

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. In 2016, monazite was not recovered domestically as a salable product. As recent as 1994, monazite was produced as a salable byproduct during processing for titanium and zirconium minerals in Florida. 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 2016 was about \$200,000, compared with \$216,000 in 2015.

Salient Statistics—United States:	2012	2013	2014	2015	2016^e
Production, mine and refinery ¹	—	—	—	—	—
Imports for consumption:					
Thorium ore and concentrates (monazite), gross weight	43	—	—	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight	4.40	2.83	11.00	2.74	1.70
Thorium compounds (oxide, nitrate, etc.), ThO ₂ content ^e	2.07	1.33	5.18	1.29	0.80
Exports:					
Thorium ore and concentrates (monazite), gross weight	—	—	—	—	—
Thorium compounds (oxide, nitrate, etc.), gross weight	3.16	1.01	² 14.80	2.16	² 26.00
Thorium compounds (oxide, nitrate, etc.), ThO ₂ content ^e	2.34	0.74	10.90	1.60	19.00
Consumption, apparent ³	(2)	0.59	(2)	(2)	(2)
Price, thorium compounds, gross weight, dollars per kilogram: ⁴					
India	60	65	65	63	65
Net import reliance ⁵ as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2012–15): Monazite: United Kingdom, 100%. Thorium compounds: India, 96%; France, 3%; and the United Kingdom, 1%. U.S. imports of monazite from the United Kingdom in 2012 were from previously stockpiled imports that were mined elsewhere.

Tariff:	Item	Number	Normal Trade Relations
			12–31–16
	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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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 2016. Globally, thorium's commercial uses included catalysts, high-temperature ceramics, and welding electrodes.

On the basis of data through August 2016, exports of thorium compounds increased significantly in 2016; however, 19.7 tons of exports to Vietnam had a significantly lower-than-average unit value (\$2.60 per kilogram) and may have been misclassified. Exports to Vietnam caused the average value of exported thorium compounds to decrease to \$30 per kilogram, compared with \$360 per kilogram in 2015. Imports of thorium compounds were estimated to contain about 0.8 tons of thorium oxide in 2016. The average value of imported thorium compounds increased to \$116 per kilogram compared with the 2015 average of \$79 per kilogram (gross weight). India maintained its position as the primary source of imported thorium compounds in 2016.

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 Brazil and Thailand were the leading exporters.

Several companies and countries were active in the pursuit of commercializing thorium as a fuel material for a new generation of nuclear reactors. Thorium-based nuclear research and development programs have been or are underway in Belgium, Brazil, Canada, China, the Czech Republic, France, Germany, India, Japan, Israel, the Netherlands, Norway, Russia, the United Kingdom, and the United States.

In 2016, lower prices for rare-earth compounds slowed the development of rare-earth mining projects containing associated thorium. Nonetheless, projects 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:⁶ 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. Thorium is found in several minerals, including monazite, thorite, and thorianite. 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 was contained in heavy-mineral sands. India's monazite was reported to have an average thorium oxide content of 9% to 10%. Geoscience Australia estimated Australia's inferred resources to be 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. Cerium and lanthanum can substitute for thorium in welding electrodes.

⁰Estimated. — Zero.

¹All domestically consumed thorium was derived from imported materials.

²Includes material that may have been misclassified.

³Defined as imports – exports. 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 2012 and from 2014 through 2016.

⁴Based on U.S. Census Bureau customs value.

⁵Defined as imports – exports; however, all exports were derived from imported materials, and net import reliance is assumed to be 100%.

⁶See [Appendix C](#) for resource and reserve definitions and information concerning data sources.