

THORIUM

(Data in metric tons of thorium oxide (ThO₂) equivalent unless otherwise noted)

Domestic Production and Use: The world's primary source of thorium is the rare-earth and thorium phosphate mineral monazite. Monazite itself may be recovered as a byproduct of processing heavy-mineral sands for titanium and zirconium minerals. In 2014, monazite was not recovered domestically as a salable product. Essentially all thorium compounds and alloys consumed by the domestic industry were derived from imports. Less than ten companies processed or fabricated various forms of thorium for uses such as catalysts, high-temperature ceramics, and welding electrodes. Thorium's use in most products has generally decreased 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 2014 was \$302,000.

Salient Statistics—United States:	2010	2011	2012	2013	2014^e
Production, mineral concentrate refinery ¹	—	—	—	—	—
Imports for consumption:					
Thorium ore and concentrates (monazite), gross weight	—	30	43	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight ²	3.03	5.71	4.40	2.83	4.00
Thorium compounds (oxide, nitrate, etc.), ThO ₂ content ^{2, e}	2.24	4.22	3.26	2.09	3.00
Exports:					
Thorium ore and concentrates (monazite), gross weight	1	—	—	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight ²	1.50	4.28	3.16	1.01	3.50
Thorium compounds (oxide, nitrate, etc.), ThO ₂ content ^{2, e}	1.11	3.17	2.34	0.74	2.60
Consumption, apparent ²	1.13	1.05	0.92	1.35	0.40
Price, thorium compounds, gross weight, dollars per kilogram: ³					
France	131	158	153	NA	NA
India	58	58	60	65	75
Net import reliance ⁴ as a percentage of apparent consumption ¹	100	100	100	100	100

Recycling: None.

Import Sources (2010–13): Monazite: United Kingdom, 100%. Thorium compounds: India, 92%; and France, 8%. U.S. imports of monazite from the United Kingdom were from previously stockpiled imports.

Tariff:	Item	Number	Normal Trade Relations
			12–31–14
	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 demand for thorium alloys, compounds, and metals has exhibited a long-term declining trend. 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 2014.

On the basis of data through September 2014, the average value of imported thorium compounds increased to \$75 per kilogram from the 2013 average of \$65 per kilogram (gross weight). The increase was primarily caused by a small quantity of high-unit-value imports from the United Kingdom valued at \$3,830 per kilogram. The average value of exported thorium compounds decreased to \$482 per kilogram based on data through September 2014, compared with \$520 per kilogram for all of 2013. The change was attributed to variations in the type and purity of compounds exported in each year.

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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. Issues associated with thorium's natural radioactivity represented a significant cost to those companies involved in its mining, processing, manufacture, transport, and use.

Interest in thorium as an energy source continued worldwide, as various countries continued research and development of thorium-fueled nuclear power as an alternative to uranium. The Chinese Academy of Sciences continued a research initiative to develop thorium molten-salt reactor technologies. 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 2014, exploration and development of rare-earth projects associated with thorium were underway in Australia, Brazil, Canada, Greenland, India, Russia, South Africa, the United States, and Vietnam.

World Refinery Production and Reserves:⁵ Production and reserves are associated with the recovery of monazite in heavy-mineral sands deposits. Without demand for the rare earths, monazite would probably not be recovered for its thorium content. In 2014, in descending order, India, Malaysia, Vietnam, and Brazil led global production of monazite. Other ore minerals with higher thorium contents, such as thorite, would be available if demand significantly increased.

World Resources:⁵ The world's leading thorium resources are found in placer, carbonatite, and vein-type deposits. According to a 2014 report by the Organization for Economic Co-operation and Development and International Atomic Energy, worldwide thorium resources from major deposit types are estimated to total more than 6 million tons of thorium.

Thorium resources are found throughout the world and are led by India, Brazil, and Australia. 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 9–10%. Geoscience Australia estimated its resources of thorium at about 0.6 million tons of thorium. Most of the known 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.

⁶Estimated. NA Not available. — Zero.

¹All domestically consumed thorium was derived from imported materials.

²Apparent consumption calculation excludes ore and concentrates.

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

⁴Defined as imports – exports + adjustments for Government and industry stock changes.

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