

BROMINE

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

Domestic Production and Use: Bromine was recovered from underground brines by two companies in Arkansas. Bromine was the leading mineral commodity, in terms of value, produced in Arkansas. The two bromine companies in the United States accounted for about one-third of world production.

Primary uses of bromine compounds are in flame retardants, drilling fluids, brominated pesticides (mostly methyl bromide), and water treatment. Bromine is also used in the manufacture of dyes, insect repellents, perfumes, pharmaceuticals, and photographic chemicals. Other products containing bromine included intermediate chemicals for the manufacture of chemical products and bromide solutions used alone or in combination with other chemicals.

Salient Statistics—United States:	2004	2005	2006	2007	2008^e
Production ¹	222,000	226,000	243,000	W	W
Imports for consumption, elemental bromine and compounds ²	62,000	60,000	44,000	30,000	38,000
Exports, elemental bromine and compounds	9,000	10,000	12,000	11,000	11,000
Consumption, apparent ³	274,000	277,000	275,000	W	W
Price, cents per kilogram, bulk, purified bromine	86.0	74.0	139.2	NA	NA
Employment, number	1,500	1,200	1,100	1,000	1,000
Net import reliance ⁴ as a percentage of apparent consumption	19	18	12	<25	<25

Recycling: Some bromide solutions were recycled to obtain elemental bromine and to prevent the solutions from being disposed of as hazardous waste. Hydrogen bromide is emitted as a byproduct in many organic reactions. This byproduct waste is recycled with virgin bromine brines and is a major source of bromine production. Plastics containing bromine flame retardants can be incinerated as solid organic waste, and the bromine can be recovered. This recycled bromine is not included in the virgin bromine production reported by the companies, but is included in data collected by the U.S. Census Bureau.

Import Sources (2004-07): Israel, 93%; China, 4%; and other, 3%.

Tariff: Item	Number	Normal Trade Relations 12-31-08
Bromine	2801.30.2000	5.5% ad val.
Hydrobromic acid	2811.19.3000	Free.
Potassium or sodium bromide	2827.51.0000	Free.
Ammonium, calcium, or zinc bromide	2827.59.2500	Free.
Other bromides and bromide oxides	2827.59.5100	3.6% ad val.
Potassium bromate	2829.90.0500	Free.
Sodium bromate	2829.90.2500	Free.
Ethylene dibromide	2903.31.0000	5.4% ad val.
Methyl bromide	2903.39.1520	Free.
Bromochloromethane	2903.49.1000	Free.
Tetrabromobisphenol A	2908.19.2500	5.5% ad val.
Decabromodiphenyl and octabromodiphenyl oxide	2909.30.0700	5.5% ad val.

Depletion Allowance: Brine wells, 5% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: Although still the leading bromine producer in the world, the U.S. dominance has decreased as other countries, such as China, Israel, Japan, and Jordan, have strengthened their positions as world producers of elemental bromine.

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Albemarle Corp., Baton Rouge, LA, acquired Sorbent Technologies Corp., Twinsburg, OH, for \$22.5 million in cash. The acquisition will broaden Albemarle's bromine-based solutions for removing mercury emissions from coal-fired powerplants.⁵ Gulf Resources Inc., Shandong, China, acquired its fifth bromine production facility in China, increasing the company's annual bromine production capacity to about 4,700 tons.⁶

The largest use of bromine is in flame retardants; however, bromine use in flame retardants is of concern because of persistence of some bromine compounds in the environment and their potential health effects. The European Court of Justice ruled that Deca-BDE (decabromodiphenyl ether), a flame retardant, can no longer be used in electronics and electrical applications. The European Union approved the use of tetrabromobisphenol-A, a flame retardant used in more than 70% of the world's electrical and electronic appliances.

Bromine and bromine compound prices increased in 2008, reflecting the expanding markets of bromine and major increases in the costs of energy, raw materials, regulatory compliance, and transportation.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ⁷	Reserve base ⁷
	2007	2008 ^e		
United States ¹	W	W	11,000,000	11,000,000
Azerbaijan	2,000	2,000	300,000	300,000
China	130,000	135,000	130,000	3,500,000
Germany	1,600	1,600	(8)	(8)
India	1,500	1,500	(9)	(9)
Israel	159,000	165,000	(10)	(10)
Japan	20,000	20,000	(11)	(11)
Jordan	69,000	70,000	(10)	(10)
Spain	(12)	(12)	1,400,000	1,400,000
Turkmenistan	(12)	(12)	700,000	700,000
Ukraine	3,000	3,000	400,000	400,000
World total (rounded)	¹³ 387,000	¹³ 398,000	Large	Large

World Resources: Bromine is found principally in seawater, evaporitic (salt) lakes, and underground brines associated with petroleum deposits. In the Middle East, the Dead Sea is estimated to contain 1 billion tons of bromine. Seawater contains about 65 parts per million of bromine, or an estimated 100 trillion tons. Bromine is also recovered from seawater as a coproduct during evaporation to produce salt.

Substitutes: Chlorine and iodine may be substituted for bromine in a few chemical reactions and for sanitation purposes. There are no comparable substitutes for bromine in various oil and gas well completion and packer applications that do not harm the permeability of the production zone and that control well "blowouts." Because plastics have a low ignition temperature, alumina, magnesium hydroxide, organic chlorine compounds, and phosphorus compounds can be substituted for bromine as fire retardants in some uses. Bromine compounds and bromine acting as a synergist with other materials are used as fire retardants in plastics, such as those found in electronics.

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Sold or used by U.S. producers.

²Imports calculated from items shown in Tariff section.

³Includes recycled product.

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

⁵Albemarle Corp., 2008, Albemarle Corporation acquires Sorbent Technologies: Albemarle Corp. press release, October 10, 1 p.

⁶Gulf Resources, Inc., 2008, Gulf Resources, Inc. announces first quarter 2008 financial results: Gulf Resources Inc. press release, May 8, 1 p.

⁷See Appendix C for definitions.

⁸From waste bitterns associated with potash production.

⁹From waste bitterns associated with solar salt.

¹⁰From the Dead Sea.

¹¹From seawater.

¹²Less than ½ unit.

¹³Excludes U.S. production.