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 2015, monazite was not recovered domestically as a salable product. Past production had been as a byproduct during processing for titanium and zirconium minerals; monazite was recovered for its rare-earth content. Essentially, all thorium compounds and alloys consumed by the domestic industry were derived from imports. The number of companies that processed or fabricated various forms of thorium for commercial use was not available. Thorium's use in most products was generally limited because of concerns over its naturally occurring radioactivity. Imports of thorium compounds are sporadic owing to changes in consumption and fluctuations in consumer inventory levels. The estimated value of thorium compounds imported for consumption by the domestic industry in 2015 was $32,000, a significant decrease compared with $761,000 in 2014.

Salient Statistics—United States:	2011	2012	2013	2014	2015[e]
Production, mine and refinery[1]	—	—	—	—	—
Imports for consumption:					
Thorium ore and concentrates (monazite), gross weight	30	43	—	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight	5.71	4.40	2.83	11.01	0.20
Thorium compounds (oxide, nitrate, etc.), ThO_2 content[e]	2.68	2.07	1.33	5.18	0.10
Exports:					
Thorium ore and concentrates (monazite), gross weight	—	—	—	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight	4.28	3.16	1.01	14.80	2.40
Thorium compounds (oxide, nitrate, etc.), ThO_2 content[e]	3.17	2.34	0.74	10.90	1.80
Consumption, apparent[2]	1.61	2.73	0.59	(2)	(2)
Price, thorium compounds, gross weight, dollars per kilogram: [3]					
France	158	153	NA	NA	NA
India	58	60	65	65	NA
Net import reliance[4] as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2011–14): Monazite: United Kingdom, 100%. Thorium compounds: India, 96%; and France, 4%. U.S. imports of monazite from the United Kingdom were from previously stockpiled imports.

Tariff: Item	Number	Normal Trade Relations 12–31–15
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.

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THORIUM

Events, Trends, and Issues: Domestic demand for thorium alloys, compounds, and metals was limited and believed to be largely for research purposes. Imports and existing stocks supplied essentially all thorium consumed in the United States in 2015. Globally, thorium's commercial uses included catalysts, high-temperature ceramics, and welding electrodes.

On the basis of data through September 2015, the average value of imported thorium compounds increased to $176 per kilogram from the 2014 average of $69 per kilogram (gross weight). The increase was caused by a cessation of lower unit value imports from India. The United Kingdom was the primary source of imported thorium compounds in 2015. The average value of exported thorium compounds increased to $345 per kilogram based on data through September 2015, compared with $129 per kilogram for all of 2014. The change was attributed to variations in the type and purity of compounds exported in each year.

Globally, monazite was produced primarily for its rare-earth-element content, and only a small fraction of the byproduct thorium produced was consumed. India was the leading producer of monazite. Thorium consumption worldwide is relatively small compared with that of most other mineral commodities. In regard to international trade, China was the leading importer of monazite and Thailand was the leading exporter.

Interest in thorium as an energy source continued worldwide, as various countries, including China, France, India, Japan, Norway, Russia, and the United States, continued research and development of thorium-fueled nuclear power. The Chinese Academy of Sciences continued a research initiative to develop thorium molten-salt reactor technologies and planned to build demonstration reactors by 2020 and commercial reactors by 2030. India continued research and development of thorium-related reactor technologies. According to India's Atomic Energy Commission, the process of selection of a site for construction of an advanced heavy-water reactor (AHWR) is in an advanced stage. The AHWR is a nuclear reactor that burns thorium in its fuel core. In Norway, a testing program backed by an international consortium of utilities, industry, and research organizations was planning to demonstrate that thorium-mixed oxide fuel could operate safely in a commercial reactor.

In 2015, exploration and development of rare-earth projects containing associated thorium were underway in Australia, Brazil, Canada, Greenland, India, Kazakhstan, Kenya, Madagascar, Malawi, Mozambique, Namibia, Sweden, Russia, South Africa, Tanzania, Turkey, the United States, and Vietnam.

World Refinery Production and Reserves:[5] Production and reserves are associated with the recovery of monazite in heavy-mineral sand deposits. Without demand for the rare earths, monazite would probably not be recovered for its thorium content under current market demand conditions.

World Resources: The world's leading thorium resources are found in placer, carbonatite, and vein-type deposits. According to a 2014 report by the Organisation for Economic Co-operation and Development's Nuclear Energy Agency and the International Atomic Energy Agency, worldwide thorium resources from major deposits are estimated to total more than 6 million tons of thorium.

Thorium resources are found throughout the world, most notably in Australia, Brazil, and India. India's Department of Atomic Energy estimated 12 million tons of monazite were contained in heavy-mineral sands. India's monazite was reported to have an average thorium oxide content of 9% to 10%. Geoscience Australia estimated its inferred resources of thorium at about 0.6 million tons of thorium. Most of the identified thorium resources in Australia are within heavy-mineral sand deposits. None of Australia's thorium resources were classified as economically recoverable. Brazil's thorium resources were estimated to be 0.6 million tons.

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.

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

[1]All domestically consumed thorium was derived from imported materials.

[2]Excludes ores and concentrates. Owing to sporadic shipments and unknown variations in the oxide content of exports, the apparent consumption calculation yields a negative value in 2014 and 2015.

[3]Based on U.S. Census Bureau customs value.

[4]Defined as imports – exports; however, all exports were derived from imports, and net import reliance is assumed to be 100%.

[5]See Appendix C for resource/reserve definitions and information concerning data sources.