

BROMINE

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

Domestic Production and Use: The quantity of bromine sold or used in the United States from four companies operating in Arkansas and Michigan accounted for 100% of elemental bromine production valued at an estimated \$240 million. Arkansas continued to be the Nation's leading bromine producer, and bromine was the leading mineral commodity in terms of value produced in the State.

Estimated bromine use was fire retardants, 27%; agriculture, 15%; petroleum additives, 15%; well drilling fluids, 10%; sanitary preparations, 5%; and other uses, 28%. Other uses included intermediate chemicals used in the manufacture of other products and bromide solutions used alone or in combination with other chemicals.

| Salient Statistics—United States: | 1993 | 1994 | 1995 | 1996 | 1997^e |
|---|-------------|-------------|-------------|-------------|-------------------------|
| Production ¹ | 177 | 195 | 218 | 227 | 250 |
| Imports for consumption, elemental bromine and compounds ² | 18 | 23 | 8 | 15 | 15 |
| Exports, elemental bromine and compounds | 19 | 18 | 14 | 14 | 14 |
| Consumption, apparent ³ | 267 | 197 | 306 | 318 | 341 |
| Price, cents per kilogram, bulk, purified bromine | 69.5 | 79.5 | 85.3 | 66.1 | 98.8 |
| Stocks, producer, yearend, elemental bromine ^e | — | — | — | — | — |
| Employment, number | 1,600 | 1,600 | 1,600 | 1,700 | 1,700 |
| Net import reliance ⁴ as a percent of apparent consumption | — | — | E | E | — |

Recycling: Approximately 35% of U.S. bromine production was converted to byproduct sodium bromide solutions, which were recycled to obtain elemental bromine. This recycled bromine is not included in the virgin bromine production reported by the companies.

Import Sources (1993-96): Israel, 89%; The Netherlands, 7%; France, 3%; and other, 1%.

| Tariff: Item | Number | Most favored nation (MFN) 12/31/97 | Non-MFN⁵ 12/31/97 |
|---|---------------|---|---|
| Bromine | 2801.30.2000 | 6.3% ad val. | 37% ad val. |
| Bromochloromethane | 2903.49.1000 | Free | 25% ad val. |
| Ammonium, calcium, or zinc bromide | 2827.59.2500 | Free | 25% ad val. |
| Decabromodiphenyl and octabromodiphenyl oxide | 2909.30.0700 | 15.6% ad val. | 15.4¢/kg + 70.5% ad val. |
| Ethylene dibromide | 2903.30.0500 | 5.4% ad val. | 46.3% ad val. |
| Hydrobromic acid | 2811.19.3000 | 1.7% ad val. | 25% ad val. |
| Potassium bromate | 2829.90.0500 | 1.2% ad val. | 25% ad val. |
| Potassium or sodium bromide | 2827.51.0000 | Free | 22¢/kg. |
| Methyl bromide | 2903.30.1520 | Free | 25% ad val. |
| Sodium bromate | 2829.90.2500 | 1.5% ad val. | 25% ad val. |
| Tetrabromobisphenol A | 2908.10.2500 | 1.0¢/kg + 15.2% ad val. | 15.4¢/kg + 62% ad val. |

Depletion Allowance: 5% on brine wells (Domestic and Foreign).

Government Stockpile: None.

BROMINE

Events, Trends, and Issues: Three bromine companies accounted for more than 75% of world production. Two of these companies are located in the United States and accounted for about 50% of production. Legislation during the 1970's and 1980's reduced the traditional demand for bromine as a gasoline additive and in agriculture, but new end uses in specialized flame retardant chemicals have demanded increasing amounts of bromine. In the second quarter of 1998, the first new domestic bromine plant built since 1976 is expected to begin production in Manistee, MI. Production capacity was expected to be 9,000 tons per year of elemental bromine and brominated salts.

Israel is the second largest producer of bromine in the world and the largest producer of elemental bromine. Approximately 90% of production was for export, accounting for about 60% of international trade in bromine and bromine compounds to more than 100 countries. A company produced bromine from Dead Sea bromine-rich brines after production of potash. Exports of elemental bromine are produced into compounds at a wholly owned plant in the Netherlands.

World Mine Production, Reserves, and Reserve Base:

| | Mine production | | Reserves ⁶ | Reserve base ⁶ |
|----------------------------|-----------------|-------------------|-----------------------|---------------------------|
| | 1996 | 1997 ^e | | |
| United States ¹ | 227 | 250 | 11,000 | 11,000 |
| Azerbaijan | 2.0 | 2.0 | 300 | 300 |
| China | 30 | 30 | NA | NA |
| France | 2.2 | 2.2 | 1,600 | 1,600 |
| India | 1.5 | 1.5 | (?) | (?) |
| Israel | 135.0 | 135.0 | (?) | (?) |
| Italy | .3 | .3 | (?) | (?) |
| Japan | 15.0 | 15.0 | (?) | (?) |
| Spain | .2 | .2 | 1,400 | 1,400 |
| Turkmenistan | 7.0 | 7.0 | 700 | 700 |
| Ukraine | 3.0 | 3.0 | 400 | 400 |
| United Kingdom | 28.0 | 28.0 | (?) | (?) |
| World total (rounded) | 450.0 | 470.0 | NA | NA |

World Resources: Resources of bromine are virtually unlimited. The Dead Sea in the Middle East is estimated to contain 1 billion tons of bromine. Seawater contains about 65 parts per million of bromine or an estimated 100 trillion tons. The bromine content of underground water in Poland has been estimated at 36 million tons.

Substitutes: Chlorine and iodine may be substituted for bromine in a few chemical reactions and for sanitation purposes. Aniline and some of its derivatives, methanol, ethanol, and gasoline-grade tertiary butyl alcohol, are effective nonlead substitutes for ethylene dibromide and lead in gasoline in some cars. There are no comparable substitutes for bromine in various oil and gas well completion and packer applications. Alumina, magnesium hydroxide, organic chlorine compounds, and phosphorus compounds can be substituted for bromine as fire retardants in some uses.

^eEstimated. E Net exporter. NA Not available.

¹Sold or used by U.S. producers.

²Imports calculated from items shown in tariff section.

³Includes recycled product beginning in 1993.

⁴Defined as imports - exports + adjustments for Government and industry stock changes.

⁵See Appendix B.

⁶See Appendix D for definitions.

⁷From waste biterms associated with solar salt. See World Resources section.

⁸From the Dead Sea. See World Resources section.

⁹From seawater. See World Resources section.