



Carbon
Removal
Alliance

Carbon Dioxide Mineralization

Carbon mineralization technologies support the U.S. mining industry by turning waste materials into valuable assets, enabling the enhanced recovery of critical minerals, remediating legacy mining operations, and generating new streams of revenue for mining companies.

Photo courtesy of Arca

How does mineralization work?.

Mineralization uses byproducts from the mining industry in carbon removal operations. These materials react naturally with atmospheric carbon dioxide to form new minerals, sequestering the carbon dioxide for millennia. This mineralization process also changes the chemistry of the rocks, stabilizing mining wastes and improving mine remediation. For example, the mineralization process can destroy toxic asbestos fibers, helping to protect the environmental safety and public health at legacy asbestos mines.

- **Active mines:** Active mines in the United States produce more than 1.8 billion tons of processing waste each year. Recovering the critical minerals in this waste would be enough to meet America's critical goals by itself.
- **Legacy mines:** There are thousands of legacy mines on federal land. These sites are often an environmental liability for the federal government and many have no clear path toward remediation. Nearly 100 of them are on the Environmental Protection Agency's Superfund National Priority List, indicating the severity of their environmental liability.

MINERALIZATION IN PRACTICE

Carbon mineralization can help access critical minerals left behind while remediating public health risks, all while utilizing byproducts from the mining industry. One example of this in practice: Our members' technology can work with abandoned asbestos mines in the United States to sequester millions of tons of carbon dioxide while destroying the toxic asbestos fibers and increasing the recovery of critical minerals like nickel and cobalt from these sites. This improves the environmental safety of these sites and the surrounding communities and advances America's critical mineral goals.

Potential impacts

Carbon mineralization can provide substantial benefits to the domestic mining industry while creating thousands of new jobs and protecting American critical mineral supply chains.

- **Enhanced critical mineral recovery:** Carbon mineralization can improve the recovery of critical minerals, such as nickel and cobalt, as well as rare earth elements. This is an incredible economic and national security opportunity. Rare earth elements are key to American defense — a single F-35 fighter jet uses 900 pounds of rare-earth elements. Yet, China dominates the global supply of these materials, which they have already begun to leverage with export restrictions on minerals necessary for American national security.
- **Improved operational efficiency:** Carbon mineralization can reduce the amount of waste products produced in the mining process and provide an effective waste management solution for legacy mine sites. This will lower the cost of waste treatment and management while improving the efficiency of mining operations.
- **New revenue opportunities:** Carbon mineralization can provide a new source of revenue for mining companies. This revenue is an opportunity to diversify mining revenue streams and boost profitability. The revenue potential from carbon mineralization on mine sites is \$100 billion — and more waste material is generated every day.

CASE STUDY:

Travertine, which has facilities in Colorado and upstate New York, has developed a process that uses gypsum, a waste product from phosphate mining and production, as a feedstock to capture carbon dioxide from the atmosphere. The process produces calcium carbonate, which stores carbon dioxide as minerals, and sulfuric acid, a key industrial input for producing fertilizer, food and beverages, and lithium iron phosphate batteries. This reduces waste management costs and increases domestic production capacity for phosphate production.

Policy recommendations

- The National Energy Dominance Council (NEDC) should recognize carbon removal as a waste management method and encourage mine operators to evaluate its potential on mine sites
- The NEDC should prioritize permits on federal lands for mine sites that integrate carbon removal.
- EPA should provide regulatory clarity that mining-related carbon removal activities do not change the non-hazardous waste designation for mine tailings under the Resource Conservation and Recovery Act
- Continue national site and geology characterization efforts on operational and legacy mines



WHAT IS CARBON REMOVAL?

Carbon removal consists of activities that are intended to remove carbon dioxide from the atmosphere or ocean and store it in a stable and durable form in order to develop American leadership in the carbon removal industry while creating domestic jobs and economic opportunities.

Photo courtesy of Carbfix

CRA MEMBER COMPANIES

 ANVIL

 ARCA

 Heirloom

 Karbonetiq

 travertine