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. One copper refinery in Texas reported production of primary selenium. One copper refiner exported semirefined selenium for toll-refining in Asia, and two other refiners generated selenium-containing slimes, which were exported for processing.

In glass manufacturing, selenium is used to decolorize the green tint caused by iron impurities in container glass and other soda-lime silica glass and is used in architectural plate glass to reduce solar heat transmission. Cadmium sulfoselenide pigments are used in plastics, ceramics, art glass, and other glasses, such as that used in traffic lights to produce a ruby-red color. Selenium is used in catalysts to enhance selective oxidation; in plating solutions, where it improves appearance and durability; in blasting caps and gun bluing; in rubber compounding chemicals; in the electrolytic production of manganese to increase yields; and in brass alloys to improve machinability.

Selenium is used as a human dietary supplement and in antidandruff shampoos. The leading agricultural uses are as a dietary supplement for livestock and as a fertilizer additive to enrich selenium-poor soils. It is used as a metallurgical additive to improve machinability of copper, lead, and steel alloys. Its primary electronic use is as a photoreceptor on the replacement drums for older plain paper photocopiers, which are gradually being replaced by newer models that do not use selenium in the reproduction process. A new use for selenium is in amorphous selenium (aSe) detector technology. The aSe detector enables the direct conversion of X-ray to digital information.

Salient Statistics—United States:	2002	2003	2004	2005	2006[e]
Production, refinery	W	W	W	W	W
Imports for consumption, metal and dioxide	422	367	412	589	430
Exports, metal, waste and scrap	87	249	160	315	140
Consumption, apparent	W	W	W	W	W
Price, dealers, average, dollars per pound, 100-pound lots, refined	4.27	5.68	24.86	51.44	30.00
Stocks, producer, refined, yearend	W	W	W	W	W
Net import reliance[1] as a percentage of apparent consumption	W	W	W	W	W

Recycling: The amount of domestic production of secondary selenium was unknown. Scrap xerographic materials were exported for recovery of the contained selenium. As electronic recycling continues to increase, a small amount of selenium may become available from other electronics.

Import Sources (2002-05): Belgium, 33%; Canada, 31%; Philippines, 15%; Germany, 6%; and other, 15%.

Tariff: Item	**Number**	**Normal Trade Relations 12-31-06**
Selenium metal	2804.90.0000	Free.
Selenium dioxide	2811.29.2000	Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: The supply of selenium is directly affected by the supply of the materials from which it is a byproduct—copper, and to a lesser extent, nickel and cobalt. Estimated domestic selenium production increased in 2006 compared with that of 2005 owing to the resolution of a labor strike at the major domestic producer. The producer continued to operate under Chapter 11 for bankruptcy protection, which it had filed for during 2005.

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China continued to use selenium as a fertilizer supplement and as an ingredient in glassmaking, and selenium dioxide as a substitute for sulfur dioxide in the manganese refining process. It is believed that consumption of selenium in China declined in 2005 and in the first quarter of 2006. Some of China's manganese refineries closed owing to higher selenium and electricity costs. The price of selenium dropped significantly during 2006 because of a decline in global consumption.

Domestic use of selenium in glass remained unchanged, while its use in copiers continued to decline. The use of selenium as a substitute for lead in free-machining brasses continued to increase as more stringent regulations on the use of lead were implemented. The use of selenium in fertilizers and supplements in the plant-animal-human food chain and as human vitamin supplements increased as its health benefits were documented. Although small amounts of selenium are considered beneficial, it can be hazardous in larger quantities.

World Refinery Production, Reserves, and Reserve Base:

	Refinery production		Reserves[2]	Reserve base[2]
	2005	2006[e]		
United States	W	W	10,000	19,000
Belgium	200	200	—	—
Canada	300	310	6,000	10,000
Chile	82	81	16,000	37,000
Finland	62	62	—	—
Germany	14	12	—	—
India	13	13	—	—
Japan	635	630	—	—
Peru	21	17	5,000	8,000
Philippines	40	40	2,000	3,000
Sweden	20	20	—	—
Other countries[3]	NA	NA	43,000	92,000
World total (rounded)	[4]1,390	[4]1,390	82,000	170,000

World Resources: The reserve base for selenium is based on identified copper deposits. Coal generally contains between 0.5 and 12 parts per million of selenium, or about 80 to 90 times the average for copper deposits. The recovery of selenium from coal, although technically feasible, does not appear likely in the foreseeable future. A recent assessment of U.S. copper resources indicated that total copper resources in identified and undiscovered resources totals about 550 million metric tons, almost 8 times the estimated U.S. copper reserve base.

Substitutes: High-purity silicon has replaced selenium in high-voltage rectifiers. Silicon is also the major substitute for selenium in low- and medium-voltage rectifiers and solar photovoltaic cells. Amorphous silicon and organic photoreceptors are substitutes in plain paper photocopiers. Organic pigments have been developed as substitutes for cadmium sulfoselenide pigments. Other substitutes include cerium oxide as either a colorant or decolorant in glass; tellurium in pigments and rubber; bismuth, lead, and tellurium in free-machining alloys; and bismuth and tellurium in lead-free brasses. Sulfur dioxide can be used as a replacement for selenium dioxide in the production of electrolytic manganese metal.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.
[1]Defined as imports – exports + adjustments for Government and industry stock changes.
[2]See Appendix C for definitions.
[3]In addition to the countries listed, Australia, China, Kazakhstan, Russia, and the United Kingdom are known to produce refined selenium, but output is not reported, and information is inadequate for formulation of reliable production estimates.
[4]Excludes U.S. production.