

## THALLIUM

(Data in kilograms unless otherwise noted)

**Domestic Production and Use:** Small quantities of thallium are consumed annually, but variations in pricing and value data make it difficult to estimate the value of consumption. The primary end uses included the following: radioisotope thallium-201 used for medical purposes in cardiovascular imaging; thallium as an activator (sodium iodide crystal doped with thallium) in gamma radiation detection equipment; thallium-barium-calcium-copper-oxide high-temperature superconductors used in filters for wireless communications; thallium in lenses, prisms, and windows for infrared detection and transmission equipment; thallium-arsenic-selenium crystal filters for light diffraction in acousto-optical measuring devices; and thallium in mercury alloys for low-temperature measurements. Other uses include as an additive in glass to increase its refractive index and density, a catalyst for organic compound synthesis, and a component in high-density liquids for gravity separation of minerals.

<b><u>Salient Statistics—United States:</u></b>	<b><u>2016</u></b>	<b><u>2017</u></b>	<b><u>2018</u></b>	<b><u>2019</u></b>	<b><u>2020<sup>e</sup></u></b>
Production, refinery	—	—	—	—	—
Imports for consumption:					
Unwrought metal and metal powders	—	—	—	—	57
Waste and scrap	—	—	23	27	—
Other articles	193	—	41	38	—
Exports:					
Unwrought metal and powders	56	34	100	290	300
Waste and scrap	286	364	853	133	320
Other articles	973	1,560	131,400	179,000	500
Consumption, estimated <sup>2</sup>	193	—	64	65	57
Price, metal, <sup>e, 3</sup> dollars per kilogram	7,400	NA	NA	7,600	8,200
Net import reliance <sup>4</sup> as a percentage of estimated consumption	NA	NA	NA	NA	NA

**Recycling:** None.

**Import Sources (2016–19):** Germany, 60%; China, 24%; Norway, 8%; and the United Kingdom, 8%.

<b><u>Tariff:</u></b>	<b><u>Item</u></b>	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b> <b><u>12–31–20</u></b>
	Unwrought and powders	8112.51.0000	4.0% ad val.
	Waste and scrap	8112.52.0000	Free.
	Other	8112.59.0000	4.0% ad val.

**Depletion Allowance:** 14% (domestic and foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** In 2020, imports of thallium unwrought metal and powder was 57 kilograms. Exports of unwrought thallium and powders were higher in 2020 compared with those of 2019. All exports of unwrought thallium and powders left the Cleveland, OH, and New Orleans, LA, customs districts and went to Taiwan. All exports of thallium waste and scrap left from the Laredo, TX, customs district and went to Mexico in 2020, the same as in 2019. Exports of other thallium articles (Schedule B number 8112.59.0000) returned to lower levels. In 2018 and 2019, reported exports of thallium articles were unusually high in quantity; these exports likely were misclassified material.

Demand for thallium for use in cardiovascular-imaging applications has declined owing to superior performance and availability of alternatives, such as the medical isotope technetium-99. A global shortage of technetium-99 from 2009 to 2011 had contributed to an increase in thallium consumption during that time period. Since 2011, consumption of thallium has declined significantly. Small quantities of thallium are used for research.

The leading global uses for thallium were gamma radiation detection equipment, high-temperature superconductors, infrared optical materials, low-melting glasses, photoelectric cells, and radioisotopes. Producers of these products were in China, Japan, the Republic of Korea, and the United States.

Thallium metal and its compounds are highly toxic materials and are strictly controlled to prevent harm to humans and the environment. Thallium and its compounds can be absorbed into the human body by skin contact, ingestion, or inhalation of dust or fumes. Under its national primary drinking water regulations for public water supplies, the U.S. Environmental Protection Agency has set an enforceable Maximum Contaminant Level of 2 parts per billion thallium in drinking water.

**World Refinery Production and Reserves:**<sup>5</sup> Thallium is produced commercially in only a few countries as a byproduct in the roasting of copper, lead, and zinc ores and is recovered from flue dust. Because most producers withhold thallium production data, global production data are limited. In 2020, global production of thallium was estimated to be less than 8,000 kilograms. China, Kazakhstan, and Russia were thought to be leading producers of primary thallium. Since 2005, substantial thallium-rich deposits have been identified in Brazil, China, North Macedonia, and Russia. Quantitative estimates of reserves are not available, owing to the difficulty in identifying deposits where thallium can be extracted economically. Previous estimates of reserves were based on the thallium content of zinc ores.

**World Resources:**<sup>5</sup> Although thallium is reasonably abundant in the Earth's crust, estimated at about 0.7 part per million, it exists mostly in association with potassium minerals in clays, granites, and soils, and it is not generally considered to be commercially recoverable from those materials. The major source of recoverable thallium is the trace amounts found in copper, lead, zinc, and other sulfide ores. World resources of thallium contained in identified zinc resources could be as much as 17 million kilograms; most are in Europe, Canada, and the United States. World identified resources of coal contain an estimated 630 million kilograms of thallium.

**Substitutes:** Although other materials and formulations can substitute for thallium in gamma radiation detection equipment and optics used for infrared detection and transmission, thallium materials are presently superior and more cost effective for these very specialized uses. The medical isotope technetium-99 can be used in cardiovascular-imaging applications instead of thallium.

Nonpoisonous substitutes, such as tungsten compounds, are being marketed as substitutes for thallium in high-density liquids for gravity separation of minerals.

<sup>0</sup>Estimated. NA Not available. — Zero.

<sup>1</sup>Includes material that may have been misclassified.

<sup>2</sup>Estimated to be equal to imports.

<sup>3</sup>Estimated price of 99.99%-pure granules in 100-gram lots.

<sup>4</sup>Defined as imports – exports. Consumption and exports of unwrought thallium were from imported material or from a drawdown in unreported inventories.

<sup>5</sup>See Appendix C for resource and reserve definitions and information concerning data sources.