticity since price and quantity move in the same direction. If the supply curve has an elasticity greater than one, then supply is considered elastic, which means a small price increase will lead to a relatively large increase in quantity supplied. A supply curve with elasticity less than one is considered inelastic, which means an increase in price will cause little change in quantity supplied. In the long-run, when producers have sufficient time to completely adjust their production to a change in price, the price elasticity of supply is usually greater than one.

As shown in Table 4-4, we draw supply elasticities from the U.S. Environmental Protection Agency's Economic Impact and Regulatory Flexibility Analysis of Proposed Effluent Guidelines and NESHAP for the Pulp, Paper, and Paperboard Industry (1993). The table presents the elasticity estimates, as well as the product in the 1993 U.S. EPA from which the elasticity is drawn.

Table 4-4 Supply Elasticity Estimates

Products	Elasticity	Source	Source Product
Paper			
Newsprint	0.29	U.S. EPA	Newsprint
Uncoated mechanical	0.33	U.S. EPA	Uncoated groundwood
Coated paper	1.65	U.S. EPA	Clay coated printing and converted paper
Uncoated freesheet	0.31	U.S. EPA	Uncoated freesheet
Tissue (need to find tissue price)	0.82	U.S. EPA	Tissue
Other printing/writing	1.20	U.S. EPA	Paper-other
Paperboard			
Unbleached Kraft paperboard	0.32	U.S. EPA	Unbleached Kraft
Semichemical paperboard	0.28	U.S. EPA	Semichemical paperboard
Bleached paperboard	0.68	U.S. EPA	Bleached paperboard for miscellaneous packaging
Recycled paperboard	0.49	U.S. EPA	Recycled paperboard

Source: U.S. Environmental Protection Agency (1993)

4.2.4 Entering Estimated Annualized Engineering Compliance Costs into Economic Model

In order to allocate estimate engineering costs across paper and paperboard product markets used in the partial equilibrium analyses, we first identified the primary product produced by affected mills and classified the primary product as one of the products used in the economic analysis. Then, using the mill-level estimates of annualized engineering compliance costs, we distributed the costs to products based upon the primary product produced at each mill. Table 4-5 reports the results of this distribution across the three regulatory options considered.

Table 4-5 Estimated Annualized Engineering Compliance Costs by Paper Product across Regulatory Options (thousands 2010 dollars)

Products	Option 1	Option 2 (proposed)	Option 3
Paper			
Newsprint	$0	$0	$0
Uncoated mechanical	$61	$61	$1,277
Coated paper	$192	$701	$2,792
Uncoated freesheet	$429	$1,234	$5,780
Tissue	$117	$117	$368
Other printing/writing	$90	$341	$1,731
Total Paper	**$890**	**$2,456**	**$11,948**
Paperboard			
Unbleached Kraft paperboard	$82	$82	$1,574
Semichemical paperboard	$633	$1,578	$9,621
Bleached paperboard	$153	$349	$5,034
Recycled paperboard	$17	$17	$17
Total Paperboard	**$885**	**$2,026**	**$16,246**
Pulp			
All pulp products	$289	$1,720	$7,549
All pulp products	**$289**	**$1,720**	**$7,549**
All products	**$2,064**	**$6,202**	**$35,743**

Note in Table 4-5 that annualized engineering compliance costs accrue to producers of pulp products. However, in the partial equilibrium models used within this EIA, we are modeling the impacts of compliance costs on prices and quantities of paper products. Because of this, we allocate the annualized engineering compliance costs accruing to pulp producers to producers of paper products that are potentially affected by this rule. This redistribution is based on the strong assumption that impacts on the pulp sector can be reallocated to producers of paper products in proportion to the estimated compliance costs absent costs expected to accrue to pulp producers. The results of this redistribution are shown in Table 4-6.

Table 4-6 Estimated Annualized Engineering Compliance Costs by Paper Product across Regulatory Options, after Redistributing Estimated Costs to Pulp Producers (thousands 2010 dollars)

Products	Option 1	Option 2 (proposed)	Option 3
Paper			
Newsprint	$0	$0	$0
Uncoated mechanical	$72	$85	$1,619
Coated paper	$224	$971	$3,539
Uncoated freesheet	$499	$1,708	$7,328
Tissue	$136	$162	$467
Other printing/writing	$105	$472	$2,194
Total Paper	**$1,035**	**$3,398**	**$15,147**
Paperboard			
Unbleached Kraft paperboard	$95	$113	$1,995
Semichemical paperboard	$737	$2,184	$12,198
Bleached paperboard	$177	$483	$6,382
Recycled paperboard	$19	$23	$21
Total Paperboard	**$1,029**	**$2,804**	**$20,596**
All products	**$2,064**	**$6,202**	**$35,743**

Using this engineering cost information and total national production of paper and paperboard products, we estimate the annualized compliance cost per ton of product produced. These annualized engineering compliance costs per ton across regulatory options are presented in Table 4-7.

Table 4-7 Annualized Engineering Compliance Costs per Ton Product Produced at National Level across Regulatory Options (in 2010 dollars)

Products		Option 1 ($/ton)	Option 2 (proposed) ($/ton)	Option 3 ($/ton)
Paper				
	Newsprint	$0.000	$0.000	$0.000
	Uncoated mechanical	$0.036	$0.043	$0.809
	Coated paper	$0.028	$0.123	$0.448
	Uncoated freesheet	$0.052	$0.180	$0.771
	Tissue	$0.019	$0.022	$0.064
	Other printing/writing	$0.021	$0.096	$0.446
	Total Paper	**$0.030**	**$0.097**	**$0.432**
Paperboard				
	Unbleached Kraft paperboard	$0.004	$0.005	$0.092
	Semichemical paperboard	$0.135	$0.401	$2.241
	Bleached paperboard	$0.032	$0.088	$1.161
	Recycled paperboard	$0.001	$0.002	$0.001
	Total Paperboard	**$0.022**	**$0.059**	**$0.434**
All products		**$0.025**	**$0.075**	**$0.433**

Note that under the proposed option, paper products incur a higher per-ton compliance cost burden, while semichemical paperboard has the highest estimated per ton compliance costs of the ten products examined. Under the most stringent Option 3, however, the per-ton weighted average compliance cost estimate for paperboard products exceeds that of paper products. Note also that mills primarily producing newsprint are unaffected by any of the regulatory options. These per-ton of product produced annualized engineering costs estimates were then entered into the series of partial equilibrium market models to estimate impacts on the respective paper and paperboard product markets.

4.2.5 Model Results

Across regulatory options, market-level changes in the paper and paperboard markets are estimated to be insignificant. For the proposed option, national-level weighted average paper and paperboard prices are predicted to increase less than 0.01%, while total quantities are predicted to also decrease less than 0.01% (Table 4-8).

Table 4-8 Summary of Market Impacts (%) Across Products and Regulatory Option

Products	Option 1		Option 2 (proposed)		Option 3	
	Price Change (%)	Quantity Change (%)	Price Change (%)	Quantity Change (%)	Price Change (%)	Quantity Change (%)
Paper						
Newsprint	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Uncoated mechanical	0.002%	-0.001%	0.003%	-0.001%	0.049%	-0.020%
Coated paper	0.002%	-0.001%	0.010%	-0.004%	0.038%	-0.015%
Uncoated freesheet	0.002%	-0.001%	0.008%	-0.004%	0.033%	-0.015%
Tissue	0.001%	0.000%	0.001%	0.000%	0.003%	-0.001%
Other printing/writing	0.001%	0.000%	0.006%	-0.001%	0.029%	-0.007%
Total Paper	**0.002%**	**-0.001%**	**0.005%**	**-0.002%**	**0.023%**	**-0.010%**
Paperboard						
Unbleached Kraft paperboard	0.000%	0.000%	0.000%	0.000%	0.005%	-0.003%
Semichemical paperboard	0.009%	-0.004%	0.026%	-0.011%	0.144%	-0.062%
Bleached paperboard	0.002%	-0.001%	0.005%	-0.001%	0.063%	-0.018%
Recycled paperboard	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Total Paperboard	**0.001%**	**-0.001%**	**0.004%**	**-0.002%**	**0.027%**	**-0.011%**
Total Paper and Paperboard	**0.001%**	**-0.001%**	**0.004%**	**-0.002%**	**0.025%**	**-0.010%**

As indicated by having the highest estimated per ton compliance costs, semichemical paperboard has the largest predicted percentage change in price and quantity.

Overall, the economic models predict an overall price increase of about 4.1 cents per ton of paper and paperboard product, from a baseline price of about $920 per ton (Table 4-9). Overall production quantities are predicted to decrease about 1500 tons, from a baseline production level of about 82 million tons. Note that the weighted average price increase is lower than the weighted per ton compliance cost increase of about 7.5 cents per ton as shown in Table 4-7. As the welfare impacts analysis that follows shows, producers absorb a portion of the regulatory program costs and do not pass on the full burden to consumers.

Table 4-9 Change in Price and Quantity (#) across Products and Regulatory Options (costs in 2010 dollars)

	Option 1		Option 2 (proposed)		Option 3	
Products	**Price Change ($/ton)**	**Quantity Change (tons/year)**	**Price Change ($/ton)**	**Quantity Change (tons/year)**	**Price Change ($/ton)**	**Quantity Change (tons/year)**
Paper						
Newsprint	$0.000	0.0	$0.000	0.0	$0.000	0.0
Uncoated mechanical	$0.016	-17.5	$0.019	-20.8	$0.366	-395.9
Coated paper	$0.023	-75.1	$0.099	-325.6	$0.361	-1,187.4
Uncoated freesheet	$0.021	-99.9	$0.071	-342.2	$0.306	-1,468.2
Tissue	$0.014	-15.2	$0.017	-18.1	$0.048	-52.1
Other printing/writing	$0.018	-15.5	$0.081	-69.8	$0.375	-324.7
Total Paper	**$0.018**	**-223.2**	**$0.060**	**-776.6**	**$0.263**	**-3,428.3**
Paperboard						
Unbleached Kraft paperboard	$0.002	-29.6	$0.002	-35.3	$0.034	-621.2
Semichemical paperboard	$0.053	-202.8	$0.157	-601.5	$0.875	-3,359.2
Bleached paperboard	$0.023	-28.0	$0.062	-76.2	$0.814	-1,006.1
Recycled paperboard	$0.001	-5.0	$0.001	-6.0	$0.001	-5.5
Total Paperboard	**$0.010**	**-265.5**	**$0.028**	**-718.9**	**$0.214**	**-4,992.0**
Total Paper and Paperboard	**$0.013**	**-488.7**	**$0.041**	**-1,495.5**	**$0.235**	**-8,420.2**

The national compliance cost estimates are often used to approximate the social cost of the rule. However, in cases where the engineering costs of compliance are used to estimate social cost, the burden of the regulation is typically measured as falling solely on the affected producers, who experience a profit loss exactly equal to these cost estimates. Thus, the entire loss is a change in producer surplus with no change (by assumption) in consumer surplus, because no changes in price and consumption are estimated. This is typically referred to as a "full-cost absorption" scenario in which all factors of production are assumed to be fixed and firms are unable to adjust their output levels when faced with additional costs.

In contrast, EPA's economic analysis builds on the engineering cost analysis and incorporates economic theory related to producer and consumer behavior to estimate changes in market conditions. Paper and paperboard producers can make supply adjustments that will generally affect the market environment in which they operate. As producers change levels of

product supply in response to a regulation, consumers are typically faced with changes in prices that cause them to alter the quantity they are willing to purchase. These changes in price and output from the market model are used to estimate the total economic surplus changes for two types of stakeholders: paper and paperboard consumers and producers.

As shown in Table 4-10, under the proposed Option 2, paper and paperboard consumers are predicted to experience a $3.3 million reduction in surplus as the result of higher prices and reduced consumption. Producer surplus is predicted to decrease about $2.9 million. Total welfare losses are then estimated at $6.2 million.

Table 4-10 Summary of Consumer and Producer Surplus Changes: 2010 (in millions of 2010 dollars)

		Surplus Change (in 2010 dollars)		
Option	**Product Type**	**Consumer**	**Producer**	**Total**
Option 1	Paper	-$0.6	-$0.4	-$1.0
	Paperboard	-$0.5	-$0.6	-$1.0
	Total	**-$1.1**	**-$1.0**	**-$2.1**
Option 2 (proposed)	Paper	-$2.0	-$1.4	-$3.4
	Paperboard	-$1.2	-$1.6	-$2.8
	Total	**-$3.3**	**-$2.9**	**-$6.2**
Option 3	Paper	-$8.7	-$6.5	-$15.1
	Paperboard	-$10.0	-$10.6	-$20.6
	Total	**-$18.7**	**-$17.1**	**-$35.7**

Again, as indicated by the relatively higher per ton compliance costs accruing to paper product producers, paper products are predicted to experience a greater proportion of the welfare losses, compared to paperboard products. For paperboard products, however, producers are predicted to have greater welfare losses than consumers of paperboard products, as opposed to the predictions for paper products.

4.2.6 Limitations

Ultimately, the regulatory program may cause negligible increases in the costs of supplying paper and paperboard products to consumers. The partial equilibrium model used in this EIA is designed to evaluate behavioral responses to this change in costs within an equilibrium setting within nationally competitive markets. The national competitive market

assumption is clearly very strong because the markets in paper products may be regional for some products, as well as some product markets within the paper industry may be interdependent. Regional price and quantity impacts could be different from the average impacts reported if local market structures, production costs, or demand conditions are substantially different from those used in this analysis.

4.3 Small Business Impacts 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 rules on small entities, the screening analysis indicates that these proposed rules will not have a significant economic impact on a substantial number of small entities (or "SISNOSE"). The supporting analyses for these determinations are presented in this section of the EIA.

4.3.1 Small Business National Overview

The industry sectors covered by the final rule were identified during the development of the engineering cost analysis. The U.S. Census Bureau's Statistics of U.S. Businesses (SUSB) provides national information on the distribution of economic variables by industry and enterprise size. The Census Bureau and the Office of Advocacy of the Small Business Administration (SBA) supported and developed these files for use in a broad range of economic analyses.[1] 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 final rule. SUSB also provides statistics by enterprise employment and receipt size (Table 2-10).

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

[1]See http://www.census.gov/csd/susb/ and http://www.sba.gov/advocacy/ for additional details.

- *Establishmen*t: A single physical location where business is conducted or where services or industrial operations are performed.
- *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 multi-establishment firm, establishments in the same industry within a state will be counted as one firm- the firm employment and annual payroll are summed from the associated establishments.
- *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 enterprise and the establishment are the same for single-establishment firms. Each multi-establishment company forms one enterprise—the enterprise employment and annual payroll are summed from the associated establishments. Enterprise size designations are determined by the sum of employment of all associated establishments.

Because the SBA's business size definitions apply to an establishment's "ultimate parent company," we assumed in this analysis that the "firm" 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.

Table 4-11 Number of Firms, Total Employment, and Estimated Salaries by Firm Size and NAICS for Primarily Affected Segments, 2006

NAICS	NAICS Description	SBA Size Standard	Small Businesses	Large Businesses	Total Firms
Number of Firms by Firm Size					
322110	Pulp Mills	750	21	10	31
322121	Paper (except Newsprint) Mills	750	137	42	179
322122	Newsprint Mills	750	11	7	18
322130	Paperboard Mills	750	57	30	87
Percentage of Firms by Firm Size					
322110	Pulp Mills	750	68%	32%	100%
322121	Paper (except Newsprint) Mills	750	77%	23%	100%
322122	Newsprint Mills	750	61%	39%	100%
322130	Paperboard Mills	750	66%	34%	100%

Source: U.S. Census Bureau. 2011. "Statistics of U.S. Businesses, Business Dynamics Statistics, Business Employment Dynamics, and Nonemployer Statistics." < http://www.sba.gov/advocacy/849/12162#susb>

4.3.2 Small Entity Economic Impact Measures

The proposed NESHAP amendments will affect the owners of the facilities that will incur compliance costs to control their regulated emissions. The owners, either firms or individuals, are the entities that will bear the financial impacts associated with these additional operating costs. The proposed rule has the potential to impact all firms owning affected facilities, both large and small.

The analysis provides EPA with an estimate of the magnitude of impacts the proposed NESHAP amendments may have on the ultimate domestic parent companies that own facilities EPA expects might be impacted by the rules. The analysis focuses on small firms because they may have more difficulty complying with a new regulation or affording the costs associated with meeting the new standard. This section presents the data sources used in the screening analysis, the methodology we applied to develop estimates of impacts, the results of the analysis, and conclusions drawn from the results.

The small business impacts analysis relies upon a series of firm-level sales tests (represented as cost-to-sales ratios) for firms that are likely to be associated with NAICS codes listed in Table 2-10. EPA obtained firm-level employment, revenues, and production levels using various sources, including the Dun & Bradstreet, the American Business Directory, corporate websites, and publically-available financial reports. Using these data, we estimated firm-level compliance cost impacts and calculated cost-to-sales ratios to identify small firms that might be significantly impacts by the rules.

For the sales test, we divided the estimates of annualized establishment compliance costs at the company-level by estimates of company sales. This is known as the cost-to-revenue 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. The sales test is often used because revenues or sales data are commonly available for entities 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 and sales as typically published are 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[2] 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 (U.S. SBA, 2010).[38]

4.3.3 Small Entity Economic Impact Analysis and Conclusions

As discussed in Section 3, 114 facilities are potentially affected by each of the regulatory options, but as the options increase in stringency the relative impacts increase. Of these 114 facilities, three are owned by small entities. Table 4-12 presents facility names, ultimate owners, number of employees, and estimates sales in 2010 for the three small firms.

[2] 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/rfaguidance11-00-06.pdf>

[3]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, June 2010.

Table 4-12 Potentially Affected Small Entities: Employees and Sales, 2010

Faculty	Ultimate Owner	Employees in 2010	Sales in 2010 (million of 2010 dollars)
Lincoln Paper and Tissue, LLC	Lincoln Paper and Tissue, LLC	350	141.2
Old Town Fuel & Fiber	Patriarch Partners, LLC	170	12.9
Port Townsend Paper Corp.	Port Townsend Paper Corp	585	181.3

Table 4-13 shows that cost-to-sales ratios for the three affected small firms do not exceed 1% for the proposed option. In fact, the ratios are well below 1%, ranging from 0.01% to about 0.16%. An impact level greater than 1% is estimated for one firm under the more stringent Option 3, however.

Table 4-13 Estimated Annualized Engineering Costs for Potentially Affected Small Entities across Regulatory Options (costs in 2010 dollars)

	Option 1		Option 2 (proposed)		Option 3	
Ultimate Owner	Estimated Annualized Costs	Estimated Costs to Sales Ratio	Estimated Annualized Costs	Estimated Costs to Sales Ratio	Estimated Annualized Costs	Estimated Costs to Sales Ratio
Lincoln Paper and Tissue, LLC	18,223	0.01%	18,223	0.01%	18,223	0.01%
Patriarch Partners, LLC	18,223	0.14%	18,223	0.14%	259,918	2.01%
Port Townsend Paper Corp	13,345	0.01%	299,058	0.16%	687,022	0.38%

EPA concludes from this analysis that a substantial number of small firms are not significantly impacted. Based upon the analysis in this section, we conclude there is no SISNOSE arising from the proposed NESHAP amendments.

4.4 Employment Impacts Analysis

While a standalone analysis of employment impacts is not included in a standard cost-benefit analysis, such an analysis is of particular concern in the current economic climate of sustained high unemployment. Executive Order 13563, states, "Our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation". Therefore, we seek to inform the discussion of labor demand and job impacts by providing an estimate of the employment impacts of the proposed regulations using labor requirements for the operation and maintenance of control requirements.

Regulations set in motion new orders for pollution control equipment and services. New categories of employment have been created in the process of implementing regulations to make our air safer to breathe. When a new regulation is promulgated, a response of industry is to order pollution control equipment and services in order to comply with the regulation when it becomes effective. Revenue and employment in the environmental technology industry have grown steadily between 2000 and 2008, reaching an industry total of approximately $300 billion in revenues and 1.7 million employees in 2008.[4] While these revenues and employment figures represent gains for the environmental technologies industry, they are costs to the regulated industries required to install the equipment. Moreover, it is not clear the 1.7 million employees in 2008 represent new employment as opposed to workers being shifted from the production of goods and services to environmental compliance activities.

Once the equipment is installed, regulated firms hire workers to operate and maintain the pollution control equipment – much like they hire workers to produce more output. Morgenstern et al. (2002) examined how regulated industries respond to regulation. The authors found that, on average for the industries they studied, employment increases in regulated firms. Of course, these firms may also reassign existing employees to perform these activities.

[4] Environmental Business International (EBI), Inc., San Diego, CA. Environmental Business Journal, monthly (copyright). http://www.ebiusa.com/ EBI data taken from the Department of Commerce International Trade Administration Environmental Industries Fact Sheet from April 2010: http://web.ita.doc.gov/ete/eteinfo.nsf/068f3801d047f26e85256883006ffa54/4878b7e2fc08ac6d85256883006c452c?OpenDocument

Environmental regulations support employment in many basic industries. In addition to the increase in employment in the environmental protection industry (via increased orders for pollution control equipment), environmental regulations also support employment in industries that provide intermediate goods to the environmental protection industry. The equipment manufacturers, in turn, order steel, tanks, vessels, blowers, pumps, and chemicals to manufacture and install the equipment. Bezdek et al. (2008) found that investments in environmental protection industries create jobs and displace jobs, but the net effect on employment is positive.

Unlike several recent RIAs, however, we do not provide employment impacts estimates based on the study by Morgenstern et al. (2002). Using plant-level data from 1979-1991, Morgenstern et al. (2002) estimate a model for four highly-polluting, regulated industries (pulp and paper, plastics, steel, and petroleum refining) to examine the effect of higher abatement costs from regulation on net employment. The results indicate that, on average across the four industries, each additional $1 million in spending on pollution abatement results in a net increase of 1.55 jobs (95% confidence interval: -2.9 to + 6.0). We do not, however, provide employment impacts estimates for this rulemaking based on the study by Morgenstern et al. (2002) because the study's results for the pulp and paper industry, specifically, were not statistically significant

The focus of this part of the analysis is on labor requirements related to the compliance actions of the affected entities within the affected sector. We do not estimate any potential changes in labor outside of the pulp and paper industry. This analysis estimates the potential employment impacts due to the operation and maintenance of control equipment, as well as additional reporting and recordkeeping requirements. No estimates of the labor used to manufacture or assemble pollution control equipment or to supply the materials for manufacture or assembly are included because U.S. EPA does not currently have this information.

The employment analysis uses a bottom-up engineering-based methodology to estimate employment impacts. The engineering cost analysis summarized in this EIA includes estimates of the labor requirements associated with implementing the proposed regulations. These labor changes may be required as an upfront, intensive expenditure of effort required to initially comply with the new requirements, or as continuous, annual efforts to sustain compliance.

We convert estimates of the number hours of labor required to full-time equivalents (FTEs) by dividing by 2,080 (40 hours per week multiplied by 52 weeks). We note that this type of FTE estimate cannot be used to make assumptions about the specific number of people involved or whether new jobs are created for new employees. In this EIA, we make no distinction in the quantitative estimates between labor changes within and outside of the regulated sector.

The results of this employment estimate are presented in Table 4-14 for the proposed NESHAP amendment alternatives. The table includes estimates of labor requirements by NESHAP option evaluated in the EIA and presents both the estimated hours required and the conversion of this estimate to FTE. The upfront and ongoing requirements are estimated at about 2.5 and 9.1 FTEs, respectively for Option 2, the proposed NESHAP option.

Table 4-14 Labor-based Employment Estimates for Operating and Maintaining Control Equipment Requirements, Proposed NESHAP Options

	Option 1		Option 2 (proposed)		Option 3	
Compliance-related Activities	**Initial Reqs.**	**Cont. Annual Reqs.**	**Initial Reqs.**	**Cont. Annual Reqs.**	**Initial Reqs.**	**Cont. Annual Reqs.**
Kraft Condensate-related Activities						
Nationwide Labor (hrs)	0	0	N/A	11,100	N/A	87,640
Full-time Equivalents (FTE)	0	0	N/A	5.3	N/A	42.1
Reporting and Recordkeeping						
Nationwide Labor (hrs)	5,244	7,866	5,244	7,866	5,244	7,866
Full-time Equivalents (FTE)	2.5	3.8	2.5	3.8	2.5	3.8
Total						
Nationwide Labor (hrs)	**5,244**	**7,866**	**5,244**	**18,966**	**5,244**	**95,506**
Full-time Equivalents (FTE)	**2.5**	**3.8**	**2.5**	**9.1**	**2.5**	**45.9**

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