THALLIUM

(Data in kilograms unless otherwise specified)

Domestic Production and Use: There has been no domestic production of thallium since 1981. 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 used as an activator (sodium iodide crystal doped with thallium) in gamma radiation detection equipment; thallium-barium-calcium-copper-oxide high-temperature superconductors; thallium used in lenses, prisms, and windows for infrared detection and transmission equipment; thallium-arsenic-selenium crystal filters used for light diffraction in acousto-optical measuring devices; and thallium used 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, a component in high-density liquids for gravity separation of minerals, and a component in wear-resistant nanocoatings such as that used on jet engine thrust vector bearings.

Salient Statistics—United States:	2019	2020	2021	2022	2023[e]
Production, refinery	—	—	—	—	—
Imports for consumption:					
Unwrought metal and metal powders	—	57	—	—	13
Waste and scrap	27	—	—	13	—
Other articles	38	—	7	—	[1]300
Exports:					
Unwrought metal and powders	290	300	190	—	—
Waste and scrap	133	359	—	—	—
Other articles	[1]79,100	580	378	2,150	4,000
Consumption, estimated[2]	65	57	7	13	13
Price, metal, dollars per kilogram[e, 3]	7,600	8,200	8,400	9,400	8,800
Net import reliance[4] as a percentage of estimated consumption	NA	NA	NA	NA	NA

Recycling: None.

Import Sources (2019–2022): Russia, 40%; China, 25%; Norway, 19%; France, 9%; Israel, 5%; and United Kingdom, 2%.

Tariff: Item	Number	Normal Trade Relations 12–31–22
Unwrought and powders	8112.51.0000	4% ad valorem.
Waste and scrap	8112.52.0000	Free.
Other	8112.59.0000	4% ad valorem.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: In 2023, Oak Ridge National Laboratory announced the development of a safe method of producing thallium metal foils, which it had begun producing at their facility in Tennessee. Commercially sourced metal was consolidated into an ingot in a special furnace and used to produce 40 non-isotopic foils. In the United States, thallium foils were last produced in 2007 at Oak Ridge National Laboratory but discontinued because of safety issues. No commercial sources are available because of the safety risks. The initiative began in 2021 with the goal to supply national laboratories across the United States with thallium foils for applications in the production of radioisotopes.

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THALLIUM

As of September 2023, there were no imports or exports of unwrought thallium metal or of waste and scrap. Data on inventory drawdown of thallium for domestic use were not available. In 2023, estimated exports of thallium articles increased from those in 2022 and were significantly more than estimated imports. Although not an import source in the previous 4 years, all imports as of September 2023 were from Mexico. The minor quantities of imports suggest that inventories of thallium remain adequate for domestic needs and for production of articles for export. In 2019, reported exports of thallium articles had been unusually high in quantity; these exports had likely been misclassified material.

The leading global uses for thallium were gamma radiation detection equipment, high-temperature superconductors, infrared optical materials, low-melting glass, photoelectric cells, and radioisotopes. Demand for thallium for use in medical nuclear-imaging applications declined owing to superior performance and availability of alternatives, such as the medical isotope technetium-99m, although thallium continued to be used in cardiovascular stress testing. Because of thallium's unique properties, new uses for thallium continued to be investigated. Ongoing research included improvements in scintillators (for radiation detection) that contain thallium as a key component for increased efficiency, and new thallium compounds for use in optoelectronics.

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:[5] Thallium is produced commercially in only a few countries as a byproduct recovered from flue dust in the roasting of copper, lead, and zinc ores. Because most producers withhold thallium production data, global production data were limited. In 2023, global production of thallium was estimated to be about 10,000 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 were 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:[5] 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 from trace amounts found in sulfide ores of copper, lead, zinc, and other metallic elements. As such, world resources of thallium are adequate to supply world requirements.

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-99m can be used in cardiovascular-imaging applications instead of thallium. Nontoxic substitutes, such as tungsten compounds, are being marketed as substitutes for thallium in high-density liquids for gravity separation of minerals.

[e]Estimated. NA Not available. — Zero.

[1]Includes material that may have been misclassified.

[2]Estimated to be equal to imports for 2019–2022. In 2023, consumption estimated to be equal to imports of unwrought metal and metal powders.

[3]Estimated price of 99.99%-pure granules in 100-gram lots.

[4]Defined as imports – exports. Consumption and exports of unwrought thallium were from imported material or from a drawdown in unreported inventories.

[5]See Appendix C for resource and reserve definitions and information concerning data sources.