RARE EARTHS[1]

(Data in metric tons of rare-earth oxide (REO) content, unless otherwise noted)

Domestic Production and Use: Rare earths were mined by one company in 2002. Bastnäsite, a rare-earth fluocarbonate mineral, was mined as a primary product at Mountain Pass, CA. The United States was a leading producer and processor of rare earths and continued to be a major exporter and consumer of rare-earth products. Domestic ore production was valued at an estimated $28 million. The estimated value of refined rare earths consumed in the United States was more than $1 billion. The approximate distribution in 2001 by end use was as follows: glass polishing and ceramics, 34%; petroleum refining catalysts, 16%; automotive catalytic converters, 15%; metallurgical additives and alloys, 14%; rare-earth phosphors for lighting, televisions, computer monitors, radar, and X-ray intensifying film, 9%; permanent magnets, 8%; and other, 4%.

Salient Statistics—United States:	1998	1999	2000	2001	2002[e]
Production, bastnäsite concentrates[e]	5,000	5,000	5,000	5,000	5,000
Imports:[2]					
Thorium ore (monazite)	—	—	—	—	—
Rare-earth metals, alloy	953	1,780	2,470	1,420	1,520
Cerium compounds	4,940	3,990	4,310	3,850	2,660
Mixed REO's	2,530	5,980	2,190	2,040	1,130
Rare-earth chlorides	1,680	1,530	1,330	2,590	1,620
Rare-earth oxides, compounds	3,720	7,760	11,200	9,150	6,930
Ferrocerium, alloys	117	120	118	118	100
Exports:[2]					
Rare-earth metals, alloys	724	1,600	1,650	884	1,160
Cerium compounds	4,640	3,960	4,050	4,110	2,980
Other rare-earth compounds	1,630	1,690	1,650	1,600	1,300
Ferrocerium, alloys	2,460	2,360	2,250	2,500	2,950
Consumption, apparent	11,500	11,500	12,100	15,100	10,600
Price, dollars per kilogram, yearend:					
Bastnäsite concentrate, REO basis[e]	4.19	4.85	5.51	5.51	5.51
Monazite concentrate, REO basis	0.73	0.73	0.73	0.73	0.73
Mischmetal, metal basis, metric ton quantity[3]	6-8	5-7	5-7	5-7	5-6
Stocks, producer and processor, yearend	W	W	W	W	W
Employment, mine and mill, number	183	78	78	90	95
Net import reliance[4] as a percentage of apparent consumption	56	70	71	67	53

Recycling: Small quantities, mostly permanent magnet scrap.

Import Sources (1998-2001): Rare-earth metals, compounds, etc.: China, 66%; France, 27%; Japan, 3%; Estonia, 2%; and other, 2%.

Tariff: Item	Number	Normal Trade Relations 12/31/02
Thorium ores and concentrates (monazite)	2612.20.0000	Free.
Rare-earth metals, whether or not intermixed or interalloyed	2805.30.0000	5.0% ad val.
Cerium compounds	2846.10.0000	5.5% ad val.
Mixtures of REO's except cerium oxide	2846.90.2010	Free.
Mixtures of rare-earth chlorides except cerium chloride	2846.90.2050	Free.
Rare-earth compounds, individual REO's (excludes cerium compounds)	2846.90.8000	3.7% ad val.
Ferrocerium and other pyrophoric alloys	3606.90.3000	5.9% ad val.

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

Government Stockpile: None.

Prepared by **James B. Hedrick [(703) 648-7725, jhedrick@usgs.gov, fax: (703) 648-7722]**

RARE EARTHS

Events, Trends, and Issues: Domestic demand for rare earths in 2002 was lower than that of 2001. U.S. imports of rare earths decreased in most trade categories as a result of decreased demand in the United States in 2002. Although the rare-earth separation plant at Mountain Pass, CA, is still closed, it is expected to resume operations, possibly in 2004. The mine at Mountain Pass continued to produce bastnäsite concentrates and cerium concentrates. The trend is for continued increased use of the rare earths in many applications, especially automotive catalytic converters, permanent magnets, and rechargeable batteries.

The *23rd Rare Earth Research Conference* was held in Davis, CA, during July 13-18, 2002. The *Fifth International Conference on f-Elements (ICFE-5)* is planned for August 24-29, 2003, in Geneva, Switzerland. The first *Scandium Symposium* is scheduled for August 17-23, 2003, in Oslo, Norway. *The International Conference on Magnetism (ICM 2003)* is to be held in Rome, Italy, July 27-August 1, 2003. The conference *Rare Earths '04* is planned for November 7-12, 2004, in Nara, Japan.

World Mine Production, Reserves, and Reserve Base: Reserves and reserve base estimates for China have been revised based on new information from that country.

	Mine production[e]		Reserves[5]	Reserve base[5]
	2001	2002		
United States	5,000	5,000	13,000,000	14,000,000
Australia	—	—	5,200,000	5,800,000
Brazil	200	200	110,000	310,000
Canada	—	—	940,000	1,000,000
China	73,000	75,000	27,000,000	89,000,000
India	2,700	2,700	1,100,000	1,300,000
Malaysia	450	450	30,000	35,000
South Africa	—	—	390,000	400,000
Sri Lanka	120	120	12,000	13,000
Former Soviet Union[6]	2,000	2,000	19,000,000	21,000,000
Other countries	—	—	21,000,000	21,000,000
World total (rounded)	83,500	85,500	88,000,000	150,000,000

World Resources: Rare earths are relatively abundant in the Earth's crust, but discovered minable concentrations are less common than for most other ores. U.S. and world resources are contained primarily in bastnäsite and monazite. Bastnäsite deposits in China and the United States constitute the largest percentage of the world's rare-earth economic resources, while monazite deposits in Australia, Brazil, China, India, Malaysia, South Africa, Sri Lanka, Thailand, and the United States constitute the second largest segment. Xenotime, rare-earth-bearing (ion adsorption) clays, loparite, phosphorites, apatite, eudialyte, secondary monazite, cheralite, and spent uranium solutions make up most of the remaining resources. Undiscovered resources are thought to be very large relative to expected demand.

Substitutes: Substitutes are available for many applications, but generally are less effective.

[e]Estimated. W Withheld to avoid disclosing company proprietary data. — Zero.

[1]Data includes lanthanides and yttrium, but excludes most scandium. See also Scandium and Yttrium.

[2]REO equivalent or contents of various materials were estimated. Data from U.S. Census Bureau.

[3]Price range from Elements—Rare Earths, Specialty Metals and Applied Technology, Trade Tech, Denver, CO, and web-based High Tech Materials, Longmont, CO.

[4]Defined as imports - exports + adjustments for Government and industry stock changes.

[5]See Appendix C for definitions.

[6]As constituted before December 1991.