

## 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 \$226 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 uses were as 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.

<b>Salient Statistics—United States:</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998<sup>e</sup></b>
Production <sup>1</sup>	195	218	227	247	234
Imports for consumption, elemental bromine and compounds <sup>2</sup>	18	14	14	11	11
Exports, elemental bromine and compounds	24	10	16	14	10
Consumption, apparent <sup>3</sup>	197	206	225	244	235
Price, cents per kilogram, bulk, purified bromine	79.5	85.3	66.0	80.2	96.8
Stocks, producer, yearend, elemental bromine <sup>e</sup>	—	—	—	—	—
Employment, number	1,600	1,600	1,700	1,700	1,700
Net import reliance <sup>4</sup> 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 (1994-97):** Israel, 89%; United Kingdom, 4%; Netherlands, 3%; Belgium, 2%; and other, 2%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations (NTR) 12/31/98</b>	<b>Non-NTR<sup>5</sup> 12/31/98</b>
Bromine	2801.30.2000	5.9% 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	14.2% 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	0.8% ad val.	25% ad val.
Potassium bromate	2829.90.0500	0.6% ad val.	25% ad val.
Potassium or sodium bromide	2827.51.0000	Free	22¢/kg.
Sodium bromate	2829.90.2500	0.7% ad val.	25% ad val.
Tetrabromobisphenol A	2908.10.2500	0.9¢/kg + 13.8% ad val.	15.4¢/kg + 62% ad val.
Vinyl bromide, methyl	2903.30.1520	Free	25% 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 fourth 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.

The financial crisis in Asia adversely affected exports of brominated materials. Some employees in the United States were laid off as a direct result of the decrease in exports.

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

	Mine production		Reserves <sup>6</sup>	Reserve base <sup>6</sup>
	1997	1998 <sup>e</sup>		
United States <sup>1</sup>	247.0	234.0	11,000	11,000
Azerbaijan	2.0	2.0	300	300
China	31.0	31.0	NA	NA
France	2.0	2.0	1,600	1,600
India	1.5	1.5	(?)	(?)
Israel	135	135	(?)	(?)
Italy	0.3	0.3	(?)	(?)
Japan	20.0	20.0	(?)	(?)
Spain	0.1	0.1	1,400	1,400
Turkmenistan	0.1	0.1	700	700
Ukraine	3.0	3.0	400	400
United Kingdom	<u>28.0</u>	<u>28.0</u>	<u>(?)</u>	<u>(?)</u>
World total (rounded)	470	457	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.

<sup>e</sup>Estimated. E Net exporter. NA Not available.

<sup>1</sup>Sold or used by U.S. producers.

<sup>2</sup>Imports calculated from items shown in tariff section.

<sup>3</sup>Includes recycled product.

<sup>4</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>5</sup>See Appendix B.

<sup>6</sup>See Appendix D for definitions.

<sup>7</sup>From waste bitterns associated with solar salt.

<sup>8</sup>From the Dead Sea. See World Resources section.

<sup>9</sup>From seawater. See World Resources section.