EarthRights International

KACHIN
A SACRIFICE ZONE FOR THE GREEN TRANSITION

“Everything is Depleted… Total Devastation”

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KACHIN, A SACRIFICE ZONE FOR THE GREEN TRANSITION

Background

In northeastern Myanmar, Kachin is a biodiversity hotspot that has been safeguarded for generations by a diverse network of Indigenous peoples and ethnic minorities. Kachin has also been at the center of a protracted armed conflict, with the Kachin Independence Organisation (KIO) struggling against the Myanmar military and associated armed groups for greater Kachin self-rule.

It is estimated that widespread mining of heavy rare earth elements (HREE), especially terbium and dysprosium, began in Kachin state in 2017. These HREE are used primarily in high-performance NdFeB magnets[1].

Figure 1 Map of rare earth mining areas in Kachin, Myanmar

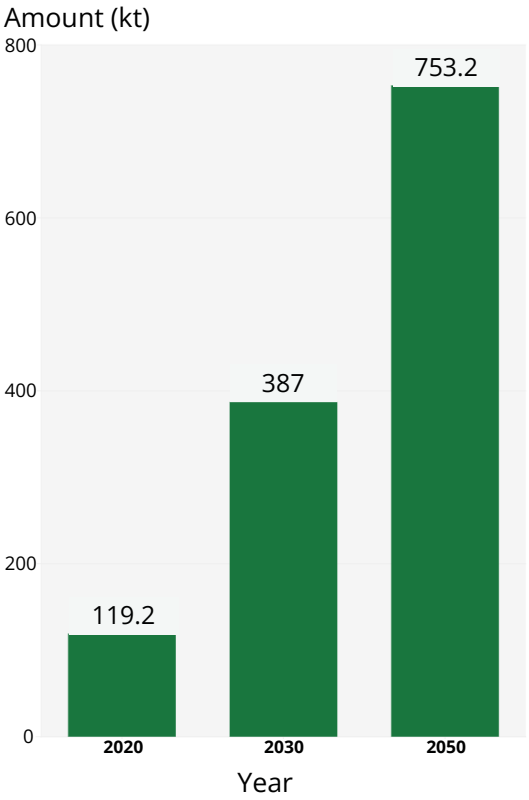
[1] 94% of dysprosium is used for permanent magnets. (European Commission, 2024).

Demand for these magnets was driven first by the electronics industry and, increasingly, by electric vehicles (EVs) and wind turbines. Between 2020 and 2030, demand is forecast to increase by 225%, with a third of demand coming from EVs and a third from wind turbines, doubling again by 2050 (U.S. Department of Energy, 2022, p. 32).

Exports of HREE from Myanmar are worth an estimated US$1.4 billion annually (Global Witness, 2024). In 2023, an estimated 57% of the global supply of terbium and dysprosium originated from Kachin (Adamas Intelligence, 2024, p. 3), through extraordinarily harmful mining practices that violated international human rights and labor rights standards. Until late 2024, mining of HREE was occurring in an area largely controlled by a Border Guard Force (BGF), effectively a militia aligned to Myanmar's military junta, which has committed well-documented crimes against humanity (Andrews, 2024, p. 19).

In March 2022, mining activities were identified at over 300 locations with 2,700 mining pools (Global Witness, 2022, p. 3), many of which emit toxic elements such as arsenic, cadmium, and lead into the water table. Mining sites increased by more than 40% between 2021 and 2023 alone (Global Witness, 2024), and by the end of 2024, the number had grown to an estimated 400 sites (Myanmar Witness, 2025).

Global demand for NdFeb magnets



Kachin civil society groups have told EarthRights that they are unaware of the rehabilitation of any mining site in the past decade of rare earth mining. Water samples collected by EarthRights and BRIDGE, a Kachin-based organization focused on environmental conservation and sustainable community development, showed that leachate from a mining site out of use for 10 years was continuing to emit heavy metals, including arsenic and cadmium, far in excess of safe levels.

While the supply chain for Kachin's HREE is opaque, open-source data reviewed by EarthRights confirms all official imports are made by companies registered in China, primarily Yunnan province, on the border with Kachin state. A Chinese state-owned conglomerate called the China Rare Earth Group has a monopoly on the processing of China's HREE, and its subsidiaries and associated companies import HREE from Myanmar. This conglomerate processes HREE and has supplied them to magnet manufacturers, after which they enter into global supply chains. Chinese magnet manufacturers represent over 90% of global magnet production (Turton, 2025).

Percentage share of global demand by application

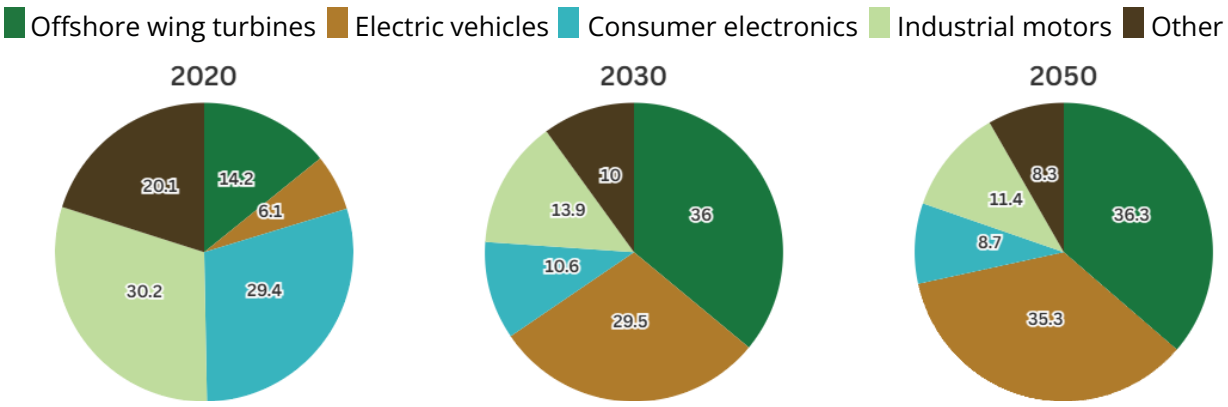


Figure 2 Projected increase in global demand for NdFeB magnets (U.S. Department of Energy, 2022, p. 32)

The significant proportion of HREE from Kachin suggests that most NdFeB magnets contain HREE from Myanmar (Adamas Intelligence, 2024, p. 3). Moreover, because HREE from Myanmar are mixed with materials from other sources during refining in China, it is not possible to verify claims of a Myanmar-free supply chain. Industry insiders have confirmed to EarthRights that even if upstream suppliers provided such assurances, they would simply not be credible[2].

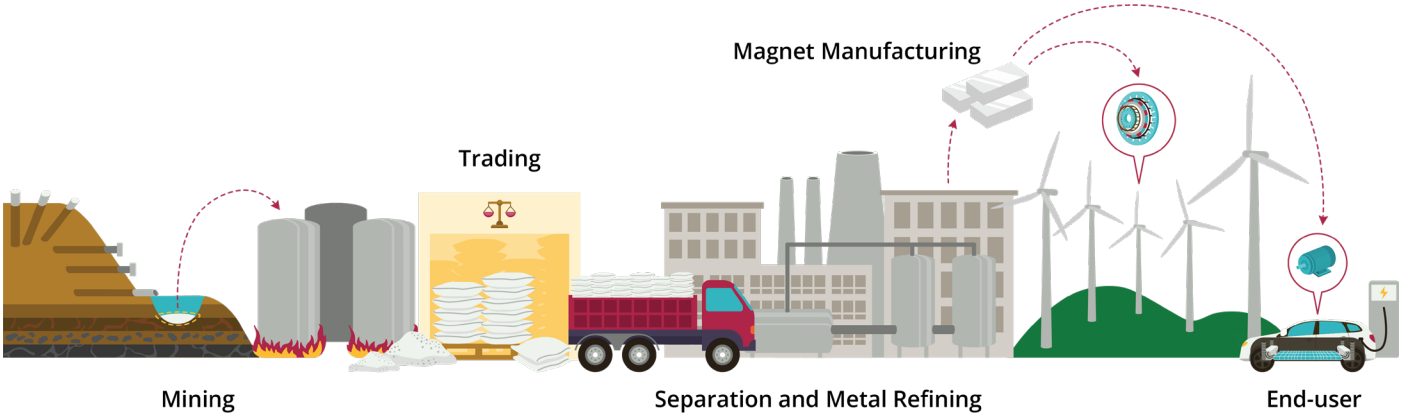


Figure 3 Overview of supply chain for NdFeB magnets

How Harmful is HREE Mining in Kachin?

HREE are mined in Kachin through a method known as in-situ leaching, which uses chemical leaching agents and precipitants. The process involves injecting chemical leaching agents, such as ammonium sulfate, into the hillside through a network of pipes. The solution moves slowly through the hillside, separating the rare earth elements from the surrounding rock. The leaching agents release heavy metals, radioactive elements, and ionic compounds.

Rare earth mining has been found to have serious environmental and health impacts (Lei et al., 2017, p. 216). In Jiangxi, for example, Chinese authorities have estimated that the clean-up bill for the environmental damage caused by the HREE industry will be around US$5.6 billion, with a full recovery expected to take between 50 and 100 years (Global Witness, 2022, p. 5).

The impacts of these mining practices on local communities in Kachin have been devastating. As described by one community member from Kachin that spoke to EarthRights:

> "Now, everything is depleted; the trees, bamboo, water, and wildlife are all gone, resulting in total devastation. ... The land is now barren of trees, bamboo, flowers, and wildlife."

In 2024, EarthRights and BRIDGE collected water and soil samples from areas impacted by rare earth mining. Testing and analysis of these samples by Naresuan University, Thailand, concluded in a report released in April 2025 that creeks in Chipwe township in Kachin were severely polluted (Phenrat, 2025, pp. 14-19).

[2] Notably, some manufacturers have assured that their components utilize "recycled" materials. However, this generally means "swarf," comprising "offcuts and grinding media generated during magnet manufacturing" rather than end-of-life products (Global Witness, 2024).

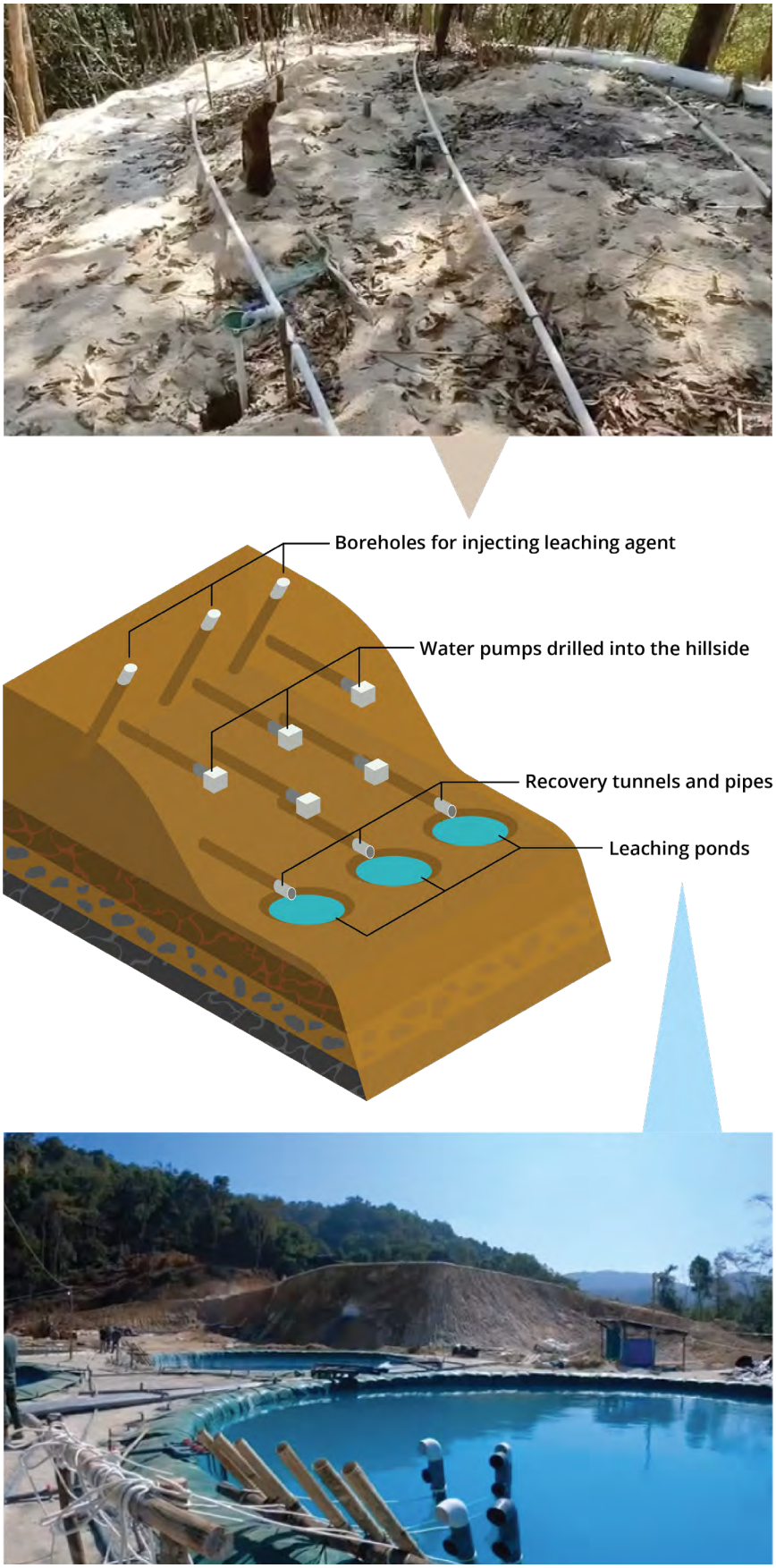


Figure 4 In-situ leaching process, photos by KRCG

Testing from a free-flowing creek downstream of mining sites recorded an "ultrahigh degree of contamination" by toxic heavy metals (including arsenic, cadmium, manganese, lead, and strontium), dysprosium, and radioactive elements (Phenrat, 2025, p. 17). The report concluded that "the effects of mining remain detectable for considerable distances from the source" (Phenrat, 2025, p. 17).

This has severe impacts on Indigenous communities, destroying their livelihoods and cutting off access to water for drinking, bathing, and irrigation (Meehan & Seng Lawn, 2024, pp. 16-26). Exposure to these pollutants can also lead to a variety of health issues, including cancer and an increased incidence of miscarriages. This is a breach of the right to water, the right to health, the right to a clean, healthy, and sustainable environment, and, with pollution of this severity, the right to life itself.

Photo by BRIDGE

Photo by BRIDGE

Sampling of water and soil from a creek and adjacent bank in Kachin, photos by BRIDGE

Findings from water testing in Kachin

Comparison of dissolved and particulate concentrations at Station 1 (baseline) and Station 3 (polluted site)

Particulate Dissolved Chinese water polution control standard*

Figure 5 Findings from water testing in Kachin (Phenrat, 2025, p. 49)

* Pollutant concentration limits taken from China's Water Pollution Control Standards for In-situ Leaching of Ionic Rare Earth Minerals (China Nonferrous Metals Industry Institute of Standards, Metrology, and Quality, 2024, p. 22).

Testing by Naresuan University also found limited surface soil pollution, suggesting that contaminants released by the leaching agents may be moving into creeks through subsurface migration or are being directly discharged into local waterways. Subsurface migration would mean widespread contamination of the water table. Further investigation is urgently required.

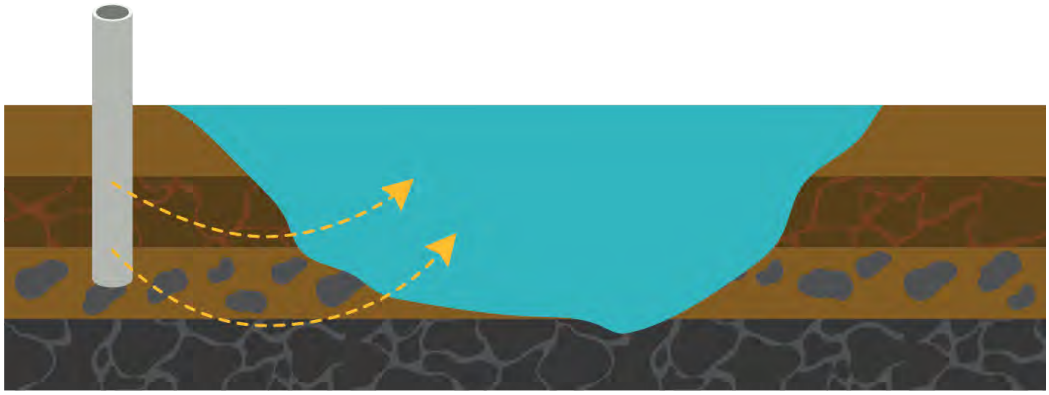


Figure 6 Sub-surface migration

Rare earth mining in Kachin has also resulted in the deaths of workers. The mining process involves pumping acid into the mountains, which weakens the soil and increases the frequency of landslides. During heavy rainfall, these landslides can trigger mine collapses. In June 2024, two landslides at HREE mining sites killed at least 35 workers (RFA Burmese, 2024). Mine workers are also exposed to harmful chemicals that have been banned in China, with deaths of mine workers, including children, being attributed by their family members to this exposure, according to local sources that EarthRights has contact with in Kachin. A community leader also told these local sources that "Miners become unwell. After working for one or two years, depending on their immunity, they start experiencing poor health. They develop kidney diseases and respiratory issues."

Conflict and Effective Control Changes in 2024

This mining is not only environmentally destructive, but is also closely connected to ongoing conflict. Myanmar is one of the most active conflict zones in the world (ACLED, 2024). Until 2024, HREE mining mostly occurred in an area controlled by a BGF. In these circumstances, the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (OECD Guidance) is clear: companies should have disengaged from supply chains likely to contain HREE from Kachin.

In late 2024, the KIO and its armed wing, the Kachin Independence Army (KIA), took control of all HREE mining in Myanmar. The KIO, one of numerous ethnic resistance organizations engaged in armed struggle with the Myanmar military, has been in conflict since 1961 and maintains effective control over large parts of Kachin state. Unlike the BGF, the KIO and the KIA have a degree of legitimacy with and accountability to communities in Kachin.

Kachin civil society organizations have called on international organizations to "acknowledge the KIO/A's governance role and support efforts to strengthen its governance capacity" (Shanan Foundation, 2025, p. 20). The UN Special Rapporteur on the Situation of Human Rights in Myanmar regularly calls on the international community to engage with ethnic resistance organizations (Andrews, 2024, p. 22). While OECD Guidance in these circumstances is unclear, companies should either disengage from supply chains likely to contain rare earths from Kachin or treat the KIO/A as a legitimate governance actor and engage with it accordingly.

Responsible Business Conduct Standards for Managing the Human Rights Risks of HREE Supply Chains

The UN Guiding Principles on Business and Human Rights (UN Guiding Principles) and OECD Guidelines for Multinational Enterprises on Responsible Business Conduct (OECD Guidelines) outline a continuum of ways that corporations can be implicated in human rights abuses, ranging from causing harm and contributing to it, to being directly linked to harm through a business relationship. Multinational corporations have been sourcing magnets reliant on HREE from Myanmar for years. This reliance and the associated harms would be clear to any corporation that has undertaken human rights due diligence required by the UN Guiding Principles and OECD Guidelines.

> Large companies in Germany are currently legally required to identify and address human rights and environmental risks in their supply chains. Under the German Supply Chain Due Diligence Act, they must always assess their direct suppliers. If they gain "substantiated knowledge" of a potential violation, as they have with HREE from Kachin, they must also assess indirect suppliers. They must take measures to prevent and remedy abuses and to report on their compliance to the Federal Office for Economic Affairs and Export Control, which can issue fines if companies violate their due diligence obligations.
>
> — Germany accounts for one in five NdFeB magnets exported from China (Adamas Intelligence, 2025).

Some companies have used alternative technologies to reduce their reliance on HREE, such as geared wind turbines (Vestas, 2024), but others have not yet substantially altered their practices.

In the EV sector, viable commercial alternatives to permanent magnet synchronous motors (PMSM) could include externally excited synchronous motors (EESM), and asynchronous motors (ASM, also known as induction motors), which replace HREE with higher amounts of copper. However, EESMs and ASMs usually require higher weight and volume (Prognos, Öko-Institut, & Wuppertal Institut, 2023, p. 40). A promising concept for EVs seems to be synchronous reluctance motors, which are being developed without the usage of HREE, but have not yet been incorporated in commercial EV production (Zorpette, 2024).

While China Rare Earth Group and Chinese magnet manufacturers have clear responsibilities, multinational corporations involved in EV and wind turbine manufacturing based in OECD countries also share responsibility for human rights abuses occurring in their supply chains.

The human rights and environmental risks related to the extraction of HREE were well-documented even before mining started to ramp up in Myanmar. The dire consequences of this mining became clear in 2016 when China intensified efforts to regulate domestic mining operations—particularly, small, illegal mines in Ganzhou, Jiangxi province—partly in response to severe environmental damage (Standaert, 2019), resulting in a significant drop in China's domestic HREE output.

The historic harms from HREE mining and the shift to Myanmar, with its long history of conflict, should have triggered enhanced human rights due diligence, followed by preventive or mitigation actions, such as suspending supplier relationships or terminating them if necessary.

However, while some companies have made efforts to address abuses in their HREE supply chains, it appears that they lacked or failed to build sufficient leverage to succeed. Despite this, companies have continued to source from supply chains reliant on HREE from Kachin, driving up demand and accelerating the harmful expansion of mining in Myanmar. In doing so, they are falling short of international human rights standards for responsible business conduct. This includes companies with turnovers that vastly exceed Myanmar's gross domestic product and that make up a substantial portion of global demand for HREE.

Tesla, for example, was estimated to be responsible for 2-3% of global demand for NdFeB magnets in 2022 (Adamas Intelligence, 2023). In 2023, Tesla's global EV deliveries increased to 1.81 million, 38% higher than 2022 (BuyACar, 2025). Using industry assumptions[3] of dysprosium and terbium content in magnets, EarthRights has estimated that the Volkswagen Group, another major producer of EVs, was potentially responsible for almost 2% of global demand for dysprosium and 3.5% of terbium in 2024. As part of their supply chain due diligence, companies should have accurately calculated their contribution to global demand.

Global corporations that continued sourcing magnets reliant on HREE, while knowing that the majority of global supply is being mined in Kachin after using extremely harmful practices and then comingled in supply chains, were likely contributing to human rights abuses in Kachin. Companies had further obligations to disengage under OECD Guidelines when the supply was controlled by a BGF.

As set out above, the number of mining sites in Myanmar increased from 300 (with 2,700 mining pools) in March 2022 to almost 400 sites in 2024. Three percent of global demand over this period is equivalent to the output of several new mining sites in Kachin and potentially dozens of mining pools.

[3] These calculations are based on an assumption of EVs requiring approximately 12.5 grams of NdFeB magnets per kW of engine output with a magnet content (by weight) of 2% dysprosium and 1% terbium. Academic papers suggest a significantly higher dysprosium content (3.5%), but interviews with industry experts conducted by EarthRights suggest the lower figure is now more appropriate. These calculations were applied to the 2024 sales of the top-selling Volkswagen Group battery electric vehicle models.

RECOMMENDATIONS

We have developed the following recommendations to improve engagement with Kachin civil society and local governance actors and to provide appropriate remedies.

Recommendations for the Private Sector

- Companies with Myanmar HREE in their supply chains should assess, including through engaging with Kachin civil society and the KIO, the current human rights and environmental impacts of HREE mining in Kachin and whether they have the leverage to mitigate these impacts, for example by facilitating access to mining experts or access to water, soil, and health testing. Companies should disengage if there continues to be severe impacts that they cannot mitigate.

- Companies that have consistently used Myanmar HREE in their supply chains should recognize that they have likely contributed to human rights abuses and environmental destruction, and should work with Kachin civil society actors to assess how to remedy their contributions, such as through supporting water and soil testing and, in the longer term, contributing to mining site remediation efforts.

- Companies in collaboration with industry bodies and governments should work to:
  - Significantly minimize the use of HREE, through existing alternative technologies and investments in new technologies;
  - Significantly improve the recycling of HREE; and
  - Ensure that HREE in their supply chains are mined in countries with strong environmental rule of law.

Recommendations for Governance Actors

- The KIO should halt HREE mining until it can establish the extent of the harms caused by mining under the BGF and put safeguards in line with international standards in place. In the absence of these safeguards, the KIO should implement minimum standards to improve mining practices and engage local civil society organizations and communities in establishing a transparent and publicly accessible framework and policies for rare earth mining

- The Chinese government should cooperate with the KIO to hold Chinese investors and mining companies operating in Myanmar accountable to Chinese standards on rare earth mining[4] and the Chinese Due Diligence Guidelines for Responsible Mineral Supply Chains. They should adopt import regulations for HREE produced in Myanmar that require evidence that they have been produced legally and are not linked to human rights abuses, conflict, or corruption.

- Governments should enact and enforce human rights and environmental due diligence legislation, including for supply chains, prioritizing substantive outcomes for rights-holders and communities over process.

[4] China has introduced several environmental and safety standards for rare earth mining, including the Rare Earth Industry Pollutant Emission Standard (GB 26451-2011) and the Ionic Rare Earth Mining Water Pollutant Emission Standard (DB36 1016-2018). More recently, it has developed standards specific to in-situ leaching, namely, the Water Pollution Control Standards for In-situ Leaching of Ionic Rare Earth Minerals.

REFERENCES

1. ACLED. (2024, December 12). *Decisive year ahead for resistance groups in Myanmar as they threaten new territories.* ACLED Data. https://acleddata.com/conflict-watchlist-2025/myanmar/
2. Adamas Intelligence. (2023, March 3). *Implications: Tesla announces next generation rare-earth-free PMSM.* Adamas Intelligence. https://www.adamasintel.com/tesla-rare-earth-free-motor/
3. Adamas Intelligence. (2024, November 5). *Rare earth magnet market outlook to 2040.* https://www.adamasintel.com/rare-earth/rare-earth-magnet-market-outlook-to-2040/
4. Adamas Intelligence. (2025, March 5). *Record rare earth magnet exports from China in 2024.* https://www.adamasintel.com/record-rare-earth-magnet-exports-from-china-in-2024/
5. Andrews, T. (2024, March 14). *A/HRC/55/65: Situation of human rights in Myanmar – Report of the Special Rapporteur on the situation of human rights in Myanmar.* Office of the United Nations High Commissioner for Human Rights. https://www.ohchr.org/en/documents/thematic-reports/ahrc5565-situation-human-rights-myanmar-report-special-rapporteur
6. BuyACar. (2025, April 17). *The latest Tesla statistics.* https://www.buyacar.co.uk/the-latest-tesla-statistics/
7. China Nonferrous Metals Industry Institute of Standards, Metrology, and Quality. (2024, April). *Water pollution control standards for in-situ leaching of ionic rare earth minerals.* http://www.cnsmq.com/uploadfile/2024/0423/20240423092729649.pdf
8. European Commission. (2024). *Raw Materials Profiles - Dysprosium: Dashboard.* RMIS – Raw Materials Information System. https://rmis.jrc.ec.europa.eu/rmp/Dysprosium
9. Global Witness. (2022, August 9). *Myanmar's poisoned mountains.* https://globalwitness.org/en/campaigns/transition-minerals/myanmars-poisoned-mountains/
10. Global Witness. (2024, May 23). *Fuelling the future, poisoning the present: Myanmar's rare earth boom.* https://globalwitness.org/en/campaigns/transition-minerals/fuelling-the-future-poisoning-the-present-myanmars-rare-earth-boom/
11. Lei, Z., Li, Y., Zhang, X., & Li, H. (2017). Overview on China's rare earth industry restructuring and regulation reforms. *Journal of Resources and Ecology,* 8(3), 217–224.
12. Meehan, P., & Seng Lawn, D. (2024). *Rare earth mining in Kachin State, Myanmar: The impacts of rare earth mining on livelihoods and local communities.* University of Warwick. https://warwick.ac.uk/fac/arts/schoolforcross-facultystudies/research/projects/rare_earth_mining_myanmar/briefing_paper_4_-_impacts_on_livelihoods_and_communities.pdf
13. Myanmar Witness. (2025, March 18). *Uncovered: The devastating impact of Myanmar's rare earth mining boom.* Center for Information Resilience. https://www.info-res.org/articles/uncovered-the-devastating-impact-of-myanmars-rare-earth-mining-boom/
14. Phenrat, T. (2025, April 28). *Environmental forensics and preliminary impact assessment of water and soil contamination from rare earth mining in Myanmar.* Faculty of Engineering, Naresuan University. https://www.eng.nu.ac.th/eng2022/News-Detail.php?Postid=2506&Lang=th
15. Prognos, Öko-Institut, & Wuppertal Institut. (2023). Souveränität Deutschlands sichern – Resiliente Lieferketten für die Transformation zur Klimaneutralität 2045. https://www.stiftung-klima.de/app/uploads/2023/11/Stiftung_Klimaneutralitaet_2023-Resiliente-Lieferketten_Langfassung-2.pdf
16. RFA Burmese. (2024, June 21). *Collapse at notorious Myanmar rare earth mine kills 15 people.* Radio Free Asia. https://www.rfa.org/english/news/myanmar/myanmar-mine-collapse-06212024072910.html

17. Shanan Foundation. (2025). *Governance of rare earth mining by the Kachin Independence Organization/Army (KIO/KIA).* https://www.boell.de/en/2025/04/22/fractured-authority-and-resource-politics-myanmar-new-report-rare-earth-mining

18. Standaert, M. (2019, July 2). *China wrestles with the toxic aftermath of rare earth mining.* Yale Environment 360. https://e360.yale.edu/features/china-wrestles-with-the-toxic-aftermath-of-rare-earth-mining

19. Turton, S. (2025, April 23). *How China's rare-earth curbs complicate West's diversification push.* Nikkei Asia. https://asia.nikkei.com/Business/Technology/Tech-Asia/How-China-s-rare-earth-curbs-complicate-West-s-diversification-push

20. U.S. Department of Energy. (2022, February 24). *Rare earth permanent magnets supply chain: Deep dive assessment.* https://www.energy.gov/sites/default/files/2022-02/rare-earth-magnets-supply-chain-report.pdf

21. Vestas. (2024). *Environment: Materials and rare earths.* https://www.vestas.com/en/sustainability/environment/materials-and-rare-earths

22. Zorpette, G. (2024, March 15). *Who will free EV motors from the rare earth monopoly? A materials breakthrough makes GE Aerospace a contender.* IEEE Spectrum. https://spectrum.ieee.org/electric-motor-no-rare-earth

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