

MERCURY

By Josef Plachy

Mercury is the only common metal that is liquid at room temperature. It occurs either as native metal or in cinnabar, corderoite, livingstonite, and other minerals. Mercury has uniform volumetric thermal expansion, good electrical conductivity, and easily forms amalgams with almost all common metals except iron.

Since 1990, primary mercury production in the United States has been a byproduct of gold mining. The decline in primary production has been countered by increased secondary production from recycled waste products and materials. Domestic consumption in 1995 continued to decrease, as many uses of mercury continued to be eliminated each year in favor of less toxic substances. Because of suspension of sales in 1994 from the National Defense Stockpile (NDS), which has been the major supplier of mercury to the domestic market in the recent years, imports of mercury escalated while exports declined in 1995. (*See table 1.*)

Legislation and Government Programs

The Defense Logistics Agency (DLA) was a major supplier of mercury until Congress suspended sales in July 1994. From 1979 through 1994, DLA sold 1,734 tons of mercury from the NDS, equivalent to more than one-fourth of its inventory in 1979. The DLA's Annual Material Plan for fiscal years 1995 and 1996 provided for annual sale of 689 metric tons (20,000 flasks). At this rate of sale, the entire mercury stockpile could be eliminated in less than seven years, if suspension were lifted. The suspension was imposed by Congress, after the United States Environmental Protection Agency (EPA) raised questions about the potential domestic environmental problems associated with the release of mercury. Also, there was concern about NDS mercury being exported for uses banned in the United States. Sales will resume only after EPA and DLA find an environmentally responsible procedure for disposal.

The U.S. Food and Drug Administration has set a level of 1 part per million mercury in fish as the safe maximum limit for human consumption. Most State limits, however, are 0.5 part per million. In 1994, the State of Maine, which has a limit of 0.43 part per million, issued a fish advisory for pregnant women and for children under 8 years of age not to eat any fish from lakes or ponds; other adults were advised to restrict their fish intake. It was soon followed by other States, and by the end of 1995, 33 States had issued freshwater fish consumption advisories because of elevated levels of mercury contamination.

In Minnesota, State law prohibits the disposal of thermostats and other mercury-containing devices unless the mercury has been removed. The State also requires that manufacturers of

thermostats provide incentives to induce purchasers to properly dispose of used thermostats. In response to this legislation, Honeywell Inc., a major manufacturer of thermostats, started a recycling program involving wholesalers and dealers of heating and cooling equipment in Minnesota. The wholesalers collect the thermostats and return them to Honeywell where the mercury bulbs are removed and shipped to a mercury reprocessor for redistilling.¹

Production

The closure of the McDermitt Mine in Nevada in 1990 marked the end of production of mercury as a principal product in the United States. The only prime virgin mercury now produced in the United States is a byproduct of processing other minerals. It is mainly a byproduct of gold mining in California, Nevada, and Utah. Metals in the gold ores, including mercury, are extracted with an aqueous cyanide solution. Typical mercury recovery is between 10% and 20%. Reported production has been withheld in this report to avoid disclosing company proprietary data. (*See table 2.*)

While most of the world production is generated by mercury mines, most of the mercury produced in the United States is derived from secondary sources. In response to increasingly stricter restrictions placed on the disposal of mercury-containing products, secondary production has continued to increase, reaching 534 tons in 1995. Mercury was recovered from a variety of waste materials, such as batteries, dental amalgams, switches (including thermostats), manometers, chlor-alkali wastewater sludges, chemical solutions, and fluorescent light tubes. Refining of recycled mercury was dominated by three companies: Bethlehem Apparatus Co., Hellertown, PA; D. F. Goldsmith Co., Evanston, IL; and Mercury Refining Co., Albany, NY.

Consumption

Domestic consumption of mercury has been in a downward trend since the early 1970's. In 1995 it amounted to 436 tons, 10% lower than in 1994. The largest commercial use of mercury in the United States was for electrolytic production of chlorine and caustic soda in mercury cells, accounting for 35% of domestic mercury consumption. It was followed by manufacture of wiring devices and switches, which accounted for 19%; and dental equipment and supplies, which used 7%. The large increase in mercury used for production of chlorine and caustic soda, from 135 tons in 1994 to 154 tons in 1995, reflects the larger amount of mercury used per unit of production

and increase in total output. (*See table 3.*)

For consumption and consumer stock data, 40 companies were canvassed and 80% responded. The respondents accounted for an estimated 87% of consumption.

Price

After hitting a low of \$122 per flask in 1991, the price of mercury has recovered in later years. The domestic dealer price increased in 1995 in response to the tighter market situation. Mercury is usually sold by the 34.5-kilogram (76-pound) flask. The Platt's Metals Week domestic dealer average price for 1995 was \$247 per flask, a 27% increase over the 1994 price. Because of the greatly reduced stockpile in Russia and production problems in other major producing countries, the price of mercury is expected to continue to increase.

World Review

World production increased by 57%, reaching 2,820 tons in 1995. Most of the 1,020-ton-increase, was generated by expanded production in Spain. Production by Minas de Almaden SA, Spain's major mercury producer, had been suspended for 5 months in 1994 to allow the company to repair its metallurgy plant to address environmental concerns. Almaden was reopened at the end of 1994 and continued escalated production in 1995 to replenish depleted stocks. (*See table 5.*)

Outlook

The ever stricter environmental policy and the advancement

of new technology is expected to reduce the future use of mercury in many devices. Many nonessential uses may be either banned or voluntarily eliminated. Production of primary mercury will rely on the mining of other minerals. Secondary production will become an even more important component of domestic supply, especially if the ban on sales of mercury from the National Defense Stockpile continues.

¹Saas, B. M., M. Salem, and L. Smith, Mercury Usage and Alternatives in the Electrical and Electronics Industries (U.S. EPA Contract 68-CO-0003, Battelle). EPA Rep. 600/R-94/047, Jan. 1994, 48 p.

OTHER SOURCES OF INFORMATION

U.S Geological Survey Publications

Bailey, E. H., Clark, A. L., and Smith, R. M., 1973, Mercury, in Brolost, D. A., and Pratt, W. P., eds., United States mineral resources: U.S. Geological Survey Professional Paper 820, pp. 401-414.

Mercury. Ch. in Mineral Commodity Summaries, annual.

Other Sources

American Metal Market (daily newspaper).

Metal Bulletin (London).

Platt's Metals Week.

Roskill Information Services Ltd. Mercury 1990, 7th ed.

TABLE 1
SALIENT MERCURY STATISTICS 1/

(Metric tons, unless otherwise specified)

	1991	1992	1993	1994	1995
<u>United States:</u>					
Producing mines	8	9	9	7	8
Mine production: Byproduct	58	64	W	W	W
<u>Secondary production:</u>					
Industrial	165	176	350	466	534
Government 2/	215	103	--	--	--
Shipments from the National					
Defense Stockpile 3/	103	267	543	86	17
Imports for consumption	56	92	40	129	377
Exports	786	977	389	316	179
Industry stocks, yearend 4/	313	436	384	469	352
Industrial consumption	554	621	558	483	436
Price: New York, average per flask	\$122.42	\$201.39	\$187.00	\$194.45	\$247.39
Employment, mine and mill, average 5/	3	--	--	--	--
World: Mine production	2,540	1,920 r/	2,270 r/	1,800 r/	2,820 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Data are rounded to three significant digits, except prices.

2/ Secondary mercury shipped from U.S. Department of Energy stocks.

3/ Primary mercury.

4/ Stocks at consumers and dealers only. Mine stocks withheld to avoid disclosing company proprietary data.

5/ McDermitt mine only.

TABLE 2
BYPRODUCT MERCURY-PRODUCING MINES IN THE UNITED STATES IN 1995

Mine	County and State	Operator
Alligator Ridge	White Pine, NV	Placer Dome U. S.
Carlin Mines Complex	Eureka, NV	Newmont Gold Co.
Enfield Bell	Elko, NV	Independence Mining Co. Inc.
Getchell	Humboldt, NV	FMC Gold Co.
McLaughlin	Napa, CA	Homestake Mining Co.
Mercur	Tooele, UT	Barrick Mercur Gold Mines Inc.
Paradise Peak	Gabbs, NV	FMC Gold Co.
Pinson Mine	Humboldt, NV	Pinson Mining Co.

TABLE 3
U. S. INDUSTRIAL CONSUMPTION OF REFINED MERCURY METAL, BY USE e/ 1/

(Metric tons)

SIC Code	Use	1994	1995
28	Chemical and allied products:		
2812	Chlorine and caustic soda manufacture	135	154
2819	Laboratory uses	24	(2/)
--	Other chemical and allied products 3/	25	(2/)
36	Electrical and electronic uses:		
3641	Electric lighting	27	30
3643	Wiring devices and switches	79	84
3692	Batteries	6	(4/)
38	Instruments and related products:		
382	Measuring and control instruments	53	43
3843	Dental equipment and supplies	24	32
--	Other uses 5/	110	93
	Total	483	436

e/ Estimated.

1/ The input of refined liquid mercury to domestic manufacturing establishments.

2/ Withheld to avoid disclosing company proprietary data; included in "Other uses."

3/ Includes pharmaceutical uses and miscellaneous catalysts.

4/ Less than 1/2 unit.

5/ Includes other electrical and electronic uses, other instruments and related products, and unclassified uses. For 1995, it also includes "Laboratory uses" and "Other chemical and allied products."

TABLE 4
U.S. IMPORTS FOR CONSUMPTION OF MERCURY AND MERCURY-BEARING WASTE AND SCRAP,
AND EXPORTS, BY COUNTRY 1/

Country	1994		1995	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Imports:				
Canada	5	\$8	107	\$232
Germany	4	136	3	51
Japan	(2/)	7	19	46
Kyrgyzstan	--	--	45	128
Russia	117	290	179	636
Spain	--	--	14	57
Other	2	53	10	37
Total	129	494	377	1,190
Exports:				
Brazil	17	40	5	29
Canada	4	30	3	22
Germany	3	18	17	47
Hong Kong	87	242	52	188
India	149	249	33	93
Korea, Republic of	5	61	3	18
Mexico	4	48	3	60
Netherlands	2	20	5	33
Venezuela	--	--	15	67
Other	45	177	43	213
Total	316	885	179	770

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 5
MERCURY: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1991	1992	1993	1994	1995 e/
Algeria	431	476	459 r/	414 r/	292 3/
China e/	760	580	520	470 r/	550
Czechoslovakia 4/ 5/	75	60	XX	XX	XX
Finland	74	85	98 e/	83 r/	90 3/
Kyrgyzstan e/	XX	300	250	200	170
Mexico	340	21	12	10 e/	15
Morocco e/ 6/	20 3/	20	20	20	20
Russia e/	XX	70	60	50 r/	50
Slovakia e/ 5/	XX	XX	50	50	50
Slovenia e/ 7/	XX	7	--	--	--
Spain	--	36 r/	643	393 r/	1,497 3/
Tajikistan e/	XX	100	80	55	50
Turkey	25	5	--	-- e/	--
U.S.S.R. e/ 8/	750	XX	XX	XX	XX
Ukraine e/	XX	100	80	50	40
United States 9/	58	64	W	W	W
Yugoslavia 7/ 10/	9	XX	XX	XX	XX
Total	2,540	1,920 r/	2,270 r/	1,800 r/	2,820

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; excluded from "Total." XX Not applicable.

1/ Table includes data available through May 30, 1996.

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Reported figure.

4/ Dissolved Dec. 31, 1992.

5/ All production in Czechoslovakia for 1991-92 came from Slovakia.

6/ Mercury was produced only as a byproduct of silver mining.

7/ All production in Yugoslavia for 1991 came from Slovenia.

8/ Dissolved in Dec. 1991.

9/ Mercury was produced only as a byproduct of gold mining.

10/ Dissolved in Apr. 1992.