THORIUM

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

Domestic Production and Use: The primary source of the world's 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 2007, 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 high-temperature ceramics, catalysts, and welding electrodes. Thorium's use in most products has decreased because of its naturally occurring radioactivity. The value of thorium alloys, compounds, and metal used by the domestic industry was estimated to have decreased to about $250,000.

Salient Statistics—United States:	2003	2004	2005	2006	2007[e]
Production, refinery[1]	—	—	—	—	—
Imports for consumption:					
Thorium ore and concentrates (monazite), gross weight	—	—	—	10.0	—
Thorium ore and concentrates (monazite), ThO_2 content	—	—	—	0.70	—
Thorium compounds (oxide, nitrate, etc.), gross weight	4.10	5.32	4.93	48.6	6.25
Thorium compounds (oxide, nitrate, etc.), ThO_2 content	3.03	3.94	3.65	36.0	4.63
Exports:					
Thorium ore and concentrates (monazite), gross weight	23	18	—	—	1.00
Thorium ore and concentrates (monazite), ThO_2 content	0.92	0.72	—	—	0.04
Thorium compounds (oxide, nitrate, etc.), gross weight	0.59	0.73	0.74	1.09	1.93
Thorium compounds (oxide, nitrate, etc.), ThO_2 content	0.44	0.54	0.55	0.81	1.43
Shipments from Government stockpile excesses ($ThNO_3$)	—	—	—	—	—
Consumption:					
Reported, (ThO_2 content)	NA	NA	NA	NA	NA
Apparent	2.62	3.40	3.10	35.2	3.20
Price, yearend, dollars per kilogram:					
Nitrate, welding-grade[2]	5.46	5.46	5.46	5.46	5.46
Nitrate, mantle-grade[3]	27.00	27.00	27.00	27.00	27.00
Oxide, yearend:					
99.9% purity[4]	82.50	82.50	82.50	175.00	200.00
99.99% purity[4]	107.25	107.25	107.25	107.25	NA
Net import reliance[5] as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2003-06): Monazite: Canada, 100%. Thorium compounds: United Kingdom, 69.7%; France, 30.2%; and other, 0.1%.

Tariff: Item	Number	Normal Trade Relations 12-31-07
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, 14% on rare-earth and yttrium content (Domestic); 14% (Foreign).

Government Stockpile: None.

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THORIUM

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 2007. Domestic demand for thorium ores, compounds, metals, and alloys has exhibited a long-term declining trend. No thorium consumption was reported in the United States in 2006, according to the U.S. Geological Survey's canvass of mines and processors. In 2007, consumption was believed to be primarily in catalysts, microwave tubes, and optical equipment and was estimated to have decreased. On the basis of data through August 2007, the average value of imported thorium compounds increased to $50.43 per kilogram from the 2006 average of $32.01 per kilogram (gross weight). The average value of exported thorium compounds decreased to $249.74 per kilogram based on data through August 2007, compared to the 2006 average value of $390.71. The use of thorium in the United States has decreased significantly since the 1980s, when consumption averaged 45 tons per year. 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.

World Refinery Production, Reserves, and Reserve Base:[6]

	Refinery production		Reserves[7]	Reserve base[7]
	2006	2007		
United States	—	—	160,000	300,000
Australia	—	—	300,000	340,000
Brazil	NA	NA	16,000	18,000
Canada	NA	NA	100,000	100,000
India	NA	NA	290,000	300,000
Malaysia	—	—	4,500	4,500
Norway	—	—	170,000	180,000
South Africa	—	—	35,000	39,000
Other countries	NA	NA	90,000	100,000
World total	NA	NA	1,200,000	1,400,000

Reserves and reserve base are contained primarily in the rare-earth ore mineral monazite. 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. No new demand, however, is expected. Reserves exist primarily in recent and ancient placer deposits. Lesser quantities of thorium-bearing monazite reserves occur in vein deposits and carbonatites.

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, zirconium, and yttrium 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]Source: U.S. Department of Defense, Defense Logistics Agency. Based on sales from the National Defense Stockpile.

[3]Source: Rhodia Canada, Inc., and Rhodia Electronics and Catalysis, Inc., f.o.b. port of entry, duty paid, ThO_2 basis.

[4]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 99.99% purity thorium oxide.

[5]Defined as imports – exports + adjustments for Government and industry stock changes.

[6]Estimates, based on thorium contents of rare-earth ores.

[7]See Appendix C for definitions.