SELENIUM

(Data in metric tons of selenium content, unless otherwise 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 $3 million. Anode slimes from other primary electrolytic refiners were exported for processing. The estimated consumption of selenium by end use was as follows: electronics, 25%; glass manufacturing, 25%; chemicals and pigments, 20%; and other, including agriculture and metallurgy, 20%. 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 and to replace lead in brasses for plumbing applications.

Salient Statistics—United States:	**1992**	**1993**	**1994**	**1995**	**1996[e]**
Production, refinery	243	283	360	373	350
Imports for consumption, metal and dioxide	371	382	411	324	350
Exports, metal, waste and scrap	175	261	246	269	270
Consumption, apparent[1]	490	460	530	517	520
Price, dealers, average, dollars per pound, 100-pound lots, refined	5.13	4.90	4.90	4.89	3.20
Stocks, producer, refined, yearend	W	W	W	W	W
Employment, number	NA	NA	NA	NA	NA
Net import reliance[2] as a percent of apparent consumption	48	39	31	38	38

Recycling: There was no domestic production of secondary selenium. Scrap xerographic materials were exported for recovery of the contained selenium. An estimated 90 tons of selenium metal recovered from scrap was imported in 1996.

Import Sources (1992-95): Canada, 43%; Philippines, 22%; Japan, 12%; Belgium, 11%; and other, 12%.

Tariff: Item	**Number**	**Most favored nation (MFN) 12/31/96**	**Non-MFN[3] 12/31/96**
Selenium metal	2804.90.0000	Free	Free.
Selenium dioxide	2811.29.2000	Free	Free.

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

Government Stockpile: None.

Prepared by **Robert D. Brown, Jr., (703) 648-4984 [Fax: (703) 648-7757].**

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Events, Trends, and Issues: Domestic and world selenium demand was about the same in 1996 as it was in 1995. World selenium production remained at about the 1995 level, so the oversupply situation was not eased. The use of selenium in glass, chemicals, and agriculture remained strong.

Selenium is 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 have tested several lead-free brasses that could be used as substitutes as more stringent regulations on lead in drinking water take effect. Bismuth is the main replacement additive; however, its supply is limited and selenium reduces the quantity of bismuth needed, without decreasing alloy properties.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production		Reserves[4]	Reserve base[4]
	1995	1996[e]		
United States	373	350	10,000	19,000
Belgium	250	250	—	—
Canada	553	550	7,000	15,000
Chile	46	45	19,000	30,000
Finland	30	30	—	—
Germany	115	115	—	—
Japan	551	550	—	—
Peru	14	14	2,000	5,000
Philippines	40	40	2,000	3,000
Serbia and Montenegro	30	30	1,000	1,000
Sweden	30	30	—	—
Zambia	25	25	3,000	6,000
Other countries	17	17	27,000	55,000
World total (rounded)	[5]2,070	[5]2,050	70,000	130,000

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.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

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

[3]See Appendix B.

[4]See Appendix C for definitions.

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