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-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:

| Production, mine | 2008 | 2009 | 2010 | 2011 | 2012^
|------------------|------|------|------|------|------
| Imports for consumption (gross weight): | | | | | |
| Unwrought and powders | 916 | 1,600 | 2,000 | 1,300 | 800
| Other | | 160 | 200 | 200 | 200
| Total | 916 | 1,760 | 2,200 | 1,500 | 1,000
| Exports (gross weight): | | | | | |
| Unwrought and powders | 43 | 260 | 45 | 34 | 50
| Waste and scrap | 51 | 75 | 55 | 42 | 50
| Other | 153 | 595 | 835 | 469 | 200
| Total | 247 | 930 | 935 | 545 | 300
| Consumption^e | 670 | 830 | 1,270 | 955 | 700
| Price, metal, dollars per kilogram^z | 4,900 | 5,700 | 5,930 | 6,000 | 6,800
| Net import reliance^ as a percentage of estimated consumption | 100 | 100 | 100 | 100 | 100

Recycling: None.

Import Sources (2008–11): Germany, 85%; Russia, 13%; and other, 2%.

Tariff: Item | Number | Normal Trade Relations
|------------|--------|------------------------
| 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 2012 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 2012, 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 2012, the company was investigating partnerships with other firms to help finance the project and continue exploration activities with the intention of eventually producing thallium.

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Beginning in 2009, there was a global shortage of the medical isotope technetium-99, which was widely used by physicians for medical imaging tests owing to its availability, cost, and the superior diagnostic quality of images produced. Following the closure of two isotope-producing nuclear reactors in Canada and the Netherlands, 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. Thallium-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 vigorous exercise. In response to the shortage of technetium-99, some medical imaging equipment producers increased production of thallium-201 in order to meet anticipated demand. In late 2010, the National Research Universal reactor in eastern Ontario, Canada, was restarted and produced medical isotopes, including technetium-99. During the first three quarters of 2012, leading producers of thallium isotopes reported declines in sales compared with those of the same period in 2011, owing to the renewed availability of technetium-99.

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 continued 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, including methods to remove thallium from mine wastewaters.

### World Mine Production and Reserves:

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<tr>
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<th>Mine production</th>
<th>Reserves</th>
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<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>United States</td>
<td>10,000</td>
<td>10,000</td>
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<tr>
<td>Other countries</td>
<td>10,000</td>
<td>10,000</td>
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<td>World total (rounded)</td>
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### World Resources:

World resources of thallium contained in zinc resources total about 17 million kilograms; most are in Canada, Europe, and the United States. Kazakhstan is believed to be one of the leading global producers of refined thallium. 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.

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**Note:**

- Estimated. — Zero.
- 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.
- Estimated price of 99.99%-pure granules or rods in 100- to 250-gram or larger lots.
- 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.
- Estimates are based on thallium content of zinc ores.
- See Appendix C for resource/reserve definitions and information concerning data sources.