# Industrial Minerals review 2025

**Foreword by Mike O'Driscoll**

## Greening the future of industrial minerals

The future for the industrial minerals sector, and of mining in general, is being shaped by a new order of geopolitical and environmental factors. Last year's foreword focused on an example of the former (U.S. tariff impact). Here, we shall focus on the latter, and in particular on mineral recycling.

Mineral recycling is one of the two missions of the mineral industry right now; the other is decarbonization. Get these right and the industry will be more resilient to the challenges to come, plus making much-needed improvements to our environment.

But mineral recycling should not be viewed as simply responding to environmental pressures, a checkbox on the corporate portfolio to allay fears and protests of damage to the environment, leading to charges of so-called greenwashing.

While mineral recycling *will* be an important contributor to the circular economy and assisting in climate protection, it will *also* evolve as an essential alternative source of raw materials, presenting opportunities in mineral recycling project developments, and increased innovation and supply of pertinent processing and sorting technologies.

This new era of industrial mineral recycling is already underway and gaining momentum. But it is not plain sailing, mindsets need to be adopted and correct processes employed. Key questions raised include:

- How to go about getting involved in this sector?
- Whether to vertically integrate? Invest for an in-house business/plant?
- How much and how far to invest? What kind of processing/sorting technology is required?
- Partner with/acquire an independent recycler? Join forces with same-sector end-use players?
- What kind of logistics are involved? Permits for handling/transport? Costs?
- Crucially: making grade acceptable, consistent and economic for customers?

## Mineral recycling key drivers

The primary drivers, which may be interlinked, responsible for accelerating industrial mineral recycling and, in particular, its growing requirement for domestic markets, may be summarized as follows:

1. Environment and market awareness of it: Climate change — saving the environment; carbon dioxide ($CO_2$) reduction; overall drive for the "circular economy" gathering momentum; sustainable development of raw materials; and, *crucially*, mineral-bearing end-product manufacturers (that is, the mineral consumers) having an increasing need to show evidence of green credentials in raw material sourcing and production (such as sustainability, $CO_2$ footprint).
2. Cost factors: Rising costs of primary mineral mining and processing, energy, logistics, waste treatment, landfill, future "environment" penalties.
3. Limited primary sources: Risky overreliance on supply/trade from limited overseas sources; for certain minerals, shortage of commercially

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**Additional notes:** (1) Among the information sources cited in the articles are the U.S. Geological Survey (USGS) Mineral Commodity Summaries 2026 (https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries). The USGS Mineral Commodity Summaries are published on an annual basis and are the earliest government publications to furnish estimates covering nonfuel mineral industry data. The data sheets contain information on the domestic industry structure, government programs, tariffs and five-year salient statistics for more than 90 individual minerals and materials. **USGS Disclaimer**: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government. (2) Throughout this review, measurements are expressed as metric units unless the author provided conversions.

developed mineral resources and processing plants.

4. Supply-chain vulnerability: Logistics stress; geopolitical impact; vulnerability particularly spotlighted by COVID-19 pandemic, Russia-Ukraine war, U.S. trade tariff issues, U.S.-Iran conflict, China-Taiwan?
5. China in change: Relevant owing to China's mainstay as world mineral supplier — overreliance by global consumers?; domestic supply issues impacted by wide range of factors = unpredictability in export availability and prices; end of an era for low-cost import reliance? Time to de-risk? = boost to alternative mineral source development *outside* China, including recycled materials as option.
6. "Criticality" of minerals recognized: Critical raw materials (CRM) recognized; "critical" and "strategic" mineral awareness now more mainstream, particularly in the energy sector (such as lithium-ion batteries, electric vehicles, solar, wind) and also electronics (such as semiconductors) = increasing government awareness/action/support/investment to include recycling programs.
7. Recycling technology more economic/established: Evolved from somewhat esoteric, expensive mineral processing sideshow to mainstream processing line; advances in processing and sorting technology; opportunities now sensed and sought after; and, significantly, more primary mineral miners increasing mine waste recycling efforts.

## Government initiatives and priority awareness

Regarding state activity in mineral recycling, the European Commission (EC) has been leading the way forward with a raft of ongoing proposals and initiatives since the early 2000s. This represents an all-out effort to push European Union (EU) countries toward a circular economy.

The Critical Raw Materials Act (CRMA) of 2024 stated three benchmarks for the EU's annual consumption of CRM: 10 percent from local extraction, 40 percent to be processed and *25 percent to come from recycled materials by 2030*.

Then in December 2025, the RESourceEU Action Plan 2025 was adopted to boost the CRMA objectives by "Unleashing The Circularity and Innovation Potential" — that is, keeping CRMs in the EU and recycling the resources already available, incentivizing the recycling of CRM, and stimulating innovation to enable substitution and efficiencies.

There has been criticism of a lack of action in these initiatives. A boost is expected from the EU Circular Economy Act 2026, due for adoption in late 2026, aiming to establish a single market for secondary raw materials, increase the supply of high-quality recycled materials, and stimulate demand for these materials within the EU, including stockpiling of recycled CRM. The overall aim is to double the EU's recycled-material use rate from 12 to 24 percent by 2030.

EC president Ursula von der Leyen at the European Industry Summit in Antwerp, Belgium, on Feb. 27, 2025, urged: "We need a paradigm shift on circular economy. We have to keep critical raw materials waste in Europe and give it new life."

The United States, although somewhat belated in its approach to mineral supply chains and secondary raw materials, has been very busy in recent years with a string of executive orders focusing on rejuvenating and funding U.S. CRM resource and recycling projects, including mine waste: for example, Executive Order (EO) 14154 "Unleashing American Energy" in January 2025, EO 14241 "Immediate Measures to Increase American Mineral Production" in March 2025 and, not least, the U.S. Inflation Reduction Act (IRA) of 2022, which through a series of tax credits aims to enhance the transition to a circular economy by driving demand for recycled critical minerals. How successful will these measures be? Let us see.

## What is being recycled?

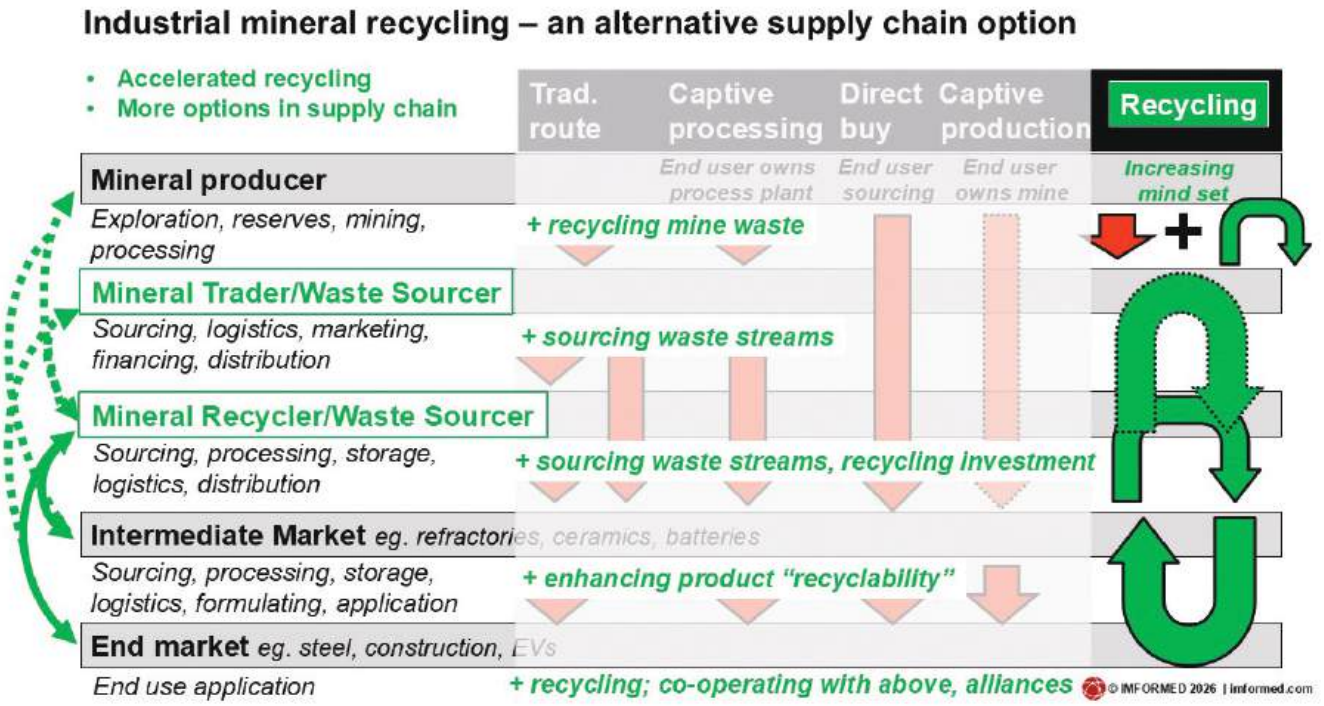
So, in short, tomorrow's "mining" will in large part be efficient and economic utilization of today's industrial waste. The latest trends and development in this growth sector are regularly under the spotlight at IMFORMED's annual Mineral Recycling Forum, held April 15-17 this year in Cannes, France.

There are three primary recyclable waste streams for industrial minerals:

1. Mining and mineral processing waste: generated at the mine or processing plant. Examples: LKAB, Sweden, to process iron ore tailings for rare earth elements, phosphorus, gypsum; Baie Minerals, ECO2, Exterra Carbon Solutions, Canada, all targeting asbestos mine tailings for magnesium oxide (MgO); ElementUS, United States,

developing process for bauxite red mud to yield gallium and scandium (recently received $29.9 million funding from the U.S. Department of War) and $67 million from the U.S. Department of Energy); Arkema-Nutrien, United States, joint venture processing phosphate rock waste fluorosilicicacid (FSA) to anhydrous hydrofluoric acid (HF); Fluorsid, Italy, also developing FSA process for synthetic fluorspar and precipitated silica; Imerys, China, recycling waste from ground calcium carbonate processing; Colorado School of Mines 2025 study revealed mining waste from just 54 active U.S. sites "contains enough CRM to meaningfully shore up domestic supply chains."

2. Mineral-bearing intermediate/end-product manufacturing waste: generated by the intermediate mineral consumer, manufacturing the end-product. Examples: ElementUS, United States, developing sintered alumina/spinel refractory material from secondary aluminium salt dross; Mota Ceramic Solutions, Portugal, expanding operations to recover and reprocess ceramic manufacturing waste; Gannon Eco, Republic of Ireland, expanding operations to recycle semiconductor manufacturing waste containing reusable HF.
3. Spent/waste mineral-bearing end-products: generated after utilization by the ultimate end-user. Examples: Sibelco, Europe and North America, expanding projects to recycle glass (and supply primary silica sand); RHI Magnesita, Refratechnik, REF Minerals, Horn, Europe, steadily increasing rate of refractory recycling; MP Materials/Apple, United States, new partnership to use recycled rare earth magnets; widespread efforts, Europe and United States, to process lithium carbonate from black mass (recycled from lithium-ion batteries), Ascend Elements, United States, succeeded in 2025.




## Alternative sourcing option evolving

All this has triggered the evolution of a new mine-to-market supply chain option for consumers of industrial minerals, with the intermediate stages of the mineral processor and the trader extending their activities to encompass specific mineral waste stream sourcing and recycling. The evolving mindset has also shifted upward to the primary miners, which are now seeking to reevaluate and reprocess their long-standing mine tailings.

One of the chief aspects to consider now is the growing trend, unlikely to diminish, from mineral consumers required to demonstrate to their customers how they are "greening" their raw material supply-chain and manufacturing processes. This may include proof of sustainable mineral sourcing, (increasing) levels of recycled material used in the end-product, reduction of $CO_2$ footprint in mineral supply and manufacturing.

The upshot is that we should see more moves from mineral buyers (and producers) to on- and near-shore mineral sourcing to markets in order to reduce the carbon footprint in logistics, plus see more mineral recycling projects closer to markets.

However, in order to make the entire recycling loop function, both efficiently and economically, there needs to be continuous and growing alliances and collaboration between each of the mineral recycling supply-chain stages.

In particular, there must be a mindset on the part of product manufacturers to raise the degree or ease of recyclability of the spent end-product, as well as ensuring increasing volumes of recycled material maintain the desired performance of the product = cooperation with the suppliers.

## Refractory market leading the way

The good news is that we are starting to see evidence of this in the mineral industry in Europe. The refractories industry is a good example, where magnesium oxide-carbon (MgO-C) bricks can perform with up to 30 percent recycled material. Catching up fast in this field are Turkey, India and South Korea.

In addition to high landfill costs (in Europe), and limited supply sources for certain refractory minerals, raw materials used to manufacture refractory bricks can account for up to 90 percent of their total carbon footprint.

In the United States, the refractory recycling sector is in its early days, and this needs to ramp up. The United States relies on significant import volumes of refractory minerals, particularly from China:

- Bauxite, 100 percent (net import reliance), from China, Guyana.
- Graphite, 100 percent, China, Canada, Mozambique, Mexico.
- Fused alumina, more than 95 percent, China, Canada, Brazil, Austria.
- Chromium, more than 79 percent, South Africa, Kazakhstan, Finland, Canada.
- Silicon carbide, 74 percent, China, Brazil.

- Alumina, 71 percent from Brazil, Jamaica, Australia, Canada.
- Magnesia, 52 percent, China, Israel, Brazil, Canada.

There has been progress over the last two years with increased activity from leading consumers such as HarbisonWalker International, and strategic acquisitions, such as RHI Magnesita buying established U.S. recycler BPI Inc.

### Recycling future in perspective

When one considers the plethora of end-markets served by industrial minerals, just think that each of these is embarking on its own specific journey to increased recycling of their products and working toward using increasing levels of recycled raw materials in them.

For perspective, according to IMFORMED research, ceramics consume some 40 different types of industrial minerals; paint/pigments, chemicals, agrimarkets, glass and food/pharma each use more than 30 different minerals; oilfield drilling, plastics, construction, abrasives, cement, refractories use more than 20 minerals.

That is a whole lot of opportunity in the development of industrial mineral recycling for the future, certainly the smart solution for helping both the sourcing and the circular economy. ■

*(Mike O'Driscoll is director and cofounder of IMFORMED Industrial Mineral Forums & Research Ltd, UK; organizing Fluorine Forum 2026, Baveno, Lake Maggiore, Oct. 26-28, Salt Forum 2026, Cannes, Nov. 16-18; Mineral Recycling Forum 2027; MagForum 2027, Antalya, May 24-26. Email mike@imformed.com or visit www.imformed.com.)*

## BARITE

**by Ji-Eun Kim, National Minerals Information Center, U.S. Geological Survey**

Barite is the mineralogical name for barium sulfate ($BaSO_4$). In commerce, the mineral is sometimes referred to as baryte. Barite is primarily used as a solid-state weighting agent in drilling fluids for oil and natural-gas drilling due to its high specific gravity (SG), low abrasion, chemical and physical inertness, low oil absorption, low solubility, nontoxicity and relatively low cost. This use typically accounts for more than 90 percent of domestic consumption, according to reports from domestic barite crushers and grinders, and approximately 70 percent of global consumption. Most barite ores require some upgrading to achieve minimum commercial purity or density levels, which includes undergoing simple beneficiation methods, such as jigging, tabling and washing, or more complex methods, such as flotation, heavy-media separation or magnetic separation. Barite was included in the U.S. Final 2025 List of Critical Minerals, published in the Federal Register (90 FR 50494).

### Production and consumption

Through October 2025, the world annual average rig count excluding the United States was 1,258 compared with 1,349 through the same period in 2024. Domestic average rig count was 564 compared with 599 through the same period in 2024. Domestically, an estimated 2.3 Mt of barite (from domestic production and imports) was sold by crushers and grinders operating in nine states. Despite the decrease in global and domestic drill rig counts, global barite sales were estimated to have increased, likely owing to deeper oil and gas wells.

Domestic barite production increased, but data were withheld to avoid disclosing company proprietary data. Three companies mined barite at four operations in Nevada. Halliburton Energy Services Inc. operated the Rossi Mine, M-I SWACO operated the Greystone Mine and Mountain Springs Mine, and Progressive Contracting Inc. operated the Coyote Mine.

World production of barite in 2025, excluding the United States, was estimated as 8.7 Mt, a 9 percent increase compared to 2024. Most of the increase was from India, which is currently the leading global producer of barite. Production in India was estimated to have increased to 3 Mt compared to 2.6 Mt in 2024. Other leading barite producing countries were China and Morocco, with production of 2.2 Mt and 1 Mt, respectively. As India continues to elevate its barite production, there are discussions that the barite reserve depletion in India could possibly lead to India becoming a barite importing country in the next 10 years. Most of India's barite is produced in Andhra Pradesh, particularly at the Mangampet Mine in the Annamaya district.

### Imports and exports

According to the U.S. Census Bureau, in 2025, U.S. barite imports were 1.81 Mt, unchanged from 2024. The leading import sources, in descending order of quantity, were India (727 kt), Morocco (340 kt), Mexico (304 kt), Laos (252 kt) and China (167 kt). Together, these five countries accounted for 99 percent of domestic barite imports. Since 2022, it is notable that imports from China have decreased while imports from Laos have increased.

Domestic barite exports were 64.3 kt in 2025, a

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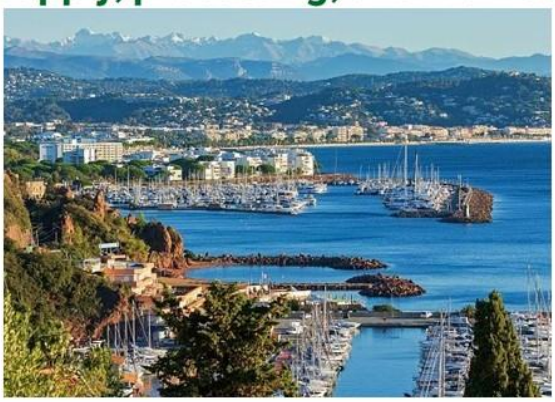

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