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 1997. Bastnasite, a rare-earth fluocarbonate 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 $57 million. Refined rare-earth products were produced primarily by three companies; one with a plant in Mountain Pass, CA; another with operations in Phoenix, AZ, and Freeport, TX; and a third with a plant in Chattanooga, TN. The estimated value of refined rare earths consumed in the United States was more than $600 million. The approximate distribution in 1996 by end use was as follows: automotive catalytic converters, 46%; petroleum refining catalysts, 25%; permanent magnets, 12%; glass polishing and ceramics, 7%; metallurgical additives and alloys, 7%; phosphors, 3%; and miscellaneous <1%.

Salient Statistics—United States:	1993	1994	1995	1996	1997[e]
Production:					
Bastnasite concentrates[2]	17,800	20,700	22,200	20,400	20,000
Monazite concentrates	W	W	—	—	—
Imports:[3] Thorium ore (monazite)	—	—	22	56	—
Rare-earth metals, alloys	235	284	905	429	507
Cerium compounds	1,270	1,890	4,090	4,760	3,390
Mixed REO's	249	354	678	879	833
Rare-earth chlorides	1,080	2,410	1,250	1,070	988
Rare-earth oxide, compounds	3,730	5,140	6,500	10,300	9,060
Ferrocerium, alloys	105	92	78	86	158
Exports:[3] Thorium ore, monazite	3	27	—	—	—
Rare-earth metals, alloys	194	329	444	250	879
Cerium compounds	1,620	4,460	5,120	6,100	6,330
Other rare-earth compounds	1,090	2,410	1,550	2,210	1,640
Ferrocerium, alloys	4,270	3,020	3,470	4,420	3,380
Consumption, apparent[4]	17,000	18,200	W	W	W
Price, dollars per kilogram, yearend:					
Bastnasite concentrate, REO basis	2.87	2.87	2.87	2.87	2.87
Monazite concentrate, REO basis	.40	.46	.44	.48	.44
Mischmetal, metal basis	12.68	12.68	9.50	8.75	8.45
Stocks, producer and processor, yearend	NA	NA	NA	NA	NA
Employment, mine and mill, number	352	350	280	NA	NA
Net import reliance[4] as a percent of apparent consumption	E	E	6	18	12

Recycling: Small quantities, mostly permanent magnet scrap.

Import Sources (1993-96): Monazite: Australia, 86%; France, 14%.

Tariff: Item	Number	Most favored nation (MFN) 12/31/97	Non-MFN[5] 12/31/97
Thorium ores and concentrates (monazite)	2612.20.0000	Free	Free.
Rare-earth metals, whether or not intermixed or interalloyed	2805.30.0000	5.0% ad val.	31.3% ad val.
Cerium compounds	2846.10.0000	6.2% ad val.	35% ad val.
Mixtures of REO's except cerium oxide	2846.90.2010	Free	25% ad val.
Mixtures of rare-earth chlorides, except cerium chloride	2846.90.2050	Free	25% ad val.
Rare-earth compounds, individual REO's (excludes cerium compounds)	2846.90.8000	3.7% ad val.	25% ad val.
Ferrocerium and other pyrophoric alloys	3606.90.3000	5.9% ad val.	56.7% ad val.

Depletion Allowance: Percentage method, monazite, 22% on thorium content and 14% on rare-earth content (Domestic), 14% (Foreign); bastnasite and xenotime, 14% (Domestic and Foreign).

Prepared by **James B. Hedrick, (703) 648-7725 [Fax: (703) 648-7722].**

RARE EARTHS

Government Stockpile:

Stockpile Status—9-30-97[6]

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposal plan FY 1997	Disposals FY 1997
REO in sodium sulfate	—	455	—	—	—

Events, Trends, and Issues: Domestic demand for rare earths in 1997 was higher than in 1996. The use of rare earths increased as the domestic economy improved with stronger than average growth through the first two quarters of 1997. Imports continued strong going into the third quarter for individual rare-earth metals and compounds, with most import categories slightly behind 1996's record high levels. Exports or rare-earth metals increased primarily to meet overseas demand for permanent magnets. Demand continued to grow for neodymium, used in permanent magnet applications and for cerium, and other rare earths used in automotive catalytic converters. A gadolinium-silicon-germanium-based magnetic refrigerator was demonstrated by scientists from Ames Laboratory and Astronautics Corporation of America.[7] China remained a major source of separated rare-earth compounds and alloys, and is expected to continue as a major world supplier.

The *Third International Conference on f Elements* (lanthanides and actinides) was held in Paris, France, from September 14-19, 1997. The *International Forum on Rare Earths: Technology and Trade*, is scheduled for March 24-26, 1998, in Beijing, China. The conference *Rare Earths '98* is scheduled for October 25-30, 1998, in Freemantle, Western Australia, Australia.

World Mine Production, Reserves, and Reserve Base:

	Mine production[e]		Reserves[8]	Reserve base[8]
	1996	1997		
United States	[9]20,400	20,000	13,000,000	14,000,000
Australia	—	—	5,200,000	5,800,000
Brazil	200	400	280,000	310,000
Canada	—	—	940,000	1,000,000
China	[9]55,000	50,000	43,000,000	48,000,000
Congo (Kinshasa)	5	5	1,000	1,000
India	2,700	2,700	1,100,000	1,300,000
Malaysia	[9]340	300	30,000	35,000
South Africa	—	—	390,000	400,000
Sri Lanka	120	120	12,000	13,000
Former Soviet Union	6,000	6,000	19,000,000	21,000,000
Other countries	5	5	21,000,000	21,000,000
World total (rounded)	84,800	79,500	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.

[e]Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

[2]As reported in Unocal Corp. annual reports and as authorized from Molycorp, Inc., personnel.

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

[4]Monazite 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.

[5]See Appendix B.

[6]See Appendix C for definitions.

[7]Ames Laboratory, 1997, Next generation of materials advances magnetic refrigeration: Ames, Iowa, Ames Laboratory at Iowa State University press release, June 10, 2 p.

[8]See Appendix D for definitions.

[9]Number reported in published reports or from company representatives.