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 1998. 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 $29 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 1997 by end use was as follows: automotive catalytic converters, 48%; petroleum refining catalysts, 17%; glass polishing and ceramics, 14%; permanent magnets, 12%; metallurgical additives and alloys, 7%; phosphors, 1%; and miscellaneous, <1%.

Salient Statistics—United States:	1994	1995	1996	1997	1998[e]
Production:					
Bastnasite concentrates[2]	20,700	22,200	20,400	[e]20,000	10,000
Monazite concentrates	W	—	—	—	—
Imports:[3] Thorium ore (monazite)	—	22	56	11	—
Rare-earth metals, alloys	284	905	429	529	760
Cerium compounds	1,890	4,090	4,760	1,810	4,310
Mixed REO's	354	678	879	974	2,490
Rare-earth chlorides	2,410	1,250	1,070	1,450	1,730
Rare-earth oxide, compounds	5,140	6,500	10,300	7,070	3,990
Ferrocerium, alloys	92	78	86	121	123
Exports:[3] Thorium ore, monazite	27	—	—	—	—
Rare-earth metals, alloys	329	444	250	991	856
Cerium compounds	4,460	5,120	6,100	5,890	4,260
Other rare-earth compounds	2,420	1,550	2,210	1,660	1,850
Ferrocerium, alloys	3,020	3,470	4,410	3,830	2,520
Consumption, apparent[4]	17,800	W	W	19,400	14,000
Price, dollars per kilogram, yearend:					
Bastnasite concentrate, REO basis	2.87	2.87	2.87	2.87	2.87
Monazite concentrate, REO basis	0.46	0.44	0.48	0.73	0.73
Mischmetal, metal basis, metric ton quantity[5]	9-11	8-11	7-11	8-12	6-8
Stocks, producer and processor, yearend	W	W	W	W	W
Employment, mine and mill, number	NA	NA	NA	NA	NA
Net import reliance[4] as a percent of apparent consumption	E	6	18	E	29

Recycling: Small quantities, mostly permanent magnet scrap.

Import Sources (1994-97): Monazite: Australia, 75%; France, 25%; Rare-earth metals, compounds, etc.: China, 65%; France, 28%; Japan, 3%; United Kingdom, 1%; and other, 3%.

Tariff: Item	Number	Normal Trade Relations (NTR) 12/31/98	Non-NTR[6] 12/31/98
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	5.8% 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).

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RARE EARTHS

Government Stockpile: None.

Events, Trends, and Issues: Domestic demand for rare earths in 1998 was lower than in 1997. Imports increased for most rare-earth categories, however, domestic mine production was estimated to have decreased substantially. The decrease in domestic mine production and the temporary closure of the separation plant at Mountain Pass, CA, is primarily the result of a blocked underground effluent pipe. Significant delays have been encountered in obtaining governmental permitting to repair and install a new underground pipe. Exports of rare earths declined as demand in overseas markets, especially those in southeast Asia, declined. The overall trend in demand was for increased use of cerium and other rare earths in automotive catalytic converters and permanent magnets. The U.S. Department of Energy provided a research grant to develop rare-earth magnetic refrigeration for use in automobile air-conditioning systems. Use of the new technology would eliminate the need for chlorofluorocarbons and hydrofluorocarbons, the traditional coolants in compressor-type cooling systems.[7]

The *Rare Earths '98* conference was held in Freemantle, Western Australia, Australia, from October 25-30, 1998. The *22nd Rare-Earth Research Conference* is scheduled for July 11-15, 1999, in Argonne, IL.

World Mine Production, Reserves, and Reserve Base:

	Mine production[e]		Reserves[8]	Reserve base[8]
	1997	1998		
United States	20,000	10,000	13,000,000	14,000,000
Australia	—	—	5,200,000	5,800,000
Brazil	1,400	1,400	280,000	310,000
Canada	—	—	940,000	1,000,000
China	[9]53,300	50,000	43,000,000	48,000,000
Congo (Kinshasa)[10]	—	—	1,000	1,000
India	2,700	2,700	1,100,000	1,300,000
Malaysia	220	250	30,000	35,000
South Africa	—	—	390,000	400,000
Sri Lanka	120	120	12,000	13,000
Former Soviet Union[11]	2,000	2,000	19,000,000	21,000,000
Other countries	—	—	21,000,000	21,000,000
World total (rounded)	79,700	66,500	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]Price range from Elements - Rare Earths, Specialty Metals and Applied Technology, Trade Tech, Denver, CO.

[6]See Appendix B.

[7]Iowa State University, 1998, Cars may be first to benefit from magnetic refrigeration: Ames, Iowa, Iowa State University news release, October 12, 2 p.

[8]See Appendix D for definitions.

[9]Number reported in China Rare Earth Information, Baotou, Inner Mongolia, China.

[10]Formerly Zaire.

[11]As constituted before December 1991.