

RARE EARTHS¹

(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 2001. Bastnasite, a rare-earth fluorocarbonate mineral, was mined as a primary product by a firm in 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 2000 by end use was as follows: automotive catalytic converters, 22%; glass polishing and ceramics, 39%; permanent magnets, 16%; petroleum refining catalysts, 12%; metallurgical additives and alloys, 9%; rare-earth phosphors for lighting, televisions, computer monitors, radar, and x-ray-intensifying film, 1%; and miscellaneous, 1%.

Salient Statistics—United States:	1997	1998	1999	2000	2001^e
Production, bastnasite concentrates ^e	10,000	5,000	5,000	5,000	5,000
Imports: ²					
Thorium ore (monazite)	11	—	—	—	—
Rare-earth metals, alloy	529	953	1,780	2,470	1,670
Cerium compounds	1,810	4,940	3,990	4,310	4,940
Mixed REOs	974	2,530	5,980	2,190	3,080
Rare-earth chlorides	1,450	1,680	1,530	1,330	1,830
Rare-earth oxides, compounds	7,060	3,720	7,760	11,200	9,070
Ferrocerium, alloys	121	117	120	118	138
Exports: ²					
Rare-earth metals, alloys	991	724	1,600	1,650	965
Cerium compounds	5,890	4,640	3,960	4,050	4,810
Other rare-earth compounds	1,660	1,630	1,690	1,650	1,930
Ferrocerium, alloys	3,830	2,460	2,360	2,250	2,500
Consumption, apparent ³	19,400	11,500	11,500	12,100	15,600
Price, dollars per kilogram, yearend:					
Bastnasite concentrate, REO basis ^e	3.53	4.19	4.85	5.51	5.51
Monazite concentrate, REO basis	0.73	0.73	0.73	0.73	0.73
Mischmetal, metal basis, metric ton quantity ⁴	8-12	6-8	5-7	5-7	5-7
Stocks, producer and processor, yearend	W	W	W	W	W
Employment, mine and mill, number	327	183	102	77	85
Net import reliance ⁵ as a percentage of apparent consumption	E	56	70	71	68

Recycling: Small quantities, mostly permanent magnet scrap.

Import Sources (1997-2000): Monazite: Australia, 67%; and France, 33%. Rare-earth metals, compounds, etc.: China, 74%; France, 21%; Japan, 3%; United Kingdom, 1%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12/31/01
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 REOs except cerium oxide	2846.90.2010	Free.
Mixtures of rare-earth chlorides, except cerium chloride	2846.90.2050	Free.
Rare-earth compounds, individual REOs (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); bastnasite and xenotime, 14% (Domestic and foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Domestic demand for rare earths in 2001 was higher than that of 2000. U.S. imports of rare earths remained at high levels in most trade categories as a result of the temporary closure of the rare-earth separation plant at Mountain Pass, CA. The plant is expected to resume separation operations. The mine at Mountain Pass continued to produce bastnasite 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 *Rare Earths—2001* conference was held in Sao Paulo, Brazil, during September 22-26, 2001. The *23rd Rare Earth Research Conference* is scheduled for July 13-18, 2002, in Davis, CA, USA. The *17th International Workshop on Rare-Earth Magnets and their Applications* is scheduled for August 19-22, 2002, in Newark, DE, USA. The *Fifth International Conference on f-Elements* is planned for August 24-29, 2003, in Geneva, Switzerland. A scandium symposium is being arranged for August 17-23, 2003, in Oslo, Norway.

World Mine Production, Reserves, and Reserve Base:

	Mine production ⁶		Reserves ⁶	Reserve base ⁶
	2000	2001		
United States	5,000	5,000	13,000,000	14,000,000
Australia	—	—	5,200,000	5,800,000
Brazil	200	200	82,000	310,000
Canada	—	—	940,000	1,000,000
China	73,000	75,000	43,000,000	48,000,000
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 ⁷	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	100,000,000	110,000,000

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 bastnasite and monazite. Bastnasite 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.

⁶Estimated. E Net exporter. W Withheld to avoid disclosing company proprietary data. — Zero.

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

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

³Monazite concentrate production was not included in the calculation of apparent domestic consumption and net import reliance. Net import reliance defined as imports - exports + adjustments for Government and industry stock changes.

⁴Price range from Elements - Rare Earths, Specialty Metals and Applied Technology, Trade Tech, Denver, CO.

⁵U.S. Department of Energy, Ames Laboratory, 2000, Versatile set of alloys could enhance performance of cryocoolers: Ames, IA, Ames Laboratory news release, August 21, 2 p.

⁶See Appendix C for definitions.

⁷As constituted before December 1991.