



# 2007 Minerals Yearbook

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MERCURY [ADVANCE RELEASE]

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# MERCURY

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In 2007, there were no mines with mercury as a principal product in production in the United States. The last mine to produce mercury as its principal product, the McDermitt Mine in northern Nevada, closed in 1992. In 2007, mercury was produced as a byproduct of domestic gold-silver processing, mainly in Nevada, and may have been produced as a byproduct of processing other metals. Imported byproduct mercury was processed, and the mercury was resold. Recycled mercury was produced from reclamation of mercury contained in fluorescent lamps and a declining supply of mercury-containing batteries, dental amalgam, electronic waste, medical devices, and thermostats. The chlorine-caustic soda industry was the leading domestic user of mercury for its mercury-cell plants and some of that mercury is recycled in-plant. Data on domestic byproduct and recycled mercury production were not available.

Since 1927, the common unit for measuring and pricing mercury has been the “flask,” which was set to conform to the historical measuring system used at Almaden, Spain (Meyers, 1951). One flask of mercury weighs 34.5 kilograms (kg), and 1 metric ton (t) of mercury contains approximately 29 flasks. The flask itself is a screw-top, welded-steel container that is approximately the size of a 2-liter bottle.

## Legislation and Government Programs

The Energy Independence and Security Act of 2007 (H.R. 6) was passed by Congress on January 4. This legislation is intended to move the United States toward greater energy independence by increasing the efficiency of products and vehicles. Section 321 of the bill specifically addresses improved standards for lighting and will phase out general service incandescent lightbulbs in the next 4 to 12 years in favor of mercury-containing compact fluorescent bulbs which use less energy (Energy Independence and Security Act of 2007, 2007). The Clean Energy Act of 2007 (P.L. 110-140) was signed in December 2007 and would reduce dependence on foreign oil and promote new technology and energy efficiency.

In 2007, the U.S. Geological Survey (USGS), in collaboration with the Economic Section of the U.S. Embassy/Lima, Peru, undertook an in-country study of mercury production, prices, imports, exports, and use in Peru. Mercury was imported for artisanal gold mining, chloralkali production, dental amalgam, and other uses (Brooks and others, 2007).

The U.S. Environmental Protection Agency (EPA) convened a series of mercury stakeholder panel meetings in Denver, CO, and Washington, DC, with representatives from academia, industry, nongovernmental organizations, and State groups in order to provide input to the U.S. Government on managing commodity-grade mercury. Discussion topics included global and U.S. supply and demand as well as short- and long-term

demand for mercury. The EPA projected that in the next several decades the global supply of mercury would overtake a declining demand for mercury. The EPA provided estimates of costs for permanent mercury storage in warehouses that would have to be constructed specifically for mercury storage during a 40-year period (U.S. Environmental Protection Agency, 2007).

The proceedings of a U.S. Geological Survey mercury workshop summarized information on mercury on Department of the Interior (DOI) lands, gave perspectives of DOI bureaus on mercury sources, provided information on monitoring mercury and minimizing mercury accumulation in wildlife and humans, and considered future directions for mercury monitoring and research on DOI lands (Colman, 2007).

The National Defense Stockpile (NDS) held an inventory of 4,436 t of mercury at several sites in the United States. Mercury sales from the NDS stockpile were suspended in 1994 in response to environmental concerns. In 2004, the DLA indicated that the mercury would be consolidated at one site in Nevada (Joseph Johnson, specialist, Defense Logistics Agency, written commun., April 30, 2004). The U.S. Department of Energy has 1,329 t of mercury in storage facilities in Oak Ridge, TN.

## Production

Mercury has not been mined as a principal product in the United States since 1992, when the McDermitt Mine in Nevada closed. In 2007, however, byproduct mercury was produced at several precious metals mines in Nevada and from foreign sources. The mercury was recovered and refined for resale (Bethlehem Apparatus Company, Inc., 2006). Data on the amount of byproduct mercury produced in the United States were not available.

## Consumption

Global human health and environmental concerns about mercury have caused an overall market shift from mercury cell technology toward nonmercury technology for chlorine-caustic soda production as well as a decline in mercury purchases by the chlorine-caustic soda industry. From 2002 through 2006, total mercury purchases by the chlorine-caustic soda industry ranged from 198 t in 2003 to 26 t in 2006 for a 5-year average of approximately 80 t. One mercury-cell facility completed conversion to membrane cell technology in 2007 and two other facilities announced plans to convert to membrane technology by the end of 2008. Based on announced plans, only four mercury-cell facilities will be in operation in the United States at the end of 2009 (Arthur E. Dungan, President, The Chlorine Institute, written commun., August 13, 2007). As mercury-cell plants close around the world, that mercury, as well as mercury

from remediation of the plant facilities and soil, will become available for recycling and sale.

Mercury use is not carefully tracked in the United States; however, only about 200 metric tons per year of mercury is consumed domestically. Domestic mercury consumption was broadly estimated to be about 50% for chlorine-caustic soda manufacture and 50% for other uses. Compact fluorescent lamps, which contain 3 to 5 milligrams (mg) of mercury, were promoted as alternatives to standard fluorescent lamps (Von Ahn, 2007).

### Prices

In 2000-03, the average price of mercury was \$140 per flask. In 2007, domestic mercury prices ranged from \$450 to \$550 per flask from January through June and then rose to \$500 to \$600 per flask from July through December (Platts Metals Week, 2007). This overall rise in price correlates with a diminished supply of mercury from recycled mercury-containing products, and an increase in gold prices which resulted in growth in the global demand for mercury for artisanal gold mining.

### Recycling

Compact fluorescent lamps, which contain 5 mg or less of mercury, have been added to the list of recyclable products because of response to H.R. 6 and P.L. 110-140 and the ban on incandescent bulbs. Lamp manufacturers and recyclers encouraged consumers to return the used lamps for recycling by providing shipping materials (Consumer Reports, 2007).

Mercury was reclaimed from end-of-service automobile convenience switches, dental amalgam, fluorescent lamps, laboratory and medical devices, and thermostats in 2007. These devices were treated in multistep high-temperature retorts in which the mercury was first volatilized and then condensed for purification and sale (Brooks and Matos, 2005). The National Vehicle Switch Recovery Program was started in 2006 to stop toxic emissions of mercury when cars are scrapped and then melted to make new steel.

Byproduct mercury from domestic and foreign sources and mercury reclaimed from end-of-service products was processed or "recycled" in the United States and then sold into the international metals market (Fialka, 2006). No data were available on the amount of mercury recycled from these respective sources.

In 2007, the major companies that recycled mercury included AERC.com, Inc., Allentown, PA; Bethlehem Apparatus Co., Inc., Bethlehem, PA; Clean Harbors Environmental Services, Inc., Braintree, MA; D.F. Goldsmith Chemical and Metal Corp., Evanston, IL; Mercury Waste Solutions, Mankato, MN; and Onyx Environmental Services, Lombard, IL. Mercury Recyclers maintains a list of as many as 50 companies whose role was mainly collection of mercury-containing materials that would ultimately be moved on to the larger companies for retorting (Mercury Recyclers, 2007).

In 2006, Thermostat Recycling Corporation (TRC) reported collection of 490 kg of mercury from mercury thermostats. The top States in terms of mercury recovered from thermostats in 2006 were Florida and Minnesota (Kohorst, 2007).

### Foreign Trade

In 2007, mercury imports totaled 67 t and exports totaled 84 t. Peru (34 t), Canada (19 t), and Germany (14 t) were the leading sources of imported mercury, and Vietnam (32 t), Peru (23 t), and Colombia (9 t) were the principal destinations for mercury exported in 2007. The total amount of mercury imported in 2007 was less than the 94 t of mercury imported in 2006. Imports of mercury vary sharply from year to year, possibly owing to stockpiling of byproduct mercury at gold smelters before shipment or upon closure of chloralkali plants.

A total of 498 t of amalgam (not chemically defined) was exported, mainly to Canada (260 t), Suriname (118 t), and Hong Kong (26 t) in 2007. In Canada, where mercury-containing chlorine-caustic waste was specifically included on a list of waste types accepted at a dedicated placement site, some of this material may have been landfilled (Stablex Canada Inc., 2006). Some mercury used for chlorine-caustic soda manufacture, however, was recycled and reused in-plant.

In 2005-06, calomel, which is a mercury chloride and a potential source of mercury, reportedly was imported from Chile; however, a review of Chilean customs data indicates that the material was cuprous chloride and not mercury chloride (Francisco Testor, regional manager, Corporación Nacional del Cobre de Chile, Chile, written commun., December 10, 2007).

### World Review

In 2007, world mercury mine production was estimated to be 1,170 t. Production estimates have a high degree of uncertainty because most companies and countries do not report primary (including byproduct) or secondary production data owing to environmental and health concerns. In 2007, China (800 t) and Kyrgyzstan (250 t) were the leaders in world mine production of mercury. In China, mercury historically has been produced as a byproduct of gold mining and from mercury mines in the Upper Yangtze, Kuniun-Qinling, Sanjiang, and South China metallogenic regions (Lixian and Ruolan, 1992, p. 147).

In 2007, an unknown quantity of byproduct mercury was shipped from Peru's large-scale gold mines to the United States for processing and resale. Mercury was then imported by Peru from Kyrgyzstan, Spain, and the United States for artisanal gold mining, chloralkali production, and dental amalgam. Some of this mercury was transshipped to other destinations in Latin America that included Brazil, Colombia, Ecuador, and Guyana. Artisanal gold mining takes place in Peru from the Department of Piura in the northwest to the Departments of Madre de Dios and Puno in the southeast (Brooks and others, 2007).

The European Union Parliament has approved a draft regulation on the safe storage of mercury and the banning of exports of mercury. The proposed ban would become effective on December 1, 2010, and an import ban was also discussed but not included in the draft legislation. A plan was proposed that would provide safe indefinite storage of the mercury in underground salt mines. The mercury would be stored in hermetically sealed steel containers and the regulation would be implemented by July 1, 2011 (Metal-Pages Ltd., 2007a).

The United Nations Environment Programme has indicated that countries must speed up their collective efforts to phase out the use of mercury and called for decisive action. Many nations have cut their industrial use of mercury; however, many poorer countries rely on mercury for small-scale gold mining (Metal-Pages Ltd., 2007b).

## Outlook

Overall, global mercury use is expected to decline with the exception of mercury used for the growing compact fluorescent lamp industry and mercury used for artisanal gold mining. High gold prices are expected to increase demand for mercury use in artisanal mining and, therefore, stimulate increased gold exploration and large-scale production. In turn, this will result in byproduct mercury production from the opening of large-scale gold mines.

Digital thermometers and thermometers containing galistan, which is a gallium-indium-tin alloy, have replaced mercury thermometers (Pennsylvania Department of Environmental Protection, 2005). Mercury dental amalgam, which is less esthetically pleasing, was used less in favor of ceramic material with more natural colors. Closure of mercury cell chlorine-caustic soda production facilities worldwide owing to pressure from international environmental and health organizations was expected to result in release of large amounts of mercury for disposal, recycling, or storage.

Recycled mercury from mercury cell chlorine-caustic soda plants, byproduct mercury recovered from domestic and foreign gold operations, and mercury contained in the NDS is expected to be more than adequate to meet domestic needs.

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TABLE 1  
SALIENT MERCURY STATISTICS<sup>1</sup>

(Metric tons unless otherwise specified)

	2003	2004	2005	2006	2007
United States:					
Secondary production, industrial	NA	NA	NA	NA	NA
Imports for consumption	46	92	212	94	67
Exports	287	278	319	390	84
Industry stocks, yearend <sup>2</sup>	94	62	38	19	18
Chloralkali	87	52	35	17	16
Other	7	11	3	2	2
Industrial consumption	72	91	40	38	31
Price, average, free market <sup>3</sup> dollars per flask	140	365	555	670	530
World, mine production	1,730 <sup>r</sup>	1,900 <sup>r</sup>	1,520 <sup>r</sup>	1,150 <sup>r</sup>	1,170 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised. NA Not available.

<sup>1</sup>Data are rounded to no more than three significant digits, except prices.

<sup>2</sup>Stocks at consumers and dealers only.

<sup>3</sup>Source: Platts Metals Week.

TABLE 2  
U.S. IMPORTS AND EXPORTS OF MERCURY, BY COUNTRY<sup>1</sup>

Country	2006		2007	
	Quantity, gross weight (metric tons)	Value (thousands)	Quantity, gross weight (metric tons)	Value (thousands)
<b>Imports:</b>				
Canada	8	\$64	19	\$93
China	(2)	19	(2)	10
Germany	14	882	14	1,090
Peru	22	209	34	163
Russia	51	1,140	--	--
United Kingdom	(2)	3	(2)	8
Other	(2)	3	(2)	1
<b>Total</b>	<b>94</b>	<b>2,320</b>	<b>67</b>	<b>1,360</b>
<b>Exports:</b>				
Argentina	3	52	--	--
Australia	3	61	--	--
Brazil	4	78	2	58
Canada	12	100	4	38
Colombia	4	84	9	215
France	2	40	--	--
Guyana	7	55	5	66
India	80	1,280	--	--
Iraq	15	275	--	--
Israel	4	46	--	--
Korea, Republic of	1	8	(2)	12
Malaysia	1	34	1	10
Mexico	8	126	--	--
Netherlands	118	1,620	--	--
Peru	(2)	3	23	298
Philippines	3	60	--	--
Singapore	25	312	7	134
Spain	21	340	--	--
Switzerland	1	7	(2)	11
United Kingdom	2	83	(2)	3
Vietnam	74	1,140	32	573
Other <sup>3</sup>	3 <sup>r</sup>	60 <sup>r</sup>	1	15
<b>Total</b>	<b>390</b>	<b>5,870</b>	<b>84</b>	<b>1,430</b>

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Less than ½ unit.

<sup>3</sup>Includes Bolivia, Germany, Honduras, Japan, Latvia, and Venezuela.

Source: U.S. Census Bureau.

TABLE 3  
 U.S. IMPORTS AND EXPORTS OF AMALGAMS<sup>1</sup> OF PRECIOUS METALS,  
 WHETHER OR NOT CHEMICALLY DEFINED, BY COUNTRY<sup>2</sup>

Country	2006		2007	
	Quantity, gross weight (metric tons)	Value (thousands)	Quantity, gross weight (metric tons)	Value (thousands)
Imports	-- <sup>r</sup>	-- <sup>r</sup>	--	--
Exports:				
Argentina	2	\$33	(3)	\$16
Australia	3	12,500	4	16,500
Brazil	2	420	2	1,860
Canada	242	116,000	260	95,300
China	24	1,230 <sup>r</sup>	1	10,200
Colombia	(3)	10	1	95
France	1	601	1	2,700
Germany	22	1,350	19	2,760
Hong Kong	37	334	26	1,120
India	6	39,100	5	34,300
Ireland	(3)	37	(3)	45
Italy	(3)	212	1	764
Japan	2	2,260	2	18,900
Korea, Republic of	1	2,270	3	6,010
Malaysia	(3)	815	(3)	841
Mexico	12	210,000	16	272,000
Netherlands	9	11,900	9	14,400
New Zealand	--	--	3	7
Nigeria	--	--	2	7
Singapore	2	5,130	1	5,900
Suriname	--	--	118	265
Switzerland	1	801	1	4,010
Taiwan	2	1,260	2	18,800
Thailand	--	--	9	182
United Kingdom	8 <sup>r</sup>	23,600	11	20,700
Other	(3)	677	2	793
Total	378 <sup>r</sup>	430,000 <sup>r</sup>	498	529,000

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>An alloy of mercury with one or more other metals.

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

<sup>3</sup>Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 4  
MERCURY: WORLD MINE PRODUCTION, BY COUNTRY<sup>1,2,3</sup>

(Metric tons)

Country	2003	2004	2005	2006	2007 <sup>c</sup>
Algeria	176	73	(4)	-- <sup>r</sup>	--
China <sup>c</sup>	610	1,140	1,100	760 <sup>r</sup>	800
Finland	25	24	20	20	20
Kyrgyzstan	300	300	200	250	250
Mexico <sup>c</sup>	15	15	6 <sup>r</sup>	8 <sup>r</sup>	8
Morocco <sup>c</sup>	10	10	10	10	10
Peru, exports <sup>5</sup>	13	12	102	22	NA
Russia <sup>c</sup>	50	50	50	50	50
Spain	500 <sup>r</sup>	250 <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Tajikistan <sup>c</sup>	30	30	30	30	30
United States <sup>6</sup>	NA	NA	NA	NA	NA
Total	1,730 <sup>r</sup>	1,900 <sup>r</sup>	1,520 <sup>r</sup>	1,150 <sup>r</sup>	1,170

<sup>c</sup>Estimated. <sup>r</sup>Revised. NA Not available. -- Zero.

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

<sup>2</sup>Table includes data available through April 29, 2008.

<sup>3</sup>Canada and Chile were thought to produce byproduct mercury, but information on their production was inadequate to make reliable estimates.

<sup>4</sup>Less than ½ unit.

<sup>5</sup>Byproduct mercury.

<sup>6</sup>Data on byproduct mercury are not available.