## (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 for organic compound synthesis, and a component in high-density liquids for sink-float separation of minerals.

Salient Statistics—United States:	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009<sup>e</sup></u>
Production, mine	(1)	(1)	$(^{1})$	(1)	(1)
Imports for consumption (gross weight)					
Unwrought and powders	23	_	—	916	800
Other	212	530	901	—	300
Total	235	530	901	916	1,100
Exports (gross weight)					
Unwrought and powders	209	_	155	43	150
Waste and scrap		—	190	51	50
Other	43	229	258	153	150
Total	252	229	603	247	350
Consumption <sup>e</sup>	300	300	300	670	750
Price, metal, dollars per kilogram <sup>2</sup>	1,900	4,650	4,560	4,900	5,700
Net import reliance <sup>e, 3</sup> as a percentage of					
estimated consumption	100	100	100	100	100

## Recycling: None.

Import Sources (2005-08): Russia, 78%; Germany, 16%; Netherlands, 4%, and other, 2%.

<u>Tariff</u> : Item	Number	Normal Trade Relations 12-31-09	
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 2009 as the supply worldwide continued to be relatively tight. The average price for high-purity granules and rod increased by about 16% in 2009 and has tripled since 2005. China continued its policy of eliminating toll trading tax benefits on exports of thallium that began in 2006, thus contributing to the shortage on the world market. Higher internal demand for many metals, including thallium, has prompted China to begin importing greater quantities of thallium.

In June, the U.S. Trade Representative issued waivers to continue Generalized System of Preferences (GSP) benefits for 112 exports from 16 nations. Without receiving waivers, these particular exports would have been excluded from the program because their trade value exceeded statutory import ceilings. The Administration conducts an annual review of the countries covered under the GSP program and products that are eligible for duty-free treatment. Based on the conclusion of the 2008 review of countries covered by the program, articles of thallium imported from Russia that are classified under Harmonized Tariff Schedule code 8112.50.0000 continued to receive duty-free status in 2009.

# THALLIUM

One of the most significant events that affected the global thallium market in 2009 was the shortage of the medical isotope technetium-99, which had been widely used by physicians for medical imaging tests owing to its availability, cost, and the superior diagnostic quality of images produced. In mid-July, two of five isotope-producing nuclear reactors, in Canada and the Netherlands, were taken out of commission for repair work, and it was unclear how long this disruption was going to last. These reactors accounted for nearly 65% of the world's supply of technetium-99 in 2008. Technetium-99 has a very short half-life so it needs to be produced on a continual basis and cannot be stockpiled. Following the closure of these two plants, medical care facilities had a difficult time acquiring adequate supplies of technetium-99 and were forced to cancel scans or use alternative types of tests. The thallium isotope 201 was the most common alternative to technetium-99 for use in scans, such as the cardiac-stress test that monitors blood perfusion into heart tissue during rigorous exercise. It was estimated that before the shortage, thallium was used in about 25% of all cardiac-perfusion tests performed in the United States. In response to the shortage of technetium-99, some medical imaging equipment producers increased production of thallium isotope 201 in order to meet anticipated demand.

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. 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, the EPA has set an enforceable Maximum Contaminant Level for thallium at 2 parts per billion. All public water supplies must abide by these regulations. The EPA continues to conduct studies at its National Risk Management Research Laboratory (NRMRL) to develop and promote technologies that protect and improve human health and the environment. Studies were conducted recently at NRMRL on methods to remove thallium from mine wastewaters.

### World Mine Production and Reserves:<sup>4</sup>

	Mine pr	Reserves <sup>°</sup>	
	2008	<u>2009<sup>e</sup></u>	
United States	$(^{1})$	$(^{1})$	32,000
Other countries	<u>10,000</u>	<u>10,000</u>	<u>350,000</u>
World total (rounded)	10,000	10,000	380,000

<u>World Resources</u>: World resources of thallium contained in zinc resources total about 17 million kilograms; most are 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 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 nonthallium HTS. While research in HTS continues, and thallium is part of that research effort, it is not guaranteed that HTS products will 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.

<sup>e</sup>Estimated. — Zero.

<sup>4</sup>Estimates are based on thallium content of zinc ores.

<sup>&</sup>lt;sup>1</sup>No reported mine production; flue dust and residues from base-metal smelters, from which thallium metal and compounds may be recovered, are exported to Canada, France, the United Kingdom, and other countries.

<sup>&</sup>lt;sup>2</sup>Estimated price of 99.999%-pure granules or rods in 100- to 250-gram or larger lots.

<sup>&</sup>lt;sup>3</sup>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.

<sup>&</sup>lt;sup>5</sup>See Appendix C for definitions. Reserve base estimates were discontinued in 2009; see Introduction.