THORIUM

(Data in metric tons of thorium oxide (ThO_2) equivalent unless otherwise noted)

Domestic Production and Use: The world's primary source of thorium is the rare-earth and thorium phosphate mineral monazite. In the United States, thorium has been a byproduct of refining monazite for its rare-earth content. Monazite itself is recovered as a byproduct of processing heavy-mineral sands for titanium and zirconium minerals. In 2011, monazite was not recovered domestically as a salable product. Essentially all thorium compounds and alloys consumed by the domestic industry were derived from imports, stocks of previously imported materials, or materials previously shipped from U.S. Government stockpiles. About eight companies processed or fabricated various forms of thorium for nonenergy uses, such as catalysts, high-temperature ceramics, and welding electrodes. Thorium's use in most products has generally decreased because of its naturally occurring radioactivity. The value of thorium compounds used by the domestic industry was estimated to have increased to $521,000 from $208,000 in 2010.

Salient Statistics—United States:	2007	2008	2009	2010	2011[e]
Production, refinery[1]	—	—	—	—	—
Imports for consumption:					
Thorium ore and concentrates (monazite), gross weight	—	—	26	—	30
Thorium ore and concentrates (monazite), ThO_2 content	—	—	1.82	—	2.1
Thorium compounds (oxide, nitrate, etc.), gross weight[2]	6.37	0.63	2.24	3.03	8.1
Thorium compounds (oxide, nitrate, etc.), ThO_2 content[2]	4.71	0.47	1.66	2.24	6.0
Exports:					
Thorium ore and concentrates (monazite), gross weight	1	61	18	1	—
Thorium ore and concentrates (monazite), ThO_2 content	0.07	4.27	1.26	0.07	—
Thorium compounds (oxide, nitrate, etc.), gross weight[2]	1.63	2.70	4.73	1.50	3.7
Thorium compounds (oxide, nitrate, etc.), ThO_2 content[2]	1.21	2.00	3.51	1.11	2.7
Consumption, apparent[2]	3.51	([3])	([3])	1.13	3.3
Price, yearend, dollars per kilogram:					
Nitrate, welding-grade[4]	5.46	5.46	5.46	5.46	5.46
Nitrate, mantle-grade[5]	27.00	27.00	27.00	27.00	27.00
Oxide, yearend, 99.99% purity[6]	200.00	252.00	252.00	252.00	252.00
Net import reliance[7] as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2007–10): Monazite: United Kingdom, 100%. Thorium compounds: France, 61%; India, 30%; Canada, 8%; and United Kingdom, 1%.

Tariff: Item	Number	Normal Trade Relations 12-31-11
Thorium ores and concentrates (monazite)	2612.20.0000	Free.
Thorium compounds	2844.30.1000	5.5% ad val.

Depletion Allowance: Monazite, 22% on thorium content, and 14% on rare-earth and yttrium content (Domestic); 14% (Foreign).

Government Stockpile: None.

Events, Trends, and Issues: Domestic mine production of thorium-bearing monazite ceased at the end of 1994 as world demand for ores containing naturally occurring radioactive thorium declined. Imports and existing stocks supplied essentially all thorium consumed in the United States in 2011. Domestic demand for thorium alloys, compounds, metals, and ores has exhibited a long-term declining trend. There were exports and domestic shipments of thorium material in the United States in 2011, according to the U.S. Census Bureau and the U.S. Geological Survey, respectively. In 2011, unreported thorium consumption was believed to be primarily in catalysts, microwave tubes, and optical equipment and was estimated to have increased. Increased costs to monitor and dispose of thorium have caused domestic processors to switch to thorium-free materials. Real and potential costs related to compliance with State and Federal regulations, proper disposal, and monitoring of thorium's radioactivity have limited its commercial value. It is likely that thorium's use will continue to decline unless a low-cost disposal process is developed or new technology, such as a nonproliferative nuclear fuel, creates renewed demand.

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THORIUM

On the basis of data through August 2011, the average value of imported thorium compounds decreased to $64.29 per kilogram from the 2010 average of $68.68 per kilogram (gross weight). The average value of exported thorium compounds decreased to $186.78 per kilogram based on data through August 2011, compared with $403.68 for 2010.

World Refinery Production and Reserves: The thorium reserve estimate for Australia has been revised based on new information from that country.

	Refinery production[8]		Reserves[9]
	2010	2011	
United States	—	—	440,000
Australia	—	—	[10]410,000
Brazil	NA	NA	16,000
Canada	NA	NA	100,000
India	NA	NA	290,000
Malaysia	—	—	4,500
South Africa	—	—	35,000
Other countries	NA	NA	90,000
World total	NA	NA	1,400,000

Reserves are contained primarily in the rare-earth ore mineral monazite and the thorium mineral thorite. Without demand for the rare earths, monazite would probably not be recovered for its thorium content. Other ore minerals with higher thorium contents, such as thorite, would be more likely sources if demand significantly increased. New demand is possible with the development and testing of thorium nuclear fuel in Russia and India. Reserves exist primarily in recent and ancient placer deposits and in thorium vein deposits such as those in the Lemhi Pass area of Idaho. Lesser quantities of thorium-bearing monazite and thorite reserves occur in certain iron ore deposits and carbonatites. Thorium enrichment is known in iron (Fe)-REE-thorium-apatite (FRETA) deposits, as found in the deposits at Mineville, NY; Pea Ridge, MO; and Scrub Oaks, NJ.

World Resources: Thorium resources occur in geologic provinces similar to those that contain reserves. The leading share is contained in placer deposits. Resources of more than 500,000 tons are contained in placer, vein, and carbonatite deposits. Disseminated deposits in various other alkaline igneous rocks contain additional resources of more than 2 million tons. Large thorium resources are found in Australia, Brazil, Canada, Greenland (Denmark), India, South Africa, and the United States.

Substitutes: Nonradioactive substitutes have been developed for many applications of thorium. Yttrium compounds have replaced thorium compounds in incandescent lamp mantles. A magnesium alloy containing lanthanides, yttrium, and zirconium can substitute for magnesium-thorium alloys in aerospace applications.

[e]Estimated. NA Not available. — Zero.
[1]All domestically consumed thorium was derived from imported materials.
[2]Thorium compound imports from the United Kingdom were believed to be material for nuclear fuel reprocessing or waste and were not used in calculating domestic apparent consumption. Thorium compound exports to Mexico were believed to be waste material shipped for disposal and were not used in calculating domestic apparent consumption. Apparent consumption calculation excludes ore and concentrates.
[3]Apparent consumption calculations in 2008 and 2009 result in negative numbers.
[4]Source: Defense Logistics Agency, DLA Strategic Materials; based on sales from the National Defense Stockpile in 1997.
[5]Source: Rhodia Canada, Inc., and Rhodia Electronics and Catalysis, Inc., f.o.b. port of entry, duty paid, ThO_2 basis.
[6]Source: Rhodia Electronics and Catalysis, Inc., 1- to 950-kilogram quantities, f.o.b. port of entry, duty paid. In 2007, Rhodia ceased sales of its 99.9% purity thorium oxide.
[7]Defined as imports – exports + adjustments for Government and industry stock changes.
[8]Estimates, based on thorium contents of rare-earth ores.
[9]See Appendix C for resource/reserve definitions and information concerning data sources.
[10]Includes thorium contained in mineralized sands.