

## SILICON

(Data in thousand metric tons of silicon content, unless otherwise noted)

**Domestic Production and Use:** Estimated value of silicon metal and alloys (excluding semiconductor-grade silicon) produced in the United States in 1999 was about \$500 million. Ferrosilicon was produced by six companies in six plants, and silicon metal was produced by four companies in seven plants. Two of the eight companies in the industry produced both products. Most of the ferrosilicon and silicon metal plants were east of the Mississippi River or in the Pacific Northwest. Most ferrosilicon was consumed in the ferrous foundry and steel industries, predominantly in the eastern one-half of the United States. The main consumers of silicon metal were aluminum producers and the chemical industry. The semiconductor industry, which manufactures chips for computers from high-purity silicon, accounted for only a few percent of silicon demand.

<b>Salient Statistics—United States:</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999<sup>e</sup></b>
Production	396	412	430	429	425
Imports for consumption	250	227	256	241	252
Exports	47	44	50	47	67
Consumption, apparent	609	594	628	616	610
Price, <sup>1</sup> average, cents per pound Si:					
Ferrosilicon, 50% Si	57.9	64.0	54.8	52.1	49
Ferrosilicon, 75% Si	58.1	62.2	48.0	43.1	42
Silicon metal	69.5	89.7	81.4	70.5	57
Stocks, producer, yearend	35	35	44	50	50
Net import reliance <sup>2</sup> as a percent of apparent consumption	35	31	32	30	30

**Recycling:** Insignificant.

**Import Sources (1995-98):** Norway, 27%; Russia, 13%; Brazil, 11%; Canada, 10%; and other, 39%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/99</b>
Ferrosilicon, 55%-80% Si:		
More than 3% Ca	7202.21.1000	1.1% ad val.
Other	7202.21.5000	1.5% ad val.
Ferrosilicon, 80%-90% Si	7202.21.7500	1.9% ad val.
Ferrosilicon, more than 90% Si	7202.21.9000	5.8% ad val.
Ferrosilicon, other:		
More than 2% Mg	7202.29.0010	Free.
Other	7202.29.0050	Free.
Silicon, more than 99.99% Si	2804.61.0000	Free.
Silicon, 99.00%-99.99% Si	2804.69.1000	5.3% ad val.
Silicon, other	2804.69.5000	5.5% ad val.

**Depletion Allowance:** Quartzite, 15% (Domestic and foreign); gravel, 5% (Domestic and foreign).

**Government Stockpile:** Information on silicon carbide in the National Defense Stockpile is discussed in the "Manufactured Abrasives" chapter.

**Events, Trends, and Issues:** Domestic apparent consumption of silicon for 1999 is projected as just slightly less than that for 1998, or approximately the same as the average for 1995-98. Of the 1999 total, ferrosilicon is estimated to account for 57% and silicon metal 43%. The annual growth rate for ferrosilicon demand is expected to fall in the range of 1% to 2%, in line with long-term trends in steel production. Trends during the first half of 1999 suggested that domestic steel production could be as much as 5% less than that for 1998. The annual growth rate for silicon metal demand has been greater than that for ferrosilicon—about 3% for silicon demand by the aluminum industry and about 8% for silicon demand by the chemical industry. While demand by the chemical industry, principally for silicones, has been affected by the Asian economic crisis, indications were that silicon demand was picking up in the Western World through at least the first half of 1999.

In terms of contained silicon, domestic production is projected to be only slightly less than that for 1998, mostly because of a decline in ferrosilicon output. Cutbacks in silicon metal production were carried out by domestic as well as foreign producers.

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Price trends for silicon materials in the U.S. market through the first three quarters of 1999 were mixed. The trend for the first three quarters indicated recovery in price for 75% ferrosilicon but, for the third consecutive year, declines in price for 50% ferrosilicon and especially silicon metal. Prices as of the end of September versus those at the beginning of the year were lower by 7% for 50% ferrosilicon and by 24% for silicon metal, and higher by 4% for 75% ferrosilicon. As of the end of September, the range in dealer import price, in cents per pound of contained silicon, was 46 to 50 for 50% ferrosilicon, 40.5 to 41.5 for 75% ferrosilicon, and 50 to 51 for silicon metal.

A unique action by the U.S. International Trade Commission may have had a bearing on prices, especially those for ferrosilicon. In August, after having replaced its changed circumstances review of imports of ferrosilicon with a reconsideration of its 1993-94 injury determinations, the Commission now found, in light of price-fixing by domestic producers, that the domestic industry had not been injured by imports. Consequently, antidumping and countervailing duties on imports of ferrosilicon from Brazil, China, Kazakhstan, Russia, Ukraine, and Venezuela no longer had a basis, and subsequently were removed by the International Trade Administration of the U.S. Department of Commerce. Legal challenges were expected.

### **World Production, Reserves, and Reserve Base:**

	Production <sup>o</sup>		Reserves and reserve base <sup>3</sup>
	1998	1999	
United States	429	425	The reserves and reserve base in most major producing countries are ample in relation to demand. Quantitative estimates are not available.
Australia	29	29	
Brazil	254	236	
Canada	58	48	
China	715	780	
Egypt	26	26	
France	145	145	
Iceland	40	52	
India	58	58	
Kazakhstan	60	65	
Macedonia	37	37	
Norway	413	395	
Poland	50	47	
Russia	362	372	
Slovakia	20	20	
South Africa	98	99	
Spain	34	44	
Ukraine	195	195	
Venezuela	39	46	
Other countries	112	110	
World total (rounded)	3,200	3,200	

Production quantities given above are combined totals of estimated content for ferrosilicon and silicon metal, as applicable. For the world, ferrosilicon accounts for about four-fifths of the total. The leading countries for ferrosilicon production were Brazil, China, Norway, Russia, Ukraine, and the United States, and for silicon metal Brazil, China, France, Norway, and the United States. China was by far the largest producer of ferrosilicon and may well have been the largest producer of silicon metal. China's production of silicon metal is not included in this tabulation because data are not available.

**World Resources:** World and domestic resources for making silicon metal and alloys are abundant, and, in most producing countries, adequate to supply world requirements for many decades. The source of the silicon is silica in various natural forms such as quartzite.

**Substitutes:** Various metals and alloys, such as aluminum and silicomanganese, can be substituted for ferrosilicon in some applications. Germanium and gallium arsenide are the principal substitutes for silicon in semiconductor and infrared applications.

<sup>o</sup>Estimated.

<sup>1</sup>Based on U.S. dealer import price.

<sup>2</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>3</sup>See Appendix C for definitions.