

## 4A PAPER AND ALLIED PRODUCTS (SIC 26)

EPA's *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures* identified five 4-digit SIC codes in the Paper and Allied Products industry (SIC 26) with at least one existing facility that operates a CWIS, holds a NPDES permit, and withdraws equal to or greater than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes. (Facilities with these characteristics are hereafter referred to as "section 316(b) facilities"). For each of the five SIC codes, Table 4A-1 below provides a description of the industry sector, a list of primary products manufactured, the total number of detailed questionnaire respondents (weighted to represent national results), and the number and percent of section 316(b) facilities.

<b>Table 4A-1: Section 316(b) Facilities in the Paper and Allied Products Industry (SIC 26)</b>					
<b>SIC</b>	<b>SIC Description</b>	<b>Important Products Manufactured</b>	<b>Number of Weighted Detailed Questionnaire Survey Respondents</b>		
			<b>Total</b>	<b>Section 316(b) Facilities</b>	
				<b>No.<sup>a</sup></b>	<b>%</b>
2611	Pulp Mills	Pulp from wood or from other materials, such as rags, linters, wastepaper, and straw; integrated logging and pulp mill operations if primarily shipping pulp.	60	26	43.6%
2621	Paper Mills	Paper from wood pulp and other fiber pulp, converted paper products; integrated operations of producing pulp and manufacturing paper if primarily shipping paper or paper products.	290	74	25.4%
2631	Paperboard Mills	Paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fiber pulp; and converted paperboard products; integrated operations of producing pulp and manufacturing paperboard if primarily shipping paperboard or paperboard products.	190	43	22.4%
<b>Total</b>			<b>539</b>	<b>142</b>	<b>26.4%</b>
<b>Other Paper and Allied Products Sectors</b>					
2676	Sanitary Paper Products	Sanitary paper products from purchased paper, such as facial tissues and handkerchiefs, table napkins, toilet paper, towels, disposable diapers, and sanitary napkins and tampons.	4	2	50.0%
2679	Converted Paper and Paperboard Products, Not Elsewhere Classified	Laminated building paper, cigarette paper, confetti, pressed and molded pulp cups and dishes, paper doilies, egg cartons, egg case filler flats, papier-mache, filter paper, foil board, gift wrap paper, wallpaper, etc.	19	3	14.2%
<b>Total Other</b>			<b>23</b>	<b>4</b>	<b>50.0%</b>
<b>Total Paper and Allied Products (SIC 26)</b>					
<b>Total SIC Code 26</b>			<b>562</b>	<b>147</b>	<b>26.1%</b>

<sup>a</sup> Individual numbers may not add up due to independent rounding.

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

The responses to the Detailed Industry Questionnaire indicate that three main sectors account for the largest numbers of section 316(b) facilities in the Paper and Allied Products industry: (1) Pulp Mills (SIC 2611), (2) Paper Mills (SIC 2621), and (3) Paperboard Mills (SIC 2631). Fifty percent of the 147 section 316(b) facilities in the Paper and Allied Products industry are paper mills. Paperboard mills and pulp mills account for 29 and 18 percent of facilities, respectively. The remainder of the Paper and Allied Products profile therefore focuses on these three industries.

## 4A.1 Domestic Production

The Paper and Allied Products industry is one of the top ten U.S. manufacturing industries, and among the top five sectors in sales of nondurable goods. Growth in the paper industry is closely tied to overall gross domestic product (GDP) growth because nearly all of the industry's end-uses are consumer oriented. Although the domestic market consumes over 90 percent of total U.S. paper and allied product output, exports have taken on an increasingly important role, and growth in a number of key foreign paper and paperboard markets are a key factor in the health and expansion of the U.S. industry (McGraw-Hill, 2000). The industry is considered mature, with growth slower than that of the GDP, and U.S. producers have been actively seeking growth opportunities in overseas markets. While exports still represent a small share of domestic shipments, they exert an important marginal influence on capacity utilization. Prices and industry profits, which are very sensitive to capacity utilization, have therefore also become very sensitive to trends in global markets. The industry has seen relatively stable production and sales over the last decade, but has experienced more volatile capacity utilization, profitability, and prices (Ince, 1999).

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

The industry is one of the primary users of energy, second only to the chemicals and metals industries. However, 56 percent of total energy used in 1998-99 was self-generated (McGraw-Hill, 2000).

### a. Output

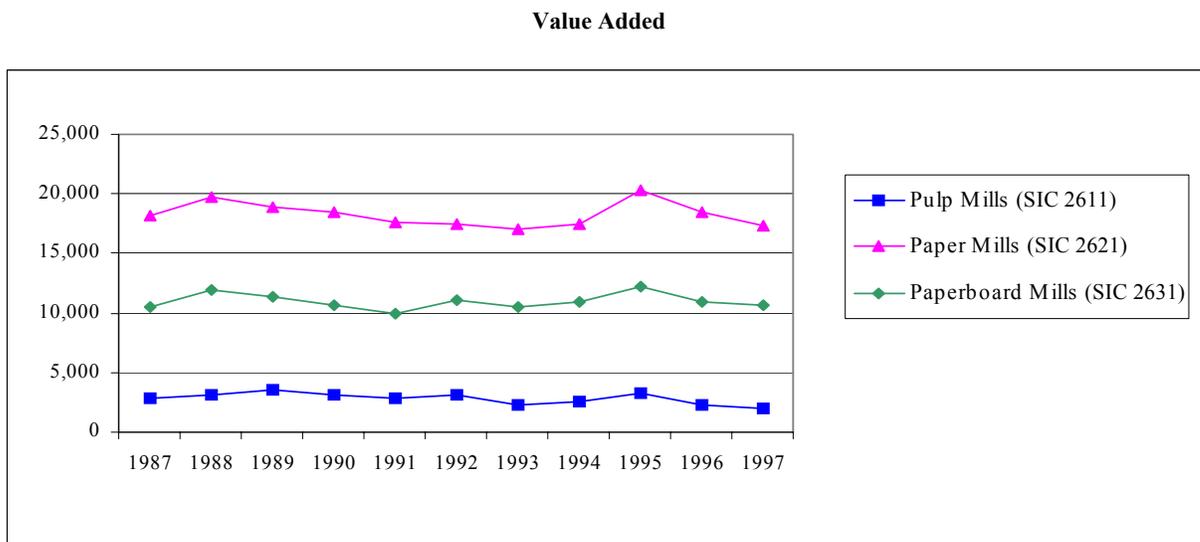
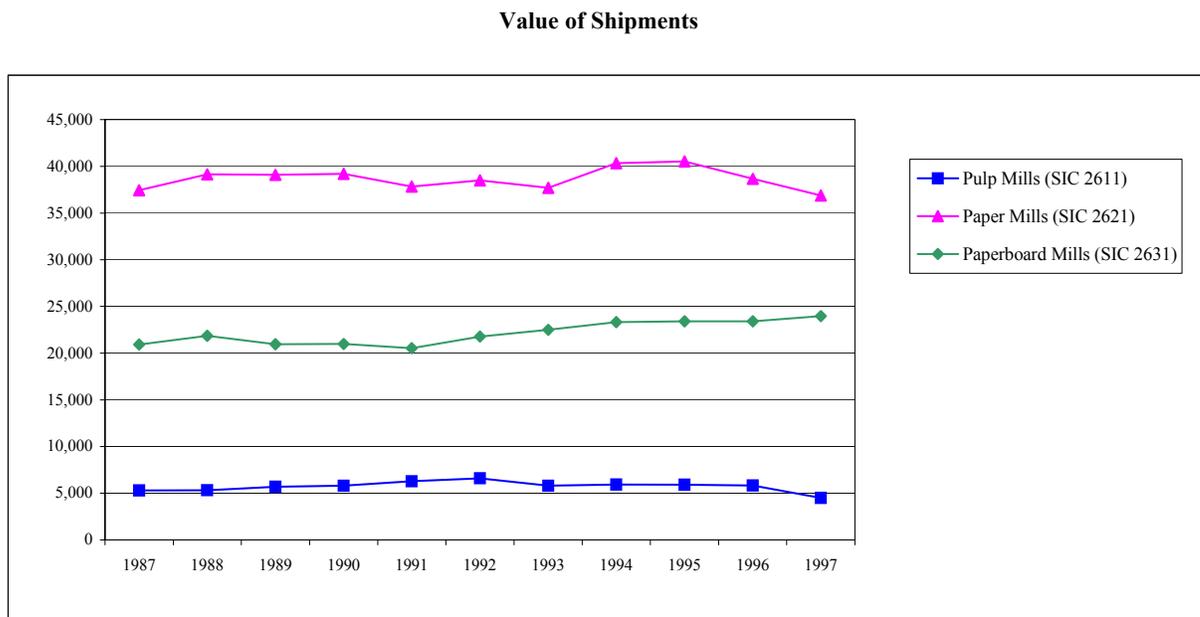
The U.S. Paper and Allied Products industry has experienced continued globalization and cyclical patterns in production and earnings over the last two decades. Capital investments in the 1980s resulted in significant overcapacity. U.S. producers experienced record sales in 1995. In 1996, lower domestic and foreign demand, declining prices, and inventory drawdowns led to a decline in the industry's total shipments by 2.2 percent in real terms. More recently, three consecutive years of increasing demand, and slowly increasing prices led to better industry performance. During these years, domestic producers controlled operating rates, to allow drawdown of high inventories and higher capacity utilization. U.S. producers have also placed a greater emphasis on foreign markets, both through export sales and investments in overseas facilities (McGraw-Hill, 2000). The paper products industry had improved sales and stronger earnings in 1999 and early 2000, but began to experience declines in sales in the second half of 2000, reflecting reduced paper and packaging demand due to the slowdown in the U.S. economy and a growth in imports (S&P, 2001). Most products were characterized by weak demand, reduced production and price reductions in 2001, due to continuing reductions in domestic demand (Paperloop, 2001).

Figure 4A-1 shows the trend in **value of shipments** and **value added** for the three profiled sectors.<sup>1</sup> Value of shipments and value added are two of the most common measures of manufacturing output. They provide insight into the overall economic health and outlook for an industry. Value of shipments is the sum of the receipts a manufacturer earns from the sale of its outputs. It is an indicator of the overall size of a market or the size of a firm in relation to its market or competitors. Value added is used to measure the value of production activity in a particular industry. It is the difference between the value of shipments and the value of purchased inputs used to make the products sold.

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<sup>1</sup> Terms highlighted in bold and italic font are further explained in the glossary.

**Figure 4A-1: Value of Shipments and Value Added for Profiled Paper and Allied Products Sectors  
(in millions, constant \$2000)**



Source: U.S. DOC, 1988-1991 and 1993-1996; U.S. DOC, 1987, 1992, and 1997.

Trends in industry output differ somewhat by stage of industry production. As Table 4A-2 shows, pulp production (SIC 2611) has experienced the slowest growth among the three profiled sectors over the period 1989 to 2000, but paper mill and paperboard mill production growth has also been well below the growth in U.S. GDP. All three sectors show periods of alternating growth and contraction in year-to-year production. Table 4A-2 shows sharp decreases in production in the first half of 2001, compared to the comparable period in 2000, in all three sectors.

Year	Pulp Mills		Paper Mills		Paperboard Mills	
	Index 1992=100	Percent Change	Index 1992=100	Percent Change	Index 1992=100	Percent Change
1989	94.9	n/a	95.3	n/a	92.1	n/a
1990	96.9	2.1%	97.8	2.6%	94.2	2.3%
1991	97.6	0.7%	97.6	-0.2%	96.6	2.5%
1992	100.0	2.5%	100.0	2.5%	100.0	3.5%
1993	98.6	-1.4%	104.0	4.0%	103.3	3.3%
1994	101.1	2.5%	106.8	2.7%	109.3	5.8%
1995	103.0	1.9%	108.3	1.4%	111.5	2.0%
1996	100.3	-2.6%	105.1	-3.0%	114.1	2.3%
1997	102.7	2.4%	110.8	5.4%	120.2	5.3%
1998	100.5	-2.1%	111.5	0.6%	119.0	-1.0%
1999	98.6	-1.9%	112.4	0.8%	122.0	2.5%
2000	98.7	0.1%	112.5	0.1%	116.9	-4.2%
<i>Total Percent Change 1989-2000</i>	<i>4%</i>		<i>18%</i>		<i>27%</i>	
<i>Average Annual Growth Rate</i>	<i>0.4%</i>		<i>1.5%</i>		<i>2.2%</i>	
Jan.-August 2000 <sup>a</sup>	100.6	n/a	113.8	n/a	119.2	n/a
Jan.-August 2001 <sup>a</sup>	91.6	-8.9%	105.3	-7.5%	112.6	-5.5%

<sup>a</sup> Data is an average over the seven month period.

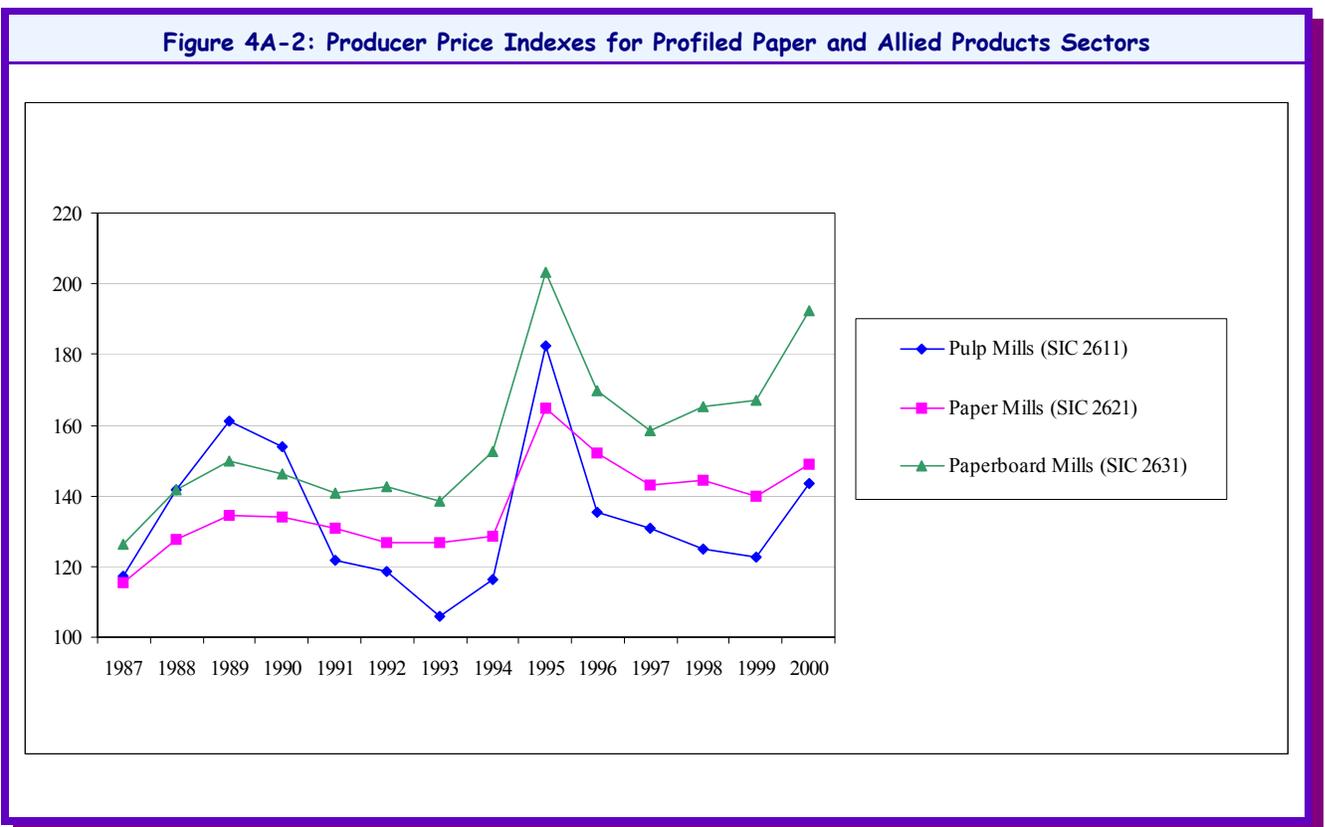
Source: Federal Reserve Board, 2001.

## b. Prices

Price levels in the U.S. paper industry closely reflect domestic and foreign demand and industry capacity and operating rates, which determine supply (S&P, 2001). Prices tend to be volatile due to mismatches between short-term supply and demand. The industry is very capital intensive, and it makes significant time to bring new capacity on-line. Prices therefore tend to escalate when demand and capacity utilization rise, and drop sharply when demand softens or when new capacity comes on line. Producers have in the past been reluctant to reduce production when demand declines, because fixed capital costs are a substantial portion of total manufacturing costs, which can result in persistent oversupply. During the recent economic slowdown, however, there is evidence that producers are more willing to incur downtime to prevent sharp reductions in prices (Ince, 1999; S&P, 2001).

The paper industry suffered from low prices throughout the early 1990s. The depressed prices were the result of the paper boom of the late 1980s wmid, 1999 and 2001). Production cutbacks in the face of substantial declines in demand in late 2000 and 2001 have prevented major price declines for paper products (S&P, 2001).

Figure 4A-2 shows the **producer price index** (PPI) at the 4-digit SIC code for the profiled pulp, paper, and paperboard sectors. The PPI is a family of indexes that measure price changes from the perspective of the seller. This profile uses the PPI to express monetary values in constant dollars.



Source: BLS, 2000.

### c. Number of facilities and firms

The Statistics of U.S. Businesses reports that the number of facilities and firms in the Pulp Mills sector decreased by 11% percent between 1989 and 1997. One of the reasons for this trend has been the dramatic increase in the number of mills that produce deinked recycled market pulp. These are secondary fiber processing plants that use recovered paper and paperboard as their sole source of raw material. Producers of deinked market pulp have experienced strong demand over the past several years in both U.S. and foreign markets. As a result, the U.S. deinked recycled market pulp capacity more than doubled between 1994 and 1998 (McGraw-Hill, 2000). Since 1994, the secondary fiber share of total papermaking fiber production has increased steadily, reaching a record 37 percent in 1999 (McGraw-Hill, 2000).

There has also been a decline in the number of paper and paperboard mills. Overcapacity in the 1990s has limited the construction of new facilities. In 1998 and 1999, 577,000 and 2.5 million tons of paper and paperboard capacity were removed from the capacity base. Over the same period, more than one million tons of pulp capacity were removed (Pponline, 1999).

Tables 4A-3 and 4A-4 present the number of facilities and firms for the three profiled Paper and Allied Products sectors between 1989 and 1997.

Year	Pulp Mills (SIC 2611)		Paper Mills (SIC 2621)		Paperboard Mills (SIC 2631)	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1989	46	n/a	322	n/a	221	n/a
1990	46	0%	327	2%	226	2%
1991	53	15%	349	7%	228	1%
1992	44	-17%	324	-7%	222	-3%
1993	46	5%	306	-6%	217	-2%
1994	52	13%	316	3%	218	0%
1995	53	2%	317	0%	219	0%
1996	62	17%	344	9%	228	4%
1997	41	-34%	259	-25%	214	-6%
<i>Total Percent Change 1989-1997</i>	<i>-11%</i>		<i>-20%</i>		<i>-3%</i>	
<i>Average Annual Growth Rate</i>	<i>-1%</i>		<i>-3%</i>		<i>0%</i>	

Source: U.S. SBA, 2000.

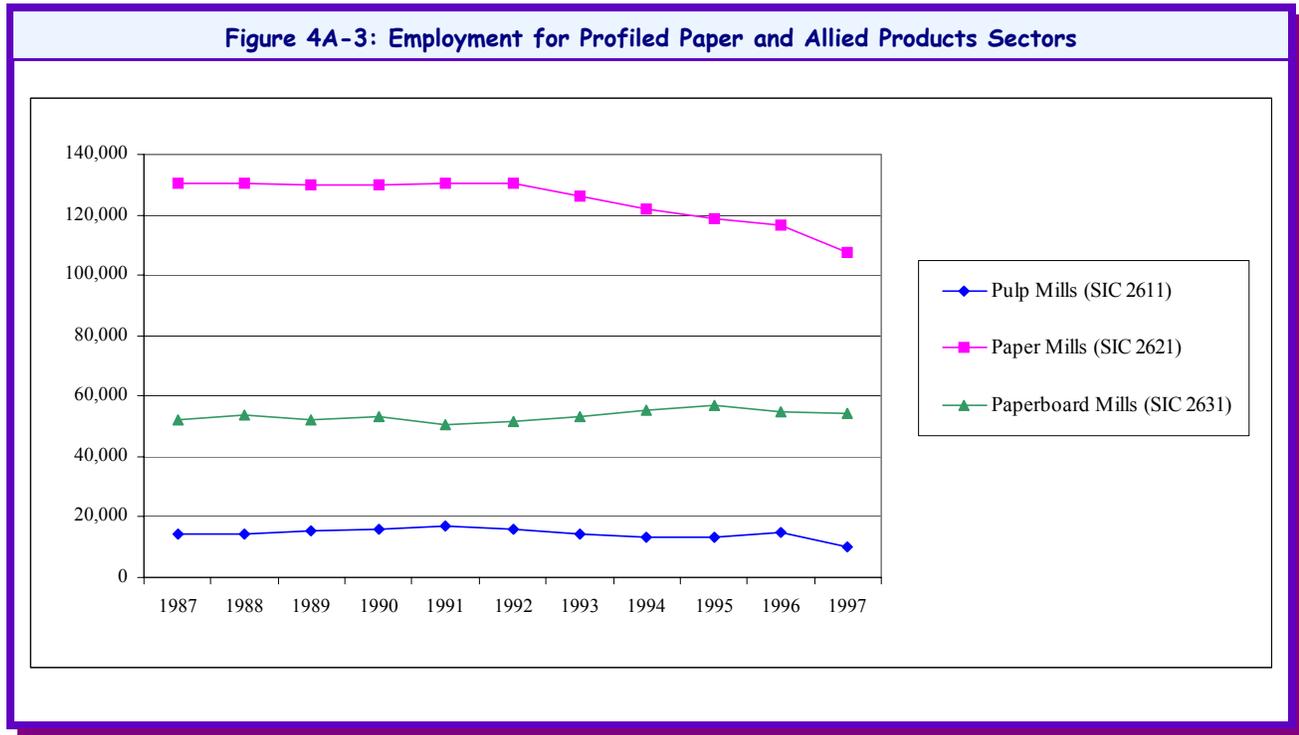
Table 4A-4: Number of Firms for Profiled Paper and Allied Products Sectors						
Year	Pulp Mills (SIC 2611)		Paper Mills (SIC 2621)		Paperboard Mills (SIC 2631)	
	Number of Firms	Percent Change	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	31	n/a	158	n/a	102	n/a
1991	37	19%	186	18%	102	0%
1992	29	-22%	161	-13%	95	-7%
1993	32	10%	153	-5%	99	4%
1994	37	16%	163	7%	96	-3%
1995	32	-14%	163	0%	93	-3%
1996	43	34%	186	14%	101	9%
1997	27	-37%	131	-30%	85	-16%
<i>Total Percent Change 1990-1997</i>	<i>-13%</i>		<i>-17%</i>		<i>-17%</i>	
<i>Average Annual Growth Rate</i>	<i>-2%</i>		<i>-3%</i>		<i>-3%</i>	

Source: U.S. SBA, 2000.

#### d. Employment and productivity

The U.S. Paper and Allied Products industry is among the most modern in the world. It has a highly skilled labor force and is characterized by large capital expenditures which are largely aimed at production improvements.

**Employment** in the three profiled paper industry sectors has remained relatively constant or declined between 1987 and 1992. Figure 4A-3 below presents employment levels for the three profiled Paper and Allied Products sectors between 1987 and 1997.



Source: U.S. DOC, 1988-1991 and 1993-1996; U.S. DOC, 1987, 1992, and 1997.

Table 4A-5 presents the change in value added per labor hour, a measure of **labor productivity**, for each of the profiled industry sectors between 1987 and 1997. The table shows that labor productivity in the Pulp Mills sector has been relatively volatile, posting several double-digit gains and losses between 1987 and 1997. These changes have been primarily driven by fluctuations in value added. Overall, the sector's productivity increased by 3 percent during this period. The Paper Mills and Paperboard Mills sectors have experienced overall labor productivity changes of 12 percent and -3 percent, respectively.

Year	Pulp Mills (SIC 2611)				Paper Mills (SIC 2621)				Paperboard Mills (SIC 2631)			
	Value Added	Prod. Hrs. (mill.)	Value Added/Hour		Value Added	Prod. Hrs. (mill.)	Value Added/Hour		Value Added	Prod. Hrs. (mill.)	Value Added/Hour	
			No.	% Change			No.	% Change			No.	% Change
1987	2,796	24	117	n/a	18,150	213	85	n/a	10,541	89	119	n/a
1988	3,154	24	132	13%	19,686	215	92	8%	11,928	91	131	10%
1989	3,502	25	138	5%	18,892	214	88	-4%	11,293	89	127	-3%
1990	3,185	28	115	-17%	18,421	211	87	-1%	10,705	91	118	-7%
1991	2,880	28	104	-10%	17,606	212	83	-5%	9,924	87	115	-3%
1992	3,092	26	118	13%	17,440	215	81	-2%	11,057	88	125	9%
1993	2,319	23	100	-15%	17,045	212	80	-1%	10,470	90	116	-7%
1994	2,577	22	118	18%	17,434	206	85	6%	10,945	94	117	1%
1995	3,320	25	134	14%	20,311	200	102	20%	12,174	98	125	7%
1996	2,329	24	97	-28%	18,415	197	93	-9%	10,939	95	115	-8%
1997	2,006	17	121	25%	17,290	183	95	2%	10,659	92	116	1%
<i>Total Percent Change 1987-1997</i>	-28%	-29%	3%		-5%	-14%	12%		1%	3%	-3%	
<i>Average Annual Growth Rate</i>	-3%	-3%	0.3%		-0.5%	-2%	1%		0.1%	0.3%	-0.3%	

Source: U.S. DOC, 1988-1991 and 1993-1996; U.S. DOC, 1987, 1992, and 1997.

### e. Capital expenditures

The Paper and Allied Products industry is a highly capital intensive industry. Capital-intensive industries are characterized by large manufacturing facilities which reflect the economies of scale required to manufacture products efficiently. **New capital expenditures** are needed to modernize, expand, and replace existing capacity. Consistent high levels of capital expenditures have made the Paper and Allied Products industry one of the most modern industries in the world (Stanley, 2000). The total level of capital expenditures for the pulp, paper, and paperboard industries was \$5.3 billion in 1997 (in constant \$2000). The Paper Mills and Paperboard Mills sectors accounted for approximately 91 percent of that spending (see Table 4A-6). Most of the spending is for production improvements (through existing machine upgrades, retrofits, or new installed equipment), environmental concerns, and increased recycling (McGraw Hill, 2000).

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

**Table 4A-6: Capital Expenditures for Profiled Paper and Allied Products Sectors (in millions, constant \$2000)**

Year	Pulp Mills (SIC 2611)		Paper Mills (SIC 2621)		Paperboard Mills (SIC 2631)	
	Capital Expenditures (\$2000 millions)	Percent Change	Capital Expenditures (\$2000 millions)	Percent Change	Capital Expenditures (\$2000 millions)	Percent Change
1987	283	n/a	3,562	n/a	1,178	n/a
1988	313	10.6%	3,851	8.1%	2,062	75.0%
1989	619	97.8%	5785	50.2%	2122	2.9%
1990	982	58.6%	4747	-17.9%	3923	84.9%
1991	1167	18.8%	4129	-13.0%	2943	-25.0%
1992	935	-19.9%	3420	-17.2%	2753	-6.5%
1993	577	-38.3%	3363	-1.7%	2286	-17.0%
1994	388	-32.8%	3716	10.5%	2202	-3.7%
1995	444	14.4%	2,423	-34.8%	2,058	-6.5%
1996	739	66.4%	3070	26.7%	2,674	29.9%
1997	467	-36.8%	2878	-6.3%	1954	-26.9%
<i>Total Percent Change 1987- 1997</i>	65%		-19%		66%	
<i>Average Annual Growth Rate</i>	5%		-2%		5%	

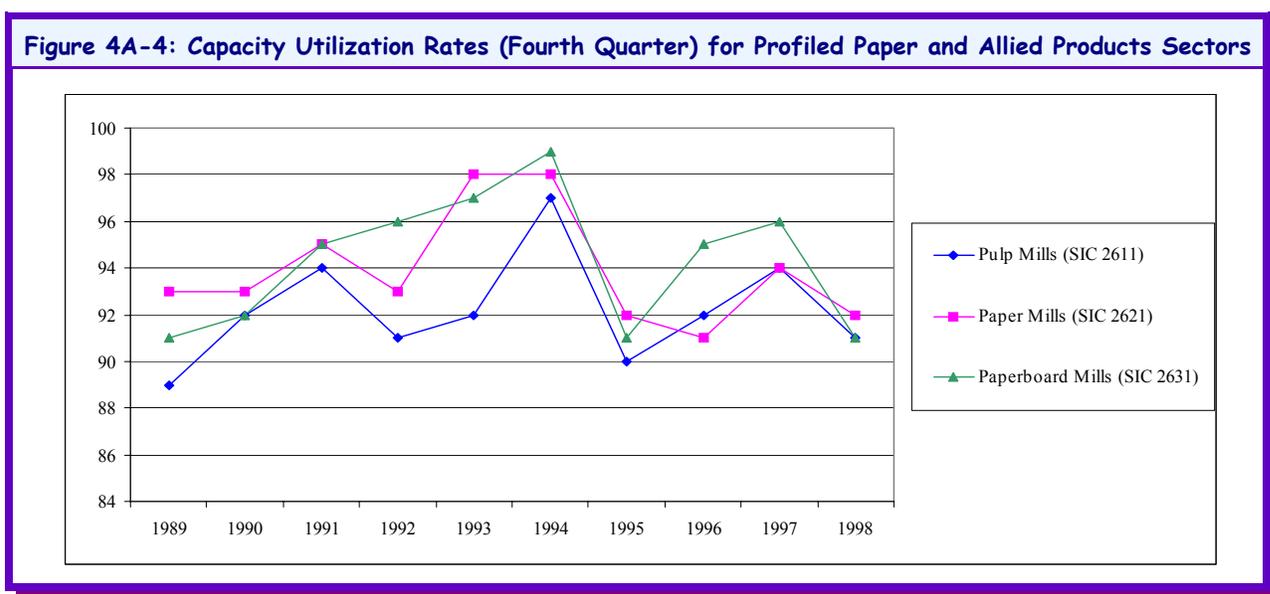
Source: U.S. DOC, 1988-1991 and 1993-1996; U.S. DOC, 1987, 1992, and 1997.

## f. Capacity utilization

**Capacity utilization** measures actual output as a percentage of total potential output given the available capacity. Capacity utilization is an index used to identify potential excess or insufficient capacity in an industry and can help project whether new investment is likely. According to the U.S. Industry and Trade Outlook, a utilization rate in the range of 92 to 96 percent is necessary for the Pulp Mills sector to remain productive and profitable (McGraw-Hill, 2000).

The capacity utilization trends shown in Figure 4A-4 show sharp fluctuations in all three profiled sectors. Capacity utilization rates increased between 1989 and 1994, and then plummeted in 1995. This sharp drop was the result of the inventory drawdown cycle which had begun in 1995 in response to low demand and oversupply (McGraw-Hill, 2000). As inventories were sold off and global economic activity started to pick up, capacity utilization rates began to increase again in 1996, peaked in 1997, and again declined in 1998 due to reduced demand from the Asian market (S&P, 2001).

Figure 4A-4 presents the capacity utilization indexes from 1989 to 1998 for the three profiled sectors.



Source: U.S. DOC, 1989-1998.

## 4A.2 Structure and Competitiveness

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

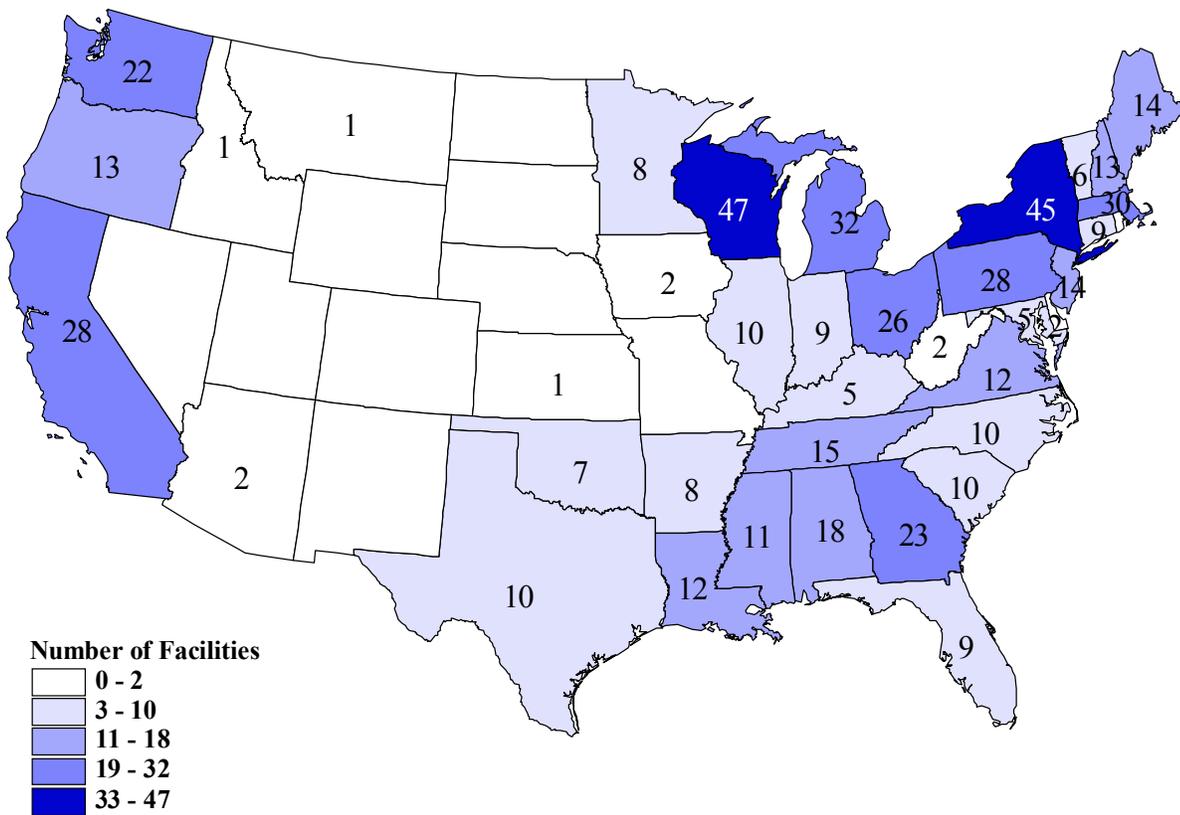
The paper industry has been consolidating through mergers and has been closing down older mills over the last few years, as a way to improve profit growth in a mature industry. About six percent of North American containerboard capacity was shut down (most on a permanent basis) in late 1998 and early 1999. Companies have been reluctant to invest in any major new capacity that might result in excess capacity (S&P, 2001). New capacity additions in 1999 in the Paper and Allied Products industry were at their lowest level in the past ten years and this limitation on new capacity is expected to continue (Pponline.com, 2000). Major recent mergers include International Paper's acquisition of Champion International in 2000 and Union Camp in 1999, Georgia-Pacific's takeover of Fort James Corp. (itself a 1997 combination of James River and Fort Howard), and Weyerhaeuser's bid in late 2000 for Willamette Industries Inc. (S&P, 2001).

**a. Geographic distribution**

The geographic distribution of pulp, paper, and paperboard mills varies with the different types of mills. Traditional pulp mills tend to be located in regions where pulp trees are harvested from natural stands or tree farms. The Southeast (GA, AL, NC, TN, FL, MS, KY), Northwest (WA, CA, AK), Northeast (ME) and Northern Central (WI, MI) regions account for the major concentrations of pulp mills. Deinked market pulp plants, on the other hand, are typically located close to large metropolitan areas, which can consistently provide large amounts of recovered paper and paperboard (McGraw-Hill, 2000).

Paper mills are more widely distributed, located in proximity to pulping operations and/or near converting sector markets. Since the primary market for paperboard products is manufacturing, the distribution of paperboard mills is similar to that of the manufacturing industry in general.

**Figure 4A-5: Number of Facilities in Profiled Paper and Allied Products Sectors by State**



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

**b. Facility size**

Most of the facilities in the three profiled industry sectors fall in the middle employment size categories, with either 100 to 249, or 250 to 499 employees. However, the larger facilities (those with 500 or more employees) account for the majority of the industries' value of shipments.

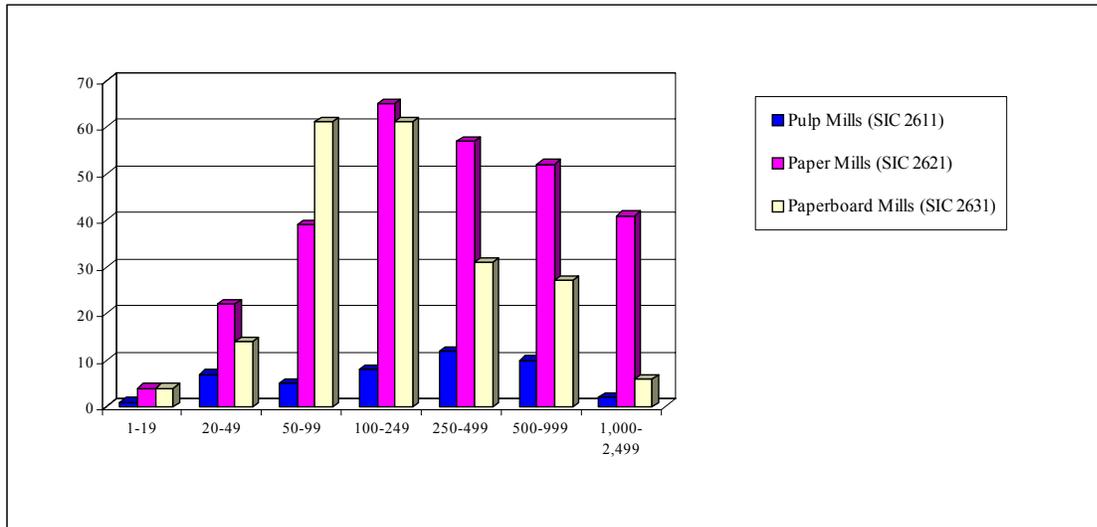
The number of independent pulp mills is smaller than the number of paper and paperboard mills, and pulp mills have considerably lower value of shipments. The larger facilities dominate value of shipments in all three sectors, however.

- ▶ Seventy-one percent of all *Pulp Mills* employ 100 employees or more. These facilities account for approximately 97 percent of the sector's value of shipments.
- ▶ Thirty-three percent of all *Paper Mills* have more than 500 employees. They account for 71 percent of the sector's value of shipments.
- ▶ Sixteen percent of all *Paperboard Mills* employ 500 people or more. These facilities account for 56 percent of the sector's value of shipments.

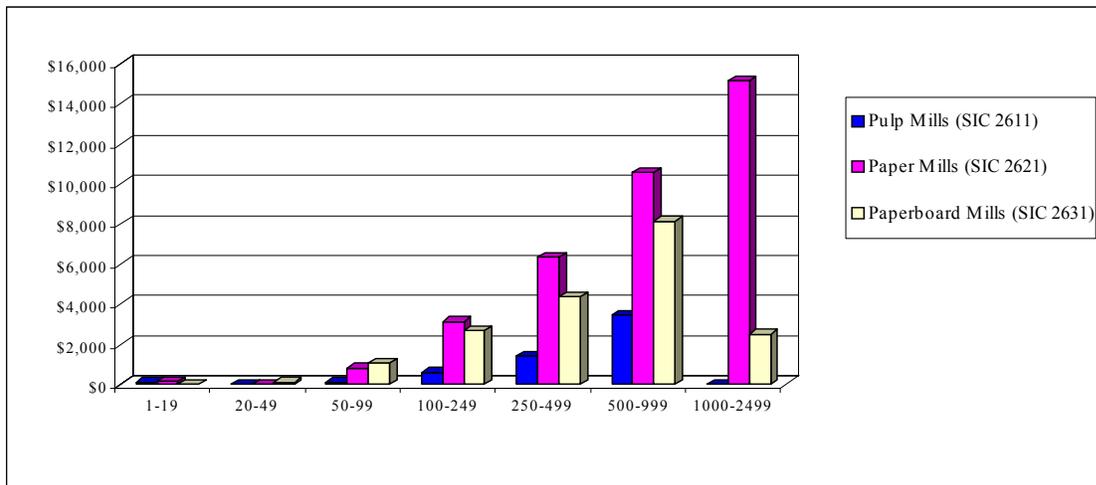
The distribution of the number of facilities and the industries' value of shipment are presented in Figure 4A-6 below.

**Figure 4A-6: Number of Facilities and Value of Shipments by Employment Size Category for Profiled Paper and Allied Products Sectors**

**Number of Facilities (1992)**



**1992 Value of Shipments (in millions)**



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

### c. Firm size

The Small Business Administration (SBA) defines small firms in the Paper and Allied Products industries according to the firm's number of employees. Firms in SIC codes 2611, 2621, and 2631 are defined as small if they have fewer than 750 employees.

The size categories reported in the Statistics of U.S. Businesses (SUSB) do not coincide with the SBA small firm standard of 750 employees. It is therefore not possible to apply the SBA size thresholds precisely. The SUSB data presented in Table 4A-6 below show the following size distribution in 1997:

- ▶ 12 of 27 firms in the *Pulp Mills* sector had less than 500 employees. Therefore, at least 44 percent of firms were classified as small. These small firms owned 15 facilities, or 37 percent of all facilities in the sector.
- ▶ 72 of 131 (55 percent) firms in the *Paper Mills* sector had less than 500 employees. These small firms owned 77, or 30 percent of all paper mills.
- ▶ 41 of 85 firms in the *Paperboard Mills* sector had less than 500 employees. Therefore, at least 48 percent of paperboard mills were classified as small. These firms owned 42, or 20 percent of all paperboard mills

An unknown number of the firms with more than 500 employees have less than 750 employees, and would therefore be classified as small firms. Table 4A-7 below shows the distribution of firms, facilities, and receipts for each profiled sector by employment size of the parent firm.

Employment Size Category	Pulp Mills (SIC 2611)			Paper Mills (SIC 2621)			Paperboard Mills SIC 2631		
	No. of Firms	No. of Facilities	Estimated Receipts (in millions, constant \$2000)	No. of Firms	No. of Facilities	Estimated Receipts (in millions, constant \$2000)	No. of Firms	No. of Facilities	Estimated Receipts (in millions, constant \$2000)
0-19	2	2	21	5	5	49	8	8	68
20-99	5	5	53	23	23	224	12	12	103
100-499	5	8	148	44	49	3,048	21	22	731
500+	15	26	3,834	59	182	33,926	44	172	18,900
<i>Total</i>	<i>27</i>	<i>41</i>	<i>4,055</i>	<i>131</i>	<i>259</i>	<i>37,246</i>	<i>85</i>	<i>214</i>	<i>19,802</i>

Source: U.S. SBA, 2000.

#### d. Concentration and specialization ratios

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

The four-firm **concentration ratio** (CR4) and the **Herfindahl-Hirschman Index** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal.<sup>2</sup> An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 ( $60^2 + 30^2 + 10^2$ ). The higher the index, the fewer the number of firms supplying the industry and the more concentrated the industry. An industry is considered concentrated if the HHI exceeds 1,000.

The concentration ratios for the three profiled industry sectors remained relatively stable between 1987 and 1992. None of the profiled industries are considered concentrated based on the CR4 or the HHI. The Pulp Mills sector has the highest concentration of the three sectors, with a CR4 of 48 percent and a HHI of 858 in 1992. Recent mergers and acquisitions have led to an increase in concentration in the paper and paperboard sector. The top five U.S. firms are reported to now control 38 percent of production capacity, with higher concentrations in individual product lines due to targeted consolidation and specialization (Ince, 1999).<sup>3</sup> The paper and paperboard mills (SICs 2621 and 2631) also account for most of the production of their primary products, as shown by their high coverage ratios. Pulp mills (SIC 2611) account for a lower percentage of all pulp shipments, with pulp also commonly produced by integrated paper mills. Data from the 1997 Census of Manufacturers reports that the coverage ratio for pulp mills declined to 59 percent in 1997, suggesting a trend away from mills specializing in pulp production (U.S. DOC, 1987, 1992, and 1992).

The **specialization ratio** is the percentage of the industry's production accounted for by primary product shipments. The **coverage ratio** is the percentage of the industry's product shipments coming from facilities from the same primary industry. The coverage ratio provides an indication of how much of the production/product of interest is captured by the facilities classified in an SIC code.

The specialization ratios presented in Table 4A-8 indicate a relatively high degree of specialization for each profiled Paper and Allied Products industry sector.

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<sup>2</sup> Note that the measured concentration ratio and the HHI are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios are therefore only one indicator of the extent of competition in an industry.

<sup>3</sup> Reported capacity concentrations for the top five firms are 60% in newsprint, 58% in uncoated groundwood, 65% in coated groundwood, 43% in containerboard, and 40% in paper grade market pulp (Ince, 1999, quoting the industry newsletter Pulp & Paper Week).

SIC Code	Year	Total Number of Firms	Concentration Ratios				Herfindahl-Hirschman Index	Specialization Ratio	Coverage Ratio
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)			
2611	1987	26	44%	69%	99%	100%	743	87%	69%
	1992	29	48%	75%	98%	100%	858	81%	72%
2621	1987	122	33%	50%	78%	94%	432	91%	96%
	1992	127	29%	49%	77%	94%	392	90%	95%
2631	1987	91	32%	51%	77%	97%	431	91%	90%
	1992	89	31%	52%	80%	97%	438	92%	89%

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

### e. Foreign trade

The Paper and Allied Products industry has been in a period of globalization for more than a decade. Many U.S. Paper and Allied Products companies are active exporters, but they also engage in foreign production, converting, and packaging operations, and have joint ventures and direct foreign capital investments in partnerships and ownerships (Stanley, 2000).

Exports play an important role in the Paper and Allied Products industry. Sixty-five percent of the industry's shipment growth between 1989 and 1998 was derived from export sales. Some of the domestic industry's key trade partners – long a target for any excess U.S. paper production – have undertaken significant investments in their own world-class production facilities (S&P, 2001). The strength of the U.S. dollar versus Asian currencies has also reduced the competitiveness of U.S. pulp exports to that region (McGraw-Hill, 2000). Despite improved demand in portions of Europe and Latin America, the Asian financial crisis, which began in 1997, still affects the global pulp industry (Stanley, 2000).

This profile uses two measures of foreign competitiveness: **export dependence** and **import penetration**. Export dependence is the share of value of shipments that is exported. Import penetration is the share of domestic consumption met by imports. Imports and exports play a much larger role in the Pulp Mills sector than for the other two sectors. Import penetration and export dependence levels for the Pulp Mills sector were an estimated 62 and 63 percent, respectively, in 2000. The Paper and Paperboard sectors, import penetration and export dependence were 17 and 11 percent in 2000, respectively. Table 4A-9 presents trade statistics for each of the profiled Paper and Allied Products industry sectors. Figure 4A-7 shows the rise in imports in all sectors in the last two years.

**Table 4A-9: Trade Statistics for Profiled Paper and Allied Products Sectors**

Year	Value of Imports (in millions, constant \$2000)	Value of Exports (in millions, constant \$2000)	Value of Shipments (in millions, constant \$2000)	Implied Domestic Consumption <sup>a</sup>	Import Penetration <sup>b</sup>	Export Dependence <sup>c</sup>
<b>Pulp Mills (SIC 2611)</b>						
1992	2,546	3,916	6,615	5,245	49%	59%
1993	2,532	3,364	5,804	4,972	51%	58%
1994	2,813	3,636	5,942	5,119	55%	61%
1995	2,944	3,693	5,907	5,158	57%	63%
1996	2,753	3,554	5,829	5,028	55%	61%
1997 <sup>d</sup>	2,815	3,561	6,330	5,584	50%	56%
1998 <sup>d</sup>	2,742	3,180	6,009	5,571	49%	53%
1999 <sup>e</sup>	2,974	3,288	6,123	5,809	51%	54%
2000 <sup>f</sup>	3,302	3,556	5,622	5,368	62%	63%
<i>Total Percent Change 1992-2000</i>	30%	-9%	-15%	2.3%		
<i>Average Annual Growth Rate</i>	3.3%	-1.2%	-2.0%	0.3%		
<b>Paper and Paperboard Mills (SIC 2621, 2631)</b>						
1992	8,500	5,402	61,994	65,092	13%	9%
1993	9,258	5,394	62,151	66,015	14%	9%
1994	8,901	5,838	64,752	67,815	13%	9%
1995	9,453	5,966	62,548	66,035	14%	10%
1996	9,658	6,715	63,386	66,329	15%	11%
1997 <sup>d</sup>	10,194	7,407	66,803	69,590	15%	11%
1998 <sup>d</sup>	10,831	6,877	65,886	69,840	16%	10%
1999 <sup>e</sup>	11,228	6,726	66,085	70,587	16%	10%
2000 <sup>f</sup>	11,198	6,698	61,956	66,456	17%	11%
<i>Total Percent Change 1992-2000</i>	32%	24%	-0.1%	2.1%		
<i>Average Annual Growth Rate</i>	3.5%	2.7%	0.0%	0.3%		

<sup>a</sup> Calculated by EPA as shipments + imports - exports.

<sup>b</sup> Calculated by EPA as imports divided by implied domestic consumption.

<sup>c</sup> Calculated by EPA as exports divided by shipments.

<sup>d</sup> Value of Shipments are estimated.

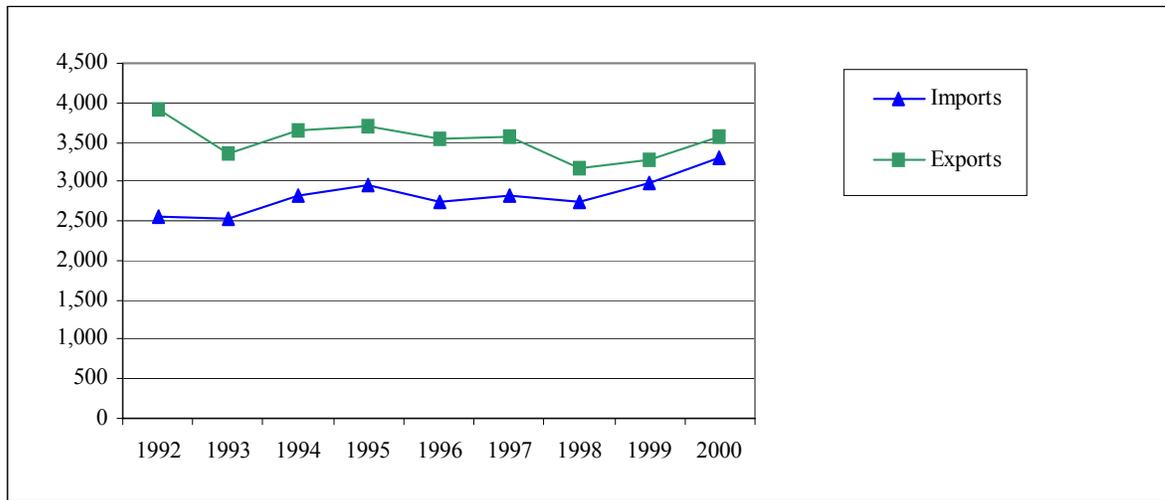
<sup>e</sup> Estimates.

<sup>f</sup> Forecasts.

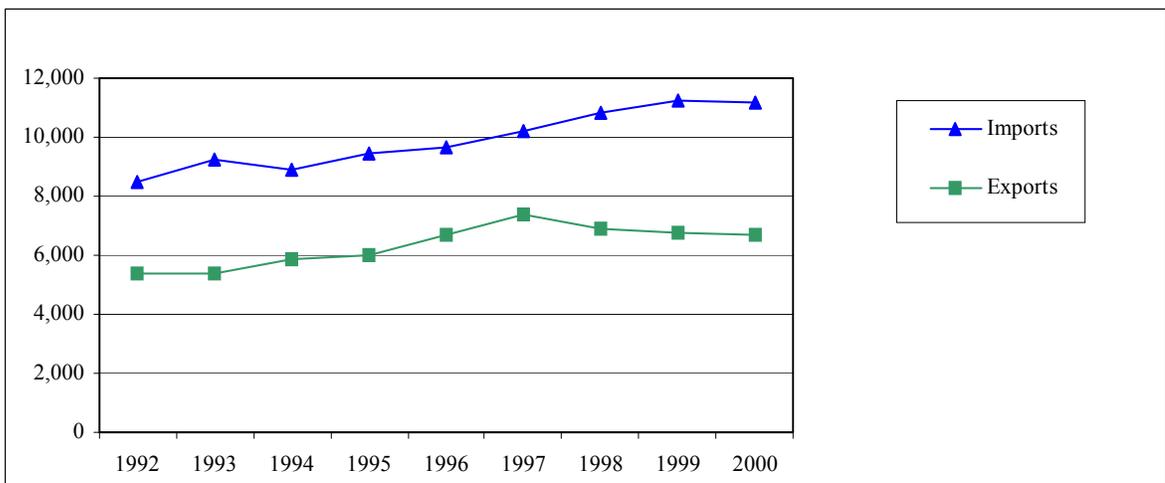
Source: U.S. DOC, 2001.

**Figure 4A-7: Value of Imports and Exports for Profiled Paper and Allied Products Sectors  
(in millions, constant \$2000)**

**Pulp Mills (SIC 2611)**



**Paper and Paperboard Mills (SIC 2621 and 2631)**



Source: U.S. DOC, 2001.

### 4A.3 Financial Condition and Performance

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

Table 4A-10 presents trends in operating margins for the Pulp Mills, Paper Mills, and Paperboard Mills sectors between 1987 and 1997. The table shows substantial year-to-year fluctuations in margins in all three sectors, but especially in the Pulp Mills sector. These fluctuations are a reflection of changes in product prices which have resulted from oversupply in the industry. More recently, earnings have suffered from a combination of price declines and higher energy costs, which Standard & Poor's estimates can account for as much as 20 percent of paper manufacturing costs in certain grades (S&P 2001). S&P also reports that consolidations in recent years have helped profit margins, by allowing companies to spread administrative and research and development costs over a larger asset base and by eliminating redundant operations (S&P 2001).

<b>Table 4A-10: Operating Margins for Profiled Paper and Allied Products Sectors (in millions, constant \$2000)</b>				
<b>Year</b>	<b>Value of Shipments</b>	<b>Cost of Materials</b>	<b>Payroll (all employees)</b>	<b>Operating Margin</b>
<b>Pulp Mills (SIC 2611)</b>				
1987	5,287	2,475	656	41%
1988	5,323	2,185	566	48%
1989	5,704	2,265	536	51%
1990	5,817	2,690	623	43%
1991	6,275	3,402	821	33%
1992	6,614	3,579	834	33%
1993	5,804	3,372	850	27%
1994	5,942	3,301	751	32%
1995	5,906	2,736	547	44%
1996	5,829	3,470	742	28%
1997	4,506	2,440	581	33%
<b>Paper Mills (SIC 2621)</b>				
1987	37,443	19,241	5,965	33%
1988	39,154	19,588	5,571	36%
1989	39,094	20,417	5,443	34%
1990	39,197	20,930	5,617	32%
1991	37,849	20,413	5,929	30%
1992	38,510	21,109	6,367	29%
1993	37,707	20,810	6,302	28%
1994	40,329	22,615	6,311	28%
1995	40,518	20,936	4,958	36%
1996	38,656	20,122	5,470	34%
1997	36,880	19,502	5,592	32%
<b>Paperboard Mills (SIC 2631)</b>				
1987	20,932	10,428	2,834	37%
1988	21,868	9,974	2,669	42%
1989	20,946	9,708	2,514	42%
1990	20,979	10,285	2,700	38%
1991	20,530	10,640	2,772	35%
1992	21,777	10,812	2,882	37%
1993	22,488	12,043	3,122	33%
1994	23,329	12,272	3,050	34%
1995	23,418	11,393	2,427	41%
1996	22,969	12,015	2,945	35%
1997	23,974	13,339	3,265	31%

Source: U.S. DOC, 1988-1991 and 1993-1996; U.S. DOC, 1987, 1992, and 1997.

## 4A.4 Facilities Operating Cooling Water Intake Structures

In 1982, the Paper and Allied Products industry withdrew 534 billion gallons of cooling water, accounting for approximately 0.7 percent of total industrial cooling water intake in the United States. The industry ranked 5<sup>th</sup> in industrial cooling water use, behind the electric power generation industry, and the chemical, primary metals, and petroleum industries (1982 Census of Manufactures).

This section presents information from EPA's *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures* on existing facilities with the following characteristics:

- ▶ they withdraw from a water of the United States;
- ▶ they hold an NPDES permit;
- ▶ they have a design intake flow of equal to or greater than two MGD;
- ▶ they use at least 25 percent of that flow for cooling purposes.

These facilities are not “new facilities” as defined by the proposed section 316(b) New Facility Rule and are therefore not subject to this regulation. However, they meet the criteria of the proposed rule except that they are already in operation. These existing facilities therefore provide a good indication of what new facilities in these sectors may look like. The remainder of this section refers to existing facilities with the above characteristics as “section 316(b) facilities.”

### a. Cooling water uses and systems

Information collected in the Detailed Industry Questionnaire found that an estimated 26 out of 66 pulp mills (39 percent), 74 out of 286 paper mills (26 percent), and 43 out of 187 paperboard mills (23 percent) meet the characteristics of a section 316(b) facility. Most section 316(b) facilities in the profiled Paper and Allied Products sectors use cooling water for contact and non-contact production line or process cooling, electricity generation, and air conditioning:

- ▶ Eighty-seven percent of section 316(b) *pulp mills* use cooling water for production line (or process) contact or noncontact cooling. The two other major uses of cooling water by pulp mills are air conditioning and electricity generation, by approximately 94 and 54 percent of facilities, respectively.
- ▶ Eighty-five percent of section 316(b) *paper mills* use cooling water for production line (or process) contact or noncontact cooling. Sixty-six percent also use cooling water for electricity generation and 57 percent for air conditioning.
- ▶ Eighty-eight percent of section 316(b) *paperboard mills* use cooling water for production line (or process) contact or noncontact cooling. The two other major uses of cooling water by pulp mills are electricity generation by approximately 70 percent and air conditioning by approximately 59 percent of facilities.

Table 4A-11 shows the distribution of existing section 316(b) facilities in the profiled Paper and Allied Products sectors by type of water body and cooling system. The table shows that most of the existing section 316(b) facilities have either a once-through system (61, or 43 percent) or employ a combination of a once-through and closed system (35, or 24 percent). Sixteen facilities (11 percent) have a recirculating system, while the remaining thirty facilities (21 percent) employ some other type of cooling system. The majority of existing facilities draw water exclusively from either a freshwater water stream or river (109, or 76 percent), or a lake or reservoir (19, or 13 percent). Ninety-six percent (138) of all 316(b) facilities in the profiled Paper and Allied Products sectors withdraw water from a combination of freshwater streams or rivers and lakes or reservoirs. The remaining six facilities (4 percent) withdraw from an estuary or tidal river. All of the CWISs drawing from an estuary or tidal river use a once-through cooling system.

<b>Table 4A-11: Number of Section 316(b) Facilities by Water Body Type and Cooling System for Profiled Paper and Allied Products Sectors</b>									
<b>Water Body Type</b>	<b>Recirculating</b>		<b>Combination</b>		<b>Once-Through</b>		<b>Other</b>		<b>Grand Total</b>
	<b>No.</b>	<b>% of Total</b>	<b>No.</b>	<b>% of Total</b>	<b>No.</b>	<b>% of Total</b>	<b>No.</b>	<b>% of Total</b>	
<b>Pulp Mills (SIC 2611)</b>									
Freshwater Stream or River	6	32%	6	32%	6	32%	1	5%	19
Freshwater Stream or River & Lake or Reservoir	0	0%	1	100%	0	0%	0	0%	1
Lake or Reservoir	0	0%	0	0%	0	0%	6	100%	6
<b>Total<sup>a</sup></b>	<b>6</b>	<b>23%</b>	<b>7</b>	<b>27%</b>	<b>6</b>	<b>23%</b>	<b>7</b>	<b>27%</b>	<b>26</b>
<b>Paper Mills (SIC 2621)</b>									
Estuary or Tidal River	0	0%	0	0%	2	100%	0	0%	2
Freshwater Stream or River	3	5%	12	20%	29	48%	16	27%	60
Freshwater Stream or River & Lake or Reservoir	0	0%	0	0%	2	100%	0	0%	2
Lake or Reservoir	0	0%	1	11%	3	33%	4	44%	9
Lake or Reservoir & Estuary or Tidal River	0	0%	0	0%	1	100%	0	0%	1
<b>Total<sup>a</sup></b>	<b>3</b>	<b>4%</b>	<b>13</b>	<b>18%</b>	<b>36</b>	<b>49%</b>	<b>20</b>	<b>27%</b>	<b>74</b>
<b>Paperboard Mills (SIC 2631)</b>									
Estuary or Tidal River	0	0%	0	0%	3	100%	0	0%	3
Freshwater Stream or River	4	13%	12	40%	14	47%	0	0%	30
Freshwater Stream or River & Lake or Reservoir	0	0%	3	50%	0	0%	3	50%	6
Lake or Reservoir	3	60%	0	0%	2	40%	0	0%	5
<b>Total<sup>a</sup></b>	<b>7</b>	<b>16%</b>	<b>15</b>	<b>35%</b>	<b>19</b>	<b>44%</b>	<b>3</b>	<b>7%</b>	<b>43</b>
<b>Total Paper and Allied Products Industry (SIC 26)</b>									
Estuary or Tidal River	0	0%	0	0%	5	100%	0	0%	5
Freshwater Stream or River	13	12%	30	28%	49	45%	17	16%	109
Freshwater Stream or River & Lake or Reservoir	0	0%	4	44%	2	22%	3	33%	9
Lake or Reservoir	3	16%	1	5%	5	26%	10	53%	19
Lake or Reservoir & Estuary or Tidal River	0	0%	0	0%	1	100%	0	0%	1
<b>Total<sup>a</sup></b>	<b>16</b>	<b>11%</b>	<b>35</b>	<b>24%</b>	<b>61</b>	<b>43%</b>	<b>30</b>	<b>21%</b>	<b>143</b>

<sup>a</sup> Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000.

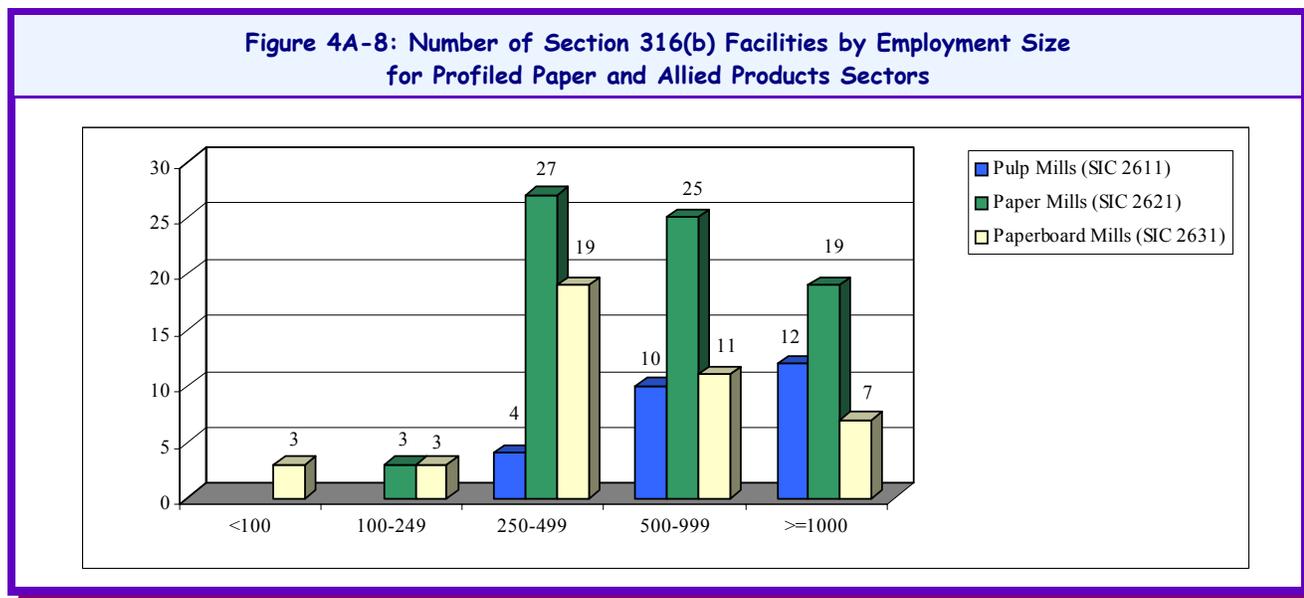
## b. Facility size

Paper and Allied Product facilities have a design intake flow of more than two MGD, withdraw from a water of the U.S., hold an NPDES permit, and use at least 25 percent of intake water for cooling purposes are generally larger than facilities that do not meet these criteria:

- ▶ Twenty-three percent of all facilities in the overall *Paper Mills* sector had fewer than 100 employees in 1992; none of the section 316(b) facilities in that sector fall into that employment category.
- ▶ Twenty-nine percent of all facilities in the *Pulp Mills* sector had fewer than 100 employees in 1992, compared with 7 percent of the section 316(b) facilities.
- ▶ Thirty-nine percent of all facilities in the *Paperboard Mills* sector had fewer than 100 employees, compared to none of the section 316(b) facilities.

The majority of section 316(b) pulp mills, 22 or 85 percent, employ 500 employees or greater. The section 316(b) paper and paperboard mills are more evenly distributed across employment categories. Twenty-seven paper mill facilities (36 percent) employ 250-499 employees, and 44 facilities (59 percent) employ 500 employees or more. Nineteen, or 44 percent, of paperboard facilities employ 250-499 employees, and 18 facilities (42 percent) employ more than 500 employees.

Figure 4A-8 shows the number of section 316(b) facilities in the profiled pulp and paper sectors by employment size category.



Source: U.S. EPA, 2000.

### c. Firm size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of existing section 316(b) facilities in the three profiled Paper and Allied Products sectors that are owned by small firms. Firms in this industry are considered small if they employ fewer than 750 people.

Table 4A-12 shows that section 316(b) facilities in this industry are predominantly owned by large firms. All of the paper and paperboard mills are owned by large firms, and ninety-two percent (68 facilities) of pulp mills are owned by large firms. Small firms own four pulp mills. An additional two pulp mill facilities are owned by firms of unknown size, which may also qualify as small firms.

SIC Code	SIC Description	Large		Small		Unknown		Total
		Number	% of SIC	Number	% of SIC	Number	% of SIC	
2611	Pulp Mills	26	100%	0	0%	0	0%	26
2621	Paper Mills	68	92%	4	5%	2	3%	74
2631	Paperboard Mills	43	100%	0	0%	0	0%	43
Total		137	96%	4	3%	2	1%	143

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

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