

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 often is the leading mineral commodity, in terms of value, produced in Arkansas. The two bromine companies in the United States account for a large percentage of world production capacity.

Globally, the leading applications of bromine compounds are in the production of flame retardants, intermediates and industrial uses such as pesticides and pharmaceuticals, drilling fluids, and water treatment, in descending order by quantity. Bromine compounds are also used in a variety of other applications, including chemical synthesis, control of mercury emissions from coal-fired powerplants, and paper manufacturing.

Salient Statistics—United States:	2012	2013	2014	2015	2016^e
Production	W	W	W	W	W
Imports for consumption, elemental bromine and compounds ¹	53,400	36,300	57,700	58,000	70,000
Exports, elemental bromine and compounds ²	13,000	18,200	20,600	25,000	19,500
Consumption, apparent	W	W	W	W	W
Employment, number ^e	1,050	1,050	1,050	1,050	1,050
Net import reliance ³ as a percentage of apparent consumption	<50	<50	<50	<50	<50

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 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 to the U.S. Geological Survey by companies but may be included in data collected by the U.S. Census Bureau.

Import Sources (2012–15): Israel, 84%; China, 7%; Jordan, 4%; and other, 5%.

Tariff: Item	Number	Normal Trade Relations 12–31–16
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.
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.
Dibromoneopentyl glycol	2905.59.3000	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.

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Events, Trends, and Issues: The United States maintained its position as one of the leading bromine producers in the world. China, Israel, and Jordan also are major producers of elemental bromine. U.S. imports of bromine and bromine compounds increased in 2016 in response to increased domestic demand.

U.S. exports presented in this publication include calcium bromide (HTS code 2827.59.2500), potassium bromide (2827.51.0000), and sodium bromide (HTS code 2827.51.0000). These are in addition to exports of elemental bromine (HTS code 2801.30.2000), ethylene dibromide (HTS code 2903.31.000), and methyl bromide (HTS code 2903.39.1520) that were published in the 2016 Mineral Commodity Summary. The addition of these compounds has more than doubled the amount of exported bromine presented in this report, as compared with prior years, and more accurately reflects the domestic industry activity. The data series was modified back to 2011.

U.S. companies did not announce prices for bromine and bromine compounds in 2016. Trade publications, however, reported that U.S. bromine prices ranged from about \$4,400 to \$5,400 per ton during the year, an increase compared with 2015 prices. Global sales of brominated flame retardants (BFRs) were strong; particularly for products developed to replace hexabromocyclododecane (HBCD), a BFR used in polystyrene building insulation foams. Owing to environmental and toxicological concerns, the production of HBCD was phased out in the European Union in 2015. Global sales of BFRs for electric and electronic applications, especially in the automotive industry, were also strong in 2016. Bromine production in Israel increased following the settlement of a workers' strike, which took place during the first half of 2015.

The use of bromine to mitigate mercury emissions at powerplants continued to increase. Bromine compounds bond with mercury in flue gases from coal-fired powerplants creating mercuric bromide, a substance that is more easily captured in flue-gas scrubbers than the mercuric chloride that is produced at many facilities.

World Production and Reserves

	Production		Reserves ⁴
	<u>2015</u>	<u>2016^e</u>	
United States	W	W	11,000,000
Azerbaijan	—	—	300,000
China	100,000	95,000	NA
India	1,700	1,700	NA
Israel	116,000	170,000	NA
Japan	20,000	20,000	NA
Jordan	100,000	100,000	NA
Turkmenistan	500	500	700,000
Ukraine	3,500	3,500	NA
World total (rounded)	<u>⁵342,000</u>	<u>⁵391,000</u>	<u>Large</u>

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. 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.

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

¹Imports calculated from items shown in Tariff section.

²Exports calculated from HTS numbers 2801.30.2000, 2827.51.0000, 2827.59.2500, 2903.31.0000, and 2903.39.1520.

³Defined as production (sold or used) + imports – exports.

⁴See [Appendix C](#) for resource and reserve definitions and information concerning data sources.

⁵Excludes U.S. production.