



2016 Minerals Yearbook

MERCURY [ADVANCE RELEASE]

MERCURY

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In 2016, mercury was produced in the United States as a byproduct of processing gold-silver ores, mainly in Nevada, and may have been produced as a byproduct of processing other metal ores. Secondary mercury was recovered from end-of-service automobile convenience switches, dental amalgam, electronic waste, fluorescent lamps and compact fluorescent lamps (CFLs), laboratory and medical measuring devices, mercury-contaminated waste, and thermostats. About 24,300 kilograms (kg) of mercury was imported in 2016, 6% less than in 2015 (table 2).

The global use of mercury continued to decline in 2016 owing to environmental and health concerns. Unable to sell it to an oversupplied domestic market and precluded from exporting it, mining and recycling companies placed additional byproduct mercury into permanent storage. However, the use of mercury in small-scale gold mining operations and in the production of Vinyl Chloride Monomer (VCM) in China continued to be substantial and was estimated to have increased in 2016 despite steps having been taken to reduce consumption in these industries.

Legislation and Government Programs

On June 22, the Frank R. Lautenberg Chemical Safety for the 21st Century Act was enacted, and the act will become effective on January 1, 2020. The act prohibits the export of cinnabar or mercury sulfide, mercury (I) chloride or calomel, mercury (II) nitrate, mercury (II) oxide, and mercury (II) sulfate unless they are exported to member countries of the Organisation for Economic Co-operation and Development for environmentally sound disposal, on the condition that the mercury will not be recovered, recycled, or reclaimed for use (U.S. Environmental Protection Agency, 2016a).

Production

Mercury was last produced as a principal product in the United States in 1992 when the McDermitt Mine in northern Nevada closed. Since then, mercury has been recovered chiefly as a byproduct of processing gold-silver ores, mainly in Nevada. Since 1998, data on the amount of primary and secondary mercury produced in the United States have not been available.

Mercury was reclaimed from end-of-service automobile convenience switches, dental amalgam, electronic waste, fluorescent lamps and CFLs, laboratory and medical measuring devices, mercury contaminated waste, and thermostats. Reclaimed mercury was either sold to domestic customers or placed in permanent storage.

Consumption

Based on industry trends and data in trade literature, domestic consumption of mercury was estimated to be less than 45,000 kg in 2016. Consumption continued to decrease

as mercury was eliminated from more consumer and industrial products. Some of the domestic uses were in batteries, dental amalgam, lighting, measuring devices, switches and relays, and thermostats (Interstate Mercury Education and Reduction Clearinghouse, 2015).

Mercury was used as a cathode in chloralkali production; however, most of the mercury was recycled internally and only a small quantity of additional or make-up mercury was required. The chloralkali industry continued to shift away from using mercury cell technology with only two mercury cell plants remaining in the United States in 2016, one in Ohio and one in West Virginia.

Prices

The domestic price of mercury, as quoted in Platts Metals Week, was discontinued in 2016. The average European Union price, minimum 99.99% mercury, published by Argus Media group – Argus Metals International, was \$1,402.40 per flask in 2016, 28% lower than the average price in 2015 and 59% lower than the highest average price in 2013 (table 1). The quoted price range for mercury started the year at \$1,800 to \$2,100 per flask and fell to \$1,100 to \$1,300 per flask by yearend. One flask of mercury weighs 34.5 kg, and 1 metric ton (t) of mercury is the equivalent to approximately 29 flasks.

Foreign Trade

Beginning on January 1, 2013, U.S. exports of elemental mercury were banned, except when the following criteria are met: there are no alternatives to mercury use for a specified application, mercury is not available from other sources in the destination country, the destination country supports the export ban exemption, the exported mercury will be used at a specific facility, and the mercury will be handled in a manner to protect human health and the environment. In 2013, a small quantity of mercury was exported to South Africa under this exemption and, in 2015, 30 kg of mercury was exported to Mexico.

In 2016, mercury imports were 24,300 kg valued at \$276,000 compared with 25,800 kg valued at \$602,000 in 2015. Canada (61%), France (30%), and Switzerland (8%) were the leading sources of mercury imported into the United States in 2016 (table 2).

In 2016, 20,200 kg of amalgam valued at \$34.3 million was imported into the United States, which was 6% less than in 2015. Amalgam is defined as mercury alloyed with one or more metals, but amalgam imports may include mercury-containing chlorine-caustic soda waste. Principal amalgam source countries were Germany (45%), the United Kingdom (13%), Italy (11%), South Africa (9%), and Argentina (8%) (table 3). In 2016, 107,000 kg of amalgam valued at \$297 million was exported from the United States, 13% more than in 2015. Principal

destinations for these exports were Mexico (25%), China (15%), Canada (13%), and India (11%) (table 3).

World Review

In 2016, world mercury mine production was estimated to be 2,480 t (table 4). China (2,000 t) was the world's leading producer of mercury, and Mexico was a leading exporter of mercury, most of which was produced in Mexico. World mercury production estimates have a high degree of uncertainty because most companies and countries do not report principal mine, byproduct mine, or recycling data for mercury. Quantities may appear erratic from year to year because production may not be reported until shipped and stockpiling may take place prior to shipment (table 4).

In October 2013, representatives of 92 countries signed the terms of the Minamata Convention, a global treaty that addresses releases of mercury into the environment. The convention, once ratified, will require participating countries to develop strategies to reduce and, if possible, eliminate the use of mercury. Among the convention's conditions are the cessation of mercury trade and the manufacture of many mercury-containing products by 2020, reduction of mercury emissions by industrial plants, and plans for safe storage of waste mercury (United Nations Environment Programme, 2013). In November 2013, the United States became the first country to ratify the convention; by yearend 2016, 128 countries had signed and 35 additional countries had ratified the convention (Minamata Convention on Mercury, 2017).

VCM production in China constituted 80% to 90% of world VCM production and was used to produce polyvinyl chloride (PVC), a widely used plastic. The majority of China's VCM production used a coal-based process that required the use of mercury. China was the only country using this process. In 2012, China produced about 10 million metric tons of PVC using 800 t of mercury (U.S. Environmental Protection Agency, 2016b, p. 3-2).

The number of chloralkali plants that used mercury cell technology decreased worldwide to 38 plants in 2015 from 44 plants in 2014. However, mercury emissions from chloralkali plants increased to 5.59 metric tons per year (t/yr) in 2015 from 5.46 t/yr in 2014 (World Chlorine Council, 2016). Data for 2016 were not available.

Outlook

Global mercury use is expected to continue to decline as more countries enact restrictions and (or) bans on the use and trade of mercury. If the Minamata Convention is ratified by more of the 128 signatories, global mercury trade and use are expected to be further reduced, most significantly in countries where mercury is used for artisanal gold mining. As a result of reduced consumption and restrictions on sales and trade, mining and recycling companies are expected to place increasing quantities of byproduct mercury into permanent storage. Use of mercury in CFL and other fluorescent lighting may decrease owing to lower unit loading and increases in the sales of alternative light-emitting diode (LED) lighting. Mercury use in electronics and measuring devices is also expected to further decrease.

Gallium alloys may provide nontoxic substitutes for mercury in a wide variety of applications that include electrical switches, liquid mirror telescopes, pumps, and sensors. Gallium can be alloyed with a variety of metals, including cesium, gold, lead, silver, and tin. Galinstan®, an alloy of gallium, indium, and tin, is liquid at room temperatures and, owing to the low toxicity of its component metals, is used as a replacement for mercury in thermometers and is being investigated for use in switches and various measuring devices. Because it has higher reflectivity and lower density than mercury, Galinstan® also is being considered as a replacement for mercury in liquid mirror telescopes for astronomy. Mercury-containing dental amalgam continues to decline in use, replaced by ceramic material with a more natural appearance. Closure of mercury cell chloralkali production facilities worldwide, owing to pressure from international environmental and health organizations, is expected to further reduce consumption and result in the release of large quantities of mercury for disposal, recycling, or storage.

Recycled mercury recovered from mercury cell chloralkali plants and commercial products and byproduct mercury recovered from domestic and foreign precious metals operations are expected to be more than adequate to meet domestic needs.

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TABLE 1
 SALIENT MERCURY STATISTICS¹

(Kilograms unless otherwise specified)

	2012	2013	2014	2015	2016
United States:					
Imports for consumption	249,000	37,700	49,500	25,800	24,300
Exports	27,600	90	--	30	--
Price, average, European Union ² dollars per flask	2,578	3,412	3,037	1,954	1,402
World, mine production metric tons	1,830 ^r	2,330 ^r	2,770 ^r	2,330 ^r	2,480

^rRevised. -- Zero.

¹Table includes data available through June 8, 2017. Data are rounded to no more than three significant digits, except prices.

²Source: Argus Media group – Argus Metals International.

Note: Industrial secondary production, stockpile, and consumption data are not available.

TABLE 2
 U.S. IMPORTS AND EXPORTS OF MERCURY, BY COUNTRY¹

Country	2015		2016	
	Quantity, gross weight (kilograms)	Value (thousands)	Quantity, gross weight (kilograms)	Value (thousands)
Imports:				
Canada	8,310	\$136	14,800	\$156
France	7,050	47	7,330	57
Germany	4,320	145	--	--
India	200	11	200	11
Switzerland	5,970	262	1,990	52
Total	25,800	602	24,300	276
Exports, Mexico	30	3	--	--

-- Zero.

¹Table includes data available through June 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 3
 U.S. IMPORTS AND EXPORTS OF AMALGAMS¹ OF PRECIOUS METALS,
 WHETHER OR NOT CHEMICALLY DEFINED, BY COUNTRY OR LOCALITY²

Country or locality	2015		2016	
	Quantity, gross weight (kilograms)	Value (thousands)	Quantity, gross weight (kilograms)	Value (thousands)
Imports:				
Argentina	1,280	\$11,200	1,630	\$12,800
Canada	153	290	526	599
Colombia	1,080	130	728	141
Germany	10,100	7,870 ^r	9,040	5,480
Italy	1,270	187	2,210	194
Japan	333	366	776	667
Mexico	830	1,090	93	649
South Africa	2,720 ^r	19,900 ^r	1,800	9,520
United Kingdom	2,460 ^r	2,530	2,690	3,700
Other	1,270	1,720	699	574
Total	21,400 ^r	45,200 ^r	20,200	34,300
Exports:				
Australia	91	1,810	35	28
Austria	15	10	20	44
Belgium	423	857	306	817
Brazil	523	5,730	327	1,950
Canada	32,000	75,600	13,400	11,300
China	4,480	5,330	15,600	9,790
France	481	574	474	168
Germany	611	1,770	3,310	2,630
Hong Kong	2,180	280	560	181
India	7,060	34,900	11,500	46,900
Italy	63	145	1,010	6,380
Japan	1,180	3,590	918	4,790
Korea, Republic of	6,700 ^r	14,200 ^r	8,140	9,580
Mexico	10,400	173,000	26,300	158,000
Netherlands	8,630	15,600	8,150	14,100
Peru	83	31	80	34
Saudi Arabia	317	4,670	407	3,980
Singapore	2,460	2,280	4,940	3,140
Taiwan	2,100	12,600	1,090	8,110
Thailand	1,020	5,780	302	1,420
United Kingdom	9,730	14,900	7,090	11,500
Other	4,080 ^r	1,960 ^r	2,940	2,670
Total	94,600 ^r	375,000	107,000	297,000

^rRevised.

¹An alloy of mercury with one or more other metals.

²Table includes data available through June 8, 2017. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 4
MERCURY: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality ²	2012	2013	2014	2015	2016 ^P
Argentina	37	28	25	25 ^e	25 ^e
Chile ³	49	19	10 ^e	10 ^e	10 ^e
China ^c	1,350	1,820	2,260	1,860	2,000
Iran	-- ^r	14 ^r	15 ^r	-- ^r	-- ^e
Kyrgyzstan	75	71	48 ^r	46 ^{e,r}	50 ^e
Mexico ^{e,4}	235	266	301	300	300
Morocco ^e	8	8	8	5	5
Norway ^e	25	25	25	20	20
Peru, exports ³	17	45	40 ^e	35 ^e	40 ^e
Russia	NA	NA	NA	NA	NA
Tajikistan ^c	32 ^r	30 ^r	35 ^r	30	30
United States ³	NA	NA	NA	NA	NA
Total	1,830 ^r	2,330 ^r	2,770 ^r	2,330 ^r	2,480

^cEstimated. ^PPreliminary. ^rRevised. NA Not Available. -- Zero.

¹Includes data available through May 18, 2017. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the countries listed, Canada and Spain may have produced byproduct mercury, but available information was inadequate to make reliable estimates of output.

³Byproduct mercury.

⁴Based on net exports.