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2017 Minerals Yearbook

SELENIUM AND TELLURIUM [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

May 2020

Selenium and Tellurium

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In 2017, selenium and tellurium were not refined in the United States. Three copper refineries produced either semirefined selenium and tellurium or selenium- and tellurium-containing copper anode slimes, and all production was exported for further processing. U.S. imports and exports of selenium and tellurium increased in 2017 compared with those in 2016. The average Platts Metals Week New York dealer price for 99.5%-pure selenium in 2017 decreased by 54% to $10.78 per pound from $23.69 per pound in 2016, reaching the lowest price since 2003. The average price for 99.99%-pure tellurium (in warehouse, Rotterdam), as reported by Argus Media group—Argus Metals International, increased by 20% in 2017 to $37.63 per kilogram from the revised price of $31.45 per kilogram in 2016, but the price was less than one-half of the 2015 price and one-third of the price in 2014 (table 1).

Except for two mines in China that began mining tellurium as a principal product in 2010 and one mine in Sweden that recovered tellurium from gold-telluride ores, selenium and tellurium were recovered as byproducts of nonferrous metal mining in 2017, principally from the anode slimes produced during the electrolytic refining of copper. Selenium and tellurium were also recovered as byproducts of gold, lead, nickel, platinum-group metals, and zinc.

Production

Three primary electrolytic copper refineries produced selenium- and tellurium-containing intermediate products in the United States in 2017. ASARCO LLC's (Tucson, AZ) copper refinery in Amarillo, TX, produced semirefined selenium and tellurium, which were exported to Mexico for further processing. Freeport-McMoRan Inc.'s (Phoenix, AZ) copper refinery in El Paso, TX, produced and exported semirefined material containing tellurium to Asia. Rio Tinto Kennecott's [a subsidiary of Rio Tinto plc (United Kingdom)] copper refinery in Garfield, UT, generated selenium- and tellurium-containing slimes, which were discarded into tailings. Most of the selenium and tellurium came from copper ores mined in Arizona and Utah.

Consumption

Selenium.—In 2017, domestic and global consumption data for selenium were unavailable. In 2010, the latest year for which data were available, major global applications for selenium were, in descending order of estimated consumption, electrolytic manganese and metallurgy, glass manufacturing, agriculture, chemicals and (or) pigments, and electronics and other (Selenium Tellurium Development Association, 2010).

The main metallurgical end use for selenium in 2017 was for the production of electrolytic manganese in China, where selenium dioxide (SeO_2) was substituted for sulfur dioxide to reduce the power required to operate electrolytic cells. In 2017, global production of manganese increased by 37% to 1.73 million metric tons, of which China remained the main producer (International Manganese Institute, 2018, p. 17). In other metallurgical applications, selenium was used with bismuth to substitute for lead as a free-machining agent in brass plumbing fixtures. Metallurgical-grade selenium also was used as an additive to cast iron, copper, lead, and steel alloys.

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 was also used in art and other glass to produce a ruby red color and in architectural plate glass to reduce solar heat transmission through the glass.

Selenium is a micronutrient essential to human and animal health, and 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 the United States.

Cadmium sulfoselenide compounds were used as pigments in ceramics, glazes, paints, and plastics. Selenium pigments have good heat stability, react well to moisture, and are resistant to ultraviolet or chemical exposure. These pigments produce a wide range of red, orange, and maroon colors but, because of the relatively high cost and the toxicity of cadmium-based pigments, their use was limited to applications where cost was not the prevailing factor and human contact was limited, such as art pieces.

Tellurium.—Industry estimates in 2010, the latest year for which data were available, for global tellurium consumption by application were solar panels, 40%; thermoelectric applications, 30%; metallurgical uses, 15%; and other, 15% (Selenium Tellurium Development Association, 2010).

In 2017, three major types of thin-film photovoltaic (PV) cells were in commercial production—amorphous silicon, cadmium telluride (CdTe), and copper indium gallium diselenide. However, thin-film solar cells accounted for only about 5% of all solar cells produced in 2017; the majority of PV solar cell production continued to be dominated by the conventional crystalline silicon technology. Global PV cell and module production in 2017 was estimated by industry sources to be 97.5 gigawatts (GW). China produced about 68 GW of solar cells and modules in 2017, with a capacity of 133 GW peak (GWp), under optimal conditions. Worldwide cumulative installations of solar cells are 415 GWp, with China leading installations at 32%, and North America at 14%. Within the United States, First Solar Inc. (Tempe, AZ), produced an initial run of a new series of CdTe solar panels in Ohio and began construction of a second facility in Vietnam, which would double the CdTe panel production capacity of the initial

site. The new facility was expected to start production in early 2019 and produce 1.2 gigawatts per year (GW/yr). First Solar was already constructing a facility in Malaysia with a capacity of 1.2 GW/yr that was expected to be operational in the third quarter of 2018. The company expected to have 5.4 GW/yr of production capacity by 2020. Tellurium consumption for solar panels, based on information from 2009, was estimated to be 91 metric tons per gigawatt of production of CdTe solar cells, or an estimated First Solar's consumption of 490 t of tellurium per year by 2020 (Zweibel, 2010; Argus Metals International, 2017a; First Solar Inc., 2017; 2018, p. 65; Fraunhofer Institute for Solar Energy Systems, ISE, 2018, p. 21).

Other uses for tellurium include thermal imaging and thermoelectric cooling. In thermal-imaging devices for infrared sensors and heat-seeking missiles, mercury-cadmium-telluride was built up on a base of cadmium-zinc-telluride and was 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. These devices 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 the cooling of infrared detectors, integrated circuits, laser diodes, and medical instrumentation, as well as in high-end automobiles to cool cup holders and seats. In China, these devices were used in refrigerators, water dispensers, and other home appliances.

In metallurgy, tellurium was used in steel as a free-machining additive, in copper to improve machinability without reducing conductivity, in lead to improve resistance to vibration and fatigue, in cast iron to help control the depth of chill, and in malleable iron as a carbide stabilizer.

Tellurium was used as a vulcanizing agent and as an accelerator in the processing of rubber and in catalysts for synthetic fiber production. Other applications included the use of tellurium as a pigment to produce blue and brown colors in ceramics and glass.

Prices

The annual average New York dealer price for 99.5%-pure selenium was $10.78 per pound in 2017, 54% less than the annual average price in 2016. In 2013, the price of selenium began the year at an average monthly price of $45 per pound, and it steadily decreased until the beginning of 2016, when it reached an average price of $19 dollars per pound in February. Prices proceeded to increase to a peak in September and October 2016 at a monthly average price of $34 per pound, and fell to a low of $8.50 per pound in December. The average monthly selenium price rose throughout the year from $8.50 per pound in January to $12.50 per pound in December. This increase was attributed to a decrease in the availability of material on the spot market and reduced production from lead concentrates (Metal-Pages, 2017c).

The average price for 99.99%-pure tellurium (in warehouse, Rotterdam), as reported by Argus Media group—Argus Metals International, increased by 20% in 2017 to $37.63 per kilogram from the revised price of $31.45 per kilogram in 2016. The average monthly tellurium price was $30.09 per kilogram at the beginning of the year, rose until it reached $48.52 per kilogram in November, and ended the year at $43.03 per kilogram. In the beginning of 2013, tellurium began at an average price of $125 per kilogram and remained stable until early 2015, when it decreased to a low of $29 dollars per kilogram in the last quarter of 2016. Some analysts thought that because there were no new applications for tellurium, the underlying demand from consumers should have remained flat, so the increases in demand could be attributed to metal traders in Asia. Tellurium was one of the metals that was traded on the Fanya Metal Exchange, and when it collapsed in 2015, a potential release of the inventory on the open market drove prices down (Metal-Pages, 2017b).

Foreign Trade

Selenium.—Exports of selenium in 2017 increased by 79% to 268 metric tons (t) from 150 t in 2016. In descending order of quantity, Hong Kong, China, the Republic of Korea, Canada, and Japan were the leading destinations for selenium exports in 2017 and collectively accounted for 75% of the export tonnage. Exports increased to Hong Kong (by 50 t), the Republic of Korea (by 35.7 t), Canada (by 25.6 t), and China (by 21.8 t). Based on unrounded data, the annual average value of exports in 2017 was $16.96 per kilogram ($7.69 per pound), 43% more than the 2016 annual average (table 2).

In 2017, imports for consumption of selenium metal, including the selenium content of SeO_2, increased by 8% from 433 t to 469 t. China, Mexico, the Philippines, Germany, Belgium, Canada, Japan, and the Republic of Korea, in descending order of quantity, collectively accounted for 96% of the imports of selenium into the United States in 2017. Based on unrounded data, the annual average value of all imported selenium materials in 2017 was $36.59 per kilogram ($16.60 per pound), 24% more than in 2016 (table 3).

In 2017, imports for consumption of SeO_2 decreased by 13% to 18.5 t from the revised quantity of 21.3 t in 2016. Three countries—Canada, China, and Germany, in decreasing order of quantity—collectively supplied the United States with 95% of the SeO_2 imports in 2017, with Canada accounting for 39% of the imports (table 3). Based on unrounded data, the annual average value of SeO_2 imports was $25.92 per kilogram ($11.76 per pound), a 39% increase compared with that in 2016.

Tellurium.—In 2017, tellurium exports were 2,310 kilograms (kg), a 12% decrease compared with the revised exports in 2016. The main destinations were Jordan and Canada, which combined accounted for 90% of total tellurium exports (table 4). Imports for consumption of tellurium increased by 24% in 2017 compared with imports in 2016. The leading suppliers, in descending order of quantity, Canada and China, accounted for 90% of the total imports of tellurium metal into the United States (table 5).

World Review

Global selenium and tellurium output cannot be determined with certainty because some companies and countries do not report production, and trade in scrap and semirefined products may be included with refined metal trade data. World production

of selenium, excluding Australia, Iran, Kazakhstan, Mexico, the Philippines, Uzbekistan, and the United States, was estimated to have decreased slightly to 2,710 t in 2017, principally owing to an estimated 126-t decrease in Canada. World production of tellurium, excluding Australia, Belgium, Chile, Colombia, Germany, Kazakhstan, Mexico, the Philippines, Poland, and the United States, was estimated to have increased by 12%, principally owing to an estimated production increase in Canada (tables 6, 7). The U.S. Geological Survey estimated that 2017 world production of tellurium was 467 t, but this does not take into account countries that were known to produce refined tellurium and did not report their output.

China.—China was the leading producer of selenium and tellurium in the world, and accounted for 34% and 62% of world production, respectively. China produced an estimated 930 t of selenium in 2017, a slight increase from the estimated 2016 production of 920 t. China's estimated production of tellurium was 290 t, a 4% increase from the 2016 production of 280 t. Production values of selenium and tellurium in China were made available by the China Nonferrous Industry Association at the Minor Metals Trade Association (MMTA) International Minor Metals Conference 2018 in Dublin, Ireland.

In 2017, the Government of China's National Development and Reform Commission announced the installation of 53 GW of solar capacity, an increase from the 2016 plan to increase PV capacity by 15 to 20 GW of annual solar power generation. These new solar plants could increase the consumption of minor metals, including cadmium, gallium, indium, selenium, and tellurium (Argus Metals International, 2018).

According to the China Nonferrous Industry Association, selenium consumption in China was expected to be more than production in 2017, with annual consumption of around 1,200 t and production of 930 t of selenium. The electrolytic manganese industry remained the leading consumer of selenium in China, accounting for 46% of selenium consumption in 2016, but the overall sector was facing decreasing manganese demand and increased substitution of manganese in stainless steel production. The tellurium market was expected to remain in surplus, owing to decreased consumption of tellurium because of increased efficiency in manufacturing thermoelectric devices. Consumption of tellurium was around 210 t from 2010 through 2012 but decreased in 2016 to 190 t (Feng, 2017).

India.—India planned to expand its solar capacity to 100 GW/yr by 2022 from 5 GW/yr in 2015 and announced a safeguard duty investigation in December 2017. This investigation was to determine if imports of cheap solar cells were a threat to the domestic industry. Five India-based solar firms—Helios Photo Voltaic, Indosolar, Jupiter Solar Power, Mundra Solar PV, and Websol Energy Systems—which were represented by the Indian Solar Manufacturers Association (ISMA), claimed that even though local demand increased, their market share had not changed owing to cheap imports. In January, the Directorate General of Safeguards suggested a 70% safeguard duty on solar cell imports in response to a petition filed by ISMA in July 2016, but the petition was temporarily withdrawn for revisions. The 70% duty was expected to inflate solar project costs and put several solar projects already under development at risk. According to CRISIL Ltd., imports from China and Malaysia accounted for around 80% of solar modules used in India (Argus Metals International, 2017b; CRISIL Ltd., 2017; Indian Solar Manufacturers Association, 2018).

Sweden.—Byproduct tellurium production at Boliden AB's Kankberg gold-tellurium mine decreased by 10% in 2017 to 34,979 kg from the revised production of 38,680 kg in 2016. Boliden reopened the Kankberg Mine in 2012, and the mine's life was expected to extend into 2020 (Boliden AB, 2018, p. 112).

Outlook

The supply of selenium and tellurium is directly affected by the 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 produced from sulfide ores. Selenium prices slowly recovered throughout 2017, ending at $12.50 per pound in December. Tellurium also recovered and ended the year at an average price of $53 per kilogram. Recovery rates of selenium and tellurium from copper slimes are not expected to increase if selenium and (or) tellurium prices remain at or near those at yearend 2017.

At the MMTA International Minor Metal Conference 2017 in Dublin, the China Nonferrous Metals Industry Association predicted that demand for selenium will fluctuate with the electrolytic manganese industry. Although other selenium-consuming industries, like solar and agricultural products, are growing, their overall demand remains relatively small. In China, production of selenium products is not sufficient for domestic demand, and imports will continue. China's consumption of tellurium has decreased since 2012 and is expected to decline further through 2018 owing to decreasing demand for tellurium-based solar cells and increased manufacturing efficiency in the alloy and thermoelectric sectors (Metal-Pages, 2017a).

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TABLE 1
SALIENT SELENIUM AND TELLURIUM STATISTICS[1]

(Kilograms, contained metal, unless otherwise specified)

	2013	2014	2015	2016	2017
Selenium:					
United States:					
Production, primary refined	W	W	W	W	--
Exports	648,000	521,000	468,000	150,000	268,000
Imports for consumption[2]	435,000 r	475,000	457,000 r	433,000 r	469,000
Price, average, commercial grade,[3] dollars per pound	36.17 r	26.78	22.09	23.69	10.78
World, refinery production	2,280,000 r	2,470,000 r	2,660,000 r	2,800,000 r	2,710,000 e
Tellurium:					
United States:					
Production, primary refined	W	W	W	W	W
Exports	42,300	27,900	40,800	2,620 r	2,310
Imports for consumption	65,300	109,000	76,000	72,700	163,000
Price, average,[4] dollars per kilogram	112.05	119.37	78.12	31.45 r	37.63
World, refinery production	365,000 r	439,000 r	411,000 r	416,000 r	467,000 e

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data. -- Zero.
[1]Table includes data available through June 14, 2019. Data are rounded to no more than three significant digits, except prices.
[2]Includes selenium metal and the selenium content of selenium dioxide.
[3]Annual average New York dealer price for 99.5% selenium. Source: Platts Metals Week.
[4]Annual average price published by the Argus Media group—Argus Metals International for duties unpaid in warehouse, Rotterdam, 99.99% tellurium.

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

Country or locality	2016		2017	
	Quantity (kilograms, contained Se)	Value	Quantity (kilograms, contained Se)	Value
Argentina	--	--	1,240	$19,200
Australia	958	$14,800	--	--
Belgium	396	6,140	--	--
Brazil	220	3,160	1,280	20,500
Canada	1,090	32,700	26,654	747,044
China	22,500	150,000	44,300	832,000
Colombia	375	9,680	336	6,950
France	--	--	2,160	39,100
Germany	390	6,050	--	--
Hong Kong	19,500	113,000	69,500	1,170,000
India	178	2,750	--	--
Indonesia	51,900	805,000	13,800	214,000
Israel	--	--	699	15,200
Japan	22,500	348,000	19,800	308,000
Korea, Republic of	4,760	73,800	40,500	696,000
Mexico	5,710	113,000	15,100	213,000
Netherlands	--	--	3,290	51,000
Philippines	--	--	4,870	30,300
Russia	19,300	91,500	19,300	101,000
Saudi Arabia	75	3,190	--	--
Turkey	--	--	2,190	34,000
United Kingdom	--	--	655	10,200
Venezuela	--	--	2,700	43,300
Total	150,000	1,770,000	268,000	4,550,000

-- Zero.

[1]Table includes data available through June 14, 2019. 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	2016 Quantity (kilograms, contained Se)	2016 Value	2017 Quantity (kilograms, contained Se)	2017 Value
Selenium:				
Belgium	27,400	$431,000	38,500	$1,300,000
Canada	14,600	235,000	30,200	789,000
Chile	--	--	5,000	180,000
China	88,200	1,420,000	94,500	3,000,000
Germany	57,300	1,320,000	55,600	2,180,000
India	--	--	8,180	301,000
Japan	19,000	1,110,000	31,500	1,840,000
Korea, Republic of	13,000	167,000	31,000	1,080,000
Mexico	64,800	788,000	82,500	1,980,000
Netherlands	6	17,000	2	11,700
New Zealand	2,540	19,100	1,510	22,500
Norway	17,800	128,000	--	--
Philippines	88,100	6,510,000	68,300	3,730,000
Russia	1,000	21,500	2,500	92,800
Serbia	960	14,400	--	--
United Kingdom	16,700	286,000	1,250	44,600
Total	411,000	12,500,000	450,000	16,600,000
Selenium dioxide:[2]				
Belgium	675 r	23,000	--	--
Canada	--	--	7,260	168,000
China	4,650 r	147,000	5,430	248,000
Germany	3,540 r	152,000 r	4,960	221,000
Japan	193 r	10,200	892	41,000
Korea, Republic of	12,200 r	226,000	--	--
Total	21,300 r	558,000 r	18,500	677,000
Grand total	433,000 r	13,000,000 r	469,000	17,200,000

rRevised. -- Zero.
[1]Table includes data available through June 14, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Selenium content calculated as 71% of gross weight of material.

Source: U.S. Census Bureau.

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

Country or locality	2016 Quantity (kilograms, contained Te)	2016 Value	2017 Quantity (kilograms, contained Te)	2017 Value
Canada	1,230 r	$252,000	904	$249,000
China	21	8,680	82	17,300
Germany	4	2,800	--	--
India	--	--	20	7,000
Jordan	352	52,800	1,170	93,600
Korea, Republic of	1,020	222,000	--	--
Singapore	15	4,000	18	2,710
Switzerland	1	4,900	63	4,220
Taiwan	--	--	48	8,850
Total	2,620 r	520,000	2,310	383,000

rRevised. -- Zero.
[1]Table includes data available through June 14, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

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

	2016		2017	
Country or locality	Quantity (kilograms, contained Te)	Value	Quantity (kilograms, contained Te)	Value
Belgium	1,500	$84,400	1,000	$61,100
Canada	37,700	2,180,000	109,000	8,350,000
China	30,900	2,340,000	37,800	2,930,000
Germany	242	55,100	9,810	989,000
Hong Kong	--	--	23	15,000
Japan	237	25,300	1,540	84,100
Netherlands	--	--	1	2,380
Philippines	2,160	188,000	1,410	122,000
Russia	--	--	2,070	95,900
Switzerland	--	--	52	10,100
Ukraine	3	8,430	1	3,680
United Kingdom	--	--	22	13,800
Total	72,700	4,880,000	163,000	12,700,000

-- Zero.

[1]Table includes data available through June 14, 2019. 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 PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Kilograms, contained selenium)

Country or locality[2]	2013	2014	2015	2016	2017
Belgium[e]	200,000	200,000	200,000	200,000	200,000
Canada[e, 3]	138,000	142,000	156,000	175,000 [r]	49,000
China[e]	510,000	625,000	810,000	920,000	930,000
Finland	72,459	93,682	93,051 [r]	104,420 [r]	105,000 [e]
Germany[e]	250,000 [r]	250,000 [r]	250,000 [r]	300,000 [r]	300,000
India[e, 4]	17,000	17,000	17,000	17,000	17,000
Japan	741,300	782,451	772,768	752,173 [r]	729,132
Peru[e]	42,000	40,000	40,000	45,000	45,000
Poland	80,200	89,800 [r]	87,000 [r]	87,000	88,000 [e]
Russia	114,160	130,810	135,000	150,000 [r]	150,000 [e]
Serbia	15,727 [r]	17,255 [r]	14,950 [r]	14,500 [e]	15,000 [e]
South Africa[5]	15,000 [e]	12,000	13,000	15,000	15,000 [e]
Sweden[e]	20,000	20,000	20,000	20,000	20,000
Turkey	59,426 [r]	52,658 [r]	50,000 [r]	--	50,000 [e]
United States	W	W	W	W	W
Total	2,280,000 [r]	2,470,000 [r]	2,660,000 [r]	2,800,000 [r]	2,710,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data. -- Zero.

[1]Table includes data available through July 31, 2018. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

[2]In addition to the countries and (or) localities listed, Australia, Iran, Kazakhstan, Mexico, the Philippines, and Uzbekistan may have produced refined selenium, but available information was inadequate to make reliable estimates of output. Australia is known to produce selenium in intermediate metallurgical products and has facilities to produce elemental selenium. In addition to having facilities for processing imported anode slimes for the recovery of selenium and precious metals, the United States has facilities for processing selenium scrap.

[3]Excludes selenium intermediates exported for refining.

[4]Production is based on fiscal year, with a starting date of April 1 of the year shown.

[5]Selenium contained within anode slimes.

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

(Kilograms, tellurium content)

Country or locality[3]	2013	2014	2015	2016	2017
Bulgaria	5,014 r	4,932 r	4,046 r	4,479 r	4,500 e
Canada[e, 4]	8,000 r	8,000 r	10,000	18,000	49,000
China	255,000	320,000	285,000	280,000	290,000 e
Japan	34,279 r	36,919	37,356	32,911 r	37,800 e
Russia[e]	31,000	32,500	35,000	35,000	44,000
South Africa[5]	7,200	5,800	6,300	6,800	7,200 e
Sweden	24,457	30,917	33,000	38,680 r	34,979
United States	W	W	W	W	--
Total	365,000 r	439,000 r	411,000 r	416,000 r	467,000 e

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data. -- Zero.

[1]Table includes data available through May 9, 2018. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Insofar as possible, data relate to refinery output only; thus, countries and (or) localities that produced tellurium contained in copper ores, copper concentrates, blister copper, or refinery residues but did not recover refined tellurium are excluded to avoid double counting.

[3]In addition to the countries and (or) localities listed, Australia, Belgium, Chile, Colombia, Germany, Kazakhstan, Mexico, the Philippines, and Poland were known to produce refined tellurium, but output was not reported; available information was inadequate to make reliable estimates of output.

[4]Excludes tellurium intermediates exported for refining.

[5]Tellurium contained within anode slimes.