

RARE EARTHS¹

[Data in metric tons of rare-earth-oxide (REO) equivalent unless otherwise noted]

Domestic Production and Use: Rare earths were mined domestically in 2022. Bastnaesite (or bastnäsite), a rare-earth fluorocarbonate mineral, was mined as a primary product at a mine in Mountain Pass, CA. Monazite, a phosphate mineral, was produced as a separated concentrate or included as an accessory mineral in heavy-mineral-sand concentrates in the southeastern United States. Mixed rare-earth compounds were also produced in the western United States. The estimated value of rare-earth compounds and metals imported by the United States in 2022 was \$200 million, a 25% increase from \$160 million in 2021. The estimated leading domestic end use of rare earths was catalysts. A significant amount of rare earths are imported as permanent magnets embedded in finished goods. Other end uses were ceramics and glass, metallurgical applications and alloys, and polishing.

Salient Statistics—United States:	2018	2019	2020	2021	2022^e
Production: ^e					
Mineral concentrates	14,000	28,000	39,000	42,000	43,000
Compounds and metals	—	—	—	120	250
Imports: ^{e, 2}					
Compounds	10,800	12,200	6,510	7,690	11,000
Metals:					
Ferrocerium, alloys	297	330	271	330	420
Rare-earth metals, scandium, and yttrium	526	627	363	580	520
Exports: ^{e, 2}					
Ores and compounds	17,900	28,300	40,000	44,000	44,000
Metals:					
Ferrocerium, alloys	1,250	1,290	625	825	1,700
Rare-earth metals, scandium, and yttrium	28	83	25	20	21
Consumption, apparent, compounds and metals ³	9,600	11,200	5,400	6,060	9,300
Price, average, dollars per kilogram: ⁴					
Cerium oxide, 99.5% minimum	2	2	2	2	1
Dysprosium oxide, 99.5% minimum	179	239	261	400	390
Europium oxide, 99.99% minimum	53	35	31	31	30
Lanthanum oxide, 99.5% minimum	2	2	2	2	1
Mischmetal, 65% cerium, 35% lanthanum	6	6	5	6	7
Neodymium oxide, 99.5% minimum	50	45	49	49	130
Terbium oxide, 99.99% minimum	455	507	670	1,300	2,000
Employment, mine and mill, annual average, number	190	202	185	293	370
Net import reliance ⁵ as a percentage of apparent consumption: ⁶					
Compounds and metals	100	100	100	>95	>95
Mineral concentrates	E	E	E	E	E

Recycling: Limited quantities of rare earths are recovered from batteries, permanent magnets, and fluorescent lamps.

Import Sources (2018–21): Rare-earth compounds and metals: China,⁷ 74%; Malaysia, 8%; Estonia and Japan, 5% each; and other, 8%. Compounds and metals imported from Estonia, Japan, and Malaysia were derived from mineral concentrates and chemical intermediates produced in Australia, China, and elsewhere.

Tariff:	Item	Number	Normal Trade Relations 12–31–22
	Rare-earth metals	2805.30.0000	5% ad valorem.
	Cerium compounds	2846.10.0000	5.5% ad valorem.
	Other rare-earth compounds:		
	Oxides or chlorides	2846.90.2000	Free.
	Carbonates	2846.90.8000	3.7% ad valorem.
	Ferrocerium and other pyrophoric alloys	3606.90.3000	5.9% ad valorem.

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

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Government Stockpile:⁸ In the addition to the materials listed below, the FY 2022 and FY 2023 potential acquisitions include cerium, 550 tons; lanthanum, 1,300 tons; neodymium, 600 tons; praseodymium, 70 tons; rare-earth magnet block, 100 tons; and samarium cobalt alloy, 50 tons.

<u>Material</u>	<u>Inventory as of 9–30–22</u>	<u>FY 2022</u>		<u>FY 2023</u>	
		<u>Potential acquisitions</u>	<u>Potential disposals</u>	<u>Potential acquisitions</u>	<u>Potential disposals</u>
Dysprosium	0.2	20	—	—	—
Europium (gross weight)	35.8	—	—	—	—
Ferrodysprosium	0.5	—	—	—	—
Yttrium	25	25	—	—	—

Events, Trends, and Issues: Global mine production was estimated to have increased to 300,000 tons of REO equivalent. China's Ministry of Industry and Information Technology raised 2022 quotas for rare-earth mining and separation to 210,000 tons and 202,000 tons of REO equivalent, respectively. The mine production quota was allocated to 190,850 tons of light rare earths and 19,150 tons of ion-adsorption clays.

World Mine Production and Reserves: Reserves for Australia and the United States were revised based on company and Government reports.

	<u>Mine production</u>		<u>Reserves⁹</u>
	<u>2021</u>	<u>2022^e</u>	
United States	42,000	43,000	2,300,000
Australia	^e 24,000	18,000	¹⁰ 4,200,000
Brazil	^e 500	80	21,000,000
Burma	^e 35,000	12,000	NA
Burundi	^e 200	—	NA
Canada	—	—	830,000
China	¹¹ 168,000	¹¹ 210,000	44,000,000
Greenland	—	—	1,500,000
India	^e 2,900	2,900	6,900,000
Madagascar	^e 6,800	960	NA
Russia	^e 2,600	2,600	21,000,000
South Africa	—	—	790,000
Tanzania	—	—	890,000
Thailand	^e 8,200	7,100	NA
Vietnam	400	4,300	22,000,000
Other countries	60	80	280,000
World total (rounded)	290,000	300,000	130,000,000

World Resources:⁹ Rare earths are relatively abundant in the Earth's crust, but minable concentrations are less common than for most other mineral commodities. In North America, measured and indicated resources of rare earths were estimated to include 3.6 million tons in the United States and more than 14 million tons in Canada.

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

^eEstimated. E Net exporter. NA Not available. — Zero.

¹Data include lanthanides and yttrium but exclude most scandium. See also the Scandium and Yttrium chapters.

²REO equivalent or content of various materials were estimated. Source: U.S. Census Bureau.

³Defined as production + imports – exports.

⁴Source: Argus Media group, Argus Metals International.

⁵Defined as imports – exports.

⁶In 2018–2020, all domestic production of mineral concentrates was exported or held in inventory, and all compounds and metals consumed were assumed to be imported material.

⁷Includes Hong Kong.

⁸Gross weight. See Appendix B for definitions.

⁹See Appendix C for resource and reserve definitions and information concerning data sources.

¹⁰For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 2.98 million tons.

¹¹Production quota; does not include undocumented production.