SULFUR

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

Domestic Production and Use: In 1999, elemental sulfur and byproduct sulfuric acid were produced at 149 operations in 30 States, Puerto Rico, and the U.S. Virgin Islands. Total shipments were valued at about $320 million. Elemental sulfur production was 9.8 million metric 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 by one company at two mines in two States, using the Frasch method of mining. One of the mines closed during the year. Byproduct sulfuric acid, representing 12% of sulfur in all forms, was recovered at 14 nonferrous smelters in 8 States by 10 companies. Three smelters closed. Domestic elemental sulfur provided 67% of domestic consumption and byproduct acid accounted for 9%. The remaining 24% 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) comprised 69% of reported sulfur demand; petroleum refining, 16%; metal mining, 7%; and chemicals, organic and inorganic, 4%. Other uses, accounting for 4% of demand, were widespread because a multitude of industrial products require sulfur in one form or another during some stage of their manufacture.

Salient Statistics—United States:	**1995**	**1996**	**1997**	**1998**	**1999[e]**
Production: Frasch[e]	3,150	2,900	2,820	1,800	1,800
Recovered elemental	7,250	7,480	7,650	8,220	8,000
Other forms	1,400	1,430	1,550	1,610	1,300
Total[e] (may be rounded)	11,800	11,800	12,000	11,600	11,100
Shipments, all forms	12,100	11,800	11,900	12,100	10,900
Imports for consumption:					
Recovered, elemental	2,510	1,960	2,060	2,270	2,700
Sulfuric acid, sulfur content	628	678	659	668	430
Exports:					
Frasch and recovered elemental	906	855	703	889	640
Sulfuric acid, sulfur content	56	38	39	51	49
Consumption, apparent, all forms	14,300	13,600	13,900	14,100	13,300
Price, reported average value, dollars per ton of elemental sulfur, f.o.b., mine and/or plant	44.46	34.11	36.06	29.14	30.00
Stocks, producer, yearend	583	646	761	283	500
Employment, mine and/or plant, number	3,100	3,100	3,100	3,100	3,100
Net import reliance[1] as a percent of apparent consumption	21	13	13	18	17

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

Import Sources (1995-98): Elemental: Canada, 70%; Mexico, 24%; Venezuela, 5%; and other, 1%. Sulfuric acid: Canada, 80%; Mexico, 6%; Japan, 5%; Germany, 4%; and other, 5%. Total sulfur imports: Canada, 72%; Mexico, 19%; Venezuela, 4%; and other, 5%.

Tariff: Item	**Number**	**Normal Trade Relations 12/31/99**
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: 23% (Domestic and foreign).

Government Stockpile: None.

Prepared by **Joyce A. Ober [(703) 648-7717, jober@usgs.gov, fax: (703) 648-7722]**

SULFUR

Events, Trends, and Issues: Frasch production continued to be plagued by technical production problems early in 1999. As production wells that had been lost to a late-1998 hurricane in the Gulf of Mexico were replaced, the west Texas mine was closed, leaving the off-shore Frasch operation as the single remaining sulfur mine in the United States and the Western Hemisphere. Although sulfur production at petroleum refineries increased, production for sulfur in all forms decreased for the second consecutive year. The decreased total production was attributed to reduced sulfur recovery at natural gas operations and lower byproduct sulfuric acid production from copper smelters. Three of seven copper smelters in the United States closed in 1999, reducing byproduct acid production by almost 20%. Further reductions in smelter acid production were expected for 2000.

Reduced production in the phosphate fertilizer industry caused by low demand for exported fertilizer contributed to significantly lower domestic sulfur consumption. Because production did not decrease as much as demand, producer stocks of sulfur increased and prices decreased. Increased demand for sulfur in other parts of the world and restricted availability of export material, especially from Canada, caused price increases for most of the rest of the world. Canadian sulfur producers, particularly natural gas operations in Alberta continued to stockpile sulfur in an effort to increase prices for their overseas exports.

Domestic Frasch sulfur production is not expected to surpass 2 million tons in the future and may not reach that level on a regular basis, depending on the demand situation. Production of recovered elemental sulfur from petroleum refineries will continue its steady growth, supported by new facilities being installed that are intended to increase the capability of current operations to handle higher-sulfur crudes from Mexico and Venezuela. Recovered sulfur from natural gas processing has decreased in recent years, and that trend may persist. The amount of byproduct sulfuric acid produced is closely tied to copper smelting; and no significant recovery in domestic copper smelting is expected for the next few years. Apparent consumption of sulfur in all forms is projected to remain steady at about at 13.3 million tons in 2000 unless phosphate fertilizer demand increases.

World Production, Reserves, and Reserve Base:

	Production—All forms		Reserves[2]	Reserve base[2]
	1998	1999[e]		
United States	11,600	11,100	140,000	230,000
Canada	9,250	9,500	160,000	330,000
China	6,150	6,000	100,000	250,000
France	1,050	1,000	10,000	20,000
Germany	1,180	1,200	NA	NA
Iran	900	900	NA	NA
Iraq	450	450	130,000	500,000
Japan	3,400	3,400	5,000	15,000
Kazakhstan	1,150	1,200	NA	NA
Mexico	1,390	1,400	75,000	120,000
Poland	1,570	1,300	130,000	300,000
Russia	4,480	4,500	NA	NA
Saudi Arabia	2,000	2,000	100,000	130,000
South Africa	532	500	NA	NA
Spain	993	950	50,000	300,000
Other countries	11,700	10,500	500,000	1,300,000
World total (may be rounded)	57,800	55,900	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.

Substitutes: There are no adequate substitutes for sulfur at present or anticipated price levels; some acids, in certain applications, may be substituted for sulfuric acid.

[e]Estimated. NA Not available.

[1]Defined as imports - exports + adjustments for Government and industry stock changes.

[2]See Appendix C for definitions.