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, zinc, and lead 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 isotope 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 or intermediate in the synthesis of organic compounds, and a component in high-density liquids for sink-float separation of minerals.

Salient Statistics—United States:	2000	2001	2002	2003	2004[e]
Production, mine	(1)	(1)	(1)	(1)	(1)
Imports for consumption[2]					
Unwrought powders	NA	NA	49	36	150
Formed and articles	NA	NA	258	45	70
Waste and scrap	NA	NA	—	—	110
Total	100	2,110	307	81	330
Exports[3]					
Unwrought powders	NA	NA	—	490	250
Formed and articles	NA	NA	463	1,557	1,250
Waste and scrap	NA	NA	188	39	—
Total	NA	NA	651	2,086	1,500
Consumption[4]	300	800	500	NA	NA
Price, metal, dollars per kilogram[5]	1,295	1,295	1,250	1,300	1,300
Net import reliance[6]	100	100	100	100	100

Recycling: None.

Import Sources (2000-03): Belgium, 93%; France, 4%; Russia, 3%; and United Kingdom, less than 1%.

Tariff: Item	Number	Normal Trade Relations[7] 12-31-04
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: Research and development activities of both a basic and applied nature were conducted during 2004 that could improve and expand the use of thallium. These activities included the development of HTS materials for such applications as magnetic resonance imaging, storage of magnetic energy, magnetic propulsion, more efficient electrical motors, and electric power generation and transmission. Materials are considered HTS if they have a critical transition (to superconductivity) temperature (Tc) above 77 K, the boiling temperature of liquid nitrogen. Presently, the HTS material attaining the highest Tc, 138 K, is a mercury-thallium-barium-calcium-copper oxide mix. Improved methods for manufacturing high-temperature superconductor tapes and films, such as thallium-barium-calcium-copper oxides with a Tc of 133 K were under development. These tapes and films could be significant energy savers if used in ultra-fast computers and power transmission systems.

A broad range of commercial applications would become available if HTS materials can be fabricated on a large scale into wires having a certain degree of flexibility and strength. Currently, HTS materials are relatively brittle metal-oxide ceramics. There are now more than 50 known HTS materials, but only two (two different formulations of bismuth-strontium-calcium-copper oxides) have been used successfully to form long-length wires.

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In medical applications, dipyridamole-thallium imaging continued to be a useful preoperative procedure for assessing long-term cardiac risks in patients with coronary artery disease or diabetes who are undergoing peripheral vascular surgery. Further use of radioactive thallium in clinical diagnostic applications, including cardiovascular and oncological imaging, was studied during 2004.

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. In 2004, the U.S. Environmental Protection Agency (EPA) continued health assessments on thallium and thallium compounds for inclusion in the agency's Integrated Risk Information System database. Further scientific information on health effects that may result from exposure to these substances was requested from the public in order to complete the assessments. The assessment for thallium was expected to be completed in 2005. The EPA also initiated studies at its National Risk Management Research Laboratory on thallium removal from mine wastewaters. The U.S. Department of Health and Human Services, Food and Drug Administration, issued a guidance document announcing an approved drug for treatment of internal bodily contamination by radioactive or nonradioactive thallium. The drug, a form of industrial and artists' pigment (Prussian blue), effectively increases the rate of elimination of thallium from the body by interrupting readsorption in the intestine by fixing the metal through ion exchange with the drug.

World Mine Production, Reserves, and Reserve Base:[8]

	Mine production		Reserves[9]	Reserve base[9]
	2003	2004		
United States	(1)	(1)	32,000	120,000
Other countries	15,000	15,000	350,000	530,000
World total (rounded)	15,000	15,000	380,000	650,000

World Resources: World resources of thallium contained in zinc resources total about 17 million kilograms; most are located in Canada, Europe, and the United States. An additional 630 million kilograms is in world coal resources. The average thallium content of the Earth's crust has been estimated to be 0.7 part per million.

Substitutes: The apparent leading potential new 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 electric 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 non-thallium HTS material next year (2005). While research in HTS continues, and thallium is part of that research effort, it is not guaranteed HTS products will be a large user of thallium in the future.

While other materials and formulations can substitute for thallium in gamma radiation detection equipment, and optics used for infrared detection and transmission, these thallium materials are presently superior and more cost effective for theses very specialized uses.

Thallium in the past was used as semiconductor material for selenium rectifiers. In the United States, selenium rectifiers are sold to a small market of hobbyist collectors of vintage radios and televisions, and even in this market, there are better and safer substitute materials.

While thallium is still used in high-density liquids for sink-float separation of minerals, nonpoisonous substitutes like tungsten compounds are being marketed.

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

[1]No reported mine production; flue dust and residues from base-metal smelters, from which thallium metal and compounds may be recovered, are being exported to Canada, France, the United Kingdom, and other countries.

[2]Reported only as total unwrought, powders, and waste and scrap prior to 2002.

[3]Export data not available prior to 2002.

[4]Based on reported imports and estimated drawdown of private stocks.

[5]Estimated price of 99.999%-pure granules in 100-gram lots.

[6]Defined as imports – exports + adjustments for Government and industry stock changes. Since thallium has not been produced domestically since 1981, it was assumed that consumption and exports of unwrought thallium were from imported material or from a drawdown in unreported inventories.

[7]Under the North American Free Trade Agreement, there is no tariff for Canada or Mexico.

[8]Estimates are based on thallium content of zinc ores.

[9]See Appendix C for definitions.