

SELENIUM

(Data in metric tons of selenium content, unless noted)

Domestic Production and Use: Primary selenium was recovered from anode slimes generated in the electrolytic refining of copper. Three copper refineries, one in Utah and two in Texas, accounted for domestic production of primary selenium. The value of production was \$4 million. Anode slimes from other primary electrolytic refiners were exported for processing. The estimated consumption of selenium by end use was as follows: electronics, 35%; glass manufacturing, 30%; chemicals and pigments, 20%; and other, including agriculture and metallurgy, 15%. In electronics, high-purity selenium was used primarily as a photoreceptor on the drums of plain paper copiers. In glass manufacturing, selenium was used as a decolorant in container glass and other soda-lime silica glasses and to reduce solar heat transmission in architectural plate glass. Cadmium sulfoselenide red pigments, which have good heat stability, were used in ceramics and plastics. Chemical uses included rubber compounding chemicals, gun bluing, catalysts, human dietary supplements and antidandruff shampoos. Dietary supplements for livestock were the largest agricultural use. Selenium was added to copper, lead, and steel alloys to improve their machinability.

Salient Statistics—United States:	1991	1992	1993	1994	1995^e
Production, refinery	260	243	283	360	360
Imports for consumption, metal and dioxide	344	371	382	411	410
Exports, metal, waste and scrap	210	175	261	246	250
Consumption, apparent ¹	510	490	460	530	540
Price, dealers, average, dollars per pound, 100-pound lots, refined, yearend	5.41	5.13	4.90	4.75	4.50
Stocks, producer, refined, yearend	W	W	W	W	W
Employment	NA	NA	NA	NA	NA
Net import reliance ² as a percent of apparent consumption	50	48	39	31	33

Recycling: There was no domestic production of secondary selenium. Scrap xerographic materials were exported for recovery of the contained selenium. An estimated 100 tons of selenium metal recovered from scrap was imported in 1995.

Import Sources (1991-94): Canada, 44%; Philippines, 18%; Japan, 13%; Belgium, 11%; and other, 14%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/95	Non-MFN³ 12/31/95
Selenium metal	2804.90.0000	Free	Free.
Selenium dioxide	2811.29.2000	Free	Free.

Depletion Allowance: 14% (Domestic), 14% (Foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Domestic selenium demand did not change in 1995, but world demand increased, especially in China, Europe, and South America. World selenium production remained at about the 1994 level, so the oversupply situation was eased. The use of selenium in glass and as a micronutrient remained strong.

Selenium remained a candidate as an additive to no-lead, free-machining brass for plumbing applications. Ordinary free-machining brass contains up to 7% lead. Industry consortia are testing several lead-free brasses that could be used as substitutes when more stringent regulations on lead in drinking water take effect. Bismuth is the main additive; however, its supply is limited and selenium reduces the quantity of bismuth needed.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production		Reserves ⁴	Reserve base ⁴
	<u>1994</u>	<u>1995^e</u>		
United States	360	360	10,000	19,000
Belgium	250	250	—	—
Canada	300	300	6,000	15,000
Chile	45	45	19,000	30,000
Finland	31	31	—	—
Germany	120	120	—	—
Japan	595	600	—	—
Peru	14	14	2,000	5,000
Philippines	40	40	2,000	3,000
Serbia and Montenegro	40	40	1,000	1,000
Sweden	50	50	—	—
Zambia	25	25	3,000	6,000
Other countries	<u>15</u>	<u>15</u>	<u>27,000</u>	<u>55,000</u>
World total (may be rounded)	⁵ 1,880	⁵ 1,890	<u>70,000</u>	<u>130,000</u>

World Resources: In addition to the reserve base of selenium, which is contained in identified economic copper deposits, 2.5 times this quantity of selenium was estimated to exist in copper or other metal deposits that were undeveloped, of uneconomic grade, or as yet undiscovered. Coal contains an average of 1.5 parts per million of selenium, which is about 80 times the average for copper deposits, but recovery of selenium from coal appears unlikely in the foreseeable future.

Substitutes: High-purity silicon has replaced selenium in high-voltage rectifiers and is the major substitute for selenium in low-and medium-voltage rectifiers. Other inorganic semiconductor materials, such as silicon, cadmium, tellurium, gallium, and arsenic, as well as organic photoconductors, substitute for selenium in photoelectric applications. Other substitutes include cerium oxide in glass manufacturing; tellurium in pigment and rubber compounding; and bismuth, lead, and tellurium in free-machining alloys.

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

¹Calculated using reported shipments, imports of selenium metal, and estimated exports of selenium metal, excluding scrap.

²Defined as imports - exports + adjustments for Government and industry stock changes.

³See Appendix B.

⁴See Appendix C for definitions.

⁵In addition to the countries listed, Australia, China, India, Kazakstan, Russia, the United Kingdom, and Zimbabwe are known to produce refined selenium.