THALLIUM

(Data in kilograms of thallium content unless otherwise noted)

Domestic Production and Use: Thallium has not been recovered in the United States since 1981. Consumption of thallium metal and thallium compounds was valued at $972,000. The primary end uses included the following: radioactive thallium-201 used 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 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 sink-float separation of minerals.

Salient Statistics—United States:	**2010**	**2011**	**2012**	**2013**	**2014[e]**
Production, refinery	—	—	—	—	—
Imports for consumption:[1]					
Unwrought and powders	2,000	1,300	—	—	50
Other	200	200	685	209	150
Total	2,200	1,500	685	209	200
Exports:[1]					
Unwrought and powders	45	34	21	3	—
Waste and scrap	55	42	26	11	5
Other	835	469	31	8	60
Total	935	545	78	22	65
Consumption[e]	1,270	955	607	187	135
Price, metal, dollars per kilogram[2]	5,930	6,000	6,800	6,990	7,200
Net import reliance[3] as a percentage of estimated consumption	100	100	100	100	100

Recycling: None.

Import Sources (2010–13): Germany, 73%; Russia, 26%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12–31–14
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: In 2014, the price for thallium metal continued to increase for the fifth consecutive year 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 2014, 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.

U.S. imports decreased by 91% during the last 5 years and estimated consumption declined by 89% during that time period. Demand for thallium for use in cardiovascular imaging applications has declined owing to price increases and superior performance and availability of alternatives, such as the medical isotope technetium-99. A global shortage of technetium-99 from 2009 to 2011 had been attributed to an increase in thallium consumption during that time period.

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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 in which thallium had been found with cobalt and manganese. In 2014, the company continued exploration activities and investigated partnerships with other firms to help finance the project. Exploration of the site was expected to conclude by yearend 2015. The company had tested a hydrometallurgical process that could be used to extract thallium from manganese ore. The potential construction of a production plant to produce thallium was dependent on obtaining licenses for operation and finding investment partners.

Two of the leading global markets of thallium were the producers of glass lenses, prisms, and windows for the fiber optics and digital camera industries, and the majority of these producers were in China, Japan, and the Republic of Korea.

In 2014, researchers at Brigham Young University successfully converted natural gas into liquid alcohol using lead and thallium. The conversion took place at a temperature that is lower than that used in current industry practices, owing to the relatively low melting points of lead and thallium. The development had the potential to benefit the growing natural gas industry because the process is cheaper and simpler than current conversion methods. The liquid alcohol produced can be used as fuel, potentially reducing dependence on petroleum.

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. 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. 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.

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 2014, 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 recoverable 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: 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 sink-float separation of minerals.

[e]Estimated. — Zero.

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

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

[3]Defined 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.