4D STEEL (SIC 331)

EPA's *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures* identified five 4-digit SIC codes in the Steel Works, Blast Furnaces, and Rolling and Finishing Mills Industries (SIC 331) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws 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 4D-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.

Table 4D-1: Section 316(b) Facilities in the Steel Industry (SIC 331)

SIC	SIC Description	Important Products Manufactured	Number of Weighted Detailed Questionnaire Survey Respondents		
			Total	Section 316(b) Facilities	
				No.	%
Steel Mills (SIC 3312)					
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	Hot metal, pig iron, and silvery pig iron from iron ore and iron and steel scrap; converting pig iron, scrap iron, and scrap steel into steel; hot-rolling iron and steel into basic shapes, such as plates, sheets, strips, rods, bars, and tubing; merchant blast furnaces and byproduct or beehive coke ovens	***161***	***40***	***24.9%***
Steel Products (SICs 3315, 3316, 3317)					
3315	Steel Wiredrawing and Steel Nails and Spikes	Drawing wire from purchased iron or steel rods, bars, or wire; further manufacture of products made from wire; steel nails and spikes from purchased materials	122	3	2.5%
3316	Cold-Rolled Steel Sheet, Strip, and Bars	Cold-rolling steel sheets and strip from purchased hot-rolled sheets; cold-drawing steel bars and steel shapes from hot-rolled steel bars; producing other cold finished steel	57	9	16.4%
3317	Steel Pipe and Tubes	Production of welded or seamless steel pipe and tubes and heavy riveted steel pipe from purchased materials	130	7	5.7%
Total Steel Products			***309***	***20***	***6.4%***
Other Sectors					
3313	Electrometallurgical Products, Except Steel	Ferro and nonferrous metal additive alloys by electrometallurgical or metallothermic processes, including high percentage ferroalloys and high percentage nonferrous additive alloys	***6***	***2***	***30.4%***
Total Steel (SIC 331)					
Total SIC Code 331[a]			**476**	**62**	**13.0%**

[a] 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 Questionnaire indicate that two main steel sectors account for the largest numbers of section 316(b) facilities: (1) Steel Mills (SIC code 3312) and (2) Steel Products (SIC codes 3315, 3316, and 3317). Of the 62 section 316(b) facilities in the steel industry, 40, or 65 percent, are steel mills, and 20, or 32 percent, are steel products facilities. The remainder of the steel industry profile therefore focuses on these two industry sectors.

4D.1 Domestic Production

Steel is one of the dominant products in the U.S. industrial metals industry. For most of the twentieth century the U.S. steel industry consisted of a few large companies utilizing an integrated steelmaking process to produce the raw steel used in a variety of commodity steel products. The integrated process requires very large capital investment to process coal, iron ore, limestone, and other raw materials into molten iron, which is then transformed into finished steel products (S&P, 2001). In recent decades, the integrated steel industry has undergone a dramatic downsizing as a result of increased steel imports, decreased consumption by the auto industry, and the advent of "minimills" (S&P, 2001).[1] While the traditional integrated facilities using basic oxygen furnaces (BOF) still account for a substantial percent of U.S. steel mill product production, the share of electric arc furnace (EAF) facilities using scrap steel as an input has grown steadily.[2] The range of products produced by EAFs has expanded over time. Initially, EAFs produced primarily lower-quality structural materials. Starting in the 1990s, EAFs began producing higher quality sheet products as well. All recent capacity additions have been at EAF facilities.

Basic steel mill products include carbon steel, steel alloys, and stainless steel. Steel forming and finishing operations may take place at facilities co-located with steelmaking or at separate facilities. These operations take steel (in the form of blooms, billets, and slabs) and use heating, rolling or drawing, pickling, cleaning, galvanizing, and electroplating processes in various combinations to produce finished bars, wire, sheets, and coils (semifinished steel products). Establishments that produce hot rolled products, along with basic BOF and EAF steelmaking facilities, are included in SIC 3312. SICs 3315, 3316, and 3317 perform additional processing of steel bars, wires, sheets, and coils (including cold-rolling of sheets) to produce steel products for a variety of end-uses (U.S. EPA, 1995).

The steel industry is the fourth largest energy-consuming sector. Energy costs account for approximately 20 percent of the total cost to manufacture steel. Steelmakers use coal, oil, electricity, and natural gas to fire furnaces and run process equipment. Minimill producers require large quantities of electricity to operate the electric arc furnaces used to melt and refine scrap metal, while integrated steelmakers are dependent on coal for up to 60 percent of their total energy requirements (McGraw-Hill, 1998).

[1] Large integrated producers include such companies as Bethlehem Steel, LTV, and U.S. Steel. Nucor is the largest U.S. minimill producer.

[2] Production from open hearth furnaces, which dominated production until the early 1950s, ended in 1991. BOF facilities have traditionally been referred to as integrated producers, because they combined iron-making from coke, production of pig iron in a blast furnace, and production of steel in the BOF. In recent years, some facilities have closed their coke ovens. These BOF facilities are no longer fully integrated.

a. Output

Steel mill products are sold to service centers (which buy finished steel, often process it further, and sell to a variety of fabricators, manufacturers, and construction industry clients), to vehicle producers, and to the construction industry. The rapid growth in sales of heavy sports utility vehicles contributed to increased steel consumption in the U.S. in the 1990s. Efforts to increase the fuel efficiency of vehicles has eroded steel's position in the automotive market as a whole, however, as aluminum and plastic has replaced steel in many automotive applications. Other end-uses for steel include a wide range of agricultural, industrial, appliance, transportation, and container applications. Use of steel in beverage cans has been largely replaced by aluminum.

Table 4D-2 shows trends in production from the two major groups of steel producers: BOF and EAF facilities.

Table 4D-2: Steel Production by Type of Producer

Year	Steel Production		Percent from BOF	Percent from EAF
	Million MT	% Change		
1990[a]	89.7	n/a	59.1%	37.3%
1991[b]	79.7	-11.1%	60.0%	38.4%
1992	84.3	5.8%	62.0%	38.0%
1993	88.8	5.3%	60.6%	39.4%
1994	91.2	2.7%	60.7%	39.3%
1995	95.2	4.4%	59.6%	40.4%
1996	95.5	0.3%	57.4%	42.6%
1997	98.5	3.1%	56.2%	43.8%
1998	98.6	0.1%	54.9%	45.1%
1999	97.4	-1.2%	53.7%	46.3%
2000	106	8.8%	53.8%	46.2%
Total Percent Change 1990-2000	18.2%			
Average Annual Growth Rate change	1.7%			
Jan-July 2000	68.5	n/a	53.8%	46.2%
Jan-July 2001	60.1	-12.3%	53.2%	46.8%

[a] 3.5 percent of 1990 production was from open hearth furnaces.
[b] 1.6 percent of 1991 production was from open hearth furnaces.

Source: AISI, 2001b; USGS, 2000; USGS, 1997; USGS, Iron and Steel Statistical Compendium.

This table shows the cyclical nature of basic steel production, with variations in growth from year to year reflecting general U.S. and world economic conditions, a world oversupply of steel capacity, the competitive strength of imports, and trends in steel's share of the automotive and other end-use markets for steel sectors. The U.S. steel industry went through a difficult restructuring process in the 1980s and early 1990s, including the closing of a number of inefficient mills, substantial investment in new technologies, and reductions in the labor force. The U.S. became a world leader in low-cost production, lead by the minimill producers. While U.S. demand for steel was strong in the late 1990s, however, there was a dramatic increase in low-price imports in 1998 which lead to a number of U.S. steel bankruptcies and steelworker layoffs. This import crisis resulted from the Asian financial crisis, with the associated decline in Asian demand for steel and currency devaluations. The President initiated the Steel Action Program in response to the crisis, focusing on strong enforcement of trade laws through the World Trade Organization and bilateral efforts to address market-distorting practices abroad.[3] The industry began to show signs of recovery in the second half of 1999, and by early 2000 capacity utilization recovered to above 90 percent and earnings were up for most major steel companies (U.S. DOC, 2000). Softness in the U.S. economy starting in 2000 resulted in significant decreases in steel demand, however. As a result, U.S steel production declined by 12 percent in the first seven months of 2001 compared with the same period in 2000 (AISI, 2001b and 2001c; S&P, 2001).

Value of shipments and ***value added*** provide measures of the value of output that can be compared with other industries.[4] Historical trends 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 inputs used to make the products sold.

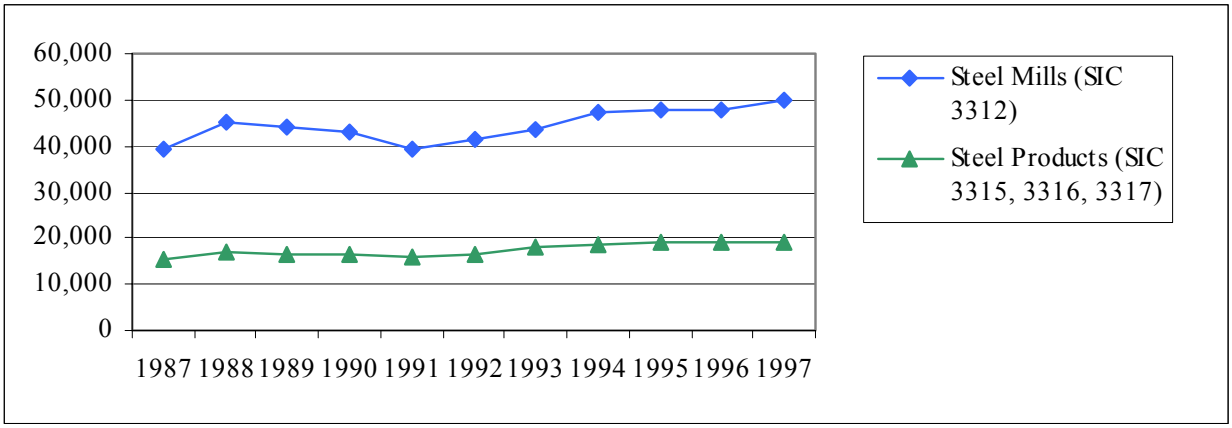
Using the relevant producer price index, value of shipments and value added for steel mills and steel products were adjusted for the changes in steel product prices. Figure 4D-1 presents trends in constant-dollar value of shipments and value added for steel mills and steel products. Value of shipments and value added from SIC 3312 (basic steel) declined in the early 1990s, and recovered through 1997, prior to the 1998 import crisis. Value of shipments and value added for steel products (SICs 3315, 3316 and 3317) were less volatile, increasing gradually over the period 1990 through 1997.

[3] World steel trade is characterized by noncompetitive practices in a number of countries, which have resulted in substantial friction over trade issues since the late 1960s. Since 1980, almost 40 percent of the unfair trade practice cases investigated in the U.S. have been related to steel products (U.S. DOC, 2000).

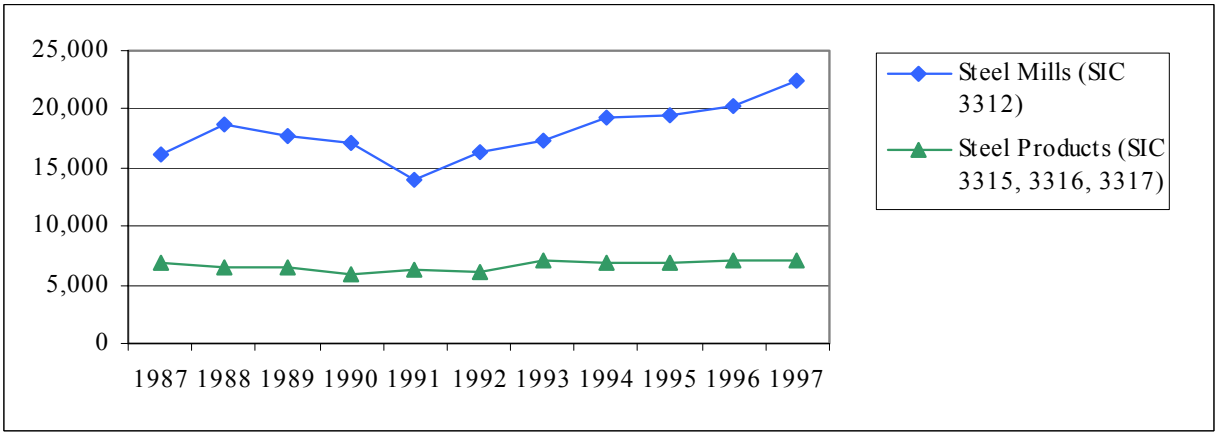
[4] Terms highlighted in bold and italic font are further explained in the glossary.

Figure 4D-1: Real Value of Shipments and Value Added for Profiled Steel Industry Sectors (in millions, constant $2000)

Value of Shipments



Value Added



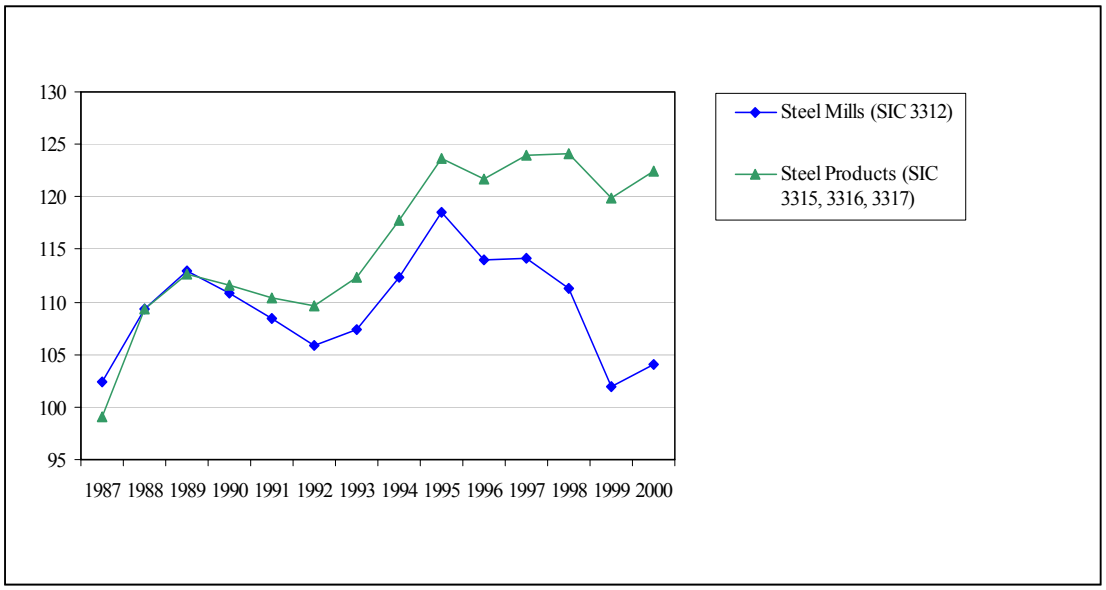
Source: U.S. DOC, 1988-1991 and 1993-1996; US. DOC, 1987, 1992, 1997.

b. Prices

The ***producer price index*** (PPI) is a family of indexes that measure price changes from the perspective of the seller. It is an indicator of product prices and is used to inflate nominal monetary values to constant dollars. This profile uses PPIs at the 4-digit SIC code level to convert nominal values to 2000 dollars.

Figure 4D-2 below shows that prices increased from 1987 to 1989 and then decreased in the early 1990s, due to a depressed domestic economy and the resulting decline in the demand for steel. Prices rebounded sharply through 1995 before eroding again, due to the global oversupply and increases in exports discussed earlier. Basic steel prices declined sharply with the growth of imports in the late 1990s, recovered in 2000, but have dropped again in 2001 with the decline in demand for steel (S&P, 2001; AISI, 2001a).

Figure 4D-2: Producer Price Index for Profiled Steel Industry Sectors



Source: BLS, 2000.

c. Number of facilities and firms

The number of steel mills fluctuated significantly between 1989 and 1998, as the U.S. industry underwent a substantial restructuring. Table 4D-3 shows substantial decreases in the number of facilities in 1992 and 1993 due to a significant decrease in the global demand for steel products and the resulting overcapacity. This decrease was followed by a significant recovery in 1995 and 1996. The import crisis in 1998 ultimately led to bankruptcy for a number of U.S. producers, including LTV and most recently Bethlehem Steel (S&P, 2001).

In contrast to the volatility and overall decrease in the number of steel mills, the number of facilities in the Steel Products sector has remained relatively stable for the past ten years, with only small decreases between 1994 and 1997.

Table 4D-3: Number of Facilities in the Profiled Steel Industry Sectors

Year	Steel Mills (SIC 3312)		Steel Products (SIC 3315, 3316, 3317)	
	Number of Facilities	Percent Change	Number of Facilities	Percent Change
1989	476	n/a	784	n/a
1990	497	4.4%	776	-1.0%
1991	531	6.8%	807	4.0%
1992	412	-22.4%	831	3.0%
1993	343	-16.7%	833	0.2%
1994	339	-1.2%	804	-3.5%
1995	391	15.3%	791	-1.6%
1996	483	23.5%	770	-2.7%
1997	297	-38.5%	727	-5.6%
1998	346	16.9%	801	10.2%
Total Percent Change 1989-1998	*-27.3%*		*2.2%*	
Average Annual Growth Rate	*-3.5%*		*0.2%*	

Source: U.S. SBA, 2000.

The trend in the number of firms over the period between 1990 and 1998 has been similar to the trend in the number of facilities in both industry sectors. The number of firms in the Steel Mill sector decreased from a high of 433 in 1991 to a low of 216 in 1997, before increasing slightly in 1998. According to the American Iron and Steel Institute (AISI), 23 U.S. steel companies either declared bankruptcy or ceased operations entirely through September 2001 since 1997, as a result on the continuing trade crisis (AISI, 2001a). The number of firms in the Steel Products sector has also decreased steadily in recent years from its peak of 661 in 1992, reflecting consolidation in ownership of capacity.

Table 4D-4 shows the number of firms in the two profiled steel sectors between 1990 and 1998.

Table 4D-4: Number of Firms in the Profiled Steel Industry Sectors

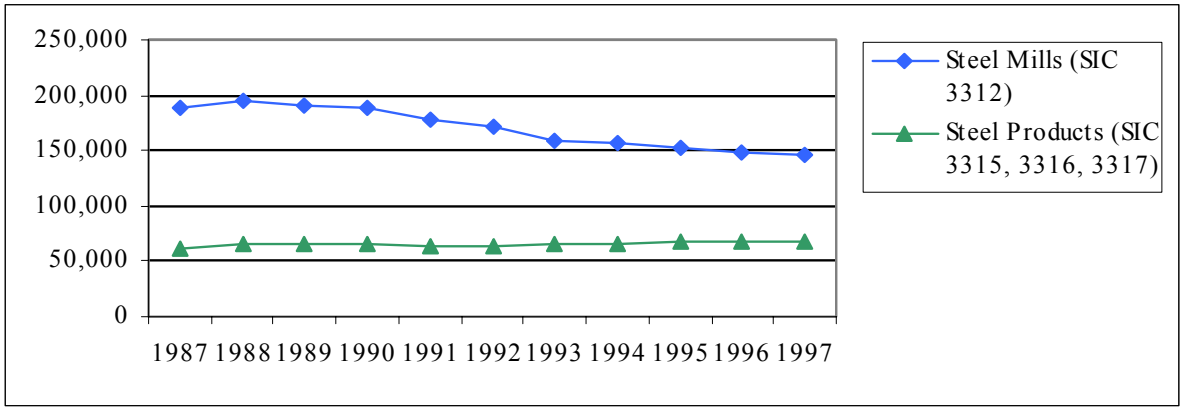
Year	Steel Mills (SIC 3312)		Steel Products (SIC 3315, 3316, 3317)	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	408	n/a	597	n/a
1991	433	6.1%	635	6.4%
1992	321	-25.9%	661	4.1%
1993	261	-18.7%	641	-3.0%
1994	258	-1.1%	618	-3.6%
1995	309	19.8%	607	-1.8%
1996	397	28.5%	583	-4.0%
1997	216	-45.6%	544	-6.7%
1998	267	26.3%	541	-0.6%
Total Percent Change 1990-1998	*-34.6%*		*-9.4%*	
Average Annual Growth Rate	*-5.2%*		*-1.2%*	

Source: U.S. SBA, 2000.

d. Employment and productivity

Employment is a measure of the level and trend of activity in an industry. Figure 4D-3 below provides information on employment from the Annual Survey of Manufactures for the Steel Mills and Steel Products sectors. The figure shows that employment levels in the Steel Mills industry decreased by a total of 23 percent between 1987 and 1997. Employment is a primary cost component for steelmakers, accounting for approximately 30 percent of total costs (McGraw-Hill, 1998). Lowering labor costs enabled the steel mills to improve profitability and competitiveness given the limited opportunity to raise prices in the competitive market for steel products. The steady declines in employment reflect the decreasing number of steel mill facilities and firms, in conjunction with aggressive efforts to improve worker productivity in order to cut labor costs and improve profits (McGraw-Hill, 1998). Employment declined further as a result of the 1998 import crisis, with almost 26,000 U.S. steelworkers reportedly losing their jobs (AISI, 2001a). Employment in the Steel Products sector over the period 1987-1997 showed a steady positive trend.

Figure 4D-3: Employment for Profiled Steel Industry Sectors



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

Table 4D-5 presents the change in value added per labor hour, a measure of ***labor productivity***, for the Steel Mill and Steel Products sectors between 1987 and 1997. Labor productivity at steel mills has increased substantially over this time period. Value added per labor hour increased 66 percent between 1987 and 1997. This increase reflects the efforts by steel mills to improve worker productivity in order to cut labor costs and improve profits. Much of the increase in labor productivity can be attributed to the restructuring of the U.S. steel industry and the increased role of minimills in production. Minimills are capable of producing rolled steel from scrap with substantially lower labor needs than integrated mills (McGraw-Hill, 1998). Labor productivity in the steel products sector has also fluctuated, but decreased 3 percent overall from 1987 to 1997.

Table 4D-5: Productivity Trends for the Profiled Steel Industry Sectors (in millions, constant $2000)

Year	Steel Mills (SIC 3312)				Steel Products (SIC 3315, 3316, 3317)			
	Value Added	Production Hours (millions)	Value Added/Hour		Value Added	Production Hours (millions)	Value Added/Hour	
			Number	Percent Change			Number	Percent Change
1987	16,067	306	53	n/a	6894	108	64	n/a
1988	18,608	324	57	8%	6480	94	69	8%
1989	17,815	348	51	-11%	6420	112	57	-17%
1990	17,177	315	55	8%	5939	93	64	12%
1991	13,990	279	50	-9%	6274	106	59	-8%
1992	16,303	277	59	18%	6160	87	71	20%
1993	17,358	268	65	10%	7078	109	65	-8%
1994	19,212	266	72	11%	6829	91	75	15%
1995	19,495	263	74	3%	6857	114	60	-20%
1996	20,192	260	78	5%	7158	134	54	-10%
1997	22,347	253	88	13%	7,010	113	62	15%
Total Percent Change 1987-1997	*39.1%*	*-17.3%*	*66.0%*		*1.7%*	*4.6%*	*-3.1%*	
Average Annual Growth Rate	*3.4%*	*-1.9%*	*5.2%*		*0.2%*	*0.5%*	*-0.3%*	

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

e. Capital expenditures

Steel production is a relatively capital intensive process. Capital-intensive industries are characterized by large, technologically complex manufacturing facilities which reflect the economies of scale required to manufacture products efficiently. The integrated production process requires large capital investments of approximately $2,000 per ton of capacity for plants and equipment to support the large-scale production capacities needed to keep unit costs low. The nonintegrated process employed in minimills is significantly less capital intensive with capital costs of approximately $500 per ton of capacity (McGraw-Hill, 1998).

New capital expenditures are needed to modernize, expand, and replace existing capacity to meet growing demand. Capital expenditures in the Steel Mills and the Steel Products sectors between 1987 and 1997 are presented in Table 4D-6 below. The table shows that, while capital expenditures in the Steel Products sector have fluctuated dramatically from one year to the next, the level of capital expenditures by Steel Mills more than doubled between 1987 and 1997. The majority of this increase was realized in the late 1980s and early 1990s, when capital expenditures increased by a total of 131 percent from 1987 to 1991. This substantial increase coincides with the advent of thin slab casting, a technology that allowed minimills to compete in the market for flat rolled sheet steel. The significant decreases in capital expenditures by steel mills that followed this expansion reflects the bottoming out of the demand for steel products in the early 1990s. The recovery in capital expenditures in the mid 1990s reflected increased demand and high utilization rates (McGraw-Hill, 1998). The import crisis of the late 1990s has put pressure on the domestic industry, and expenditures for new capacity are likely to have decreased since 1997 (McGraw-Hill, 2000).

Table 4D-6: Capital Expenditures for the Profiled Steel Industry Sectors (in millions, constant $2000)

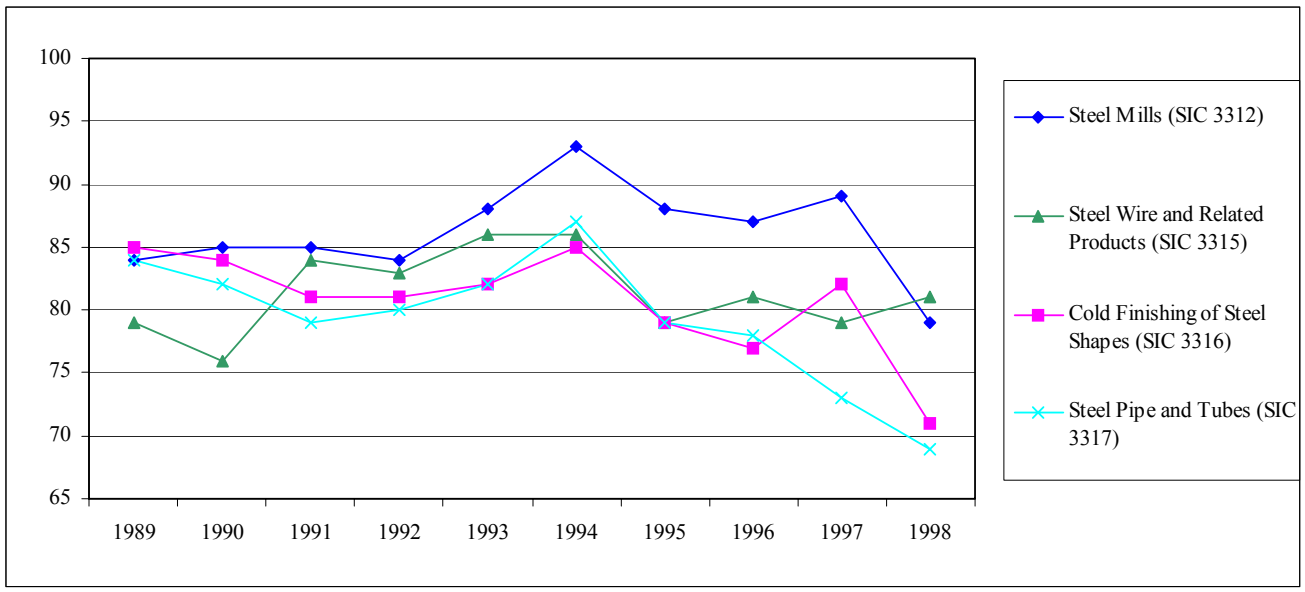
Year	Steel Mills (SIC 3312)		Steel Products (SIC 3315, 3316, 3317)	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	1,241	n/a	661	n/a
1988	1,801	45.1%	479	-27.5%
1989	2302	27.8%	556	16.1%
1990	2400	4.3%	575	3.4%
1991	2868	19.5%	434	-24.5%
1992	2175	-24.2%	458	5.5%
1993	1724	-20.7%	498	8.7%
1994	2420	40.4%	554	11.2%
1995	2414	-0.2%	528	-4.7%
1996	2573	6.6%	587	11.2%
1997	2,513	-2.3%	590	0.5%
Total Percent Change 1987-1997	*102.5%*		*-10.7%*	
Average Annual Growth Rate	*7.3%*		*-1.1%*	

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 and is used as a key barometer of an industry's health. Capacity utilization is an index used to identify potential excess or insufficient capacity in an industry which can help to project whether new investment is likely. Figure 4D-4 presents the capacity utilization index from 1989 to 1998 for the 4-digit SIC codes that make up the Steel Mill and Steel Products sectors. As shown in the figure, the index follows similar trends in each SIC code. For all sectors, capacity utilization peaked in 1994 and has decreased through most of the late 1990s. This trend reflects the over-capacity in the U.S. steel industry that has followed the substantial capacity additions in the late 1980s and early 1990s and increased imports throughout the 1990s.

Figure 4D-4: Capacity Utilization Rates (Fourth Quarter) for Profiled Steel Industry Sectors



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

4D.2 Structure and Competitiveness

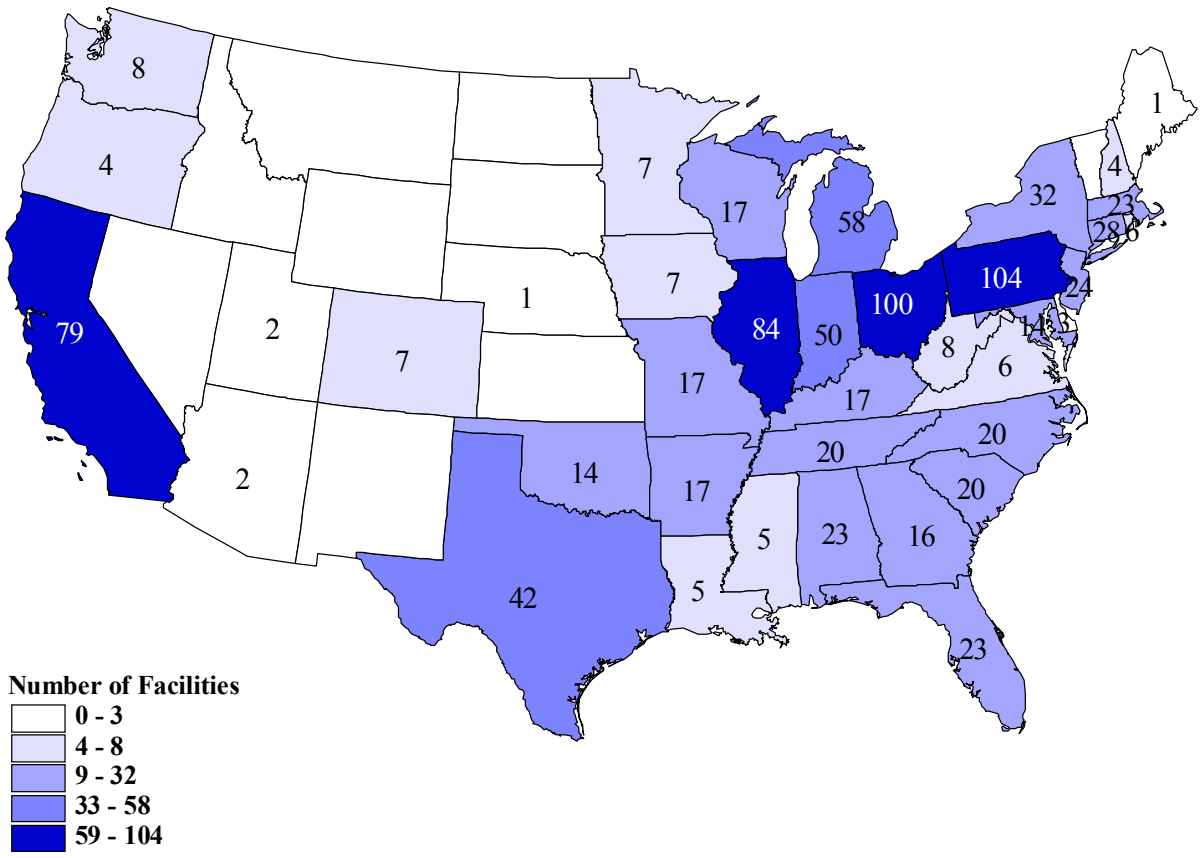
The companies that manufacture steel operate in a highly capital intensive industry. The steel mill industry is comprised of two different kinds of facilities, integrated mills and minimills. The integrated steelmaking process requires expensive plant and equipment purchases that will support production capacities ranging from two million to four million tons per year. Until the early 1960s integrated steelmaking was the dominant method of steel manufacturing in the U.S. Since then, the integrated steel business has undergone dramatic downsizing due to competition from minimills and imports. These trends have reduced the number of integrated steelmakers (S&P, 2000). Minimills vary in size, from capacities of 150,000 tons at small facilities to larger facilities with annual capacities of between 400,000 tons and two million tons. Integrated companies have significant capital costs of approximately $2,000 per ton of capacity compared with minimills' $500 per ton. Because minimills do not require as much investment in capital equipment as integrated steelmakers, minimills have been able to lower prices, driving integrated companies out of many of the commodity steel markets (S&P, 2000). The advent of minimills, with their lower initial capital investments, has made it easier for firms to enter the market.

a. Geographic Distribution

Steel mills are primarily concentrated in the Great Lakes Region (New York, Pennsylvania, Ohio, Indiana, Illinois, and Michigan). Historically, mill sites were selected for their proximity to water (both for transportation and for use in cooling and processing) and the sources of their raw materials, iron ore and coal. The geographic concentration of the industry has begun to change as minimills can be built anywhere where electricity and scrap are available at a reasonable cost and where a local market exists (U.S. EPA, 1995). The Steel Products sector is concentrated in the Great Lakes region and California. Ohio, Illinois, Pennsylvania, Michigan, and California manufactured 41 percent of all steel products in the U.S.

Figure 4D-5 below shows the distribution of U.S. steel mills and steel products facilities.

Figure 4D-5: Geographical Distribution of Facilities in the Profiled Steel Industry Sectors



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

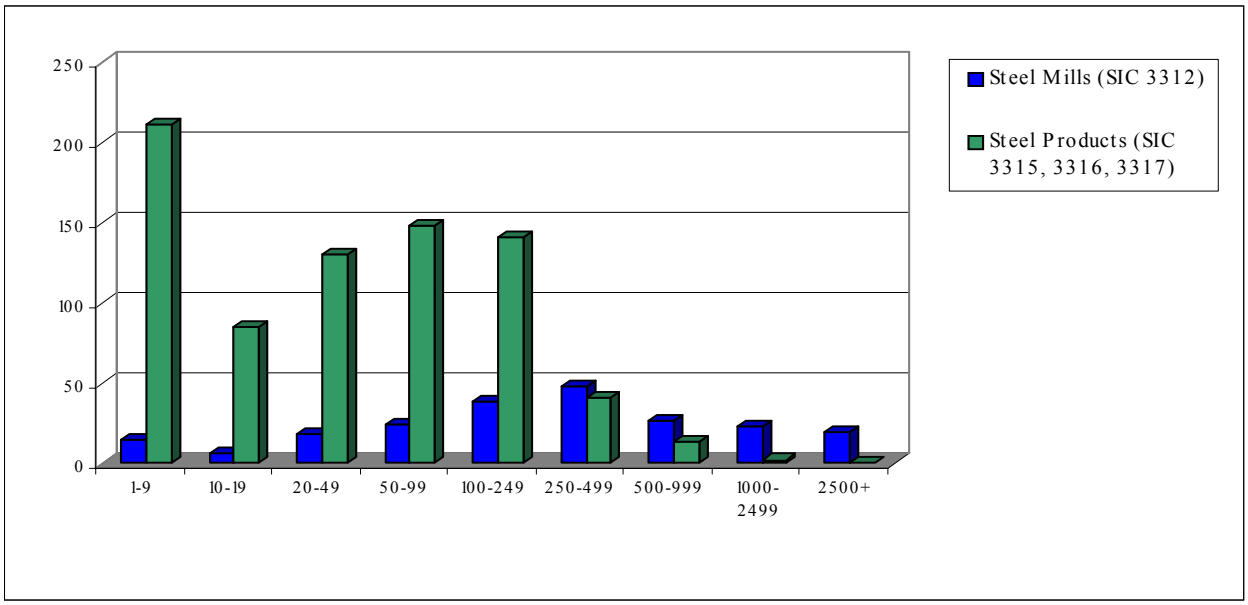
b. Facility size

Seventy-one percent of all steel mills employed 100 or more employees in 1992, as shown in Figure 4D-6. The vast majority, approximately 98 percent, of industry value of shipments in the same year was produced by facilities with more than 100 employees. Facilities with more than 1,000 employees accounted for approximately 69 percent of all steel mill shipments. Data from the 1997 Census of Manufactures for Iron and Steel Mills (NAICS 331111), which is roughly comparable to the SIC 3312 data shown in Figure 4D-6, shows that the 11 percent of facilities with more than 1,000 employees accounted for 63 percent of industry value of shipments in 1997, reflecting growth in the role of minimills from 1992 to 1997.

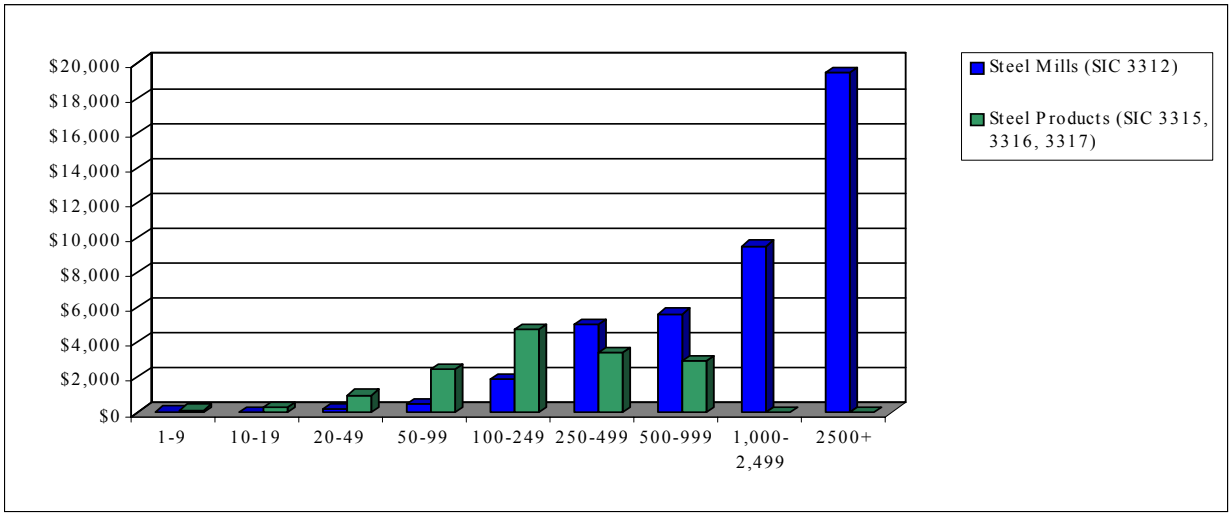
The Steel Products sector is characterized by smaller facilities than steel making, with only 26 percent of facilities in the steel product industry employing 100 or more employees in 1992. While the majority of facilities in the Steel Products sector employed less than 100 people, most of the output from this sector was produced at the largest facilities. Figure 4D-6 shows that steel products facilities with more than 100 employees accounted for approximately 74 percent of the industry's 1992 value of shipments.

Figure 4D-6: Value of Shipments and Number of Facilities by Employment Size Category for the Profiled Steel Industry 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 profiled steel industries according to the firms' number of employees. Firms in both Steel Mills (SIC 3312) and Steel Products (SIC 3315, 3316, and 3317) are defined as small if they have 1,000 or fewer employees. Table 4D-7 below shows the distribution of firms, facilities, and receipts by the employment size of the parent firm.

The size categories reported in the Statistics of U.S. Businesses (SUSB) do not coincide with the SBA small firm standard of 1,000 employees. It is therefore not possible to apply the SBA size thresholds precisely. The SUSB data presented in Table 4D-6 show that in 1997, 141 of 216 firms in the Steel Mills sector had less than 500 employees. Therefore, at least 65 percent of firms in this sector were classified as small. These small firms owned 143 facilities, or 48 percent of all facilities in the sector, and accounted for 5 percent of industry receipts. In contrast, the 75 largest firms that employ over 500 employees own 52 percent of all facilities in SIC 3312 and are responsible for 95 percent of all industry receipts. Some of these 75 firms may be defined as small under SBA Standards.

Of the 544 ultimate parent firms with facilities that manufacture steel products, 435, or 80 percent, employ fewer than 500 employees, and are therefore considered small businesses. Small firms own 65 percent of facilities in the industry and account for 28 percent of industry receipts. The 109 larger firms that employ over 500 employees own 109 of the 727 facilities in SIC codes 3315, 3316, and 3317 and are responsible for 72 percent of all industry receipts. Again, some of these 109 firms may be classified as small under the SBA Standards.

Table 4D-7: Number of Firms, Facilities, and Estimated Receipts in the Profiled Steel Industry Sectors by Employment Size Category, 1997

Employment Size Category	Steel Mills (SIC 3312)			Steel Products (SIC 3315, 3316, 3317)		
	Number of Firms	Number of Facilities	Estimated Receipts (in millions, constant $2000)	Number of Firms	Number of Facilities	Estimated Receipts (in millions, constant $2000)
0-19	74	74	277	211	211	348
20-99	31	31	116	128	136	1,453
100-499	36	38	2,204	96	126	3,516
500+	75	154	49,018	109	254	13,922
Total	*216*	*297*	*51,615*	*544*	*727*	*19,240*

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.[5] 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

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

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 Steel Mills (SIC 3312) and Steel Products sectors (SICs 3315, 3316, 3317) are considered competitive, based on standard measures of concentration. The CR4 and the HHI for all the relevant SIC codes are below the benchmarks of 50 percent and 1,000, respectively. The concentration ratios presented in Table 4D-8 indicate that the majority of the output generated in these industry sectors is not concentrated in a few large firms. Moreover, the table shows that each of the industry sectors has became more competitive between 1987 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 and coverage ratios in Table 4D-8 show that steel mills (SIC 3312) are highly specialized in the production of steel products. These establishments also account for virtually all of the steel mill product produced in the U.S. Steel Product establishments classified in SIC codes 3315, 3316, and 3317 are also highly specialized, although 20 percent of production in SIC code 3316 are products classified in a different industry. Establishments in SIC codes 3316 and 3317 account for over 95 percent of U.S. production of their primary products, and SIC 3315 accounts for 88 percent. More recent data from the 1997 Census of Manufactures (based on NAICS codes) shows similar specialization and coverage ratios for these industries.

Table 4D-8: Selected Ratios for the Profiled Steel Industry Sectors

SIC Code	Year	Total Number of Firms	Concentration Ratios					Specialization Ratio	Coverage Ratio
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index		
Steel Mills									
3312	1987	271	44%	63%	81%	94%	607	98%	97%
	1992	135	37%	58%	81%	96%	551	98%	97%
Steel Products									
3315	1987	274	21%	34%	54%	78%	212	96%	88%
	1992	271	19%	32%	54%	80%	201	96%	88%
3316	1987	156	45%	62%	82%	95%	654	80%	94%
	1992	158	43%	60%	81%	96%	604	80%	95%
3317	1987	155	23%	34%	58%	85%	242	91%	92%
	1992	166	19%	31%	53%	80%	194	95%	97%

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

e. Foreign trade

The global market for steel continues to be extremely competitive. From 1945 until 1960, the U.S. steel industry enjoyed a period of tremendous prosperity and was a net exporter until 1959. However, by the early 1960s, foreign steel industries had thoroughly recovered from World War II and had begun construction of new plants that were more advanced and efficient than the U.S. integrated steel mills. Foreign producers also enjoyed lower labor costs, allowing them to take substantial market share from U.S. producers. This increased competition from foreign producers, combined with decreased consumption in some key end use markets, served as a catalyst for the restructuring and downsizing of the U.S. steel industry. The industry has emerged from this restructuring considerably smaller, more technologically advanced and internationally competitive (S&P, 2000).

This profile uses two measures of foreign competition: ***export dependence*** and ***import penetration***. Export dependence is the share of value of shipments that is exported. Import penetration is the share of implied domestic consumption met by imports. Table 4D-9 presents trade statistics for the profiled steel industry sectors from 1990 to 2000. The table shows that while the trend in export dependence has been relatively stable, import penetration has been increasing since the early 1990s. Historically, the U.S. steel industry has exported a relatively small share of shipments when compared to steel industries in other developed nations (McGraw-Hill, 2000). U.S. exports rose in 1995 to the highest level since 1941, but steel exports only accounted for only 7 percent of shipments that year. Imports as a percentage of implied domestic consumption rose to an estimated 30 percent in 1998, from 18 percent in the early 1990s. This increase in imports reflects excess steel capacity worldwide and the competitiveness of foreign steel producers, as described previously. The AISI reports that imports have continued high through August 2001, although 26 percent lower than during the first eight months of 2000 (reflecting a decline in U.S. demand for steel), after the three highest annual import volumes in the period 1998 through 2000 (AISI, 2001a).

Table 4D-9: Import Share and Export Dependence: Steel Mill Products (in thousand metric tons)

Year	Raw Steel Production	Imports	Exports	Shipments	Implied Domestic Consumption[a]	Import Penetration[b]	Export Dependence[c]
1990	89,700	15,600	3,900	77,100	88,800	18%	5%
1991	79,700	14,400	5,760	71,500	80,140	18%	8%
1992	84,300	15,500	3,890	74,600	86,210	18%	5%
1993	88,800	17,700	3,600	80,800	94,900	19%	4%
1994	91,200	27,300	3,470	86,300	110,130	25%	4%
1995	95,200	22,100	6,420	88,400	104,080	21%	7%
1996	95,500	26,500	4,560	91,500	113,440	23%	5%
1997	98,500	28,300	5,470	96,000	118,830	24%	6%
1998	98,600	37,700	5,010	92,900	125,590	30%	5%
1999	97,400	32,400	4,920	96,300	123,780	26%	5%
2000[d]	106,000	36,800	6,000	105,000	135,800	27%	6%
Total Percent Change 1990-2000	*18.2%*	*135.9%*	*53.8%*	*36.2%*	*52.9%*		
Average Annual Growth Rate	*1.7%*	*9.0%*	*4.4%*	*3.1%*	*4.3%*		

[a] Calculated by EPA as shipments + imports - exports.
[b] Calculated by EPA as imports divided by implied domestic consumption.
[c] Calculated by EPA as exports divided by shipments.
[d] Estimated

Source: USGS, 2001; USGS, 1999, USGS, 1997; USGS, 1994; USGS, Historical Statistics for Mineral Commodities in the US.

4D.3 Financial Condition and Performance

The steel industry is generally characterized by relatively large plant sizes and technologically complex production processes which reflect the economies of scale required to manufacture steel efficiently. Because of the high fixed costs associated with steel manufacturing operations, larger production volumes are required to spread these costs over a greater number of units in order to maintain profitability. ***Operating margins*** for steel producers can be volatile due to changes in raw material costs, energy costs, and production levels relative to capacity (S&P, 2001).

Table 4D-10 presents trends in operating margins for steel mills and steel products manufacturers. The table shows that operating margins were relatively stable in both industry sectors between 1987 and 1997. The decrease in operating margins for steel mills and, to a lesser extent, steel products producers in 1991 resulted from a worldwide decrease in steel consumption (McGraw-Hill, 1998).

Table 4D-10: Operating Margins for the Profiled Steel Industry Sectors (in millions, constant $2000)

Year	Steel Mills (SIC 3312)				Steel Products (SIC 3315, 3316, 3317)			
	Value of Shipments	Cost of Materials	Payroll (all employees)	Operating Margin	Value of Shipments	Cost of Materials	Payroll (all employees)	Operating Margin
1987	$39,209	$23,251	$6,528	24.1%	$15,217	$9,830	$2,022	22.1%
1988	$45,284	$27,430	$6,693	24.6%	$16,845	$10,850	$2,055	23.4%
1989	$44,084	$26,678	$6,597	24.5%	$16,378	$10,730	$1,988	22.3%
1990	$43,172	$26,269	$6,885	23.2%	$16,393	$10,804	$2,081	21.4%
1991	$39,158	$24,748	$6,664	19.8%	$15,959	$10,598	$2,088	20.5%
1992	$41,537	$24,984	$6,923	23.2%	$16,722	$10,891	$2,231	21.5%
1993	$43,401	$26,073	$6,786	24.3%	$17,981	$11,599	$2,343	22.5%
1994	$46,994	$28,054	$6,748	25.9%	$18,744	$11,954	$2,302	23.9%
1995	$47,892	$28,725	$6,589	26.3%	$18,990	$12,309	$2,297	23.1%
1996	$47,538	$29,859	$6,805	22.9%	$18,850	$12,152	$2,370	23.0%
1997	$49,777	$29,699	$6,789	26.7%	$18,947	$11,989	$2,414	24.0%
Total Percent Change 1987-1997	*27%*	*28%*	*4%*		*25%*	*22%*	*19%*	
Annual Average Growth Rate	*2.4%*	*2.5%*	*0.4%*		*2.2%*	*2.0%*	*1.8%*	

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

The sharp decline in prices caused by the import surge in 1998 and low operating rates resulted in reduced profitability for U.S. producers. The industry reported an operating loss of $51 million in the first half of 1999, compared with an operating profit of $537 million in the first half in the first half of 1998. Federal legislation was passed in August 1999 authorizing federal loan guarantees of up to $1 billion to the steel industry, to allow steel companies to borrow at market rates to modernize their plants (McGraw-Hill, 2000). Standard & Poor's reported that low operating rates, decreased volume, and lower product prices again led to operating losses for the eight largest steelmakers in the first quarter of 2001, compared with operating profits in the first quarter of 2000. As of June 2001, eight U.S. steel producers had gone bankrupt in the prior two years, including LTV and Trico Steel (a minimill joint venture), (S&P, 2001).

4D.4 Facilities Operating Cooling Water Intake Structures

In 1982, the Primary Metals industries as a whole (including Nonferrous and Steel producers) withdrew 1,312 billion gallons of cooling water, accounting for approximately 1.7 percent of total industrial cooling water intake in the United States. The industry ranked 3rd in industrial cooling water use, behind the electric power generation industry, and the chemical industry (1982 Census of Manufactures).

This section 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 section 316(b) New Facility Rule and are therefore not subject to this regulation. However, they meet the criteria of the 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 EPA's *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures* found that an estimated 40 out of 158 steel mills (25 percent) and 19 out of 312 steel product manufacturers (6 percent) meet the characteristics of a section 316(b) facility.

Minimills use electric-arc-furnace (EAF) to make steel from ferrous scrap. The electric-arc-furnace is extensively cooled by water and recycled through cooling towers (U.S. EPA, 1995). This is important to note since most new steel facilities are minimills.

Steel section 316(b) facilities use cooling water for a combination of purposes, including contact and non-contact production line or process cooling, electricity generation, and air conditioning:

- All section 316(b) steel mills use cooling water for production line (or process) contact or noncontact cooling. The other major uses of cooling water by steel mills are air conditioning (69 percent), electric generation (43 percent), and other uses (40 percent).

- Ninety-five percent (18 facilities) of section 316(b) steel product facilities use cooling water for production line (or process) contact or noncontact cooling. Other major uses of cooling water for steel product facilities include other uses (79 percent), air conditioning (33 percent), and electric generation (6 percent).

Table 4D-11 shows the distribution of existing section 316(b) facilities in the profiled steel sectors by type of water body and cooling system. The table shows that most of the existing section 316(b) facilities employ a combination of a once-through and recirculating system (25, or 41%) or a once through system (20, or 33%). The largest proportion of existing facilities draw water from a freshwater stream or river (49, or 82%).

Table 4D-11: Number of Section 316(b) Facilities in the Profiled Steel Industry Sectors by Water Body Type and Cooling System Type

Water Body Type	Cooling Systems								Total
	Recirculating		Combination		Once-Through		Unknown		
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Steel Mills (SIC 3312)									
Freshwater Stream or River	3	10%	10	32%	12	40%	5	18%	30
Great Lake	0	0%	9	88%	1	12%	0	0%	10
Total [†]	***3***	***8%***	***18***	***46%***	***13***	***33%***	***5***	***13%***	***40***
Steel Products (SIC 3315, 3316, 3317)									
Freshwater Stream or River	6	33%	6	33%	6	33%	0	0%	19
Lake or Reservoir	0	0%	0	0%	0	0%	1	100%	1
Total [†]	***6***	***31%***	***6***	***31%***	***6***	***31%***	***1***	***6%***	***20***
Total for Profiled Steel Industry (SIC 3312, 3315, 3316, 3317)									
Freshwater Stream or River	9	19%	16	32%	19	38%	5	11%	49
Great Lake	0	0%	9	88%	1	12%	0	0%	10
Lake or Reservoir	0	0%	0	0%	0	0%	1	100%	1
Total [a]	***9***	***16%***	***25***	***41%***	***20***	***33%***	***7***	***11%***	***60***

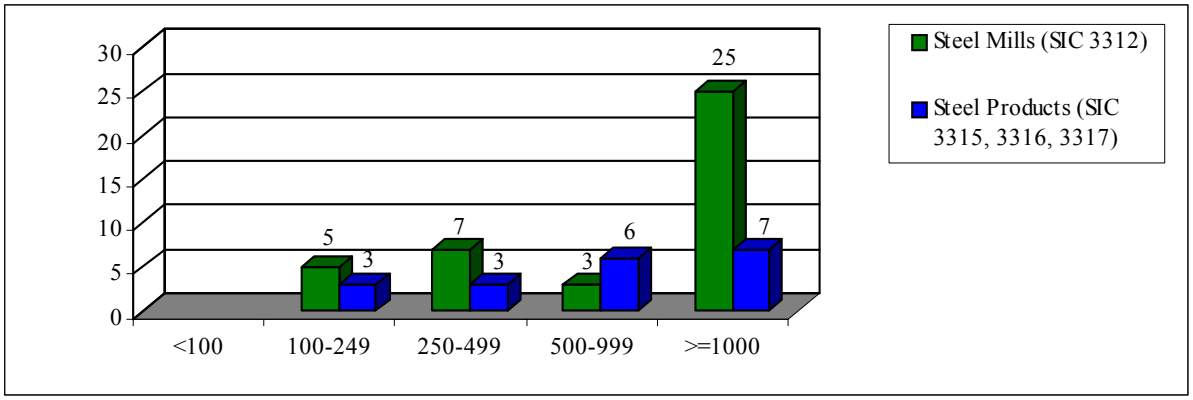
[a] Individual numbers may not add up to total due to independent rounding.

Source: U.S. EPA, 2000.

b. Facility size

The distribution of employment for section 316(b) facilities for steel mills and steel products tends to be larger than the distribution for their respective industries. Sixty-three percent of 316(b) steel mills employ over 1,000 people. None of the 316(b) steel product manufacturers employ less than 100 people.

Figure 4D-7: Number of Section 316(b) Facilities in the Profiled Steel Industry Sectors by Employment Size



Source: U.S. EPA, 2000.

d. Firm size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of existing section 316(b) profiled steel industry facilities owned by small firms. Table 4D-12 shows that of the 40 section 316(b) steel mills, 6, or 16 percent, are owned by small firms. There are three section 316(b) steel product facilities that are owned by a small firm.

Table 4D-12: Number of Section 316(b) Facilities by Firm Size for the Profiled Steel Sectors

SIC Code	Large		Small		Total
	Number	% of SIC	Number	% of SIC	
Steel Mills (SIC 3312)					
3312	***34***	***84%***	***6***	***16%***	***40***
Steel Products (SIC 3315, 3316, 3317)					
3315	3	100%	0	0%	3
3316	6	67%	3	33%	9
3317	7	100%	0	0%	7
Total†	**17**	**84%**	**3**	**16%**	**20**
Total for Profiled Steel Facilities (SIC 3312, 3315, 3316, 3317)					
Total[a]	**51**	**84%**	**9**	**16%**	**60**

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

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

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