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Rare Earth Elements and U.S. Supply Chains

Rare earth elements (REEs) have catalytic, magnetic, electrical, and luminescent properties vital for civilian and defense purposes. REEs may include 17 elements—scandium (atomic symbol Sc), yttrium (Y), and the 15 lanthanides—although some classifications exclude Sc. REEs typically are found together in nature (Sc is not found in nature with other REEs) and are not rare in the Earth's crust. The U.S. Geological Survey's (USGS's) 2025 Critical Minerals List (2025 CML) includes most REEs, except for promethium (Pm), because these elements are essential for the U.S. economy and security, have vulnerable U.S. supply chains, and are vital for products and services. Congress may consider the role of the federal government, international diplomacy and partnerships, and public-private partnerships in making U.S. REE supply chains more resilient to help promote a strong economy and national security.

Light to Heavy REEs

The 15 lanthanides—which have similar electron configuration and atomic size, making them essential for some applications—make up one row of the periodic table. They generally can be categorized as *light to heavy REEs*.

The *light REEs* (LREEs, with lower atomic numbers and atomic weights than the *heavy REEs* [HREEs]) include lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), Pm (rare and unstable), samarium (Sm), europium (Eu), and gadolinium (Gd).

The HREEs include terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), and lutetium (Lu), plus Sc and Y.

U.S. Applications

Some U.S. REE applications, listed from greatest to least demand, include

- catalysts (primarily Nd, La, Ce and Pr; used in oil refineries, catalytic converters, fuel additives, chemical processing, air pollution controls);
- magnets (primarily Nd, Tb, Dy, Pr; used in electronics, vehicles, refrigeration, power generation, medical imaging) and metal alloys (primarily Nd, Y, La, Ce, Pr; used in batteries, fuel cells, steel, superalloys, aluminum/magnesium);
- glass and polishing (primarily Nd, Gd, Er, Ho, La, Ce, Pr; used in polishing compounds, pigments and coatings, ultraviolet resistant glass, photo-optical glass, x-ray imaging);
- phosphors (primarily Nd, Eu, Tb, Y, Er, Gd, Ce, Pr; used in phosphors-based displays, fluorescent lights, medical imaging, lasers, fiber optics); and
- ceramics (primarily Nd, Y, Eu, Dy, Lu, Gd, La, Ce, Pr; used in capacitors, sensors, colorants, scintillators, refractories).

Some U.S. REE defense applications include satellite communications, guidance systems, aircraft structures, fly-by-wire, and smart missiles (primarily Nd, Eu, Tb, Dy, Y, Lu, Sm, Pr, La).

Dominance of the People's Republic of China

The People's Republic of China (PRC, or China) mines about 60% and processes and separates about 90% of global REEs. It also manufactures about 94% of REE-based magnets. China's monopolistic role in the REE market has included subsidizing China's REE industry, distorting REE prices, hindering fair competition, and restricting REE supplies. In 2023, the PRC banned the export of REE processing and refining technologies. In 2025, it announced export controls on Sm, Gd, Tb, Dy, Lu, Sc, and Y.

China is the leading producer of Sc, Y, and the 14 lanthanides on the USGS 2025 CML. In 2025, the largest REE mine production was in China (270,000 metric tons [MT] of rare earth oxide equivalent [REO]), followed by the United States (51,000 MT total from two mines, one each in California and Georgia), Australia (29,000 MT), and Burma (22,000 MT). In 2025, the largest *estimated reserves* (i.e., the working inventory of mining companies' supplies of an economically extractable mineral commodity) were in China (44 million MT), followed by Brazil (21 million MT), Australia (6.3 million MT), Russia (3.8 million MT), Vietnam (3.5 million MT), the United States (1.9 million MT), and Greenland (1.5 million MT). In 2025, the United States was 67% net import reliant for most REEs from China, Malaysia, Estonia, and Japan. It was 100% net import reliant for Sc from Japan and China and for Y from China, Germany, Austria, and the Republic of Korea.

REE Resources

Several Congresses and Administrations have directed the USGS to identify critical mineral resources, including REE resources, in the United States and other countries (e.g., Afghanistan) and to track global REE mine production and reserves to increase U.S. REE supply chains' resilience. The USGS critical minerals update summarizes some related federal government activities from 2017 to 2025.

The USGS defines a *resource* as a concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible. Principal economic sources of REEs include the minerals bastnaesite, monazite, and loparite, as well as some surficial clay deposits. Other less conventional potential surficial sources may include heavy mineral sands, placer deposits, mine waste, coal, and coal ash. The Department of Energy (DOE) collaborates with the USGS to investigate some of these unconventional REE sources and supports other REE supply chain efforts.

REE minerals form in atypical geologic conditions and occur in uncommon minerals in unusual rock types, so potential resources occur in only a few places around the globe. REE minerals typically occur in small concentrations in rocks. A high-grade REE deposit is usually less than 10% by weight concentration. REE minerals may contain multiple REEs bound tightly together in the mineral's crystal structure and may contain thorium and/or uranium; these characteristics may lead to technical challenges and higher costs to separate individual REEs, and to separate and dispose of any uranium or thorium.

Congress established and appropriated funds in P.L. 117-58 for the USGS Earth Mapping Resources Initiative (Earth MRI) to identify critical mineral resources. In 2025, the USGS published some reports about domestic REE resources, including studies of REEs in some Mountain Pass, CA, deposits and coal deposits.

REE Mining and Processing

In 2010, the USGS published an overview of REE resources, potential domestic deposits, and information about exploration projects and mining. The USGS identified REE deposits in Alaska, California, Colorado, Florida, Georgia, Idaho, Illinois, Missouri, Nebraska, New Mexico, New York, North Carolina, South Carolina, and Wyoming. In 2018, the USGS published an expanded, updated overview of domestic REE deposits and global REE advanced exploration and active mines. (See also a 2023 review of global REE projects.) According to the USGS, major active REE mines include Bayan Obo, Daluxiang, Maoniuping, Weishan, and south China clay deposits in China; bastnaesite in Mountain Pass, CA; heavy mineral sands in the southeastern United States; Mount Weld in Australia; Karnasurt Mountain in Russia; Buena Norte in Brazil; and Dong Pao Mine in Vietnam. The USGS identified some advanced REE exploration projects in Bear Lodge, WY; Bokan Mountain, AK; Elk Creek, NE; and Round Top, TX, in the United States, plus others in Australia, Brazil, Canada, Greenland, Kazakhstan, Kenya, Kyrgyzstan, India, Madagascar, Malawi, Namibia, South Africa, Sweden, Tanzania, and Turkey.

Because of the geologic characteristics described above, REE ore mineral extraction is more technically challenging and expensive than some other types of mineral extraction, such as copper mining and refining. Large amounts of non-ore material may need to be extracted to process the ore minerals. Mining of surficial deposits is less technically challenging and less expensive than mining the subsurface; however, most surficial deposits have comparatively lower concentrations of REEs than ore minerals, requiring more total material extraction to recover the same amount of REEs by weight. After extraction, the minerals must be further processed, often with complex chemical and physical treatments, to yield high-purity oxides of individual REEs (e.g., NdO). The mined material is often transported to other facilities away from the mine for processing, with additional land, energy, water, and infrastructure requirements plus transport costs. For metallurgical applications, such as magnets, the REOs are further processed and separated to high-purity metals (e.g., 99.9% Nd metal) and then combined into metal alloys (e.g., Nd-iron-boron based magnets). Because of mineralogic and technical challenges, only some REEs may be extracted or processed from REE minerals. For example, the Mountain Pass mine in California produced Eu, Ce, and La in the past due to higher demand for some applications and now produces Nd and Pr due to higher demand for magnets.

Initiatives for Resilient REE U.S. Supply Chains

Congress and the Trump Administration have directed the USGS, DOE, and other federal entities to advance and support research and development to identify REE resources and supply chain vulnerabilities, as well as to advance extraction, processing, separation, component development, product manufacturing, and recycling. The federal government is working with private companies and some other countries to secure resilient REE supply chains. In May 2025, MP Materials, which operates the Mountain Pass REE mine, signed a memorandum of understanding (MOU) with the Saudi Arabian mining company Maaden to develop an REE supply chain in Saudi Arabia, during a U.S.-Saudi Arabia Investment Forum where President Trump secured a $600 billion Saudi Arabian investment in the energy, defense, and mining sectors. In 2024, the Department of Defense (DOD), which is "using a secondary Department of War designation" under Executive Order 14347, dated September 5, 2025, announced a goal to secure a complete mine-to-magnet REE supply chain by 2027. In July 2025, MP Materials established a public-private partnership with DOD where DOD will acquire $500 million in stock; extend a $150 million loan for HREE separation expansion; and commit to an REE price floor, offering direct payments to MP Materials if prices fall below $110 per kilogram of Nd-Pr. In January 2026, the Trump Administration announced further critical minerals and REEs initiatives that led to the formation of a critical mineral trade zone, investments in USA Rare Earth company, and a critical minerals ministerial. On February 2, 2026, the White House announced Project Vault, a $12 billion initiative to establish the U.S. Strategic Critical Minerals Reserve. USA Rare Earth has indicated it may supply REEs to the stockpile to help reduce U.S. reliance on REE supplies from China.

Congressional Considerations

Congress may consider whether federal efforts—such as the USGS's Earth MRI, DOE's Critical Materials Collaborative, DOD's public-private partnerships, and the Export-Import Bank's role in Project Vault—are sufficient to develop resilient U.S. REE supply chains. Legislation introduced in the 119th Congress may further support this aim. For example, H.R. 2969 and S. 1463 would allow the Secretary of the Interior to enter into MOUs with foreign countries for scientific and technical cooperation to map critical minerals and REEs. S. 429 would secure reliable critical minerals and REE supplies through trade and strategic partnerships, while S. 789 would do so through global resource assessments and technologies partnerships. H.R. 7126 and S. 3659 would establish a U.S. strategic resilience reserve. H.R. 6696 and S. 2839 would establish a critical minerals security alliance. S. 2550 would provide for international cooperation for secure supply chains.

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