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. Two copper refineries in Texas accounted for domestic production of primary selenium. Anode slimes from other primary electrolytic refiners were exported for processing. The estimated consumption of selenium by end use was as follows: glass manufacturing, 35%; chemicals and pigments, 20%; electronics, 12%; and other, including agriculture and metallurgy, 33%. In glass manufacturing, selenium was used to decolor 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 supplementation for livestock was the largest agricultural use. Combinations of bismuth and selenium were added to brasses to replace lead in plumbing applications. Selenium was added to copper, lead, and steel alloys to improve their machinability. In electronics, high-purity selenium was used primarily as a photoreceptor on the drums of plain paper copiers; but this application has reached the replacement only stage because selenium has been supplanted by newer materials in currently manufactured copiers.

Salient Statistics—United States:	1997	1998	1999	2000	2001e
Production, refinery	W	W	W	W	W
Imports for consumption, metal and dioxide	346	339	326	452	500
Exports, metal, waste and scrap	127	151	233	89	75
Consumption, apparent[1]	W	W	W	W	W
Price, dealers, average, dollars per pound, 100-pound lots, refined	2.94	2.49	2.55	3.82	3.85
Stocks, producer, refined, yearend	W	W	W	W	W
Employment, number	NA	NA	NA	NA	NA
Net import reliance[2] as a percentage of apparent consumption	W	W	W	W	W

Recycling: There was no domestic production of secondary selenium. Scrap xerographic materials were exported for recovery of the contained selenium. An estimated 25 tons of selenium metal recovered from scrap was imported in 2001.

Import Sources (1997-2000): Canada, 38%; Philippines, 34%; Belgium, 10%; United Kingdom, 5%; and other, 13%.

Tariff: Item	Number	Normal Trade Relations 12/31/01
Selenium metal	2804.90.0000	Free.
Selenium dioxide	2811.29.2000	Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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SELENIUM

Events, Trends, and Issues: Domestic selenium consumption increased slightly when compared with that of 2000. World selenium demand and production were steady, so the long-term oversupply situation was not eased slightly in 2001. Lower production of selenium was caused by the use of ores with lower selenium content, the use of solvent extraction in place of older slime-producing technology, and the closure of some copper operations owing to low copper prices. The price of selenium was nearly constant at $3.65 per pound for the first half of the year. Concern over supply caused the price to increase to more than $4.00 per pound in the second half of the year.

The use of selenium in glass remained strong. The use in copiers continued to decline, while the use in metallurgical additives increased. The use of selenium as an additive to no-lead, free-machining brasses for plumbing applications continued to increase as more stringent regulations on lead in drinking water were met (ordinary free-machining brass contains up to 7% lead). Alloys with bismuth/selenium additions are dominating this market. Selenium also reduces the quantity of bismuth needed, without adverse effects on alloy properties.

Research continued to confirm the effectiveness of dietary selenium supplementation for human cancer prevention, and the use of selenium supplements in the plant-animal-human food chain increased. However, even if proven safe and effective, the dosage requirement for direct human consumption would be small, 200 to 400 micrograms per day per person; consequently, selenium demand would not change dramatically. Increased supplementation of fertilizer could be another way to achieve this public health benefit. Selenium already is added to fertilizer used to improve feed for livestock.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production		Reserves[3]	Reserve base[3]
	2000	2001[e]		
United States	W	W	10,000	19,000
Belgium	150	200	—	—
Canada	350	360	7,000	15,000
Chile	49	45	19,000	30,000
Finland	26	25	—	—
Germany	100	100	—	—
Japan	612	600	—	—
Peru	23	25	2,000	5,000
Philippines	40	40	2,000	3,000
Sweden	20	20	—	—
Yugoslavia	15	20	1,000	1,000
Zambia	10	10	3,000	6,000
Other countries[4]	10	10	27,000	55,000
World total (rounded)	[5]1,410	[5]1,460	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; bismuth, lead, and tellurium in free-machining alloys; and bismuth and tellurium in lead-free brasses.

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

[1]Defined as reported shipments + imports of selenium metal - estimated exports of selenium metal, excluding scrap.

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

[3]See Appendix C for definitions.

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

[5]Excludes U.S. production.