

THALLIUM

(Data in kilograms of thallium content unless otherwise noted)

Domestic Production and Use: Thallium is a byproduct metal recovered in some countries from flue dusts and residues collected in the smelting of copper, lead, and zinc ores. Although thallium was contained in ores mined or processed in the United States, it has not been recovered domestically since 1981. Consumption of thallium metal and thallium compounds continued for most of its established end uses. These included the use of radioactive thallium-201 for medical purposes in cardiovascular imaging; thallium as an activator (sodium iodide crystal doped with thallium) in gamma radiation detection equipment (scintillometer); thallium-barium-calcium-copper oxide high-temperature superconductor (HTS) 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 as an alloying component with mercury for low-temperature measurements. Other uses included 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 sink-float separation of minerals.

Salient Statistics—United States:	2009	2010	2011	2012	2013^e
Production, refinery	—	—	—	—	—
Imports for consumption: ¹					
Unwrought and powders	1,600	2,000	1,300	—	—
Other	160	200	200	685	600
Total	1,760	2,200	1,500	685	600
Exports: ¹					
Unwrought and powders	260	45	34	21	—
Waste and scrap	75	55	42	26	70
Other	595	835	469	31	25
Total	930	935	545	78	95
Consumption ^e	830	1,270	955	607	505
Price, metal, dollars per kilogram ²	5,700	5,930	6,000	6,800	6,990
Net import reliance ³ as a percentage of estimated consumption	100	100	100	100	100

Recycling: None.

Import Sources (2009–12): Germany, 80%; Russia, 19%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations
		<u>12–31–13</u>
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.

Events, Trends, and Issues: The price for thallium metal remained high in 2013 as global supply continued to be relatively constrained. Price increases for thallium in recent years were attributed to the limited availability of thallium produced in China. In 2013, China maintained its policy of eliminating toll-trading tax benefits on exports of thallium that began in 2006, thus contributing to reduced supply conditions on the world market. In July 2010, China canceled a 5% value-added-tax rebate on exports of many minor metals, including fabricated thallium products. Higher internal demand for many metals has prompted China to begin importing greater quantities of thallium.

In late 2011, a Brazilian minerals exploration company discovered a substantial thallium deposit in northwest Bahia, Brazil. According to the company, the deposit was unique because it was the only known occurrence in the world that thallium had been found with cobalt and manganese. In 2013, the company continued exploration activities and investigated partnerships with other firms to help finance the project.

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In 2012, leading producers of thallium isotopes used in medical imaging reported declines in sales compared with those of the same period in 2011. Beginning in 2009, there was a global shortage of the medical isotope technetium-99, which was widely used for medical imaging tests owing to the superior diagnostic quality of images produced. Following the closure of two isotope-producing nuclear reactors in Canada and the Netherlands in 2009, medical care facilities substituted thallium-201 for technetium-99 in cardiac scans and producers increased production of thallium-201 in order to meet anticipated demand. In late 2010, the National Research Universal reactor in eastern Ontario, Canada, restarted production of technetium-99, which was cited for declining consumption of thallium-201 since 2011. Although consumption of thallium-201 was anticipated to return to pre-2009 levels, future disruption to the supply of technetium-99 could potentially increase thallium consumption.

Thallium metal and its compounds are highly toxic materials and are strictly controlled to prevent a threat 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. The leading sources of thallium released into the environment are coal-burning powerplants and smelters of copper, lead, and zinc ores. The major sources of thallium in drinking water are ore-processing sites and discharges from electronics, drugs, and glass factories. Further information on thallium toxicity can be found in the U.S. Environmental Protection Agency (EPA) Integrated Risk Information System database. Under its national primary drinking water regulations for public water supplies, the EPA has set an enforceable Maximum Contaminant Level for thallium at 2 parts per billion. The EPA continued to conduct studies at its National Risk Management Research Laboratory to develop and promote technologies that protect and improve human health and the environment, including methods to remove thallium from mine wastewaters.

World Refinery Production and Reserves: There are only a few countries where thallium is obtained commercially as a byproduct in the roasting of copper, lead, and zinc ores or is collected from flue dust. Because most producers withhold thallium production data, estimating global production is challenging. In 2013, global production of thallium was estimated to be less than 10,000 kilograms. China, Kazakhstan, and Russia were believed to be leading producers of primary thallium. Since 2005, substantial thallium-rich deposits have been identified in China, Macedonia, and Russia.

World Resources: Although the metal is reasonably abundant in the Earth's crust at a concentration estimated to be 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 forms. The major source of commercial thallium is the trace amounts found in copper, lead, zinc, and other sulfide ores. 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 thallium content of zinc ores. World resources of thallium contained in zinc resources could be as much as 17 million kilograms; most are in Canada, Europe, and the United States. An additional 630 million kilograms is in world coal resources.

Substitutes: The apparent leading potential demand for thallium could be in the area of HTS materials, but demand will be based on which HTS formulation has a combination of favorable electrical and physical qualities and is best suited for fabrication. A firm presently using a thallium HTS material in filters for wireless communications is considering using a HTS that does not contain thallium. If research on HTS not using thallium is successful, HTS products would not be a large user of thallium in the future.

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.

Nonpoisonous substitutes like tungsten compounds are being marketed as substitutes for thallium in high-density liquids for sink-float separation of minerals.

⁰Estimated. — Zero.

¹Thallium content was estimated by the U.S. Geological Survey.

²Estimated price of 99.99%-pure granules or rods in 100- to 250-gram or larger lots.

³Defined as imports – exports + adjustments for Government and industry stock changes. Consumption and exports of unwrought thallium were from imported material or from a drawdown in unreported inventories.