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 domestic production of primary selenium. One producer exported semirefined selenium for toll-refining in Asia, and two other companies generated selenium-containing slimes, which were exported for processing.

The estimated consumption of selenium by end use was as follows: glass manufacturing, 40%; chemicals and pigments, 20%; electronics, 10%; and other, including agriculture and metallurgy, 30%. In glass manufacturing, selenium is used to decolorize the green tint caused by iron impurities in glass containers 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:	**2001**	**2002**	**2003**	**2004**	**2005[e]**
Production, refinery	W	W	W	W	W
Imports for consumption, metal and dioxide	483	422	367	412	440
Exports, metal, waste and scrap	41	87	249	160	315
Consumption, apparent	W	W	W	W	W
Price, dealers, average, dollars per pound, 100-pound lots, refined	3.80	4.27	5.68	24.86	52.00
Stocks, producer, refined, yearend	W	W	W	W	W
Employment, number	NA	NA	NA	NA	NA
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 (2001-04): Canada, 43%; Belgium, 19%; Philippines, 19%; Germany, 6%; and other, 13%.

Tariff: **Item**	**Number**	**Normal Trade Relations 12-31-05**
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. Continued concern about the adequacy of the selenium supply caused the price of selenium to rise to $53 per pound by the end of the first quarter 2005, where it remained through the end of the third quarter.

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SELENIUM

Estimated domestic selenium production decreased in 2005 as compared with that of 2004 owing to a labor strike at the major domestic producer that began in July and continued at least until October, when the producer announced that it had filed for bankruptcy protection. The future of U.S. production is therefore uncertain. Despite the declining domestic production, selenium exports rose to the highest level since 1996. It was believed that domestic exports shipped to Australia, Hong Kong, the Philippines, and other Southeast Asian countries were further processed and reexported to China. It was estimated that more than 50% of domestic exports of selenium eventually were consumed in China.

China continued to use selenium as a fertilizer supplement, as an ingredient in glassmaking, and as a substitute for sulfur dioxide in the form of selenium dioxide in the manganese smelting process. It has been estimated that China's consumption of selenium increased in 2004 and in the first quarter of 2005. In the early part of 2005, however, consumption of selenium used by the electrolytic manganese metal producers dropped drastically as many of the manganese refineries were closed by the Chinese Government because of enforcement of new environmental practices. Other manganese refineries closed owing to higher selenium and electricity costs.

Domestic use of selenium in glass remained unchanged, while 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. Selenium's higher cost, however, has limited its use in many of its applications. 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]
	2004	2005[e]		
United States	W	W	10,000	19,000
Belgium	200	200	—	—
Canada	250	250	6,000	10,000
Chile	40	84	16,000	37,000
Finland	40	40	—	—
Germany	100	14	—	—
India	12	12	—	—
Japan	600	650	—	—
Peru	21	26	5,000	8,000
Philippines	40	40	2,000	3,000
Serbia and Montenegro	10	9	1,000	2,000
Sweden	20	20	—	—
Other countries[3]	NA	NA	42,000	90,000
World total (rounded)	[4]1,330	[4]1,350	82,000	170,000

World Resources: The reserve base for selenium is based on identified economic copper deposits. An additional 2.5 times this reserve base is estimated to exist in copper and other metal deposits that have not yet been discovered. 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.

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.

[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.