

## RARE EARTHS<sup>1</sup>

(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 1996. 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 \$64 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 \$500 million. The approximate distribution in 1995 by end use was as follows: automotive catalytic converters, 44%; petroleum refining catalysts, 25%; permanent magnets, 11%; glass polishing and ceramics, 9%; metallurgical additives and alloys, 8%; phosphors, 3%; and miscellaneous <1%.

<b>Salient Statistics—United States:</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996<sup>e</sup></b>
Production:					
Bastnasite concentrates <sup>2</sup>	20,700	17,800	20,700	22,200	20,000
Monazite concentrates	W	W	W	—	—
Imports: <sup>3</sup>					
Thorium ore (monazite)	—	—	—	22	—
Rare-earth metals, alloys	352	235	284	905	442
Cerium compounds	806	1,270	1,890	4,091	4,723
Mixed REO's	295	249	354	678	918
Rare-earth chlorides	728	1,080	2,410	1,249	988
Rare-earth oxide, compounds	3,100	3,730	5,140	6,499	13,669
Ferrocerium, alloys	94	105	92	78	97
Exports: <sup>3</sup>					
Thorium ore, monazite	—	3	27	—	—
Rare-earth metals, alloys	44	194	329	444	272
Cerium compounds	1,930	1,620	4,460	5,117	5,913
Other rare-earth compounds	1,310	1,090	2,410	1,546	2,524
Ferrocerium, alloys	2,430	4,270	3,020	3,471	2,685
Consumption, apparent <sup>4</sup>	21,400	17,000	18,200	25,400	29,500
Price, dollars per kilogram, yearend:					
Bastnasite concentrate, REO basis	2.87	2.87	2.87	2.87	2.87
Monazite concentrate, REO basis	.41	.40	.46	.44	.47
Mischmetal, metal basis	12.68	12.68	12.68	9.50	9.50
Stocks, producer and processor, yearend	W	NA	NA	NA	NA
Employment, mine and mill, number	372	352	350	280	NA
Net import reliance <sup>4</sup> as a percent of apparent consumption	33	E	E	6	32

**Recycling:** Small quantities, mostly permanent magnet scrap.

**Import Sources (1992-95):** Monazite: Australia, 89%; and Malaysia 11%. Oxides, compounds, and metal: France, 48%; China, 35%; India, 11%; Japan, 4%; and other, 2%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Most favored nation (MFN) 12/31/96</b>	<b>Non-MFN<sup>5</sup> 12/31/96</b>
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	6.5% 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.

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**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).

### Government Stockpile:

#### Stockpile Status—9-30-96

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposals Jan.-Sept. 96
REO in sodium sulfate	—	454	—	—

**Events, Trends, and Issues:** Domestic demand for rare earths in 1996 was higher than in 1995. Compared with 1995, the use of rare earths continued to increase as the domestic economy improved through the first two quarters of the year. In the third quarter the domestic economy slowed sharply, keeping interest rates stable and inflation on the decline. Imports were very strong going into the third quarter for individual rare-earth compounds, including cerium compounds. Rare-earth prices remained competitive throughout 1996, with firming of domestic prices for cerium and neodymium because of strong demand. Demand continued to grow for cerium used in automotive catalytic converters and for neodymium used in permanent magnet applications. China remained a major source of separated rare-earth compounds and alloys, and is expected to continue as a major world supplier.

The *21st Rare Earth Research Conference* was held in the United States in Duluth, MN, on July 7-11, 1996. The *Third International Conference on f Elements* is scheduled for September 14-19, 1997, in Paris, France.

### World Mine Production, Reserves, and Reserve Base:

	Mine production <sup>6</sup>		Reserves <sup>6</sup>	Reserve base <sup>6</sup>
	1995	1996		
United States	<sup>7</sup> 22,200	<sup>7</sup> 20,000	13,000,000	14,000,000
Australia	—	—	5,200,000	5,800,000
Brazil	400	400	280,000	310,000
Canada	—	—	940,000	1,000,000
China	<sup>8</sup> 48,000	50,000	43,000,000	48,000,000
India	2,700	2,700	1,100,000	1,300,000
Malaysia	<sup>8</sup> 448	400	30,000	35,000
South Africa	—	—	390,000	400,000
Sri Lanka	120	120	12,000	13,000
Thailand	—	—	1,000	1,100
Former Soviet Union	6,000	6,000	19,000,000	21,000,000
Zaire	11	10	1,000	1,000
Other countries	<u>5</u>	<u>5</u>	<u>21,000,000</u>	<u>21,000,000</u>
World total (rounded)	79,900	79,600	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. It is expected that substantial additional resources will be discovered as the industry completes its fourth decade of major industrial expansion. 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, eudyalite, secondary monazite, cheralite, and spent uranium solutions make up most of the remaining resources. Undiscovered resources of rare earths are thought to be very large relative to expected demand.

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

<sup>6</sup>Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>As reported in Unocal Corp. annual reports and as authorized from Molycorp, Inc., personnel. Data rounded to three significant digits.

<sup>3</sup>REO equivalent or contents of various materials were estimated. Data from U.S. Bureau of the Census. Data rounded to three significant digits.

<sup>4</sup>Monazite concentrate production was not included in the calculation of apparent domestic consumption and net import reliance. Data rounded to three significant digits. Net import reliance defined as imports - exports + adjustments for Government and industry stock changes.

<sup>5</sup>See Appendix B.

<sup>6</sup>See Appendix C for definitions.

<sup>7</sup>Number reported in published reports or from company representatives.