

2013 Minerals Yearbook

MERCURY [ADVANCE RELEASE]

Mercury

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Globally, the use of mercury continued to decline in 2013 because of environmental and health concerns. Mining and recycling companies were beginning to place more byproduct mercury into permanent storage rather than sell it. However, the use of mercury has not decreased in the compact fluorescent lamp (CFL) industry or in small-scale gold mining.

In 2013, mercury was produced as a byproduct of processing domestic gold-silver ores, mainly in Nevada, and may have been produced as a byproduct of processing other metal ores. About 38 metric tons (t) of mercury was imported in 2013, 85% less than in 2012. Mercury also was recovered from end-of-service fluorescent lamps and CFLs, mercury-containing automobile convenience switches, batteries, dental amalgam, electronic waste, medical devices, and thermostats. The manufacture of switches and relays was thought to be the leading domestic use for mercury (Interstate Mercury Education and Reduction Clearinghouse, 2014). Large quantities of mercury were involved in the manufacture of chlorine using mercury cell technology but most of that mercury was recycled in-plant.

Legislation and Government Programs

The U.S. Geological Survey (USGS) released a study tracking environmental and health concerns for mercury and the Federal legislation governing mercury in the United States, beginning with authorization of the Clean Air Act and mercury's designation as a hazardous pollutant in 1971. The report further tracks the resulting substantial reduction in mercury use since 1980 through substitution and development of alternative products that do not use mercury. In 1980, U.S. mercury consumption was 2,030 t and the leading markets were batteries (49%), chloralkali manufacture (16%), and paint (15%). By 1996, U.S. consumption declined to 372 t with the three leading end-use sectors being chloralkali manufacturing (38%), electrical and electronic instrumentation (13%), and instruments and measuring devices (11%). In 2010, about 50 t of mercury was used domestically and the three leading end-use sectors were dental amalgam (35% to 57%), electrical and electronic instrumentation (29%), and batteries (8%) (Wilburn, 2013, p. 1, 8, 9, 11).

Production

Mercury was last produced as a principal product in the United States in 1992 when the McDermitt Mine in northern Nevada closed. Mercury was recovered chiefly as a byproduct of processing gold-silver ores, mainly in Nevada. In 2013, data on the amount of mercury produced in the United States were not available.

Consumption

Based on industry trends and data in trade literature, domestic consumption of mercury was estimated to be less than 50 t in 2013. Consumption continued to decrease as mercury was eliminated from more consumer and industrial products.

Based on 2010 estimates, the U.S. chloralkali industry probably accounted for 2% to 7% of U.S. mercury consumption. This industry continued to shift away from using mercury cell technology with only two mercury cell plants remaining in the United States in 2013, one in Ohio and one in West Virginia.

Mercury was reclaimed from end-of-service automobile convenience switches, CFLs, dental amalgam, fluorescent lamps, laboratory and medical devices, mercury contaminated waste, and thermostats. In 2010, the overall recycling rate for mercury contained in products was less than 10%. For mercury products targeted by State, municipal, or industry collection activities, the mercury recovery rate was greater but still less than 25%. The recycling rate for the chloralkali manufacturing industry was estimated to be 50% (Wilburn, 2013, p. 1, 7). Reclaimed mercury was either sold to domestic customers or placed in permanent storage. With the U.S. ban on elemental mercury exports after December 31, 2012, only domestic markets remained for reclaimed mercury.

Prices

The domestic price of mercury averaged \$1,850 per flask in 2013, unchanged since 2011 (table 1). The price range for mercury, as quoted in Platts Metals Week, remained unchanged throughout the year. The low and high prices were quoted as \$1,750 per flask and \$1,950 per flask, respectively. One flask of mercury weighs 34.5 kilograms (kg), and 1 t of mercury is the equivalent to approximately 29 flasks.

Foreign Trade

In 2013, mercury exports were only 90 kg (0.09 t) valued at \$9,900, down from 103 t valued at \$243 million in 2012 (table 2). The large decline occurred because of the export ban that began on January 1, 2013. U.S. exports of elemental mercury were banned, except when there are no alternatives to mercury use for a specified application and 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. All of these conditions were met and mercury was exported only to South Africa.

In 2013, mercury imports were 38 t valued at \$885,000 compared with 249 t valued at \$4.86 million in 2012 (table 2). The large decline in imports may have occurred in part because foreign companies that stored byproduct mercury for 2 to 3 years appear to have exported their inventories to the United States for processing in 2012. Canada (76%) and Germany (21%) were the leading sources of mercury imported into the United States in 2013 (table 2).

In 2013, 21 t of amalgam valued at \$57.1 million was imported into the United States, the same quantity as in 2012. Amalgam is defined as mercury alloyed with one or more metals and may include mercury-containing chlorine-caustic soda waste. Principal amalgam source countries were Germany (38%), Japan (19%), and Argentina and the United Kingdom (10% each) (table 3). In 2013, 153 t of amalgam valued at \$360 million was exported from the United States, 11% less than in 2012. Principal destinations for these exports were Canada (35%), Mexico (23%), India (8%), Germany (6%), China (5%), and the Netherlands and the United Kingdom (4% each) (table 3).

World Review

In 2013, world mercury mine production was estimated to be 1,880 t. China (1,600 t) and Kyrgyzstan (100 t) were the world's leading producers of mercury. World production estimates have a high degree of uncertainty because most companies and countries do not report primary mine, byproduct mine, or recycling data. Quantities may appear erratic from year to year because production may not be reported until shipped and stockpiling may take place prior to shipment.

In January 2013, representatives of 50 countries agreed to the terms of the Minamata Convention treaty, which deals with releases of mercury into the environment. The treaty, once ratified, will require participating countries to develop strategies to reduce and, if possible, eliminate the use of mercury. Among the treaty'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, 2013c, d). In November 2013, the United States became the first country to ratify the treaty (United Nations Environment Programme, 2013b).

The United Nations Environment Programme reported that anthropogenic emissions of mercury to the atmosphere were 1,960 t in 2010. Emissions were from previously released mercury in soils and oceans, artisanal gold mining, coal burning powerplants, residential heating and cooking, and various industrial sources. Industrialization in Asia was estimated to contribute 40% of the global emissions to the atmosphere. Anthropogenic releases to water were estimated to be a minimum of 1,000 t. Sources for water contamination included industrial sites, such as factories and powerplants; contaminated sites such as old mines and landfills; artisanal gold mining; and deforestation (United Nations Environment Programme, 2013a).

The number of chloralkali plants that used mercury cell technology decreased worldwide to 50 plants in 2012 from 53 plants in 2011. Mercury emissions from chloralkali plants decreased to 6.2 tons per year (t/yr) in 2012 from 6.9 t/yr in

2011 (Euro Chlor, 2012, p. 17; Euro Chlor, 2013, p. 23). Data were not available for 2013.

Outlook

Global mercury use may continue to decline as more countries enact restrictions and (or) bans on the use and trade of mercury. Additionally, mining and recycling companies were beginning to place more byproduct mercury into permanent storage rather than selling it as worldwide pressure continues to reduce mercury pollution. If the Minamata Convention treaty is ratified by all of the 100 signatories then global mercury trade and use will be reduced, most significantly in many countries where mercury is still used for artisanal gold mining. Increased markets for CFLs may result in increased mercury use by that industry but even that market may decline because of increased sales of light-emitting diode (LED) lighting.

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 that include silver, gold, lead, cesium, 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 a replacement for mercury in thermometers and was being investigated for use in switches and various measuring devices. Because of its higher reflectivity and lower density than mercury, galistan also was being considered as a replacement for mercury in liquid mirror telescopes for astronomy. Mercury-containing dental amalgam has declined in use, replaced by ceramic material with a more natural appearance. Closure of mercury cell chlorine-caustic soda production facilities worldwide, owing to pressure from international environmental and health organizations, was expected to result in the release of large quantities of mercury for disposal, recycling, or storage.

Recycled mercury from mercury cell chlorine-caustic soda plants, 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

(Metric tons unless otherwise specified)

		2009	2010	2011	2012	2013
United States:						
Imports for consumption	_	206	294	110	249	38
Exports		753	459	133	103	(2)
Industry stocks, yearend: ³		30	NA	NA	NA	NA
Chloralkali		27	NA	NA	NA	NA
Other		3	NA	NA	NA	NA
Price, average, free market ⁴	dollars per flask	610	1,076	1,850	1,850	1,850
World, mine production		1,880 r	2,150 ^r	1,850 ^r	1,580 ^r	1,880 e

^eEstimated. ^rRevised. NA Not available.

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

¹Data are rounded to no more than three significant digits, except prices.

²Less than ½ unit.

³Stocks at consumer and dealers only.

⁴Source: Platts Metals Week.

 $\label{eq:table 2} \textbf{U.S. IMPORTS AND EXPORTS OF MERCURY, BY COUNTRY}^{1}$

	201	2	2013		
	Quantity,		Quantity,		
	gross weight	Value	gross weight	Value	
Country	(metric tons)	(thousands)	(metric tons)	(thousands)	
Imports:					
Argentina	130	\$3,560			
Canada	46	133	29	\$31	
Chile	52	139			
Germany	11	862	8	818	
Mexico	6	39			
Ukraine	3	113			
Other	1	15	1	36	
Total	249	4,860	38	885	
Exports:					
Brazil					
Canada	4	44			
Indonesia	75	102			
Nigeria	18	17			
Peru		13			
Other	1	67	(2)	10	
Total	103	243	(2)	10	

⁻⁻ Zero.

Source: U.S. Census Bureau.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

 $\label{table 3} U.S. \ IMPORTS \ AND \ EXPORTS \ OF \ AMALGAMS^1 \ OF \ PRECIOUS \ METALS, \\ WHETHER \ OR \ NOT \ CHEMICALLY \ DEFINED, \ BY \ COUNTRY^2$

	201	2	2013		
	Quantity,		Quantity,		
	gross weight	Value	gross weight	Value	
Country	(metric tons)	(thousands)	(metric tons)	(thousands)	
Imports:					
Argentina	2	\$19,800 r	2	\$19,400	
Canada	(3)	309	1	\$1,030	
Germany	6	6,770 ^r	8	8,320	
Japan		3,060	4	4,490	
Mexico		5,240 ^r	(3)	7	
Russia	1	11,400	1	7,500	
South Africa	1	12,000	1	12,700	
United Kingdom		1,930 ^r	2	2,380	
Other		16,000 r	4	1,300	
Total	21	76,200	21	57,100	
Exports:		•			
Austria	36	100	(3)	41	
Belgium	(3)	815	2	1,720	
Canada		18,600	53	52,700	
China	7	7,130	7	15,300	
Denmark	(3)	19	(3)	10	
France	(3)	6,690	(3)	842	
Germany	6	23,500	9	6,730	
Hong Kong	(3)	235	2	174	
India		57,400	12	56,400	
Japan		6,430	2	6,490	
Korea, Republic of		38,000	3	16,000	
Mexico		42,500	35	124,000	
Netherlands	10	26,000	6	12,600	
Peru	1	271	(3)	12	
Philippines		24			
Singapore	(3)	683	3	2,620	
Taiwan		20,100	5	24,800	
Thailand		17,900	3	20,200	
Trinidad and Tobago		39			
United Kingdom	6	5,950	6	10,400	
Venezuela	·		3	143	
Other	6	13,200 ^r	7	9,210	
Total	171	286,000	153	361,000	

^rRevised. -- Zero.

Source: U.S. Census Bureau.

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

²Data are rounded to no more than three significant digits; may not add to totals shown.

 $^{^3}$ Less than $\frac{1}{2}$ unit.

 $\label{eq:table 4} \text{MERCURY: WORLD MINE PRODUCTION, BY COUNTRY}^{1,\,2}$

(Metric tons)

Country ³	2009	2010	2011	2012	2013 ^e
Chile ⁴	88	176	90	52	50
China ^e	1,430	1,600	1,500	1,350	1,600
Finland	6 r	9 r	r	r	
Kyrgyzstan	140 ^r	99 ^r	113 ^r	75 ^r	100
Mexico ^{e, 5}	15 ^r	15 ^r	r	r	
Morocco ^e	10	10	9 r	8 r	5
Peru, exports ⁴	107 ^r	159 ^r	53 ^r	17 ^r	45
Russia ^e	50	50	50	50	50
Tajikistan ^e	30	30	30	32 ^r	32
United States ⁴	NA	NA	NA	NA	NA
Total	1,880 ^r	2,150 ^r	1,850 ^r	1,580 ^r	1,880

^eEstimated. ^rRevised. NA Not available.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data available through May 6, 2014.

³Canada and Spain are thought to produce byproduct mercury, but information on production is inadequate to make reliable estimates.

⁴Byproduct mercury.

⁵Beginning in 2012, data for Mexico are obtained by substracting imports from Mexico's exports, because the Servico Geológico Mexicano and the Secretaría de Economía no longer publish production data for Mexico.