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2021 Minerals Yearbook

SELENIUM AND TELLURIUM [ADVANCE RELEASE]

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Selenium and Tellurium

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In 2021, two electrolytic copper refineries in the United States produced selenium- and tellurium-containing anode slimes. One of these plants recovered copper telluride from slimes. The selenium and tellurium materials generated at U.S. operations were exported for further processing and were not refined domestically. Exports of selenium increased by 54% to 227 metric tons (t) from 147 t in 2020, and imports of selenium (selenium metal and the selenium content of selenium dioxide) increased by 8% to 417 t in 2021 from 384 t in 2020 (tables 1, 2, 3). Tellurium exports were 2 t in 2021 compared with 0.2 t (revised) in 2020, and imports of tellurium increased to 42 t from 12 t in 2020 (tables 1, 4, 5). The annual average price for 99.5%-minimum-purity selenium in U.S. warehouses (as reported by Argus Metals International) increased by 25% to $18.18 per kilogram in 2021 from $14.58 per kilogram in 2020. The annual average price for 99.95%-minimum-purity tellurium in U.S. warehouses (as reported by Argus Metals International) increased by 17% to $69.72 per kilogram in 2021 from $59.37 per kilogram in 2020 (table 1).

Selenium and tellurium were recovered predominantly as byproducts of nonferrous metal production in 2021, principally from anode slimes generated during the electrolytic refining of primary copper. Selenium and tellurium also can be produced as byproducts of gold, lead, nickel, platinum-group metals, and zinc. Two mines in China and one mine in Sweden were known to produce tellurium as a principal product. In 2021, world production of refined selenium was estimated to be 3,120 t compared with 3,130 t (revised) in 2020, and global production of refined tellurium was estimated to be 609 t compared with 611 t (revised) in 2020 (tables 6, 7). Selenium and tellurium were produced in multiple countries that were excluded from the estimated world totals because available information was inadequate to make reliable estimates of output.

Government Actions and Legislation

On March 25, the U.S. Department of Energy (DOE) announced that it would provide $128 million in funding for projects to lower costs, improve performance, and accelerate the deployment of solar energy technologies. The investment included $20 million for research and development of low-cost manufacturing techniques for cadmium telluride (CdTe) solar cells, the leading global end use for tellurium. The DOE set a goal of decreasing the overall cost of solar energy by 60% within the next 10 years (U.S. Department of Energy, 2021).

Production

In 2021, Freeport-McMoRan Inc. recovered selenium-containing anode slimes and copper telluride from tellurium-containing anode slimes at its copper refinery in El Paso, TX, and Rio Tinto Group produced selenium- and tellurium-containing anode slimes at its Kennecott refinery near Salt Lake City, UT. The selenium and tellurium materials generated at U.S. operations were exported for further processing and were not refined domestically. Rio Tinto was commissioning a newly constructed tellurium plant at the Kennecott refinery and expected to produce 10 metric tons per year of tellurium at full capacity (Rio Tinto Group, 2022, p. 70). ASARCO LLC's refinery in Amarillo, TX, remained idle for all of 2021 following what the company described as a temporary shutdown in October 2019 because of a worker strike. Although the strike ended in July 2020, ASARCO had not publicly announced as of yearend 2021 when operations were expected to resume nor a reason for the continued closure (Grupo México, S.A.B. de C.V., 2021, p. 83; 2022, p. 221). Domestic production data for selenium and tellurium were withheld to avoid disclosing company proprietary data.

Consumption

Selenium.—The leading worldwide end use for selenium in 2021 was estimated to be for the production of electrolytic manganese in China (Beijing Antaike Information Co., Ltd., 2024, p. 6), where selenium dioxide increases the efficiency of manganese electrodeposition. In other metallurgical applications, selenium was used as an additive in the casting of copper, iron, lead, and steel alloys to improve machinability and with bismuth to substitute for lead as a free-machining agent in brass plumbing fixtures.

In the glass industry, selenium was used to decolorize the green tint caused by iron impurities in container glass and other soda-lime silica glass. It also was added to art and other glass to produce a ruby red color and to architectural plate glass to reduce solar heat transmission. Cadmium sulfoselenide compounds were used as pigments in ceramics, glazes, paints, and plastics. Selenium pigments have good heat stability, dissolve well into solution, are resistant to ultraviolet or chemical exposure, and produce a wide range of red, orange, and maroon colors. Owing to the relatively high cost and toxicity of cadmium-based pigments, use was limited to applications where cost was not the prevailing factor and human contact was limited, such as art pieces.

Selenium is a micronutrient essential to human and animal health. In areas with selenium-poor soils, selenium was added to fertilizer and applied to acreage used to grow animal feed to increase selenium in the diet of animals and, in turn, the diet of humans. This practice was more common outside of the United States. Selenium also was used as an active ingredient in antidandruff shampoos, in blasting caps to control delays, in catalysts to enhance selective oxidation, 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 plating

solutions to improve appearance and durability, in rubber compounding chemicals to act as a vulcanizing agent, and in thin-film photovoltaic copper-indium-gallium-diselenide (CIGS) solar cells.

Tellurium.—Globally, tellurium was used principally in the production of CdTe for thin-film photovoltaic (PV) cells. World output of CdTe PV cells increased to approximately 8.5 gigawatts (GW) in 2021 compared with about 6 GW in 2020. The other types of thin-film PV cells that were manufactured commercially were CIGS cells (approximately 1.8 GW produced in 2021) and amorphous silicon cells (approximately 0.2 GW produced in 2021). Thin-film cells accounted for about 5% of global solar cells produced in 2021; the vast majority of PV cell output continued to be dominated by crystalline silicon technology. Total world production of PV cells in 2021 was nearly 250 GW compared with approximately 175 GW in 2020. Asia (predominantly China) accounted for about 95% of solar cell output in 2021 (Fraunhofer Institute for Solar Energy Systems, ISE, 2024, p. 11, 12, 27, 29).

First Solar, Inc., the leading domestic manufacturer of solar modules, produced 7.9 GW of CdTe cells at its plants in Malaysia, the United States, and Vietnam in 2021, 34% greater than output in 2020. The company began construction of a third U.S. manufacturing facility in Ohio that was expected to open in the first half of 2023. Upon completion, the total production capacity of First Solar's operations in the United States would increase by 3.3 gigawatts per year (GW/yr) to 6 GW/yr (First Solar, Inc., 2022, p. [3], 7, 44).

Other uses for tellurium included thermal imaging and thermoelectric cooling. In thermal-imaging devices for infrared sensors and heat-seeking missiles, mercury-cadmium-telluride is built up on a base of cadmium-zinc-telluride and used to convert the raw image into a crisp screen picture in a cryo-cooled environment. Semiconducting bismuth telluride was used in thermoelectric cooling devices, which consist of a series of semiconducting material couples that, when connected to a direct current, cause one side of the thermoelement to cool and the other side to heat. Thermoelectric coolers were used in electronics and military applications, such as infrared detectors, integrated circuits, laser diodes, and medical instrumentation, as well as in high-end automobiles to cool cup holders and seats. Metallurgical applications of tellurium were as an alloying additive in steel to improve machining characteristics, in cast iron to help control the depth of chill, in lead alloys to improve resistance to vibration and fatigue, in malleable iron as a carbide stabilizer, and as a minor additive in copper alloys to improve machinability without reducing conductivity. Tellurium also was used as an accelerator and vulcanizing agent in the processing of rubber, as a component of catalysts for synthetic fiber production, and as a pigment to produce blue and brown colors in ceramics and glass.

Prices

The annual average price for 99.5%-minimum-purity selenium in U.S. warehouses (as reported by Argus Metals International) increased by 25% to $18.18 per kilogram in 2021 from $14.58 per kilogram in 2020. The annual average price for 99.95%-minimum-purity tellurium in U.S. warehouses (as reported by Argus Metals International) increased by 17% to $69.72 per kilogram in 2021 from $59.37 per kilogram in 2020 (table 1).

Foreign Trade

Selenium.—In 2021, U.S. exports of selenium increased by 54% to 227 t from 147 t in 2020 (tables 1, 2). The leading destinations for selenium shipments from the United States were Egypt (37% of exports), China and Hong Kong (21%), Mexico (17%), the Philippines (10%), and Indonesia (5%). U.S. imports for consumption of selenium (consisting of selenium metal and the selenium content of selenium dioxide) were 417 t, 8% greater than 384 t in 2020 (tables 1, 3). Mexico was the leading supplier of selenium metal in 2021 and accounted for 23% of imports, followed by the Philippines (22%), Germany (11%), Russia (10%), and Poland (8%). Selenium dioxide imports were sourced primarily from the Republic of Korea (96%).

Tellurium.—Shipments of tellurium from the United States to international markets totaled 2 t in 2021, an increase from 0.2 t in 2020, and were predominantly sent to Canada (79% of exports) (tables 1, 4). U.S. imports for consumption of tellurium were 42 t in 2021 compared with 12 t in 2020. The majority of tellurium imports originated in Canada (60%), followed by the Philippines (23%) and Germany and Japan (7% each) (tables 1, 5).

World Review

For multiple countries, available data were inadequate to make reliable estimates of refined selenium and tellurium output. Many companies and countries did not report selenium and tellurium production or information regarding the selenium and tellurium content of copper ores, and trade in scrap and semirefined selenium and tellurium products may have been included with data for refined metal. Most of the production estimates reported in tables 6 and 7 were based on trends in the production of primary electrolytically refined copper.

World production of refined selenium was estimated to be 3,120 t in 2021 compared with 3,130 t (revised) in 2020, and global output of refined tellurium was estimated to be 609 t in 2021 compared with 611 t (revised) in 2020 (tables 6, 7). Selenium and tellurium were produced in multiple countries that were excluded from the estimated world totals. Among those countries with sufficient available data to generate an estimate of output, the leading producers of refined selenium were estimated to be China (40% of global production), followed by Japan (23%), Germany and Russia (10% each), and Belgium (6%). China also was estimated to be the leading producer of refined tellurium (54%), followed by Russia and Japan (11% each), Uzbekistan (8%), and Canada (7%).

China.—According to Beijing Antaike Information Co., Ltd., consumption of selenium and tellurium in China were approximately 2,600 t and 500 t, respectively, in 2021. The electrolytic manganese industry was the leading consumer of selenium, followed by agriculture; glass production; ceramic pigments and chemicals; and electronics, infrared products, and PV cells. End uses for tellurium, in descending order of quantity, were PV cells, semiconductors, metallurgy, petrochemicals, and infrared products (Beijing Antaike Information Co., Ltd., 2024, p. 6, 14).

Outlook

The supply of selenium and tellurium is affected directly by production of the principal product from which it is derived—copper—and, to a lesser extent, by the production of gold, lead, nickel, platinum-group metals, and zinc. Global output of primary electrolytically refined copper, from which selenium and tellurium are recovered as byproducts, is expected to increase during the next 5 years as copper demand and capacities increase. Production of CdTe solar cells also is expected to increase in the long term as the cost of solar energy generation becomes more competitive with that of traditional methods of electricity generation.

References Cited

Beijing Antaike Information Co., Ltd., 2024, The current situation and development trends of China's selenium & tellurium industry: MMTA International Minor Metals Conference, Singapore, April, 18 p.

First Solar, Inc., 2022, Annual report 2021: Tempe, AZ, First Solar, Inc., [140] p. (Accessed October 10, 2024, at https://s202.q4cdn.com/499595574/files/doc_financials/2021/2021-AR.pdf.)

Fraunhofer Institute for Solar Energy Systems, ISE, 2024, Photovoltaics report: Freiburg, Germany, Fraunhofer Institute for Solar Energy Systems, ISE, July 29, 56 p. (Accessed October 10, 2024, at https://www.ise.fraunhofer.de/content/dam/ise/de/documents/publications/studies/Photovoltaics-Report.pdf.)

Grupo México, S.A.B. de C.V., 2021, Reporte anual 2020 [Annual report 2020]: Mexico City, Mexico, Grupo México, S.A.B. de C.V., [329] p. (Accessed June 4, 2021, at https://www.gmexico.com/GMDocs/ReportesFinancieros/ING/2020/RF_EN_2020_BMV.pdf.) [In Spanish.]

Grupo México, S.A.B. de C.V., 2022, Invertimos en un futuro sustentable—Disciplina. Inversión. Trabajo—Informe anual 2021 [We invest in a sustainable future—Discipline. Investment. Work—Annual report 2021]: Mexico City, Mexico, Grupo México, S.A.B. de C.V., [533] p. (Accessed June 27, 2022, at https://www.gmexico.com/GMDocs/ReportesFinancieros/Esp/2021/RF_ES_2021_IFN.pdf.) [In Spanish.]

Rio Tinto Group, 2022, Annual report 2021: London, United Kingdom, Rio Tinto Group, 420 p. (Accessed March 21, 2022, at https://cdn-rio.dataweavers.io/-/media/content/documents/invest/reports/annual-reports/2021/rt-annual-report-2021.pdf?rev=d54c8b0596a44e159024ac7421a4d38d.)

U.S. Department of Energy, 2021, DOE announces goal to cut solar costs by more than half by 2030: Washington, DC, U.S. Department of Energy press release, March 25. (Accessed September 29, 2022, at https://www.energy.gov/articles/doe-announces-goal-cut-solar-costs-more-half-2030.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Byproduct Mineral Commodities Used in Photovoltaic Cells. Circular 1365, 2010.

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

Mineral Commodity Profiles—Selenium. Open-File Report 03–018, 2004.

Selenium. Ch. in Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply, Professional Paper 1802, 2017.

Selenium. Ch. in Mineral Commodity Summaries, annual.

Selenium Recycling in the United States in 2004. Circular 1196–T, 2010.

Selenium (Se). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Tellurium. Ch. in Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply, Professional Paper 1802, 2017.

Tellurium. Ch. in Mineral Commodity Summaries, annual.

Tellurium (Te). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Other

Selenium. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Tellurium. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1
SALIENT SELENIUM AND TELLURIUM STATISTICS[1]

(Kilograms, metal content, unless otherwise specified)

	2017	2018	2019	2020	2021
Selenium:					
United States:					
Production, anode slimes	W	W	W	W	W
Exports	242,000	158,000	361,000	147,000	227,000
Imports for consumption[2]	469,000	458,000	470,000 r	384,000	417,000
Price, average, United States, dollars per kilogram[3]	34.28	37.15	20.17	14.58	18.18
Price, average, Europe, dollars per kilogram[4]	36.23	38.98	20.44	14.71	18.47
World, refinery production[5]	2,790,000	3,060,000	3,040,000	3,130,000 r	3,120,000
Tellurium:					
United States:					
Production, anode slimes	W	W	W	W	W
Exports	2,310	4,150	827	197 r	2,020
Imports for consumption	163,000	192,000	59,300	11,900	41,800
Price, average, United States, dollars per kilogram[6]	37.61	79.55	68.11	59.37	69.72
Price, average, Europe, dollars per kilogram[7]	37.63	73.67	60.45	56.05	67.26
World, refinery production[5]	516,000 r	575,000 r	598,000 r	611,000 r	609,000

rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through July 7, 2022. Data are rounded to no more than three significant digits, except prices.
[2]Includes selenium metal and the selenium content of selenium dioxide.
[3]Average annual price for selenium, free on board, U.S. warehouse, 99.5% minimum purity. Source: Argus Media group, Argus Metals International.
[4]Average annual price for selenium, in warehouse, Rotterdam, 99.5% minimum purity. Source: Argus Media group, Argus Metals International.
[5]May include estimated data. Excludes multiple selenium- and tellurium-producing countries for which available information was inadequate to make reliable estimates of output.
[6]Average annual price for tellurium, free on board, U.S. warehouse, 99.95% minimum purity. Source: Argus Media group, Argus Metals International.
[7]Average annual price for tellurium, in warehouse, Rotterdam, 99.99% minimum purity. Source: Argus Media group, Argus Metals International.

TABLE 2
U.S. EXPORTS OF SELENIUM METAL[1]

Country or locality	2020 Selenium content (kilograms)	2020 Value	2021 Selenium content (kilograms)	2021 Value
Brazil	--	--	6,650	$83,700
Bulgaria	2,580	$39,400	1,040	23,900
Canada	2,290	71,500	3,700	108,000
China	4,610	57,400	2,800	47,300
Dominican Republic	4,730	93,200	2,950	45,700
Ecuador	--	--	1,140	26,300
Egypt	54,600	892,000	85,200	1,510,000
France	279	4,720	--	--
Germany	--	--	1,690	26,300
Hong Kong	34,900	119,000	44,700	212,000
Indonesia	4,800	74,400	10,300	134,000
Israel	--	--	51	3,250
Italy	351	8,460	226	3,500
Korea, Republic of	15,300	51,400	648	16,600
Mexico	10,100	143,000	39,600	569,000
Netherlands	428	14,800	--	--
New Zealand	--	--	200	7,000
Panama	500	8,650	--	--
Peru	--	--	1,100	19,400
Philippines	1,020	2,660	21,800	197,000
South Africa	6,520	90,900	1,950	27,400
Thailand	3,560	55,200	--	--
United Arab Emirates	--	--	769	11,900
United Kingdom	--	--	100	10,000
Venezuela	772	12,000	746	11,600
Total	147,000	1,740,000	227,000	3,100,000

-- Zero.

[1]Table includes data available through June 16, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 3
U.S. IMPORTS FOR CONSUMPTION OF SELENIUM[1]

Class and country or locality	2020 Selenium content (kilograms)	2020 Value	2021 Selenium content (kilograms)	2021 Value
Selenium metal:				
Australia	3	$5,500	--	--
Belgium	16,800	235,000	18,200	$324,000
Canada	46,000	485,000	21,300	415,000
Chile	6,300	84,300	24,500	404,000
China	1,340	32,500	2,080	43,600
France	530	15,900	--	--
Germany	51,100	1,140,000	37,000	1,020,000
India	225	12,000	--	--
Ireland	1	4,780	1	2,320
Italy	--	--	8,000	169,000
Japan	45,000	1,530,000	11,200	1,460,000
Korea, Republic of	12,000	148,000	4,000	66,600
Mexico	57,100	624,000	79,000	1,080,000
Netherlands	3	6,210	4	10,600
New Zealand	1	7,360	338	17,500
Pakistan	30,000	368,000	--	--
Philippines	63,300	3,270,000	77,600	3,840,000
Poland	31,500	358,000	28,200	351,000
Russia	5,190	59,600	34,500	559,000
Total	366,000	8,380,000	346,000	9,760,000
Selenium dioxide:[2]				
Belgium	18	2,080	--	--
China	2,040	46,300	1,020	28,200
Germany	959	29,900	1,600	57,600
Japan	386	19,900	--	--
Korea, Republic of	13,700	507,000	68,200	2,610,000
Philippines	667	25,900	--	--
Total	17,800	632,000	70,900	2,700,000
Grand total	384,000	9,010,000	417,000	12,500,000

-- Zero.

[1]Table includes data available through June 16, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Selenium content calculated as 71% of the gross weight of selenium dioxide.

Source: U.S. Census Bureau.

TABLE 4
U.S. EXPORTS OF TELLURIUM METAL[1]

Country or locality	2020 Tellurium content (kilograms)	2020 Value	2021 Tellurium content (kilograms)	2021 Value
Brazil	--	--	362	$30,800
Canada	132	$54,900	1,580	64,100
China	4	5,700	2	9,160
Indonesia	1	3,770	--	--
Korea, Republic of	39	36,000	27	24,500
Mexico	3	6,520	--	--
Singapore	18	2,720	41	6,300
Total	197 r	110,000 r	2,020	135,000

rRevised. -- Zero.
[1]Table includes data available through June 16, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 5
U.S. IMPORTS FOR CONSUMPTION OF TELLURIUM METAL[1]

Country or locality	2020 Tellurium content (kilograms)	2020 Value	2021 Tellurium content (kilograms)	2021 Value
Australia	46	$49,500	--	--
Belgium	132	5,690	900	$84,200
Canada	2,250	1,020,000	25,200	3,000,000
China	1,800	186,000	305	59,400
Germany	735	47,300	3,000	142,000
Japan	1,740	123,000	2,940	202,000
Netherlands	--	--	1	2,000
Philippines	5,230	413,000	9,500	806,000
Ukraine	--	--	1	4,200
United Kingdom	1	2,840	--	--
Total	11,900	1,850,000	41,800	4,300,000

-- Zero.
[1]Table includes data available through June 16, 2022. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
SELENIUM: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Kilograms, selenium content)

Country or locality[3]	2017	2018	2019	2020	2021
Belgium[e]	200,000	200,000	200,000	200,000	200,000
Canada	72,000	85,000	57,000	60,000 [e]	57,000 [e]
China	930,000	1,050,000 [e]	1,100,000 [e]	1,200,000 [e]	1,260,000 [e]
Finland	100,198	108,918	115,236	84,213 [r]	80,000 [e]
Germany[e]	300,000	300,000	300,000	300,000	300,000
India	17,000 [e]	17,000 [e]	14,600	14,000 [e]	14,000 [e]
Japan	729,132	749,677	708,812	740,000 [e]	720,000 [e]
Peru[e]	45,000	45,000	40,000	35,000	36,000
Poland	73,900	66,360	75,760	73,800 [r]	74,000 [e]
Russia	150,000 [e]	303,000	331,000	338,000 [r]	300,000 [e]
Serbia	19,000	29,000	17,000	10,000	10,000 [e]
South Africa[e]	12,000	9,300	8,500	8,200 [r]	9,000
Sweden	89,000	45,000	19,000	10,000	5,000 [e]
Turkey[e]	50,000	50,000	50,000	50,000	50,000
United States, anode slimes	W	W	W	W	W
Uzbekistan	2,900	1,900	2,300	2,300	2,300 [e]
Total	2,790,000	3,060,000	3,040,000	3,130,000 [r]	3,120,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in total.

[1]Table includes data available through May 19, 2022. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Unless otherwise noted, data relate to refinery output only to the extent possible. Countries and (or) localities that produced selenium contained in copper ore, copper concentrates, copper anode, blister copper, or refinery residues but did not recover refined selenium are excluded.

[3]In addition to the countries and (or) localities listed, Australia, Chile, Iran, Kazakhstan, the Republic of Korea, Mexico, the Philippines, and Zimbabwe may have produced refined selenium, but available information was inadequate to make reliable estimates of output.

TABLE 7
TELLURIUM: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Kilograms, tellurium content)

Country or locality[3]	2017	2018	2019	2020	2021
Bulgaria	5,095	3,931	2,944	3,676 [r]	4,000 [e]
Canada	49,000	40,000 [e]	40,000 [e]	44,000 [e]	44,000 [e]
China	291,000	307,000 [e]	325,000 [e]	330,000 [e]	330,000 [e]
Japan	37,754	57,231	66,664	70,000 [e]	68,000 [e]
Russia	44,000	70,000	70,600 [r]	70,200 [r]	70,000 [e]
South Africa[e]	5,300	4,200	3,900	3,700 [r]	3,800
Sweden, tellurium concentrate	34,979	44,641	40,953	41,742	41,376
United States, anode slimes	W	W	W	W	W
Uzbekistan	48,400	47,500	48,000 [e]	48,000 [e]	48,000 [e]
Total	516,000 [r]	575,000 [r]	598,000 [r]	611,000 [r]	609,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in total.

[1]Table includes data available through May 18, 2022. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Unless otherwise noted, data relate to refinery output only to the extent possible. Countries and (or) localities that produced tellurium contained in copper ore, copper concentrates, copper anode, blister copper, or refinery residues but did not recover refined tellurium are excluded.

[3]In addition to the countries and (or) localities listed, Australia, Belgium, Chile, Germany, Indonesia, Kazakhstan, Mexico, and the Philippines may have produced refined tellurium, but available information was inadequate to make reliable estimates of output.