

## SULFUR

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

**Domestic Production and Use:** In 2000, elemental sulfur and byproduct sulfuric acid were produced at 128 operations in 30 States and the U.S. Virgin Islands. Total shipments were valued at about \$320 million. Elemental sulfur production was 9.4 million tons; Texas and Louisiana accounted for about 50% of domestic production. Elemental sulfur was recovered at petroleum refineries, natural-gas-processing plants, and coking plants by 52 companies at 121 plants in 26 States and the U.S. Virgin Islands. Elemental sulfur was produced at one mine by using the Frasch method of mining; that mine closed during the year. Byproduct sulfuric acid, representing 10% of sulfur in all forms, was recovered at 11 nonferrous smelters in 8 States by 9 companies. Three copper smelters that previously generated byproduct sulfuric acid were idle. Domestic elemental sulfur provided 67% of domestic consumption, and byproduct acid accounted for 7%. The remaining 26% of sulfur consumed was provided by imported sulfur and sulfuric acid. About 90% of sulfur was consumed in the form of sulfuric acid. Agricultural chemicals (primarily fertilizers) composed 70% of reported sulfur demand; petroleum refining, 15%; metal mining, 6%; and organic and inorganic chemicals, 5%. Other uses, accounting for 4% of demand, were widespread because a multitude of industrial products required sulfur in one form or another during some stage of their manufacture.

<b>Salient Statistics—United States:</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000<sup>e</sup></b>
Production:					
Frasch <sup>e</sup>	2,900	2,820	1,800	1,780	1,000
Recovered elemental	7,480	7,650	8,220	8,220	8,400
Other forms	<u>1,430</u>	<u>1,550</u>	<u>1,610</u>	<u>1,320</u>	<u>1,000</u>
Total <sup>e</sup>	11,800	12,000	11,600	11,300	10,400
Shipments, all forms	11,800	11,900	12,100	11,100	10,600
Imports for consumption:					
Recovered, elemental	1,960	2,060	2,270	2,580	3,000
Sulfuric acid, sulfur content	678	659	668	447	460
Exports:					
Frasch and recovered elemental	855	703	889	685	700
Sulfuric acid, sulfur content	38	39	51	51	58
Consumption, apparent, all forms	13,600	13,900	14,100	13,400	13,300
Price, reported average value, dollars per ton of elemental sulfur, f.o.b., mine and/or plant	34.11	36.06	29.14	37.81	32.00
Stocks, producer, yearend	646	761	283	451	300
Employment, mine and/or plant, number	3,100	3,100	3,100	3,000	3,000
Net import reliance <sup>1</sup> as a percent of apparent consumption	13	13	18	16	22

**Recycling:** About 3 million tons of spent acid was reclaimed from petroleum refining and chemical processes.

**Import Sources (1996-99):** Elemental: Canada, 67%; Mexico, 23%; Venezuela, 7%; and other, 3%. Sulfuric acid: Canada, 75%; Japan, 8%; Mexico, 7%; Germany, 4%; and other, 6%. Total sulfur imports: Canada, 70%; Mexico, 20%; Venezuela, 4%; and other, 6%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12/31/00</b>
Sulfur, crude or unrefined	2503.00.0010	Free.
Sulfur, all kinds, other	2503.00.0090	Free.
Sulfur, sublimed or precipitated	2802.00.0000	Free.
Sulfuric acid	2807.00.0000	Free.

**Depletion Allowance:** 22% (Domestic and foreign).

**Government Stockpile:** None.

## SULFUR

**Events, Trends, and Issues:** The last domestic Frasch sulfur mine closed in August as a result of reduced demand, low prices, and increased production costs, thus permanently ending discretionary sulfur production in the United States. Production of recovered elemental sulfur from petroleum refineries will continue its steady growth, supported by new facilities being installed to increase refining capacity and the capability of current operations to handle higher sulfur crude oil, especially from Mexico and Venezuela. During the next few years, oil refineries will be installing additional equipment to remove even more sulfur from gasoline to comply with the new environmental regulations enacted in 2000. Recovered sulfur from natural gas processing was about the same. The amount of byproduct sulfuric acid produced is closely tied to copper smelting, which has experienced a slump in recent years; and so, byproduct acid production continued its downward trend.

World production of native sulfur decreased in response to increased production of recovered elemental sulfur; pyrites production decreased because of environmental and cost considerations. Many countries that had not previously recovered sulfur at oil refineries were upgrading their refineries for that purpose and improving sulfur capture at nonferrous metal smelters. Improving economic conditions in developing countries prompted increased environmental protection measures approaching those in Japan, North America, and Western Europe.

Apparent consumption of sulfur in all forms is projected to remain steady at about 13.3 million tons in 2001 unless phosphate fertilizer demand increases. To supply steady consumption while production decreases, additional imports will be necessary. Additional facilities for importing formed sulfur were under development.

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

	Production—All forms		Reserves <sup>2</sup>	Reserve base <sup>2</sup>
	1999	2000 <sup>e</sup>		
United States	11,300	10,400	140,000	230,000
Canada	10,100	10,300	160,000	330,000
Chile	1,040	1,100	NA	NA
China	5,690	5,200	100,000	250,000
Finland	725	730	NA	NA
France	1,100	1,100	10,000	20,000
Germany	1,190	1,200	NA	NA
Iran	910	920	NA	NA
Italy	678	700	NA	NA
Japan	3,460	3,500	5,000	15,000
Kazakhstan	1,320	1,400	NA	NA
Kuwait	675	680	NA	NA
Mexico	1,310	1,300	75,000	120,000
Netherlands	574	580	NA	NA
Poland	1,510	1,300	130,000	300,000
Russia	5,270	5,500	NA	NA
Saudi Arabia	2,400	2,400	100,000	130,000
Spain	955	900	50,000	300,000
United Arab Emirates	1,090	1,200	NA	NA
Other countries	<u>6,700</u>	<u>7,000</u>	<u>630,000</u>	<u>1,800,000</u>
World total (may be rounded)	57,100	57,400	1,400,000	3,500,000

**World Resources:** Resources of elemental sulfur in evaporite and volcanic deposits and sulfur associated with natural gas, petroleum, tar sands, and metal sulfides amount to about 5 billion tons. The sulfur in gypsum and anhydrite is almost limitless, and some 600 billion tons are contained in coal, oil shale, and shale rich in organic matter, but low-cost methods have not been developed to recover sulfur from these sources. The domestic resource is about one-fifth of the world total. Elemental sulfur deposits have become marginal reserves unless the deposits are already developed. Sulfur from petroleum and metal sulfides may be recovered where they are refined, which may be in the country of origin or in an importing nation. The rate of sulfur recovery from refineries is dependent on the environmental regulations where refining is accomplished, most of which are becoming more stringent.

**Substitutes:** Substitutes for sulfur at present or anticipated price levels are not satisfactory; some acids, in certain applications, may be substituted for sulfuric acid.

<sup>e</sup>Estimated. NA Not available.

<sup>1</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>2</sup>See Appendix C for definitions.