SELENIUM

(Data in metric tons, selenium content, unless otherwise specified)

Domestic Production and Use: Selenium is recovered principally as a byproduct of the electrolytic refining of primary copper, where it accumulates in the residues of copper anodes. In 2025, two primary electrolytic copper refineries operated in the United States, one in Texas and one in Utah, and produced crude selenium and selenium-bearing anode slimes. Selenium was not refined in the United States. Downstream companies processed imported selenium to manufacture high-purity selenium products, selenium dioxide, and other selenium compounds. Domestic selenium production, consumption, and stocks were withheld to avoid disclosing company proprietary data.

Selenium is used in agriculture as a fertilizer additive to increase plant tolerance to environmental stressors; in antidandruff shampoos as an active ingredient; in blasting caps to control delays; in catalysts to enhance selective oxidation; in copper, lead, and steel alloys to improve machinability; in the electrolytic production of manganese metal to increase yields; in glass manufacturing to decolorize the green tint caused by iron impurities in container glass and other soda-lime silica glass; in gun bluing to improve cosmetic appearance and provide corrosion resistance; in photocells and solar cells used in electronics for its photovoltaic and photoconductive properties; in pigments to produce orange and red colors; in plating solutions to improve appearance and durability; in rubber-compounding chemicals to act as a vulcanizing agent; and in thin-film copper-indium-gallium-diselenide (CIGS) solar cells. Selenium is also an essential micronutrient and is used as a dietary supplement for humans and livestock. In 2025, estimated end uses for selenium in global consumption were metallurgy (including electrolytic manganese metal production), 40%; agriculture and animal health, 20%; glass manufacturing, 20%; electronics and photovoltaics, 10%; chemicals and pigments, 5%; and other applications, 5%.

Salient Statistics—United States:	**2021**	**2022**	**2023**	**2024**	**2025[e]**
Production, crude and anode slimes	W	W	W	W	W
Imports for consumption:					
Selenium	346	351	269	225	400
Selenium dioxide	71	10	8	5	9
Exports[1]	227	192	94	108	290
Consumption, apparent[2]	W	W	W	W	W
Price, annual average, dollars per kilogram:					
United States[3]	18.18	23.07	23.11	24.19	28
Europe[4]	18.47	19.82	19.30	24.86	29
Stocks, producer, yearend	W	W	W	W	W
Net import reliance[5] as a percentage of apparent consumption	>50	>50	>50	>50	>50

Recycling: Insignificant. Most scrap from electronic materials was exported for recovery of contained selenium.

Import Sources (2021–24): Selenium: Philippines, 25%; Mexico, 14%; Chile, 12%; Poland, 11%; and other, 38%. Selenium dioxide: Republic of Korea, 78%; China, 10%; Philippines, 7%; Germany, 4%; and other, 1%.

Tariff: Item	**Number**	**Normal Trade Relations 12–31–25**
Selenium	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 materials from which it is a byproduct, primarily copper. In 2025, domestic production of crude selenium and selenium-bearing copper anode slimes was estimated to have decreased from that in 2024, reflecting lower output of copper cathodes from primary electrolytic refineries in the United States. Reported annual average prices for selenium increased in both U.S. and European warehouses. In the United States, the average price increased by 16% to an estimated $28 per kilogram in 2025 from $24.19 per kilogram in 2024. In Europe, the average price was an estimated $29 per kilogram in 2025, 17% greater than $24.86 per kilogram in 2024.

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China was the leading producer of refined selenium in 2025 and accounted for 53% of estimated global production (excluding production in multiple countries for which available information was inadequate to make reliable estimates of output). Selenium production in China increased significantly over the past 10 years, corresponding with an increase of nearly 75% in the production capacity of electrolytically refined copper. The production capacity of copper anodes, the feedstock material for electrolytic copper refineries, more than doubled over the same time period. In January 2025, the first batch of refined selenium was shipped from a recently completed plant in Kazakhstan. The facility was expected to produce approximately 75 tons per year of selenium with a purity of 99.5%.

World Refinery Production and Capacity: Significant revisions were made to the 2024 production for Finland and India based on company and Government reports.

	Refinery production[e, 6]		Refinery capacity[e, 6]
	2024	2025	
United States (crude and anode slimes)	W	W	W
Belgium	200	200	[7]300
Canada	130	130	180
China	1,800	2,000	2,500
Finland	[7]38	39	170
Germany	49	47	60
India	88	90	100
Japan	730	640	800
Kazakhstan	2	50	100
Mexico	[7]78	88	190
Peru	[7]53	48	65
Poland	[7]68	67	90
Russia	310	320	350
Serbia	69	71	100
South Africa	11	10	15
Turkey	43	43	50
Uzbekistan	2	2	3
Other countries[8]	NA	NA	NA
World total (rounded)	[9]3,670	[9]3,800	5,100

World Resources:[10] Reserves and resources of selenium are generally not reported at the mine or country level and cannot be reliably quantified. More than 80% of selenium has been produced from anode slimes as a byproduct of primary electrolytic copper refining. Other potential sources of selenium include lead, nickel, and zinc ores. Coal generally contains significant quantities of selenium, but recovery of selenium from coal fly ash, although technically feasible, will likely not be economical in the foreseeable future.

Substitutes: Amorphous silicon and cadmium telluride are the two principal competitors with CIGS in thin-film photovoltaic cells. Organic pigments have been developed as substitutes for cadmium sulfoselenide pigments. Silicon is the major substitute for selenium in low- and medium-voltage rectifiers. Sulfur dioxide can be used as a replacement for selenium dioxide in the production of electrolytic manganese metal but is not as energy efficient. Other substitutes include bismuth, lead, and tellurium in free-machining alloys; bismuth and tellurium in lead-free brasses; cerium oxide as either a colorant or decolorant in glass; and tellurium in pigments and rubber.

[e]Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data.
[1]Includes Schedule B of the United States number 2804.90.0000 (selenium) only; there is no exclusive Schedule B number for selenium dioxide.
[2]Defined as production (selenium content of crude selenium and anode slimes) + imports (excluding selenium dioxide) – exports ± adjustments for industry stock changes.
[3]Minimum purity of 99.5%, free on board, U.S. warehouse. Source: Argus Media group, Argus Non-Ferrous Markets.
[4]Minimum purity of 99.5%, in warehouse, Rotterdam. Source: Argus Media group, Argus Non-Ferrous Markets.
[5]Defined as imports (excluding selenium dioxide) – exports ± adjustments for industry stock changes.
[6]Unless otherwise noted, data are for refined selenium only to the extent possible. Countries that produced selenium contained in copper ore and concentrate, copper smelter products (such as blister and anodes), copper refinery residues (such as anode slimes), and (or) other selenium-containing materials but did not recover refined selenium are excluded.
[7]Reported.
[8]In addition to the countries listed, Armenia, Australia, Chile, Iran, the Republic of Korea, the Philippines, Zambia, and Zimbabwe may have produced refined selenium, but available information was inadequate to make reliable estimates of output.
[9]Excludes U.S. production.
[10]See Appendix C for resource and reserve definitions and information concerning data sources.