CRITICAL minerals REVIEW

2025

ISSUE 1

How financial risk-sharing agreements can attract investment in Canada's critical minerals

Protecting Ontario's critical minerals and energy sector

Solid opportunities for Canadian-based critical mineral supply chains

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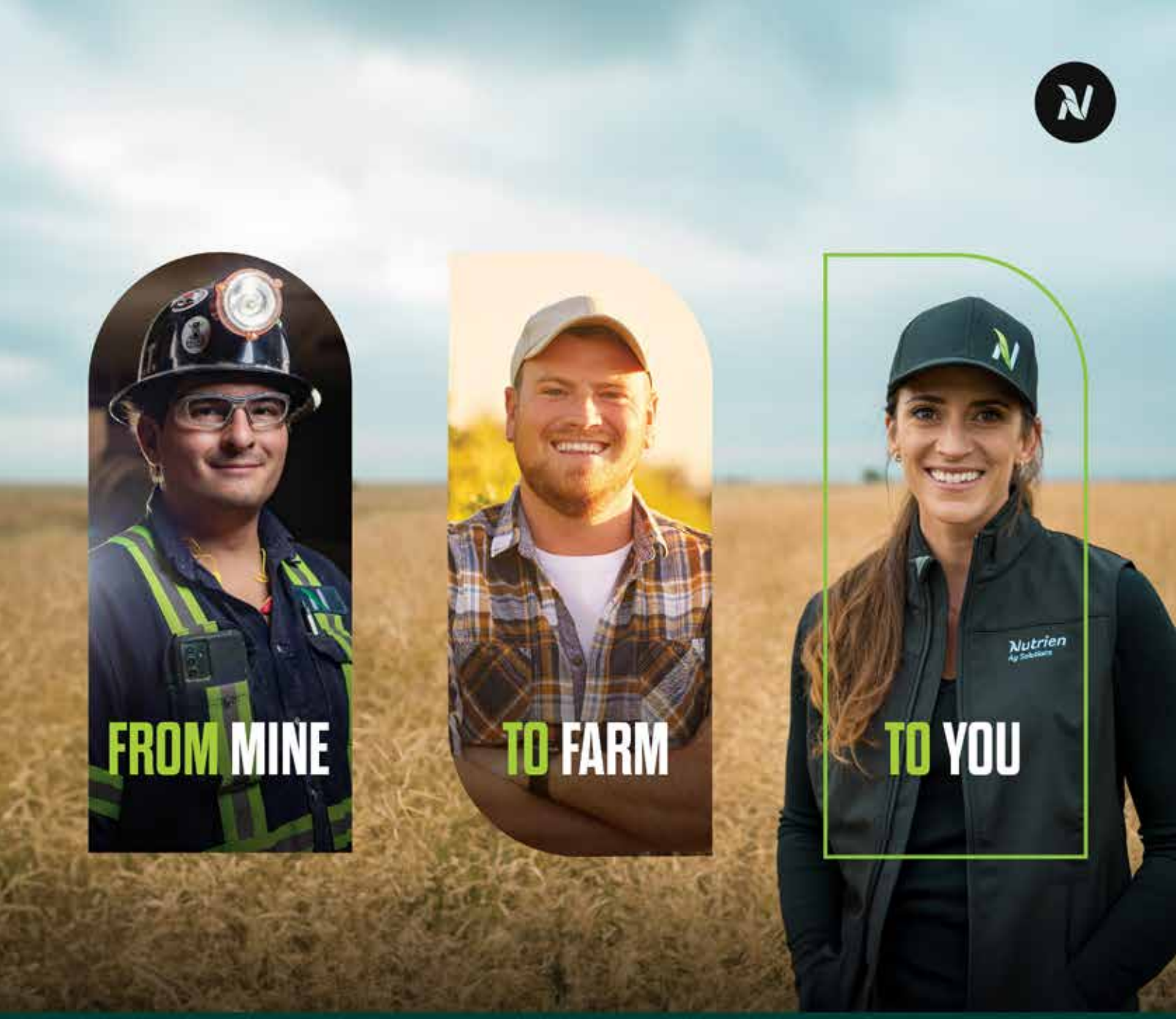

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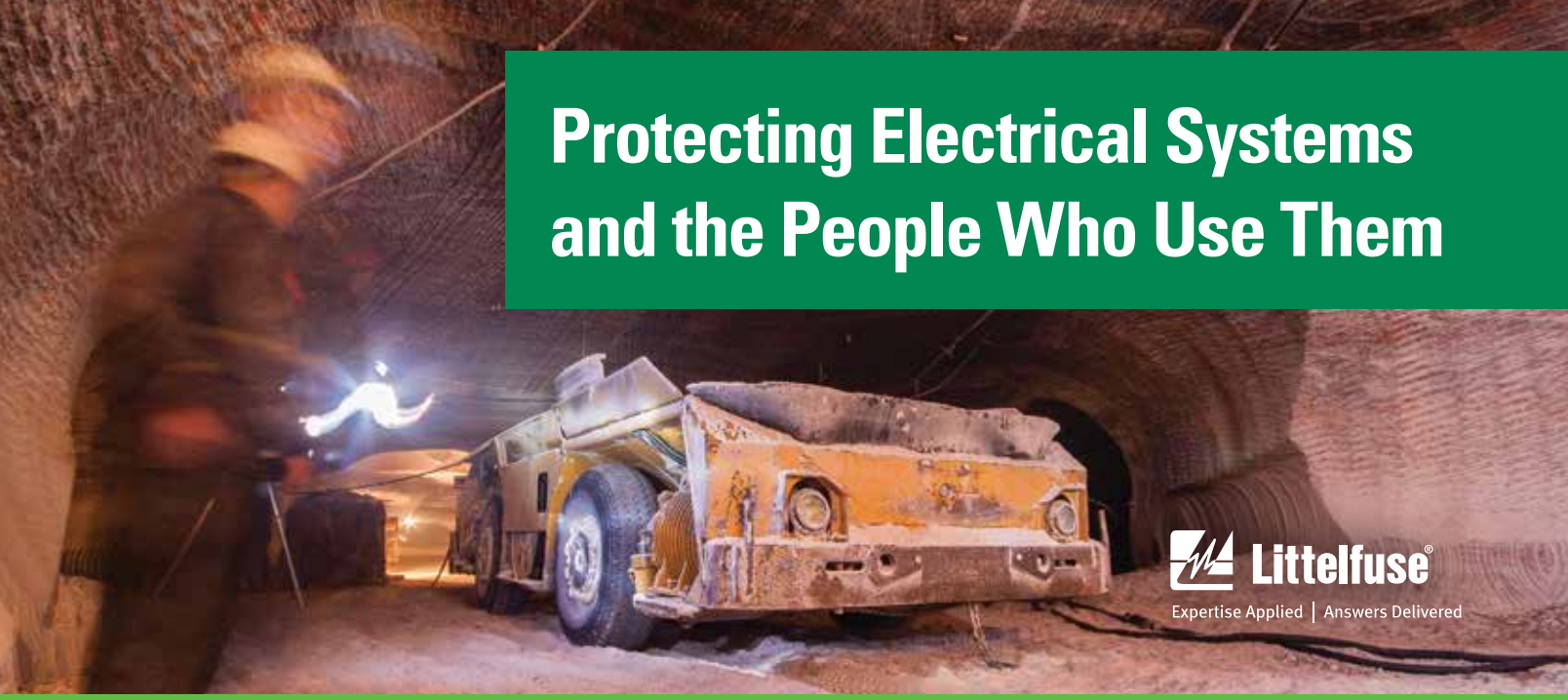

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CRITICAL minerals REVIEW

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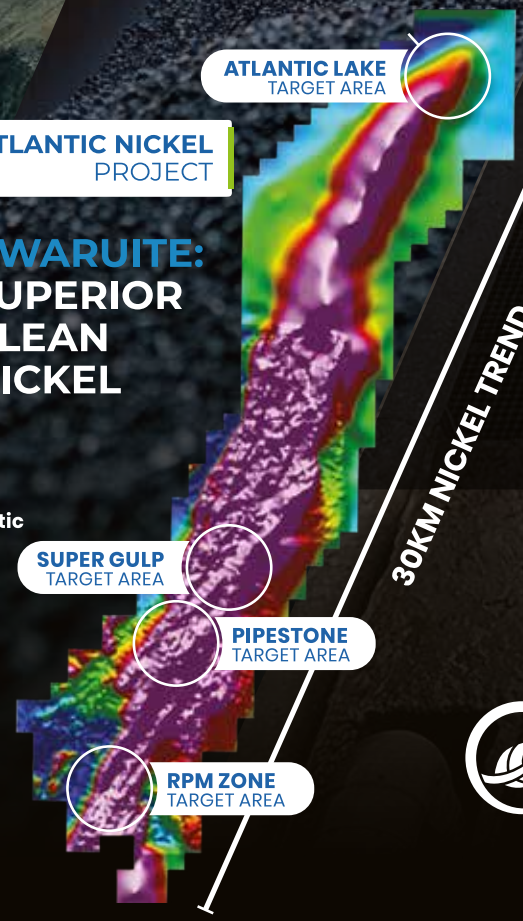

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USGS science for a changing world

"The development of awaruite deposits in other parts of Canada may help alleviate any prolonged shortage of nickel concentrate. Awaruite, a natural iron-nickel alloy, is much easier to concentrate than pentlandite, the principal sulfide of nickel."

BROOKINGS

"Even if the U.S. and EU were to dig more minerals out of the ground, many of these minerals would need to be shipped overseas for concentrating, refining, and smelting without significant increases in U.S. and European mineral refining and smelting capacity."

– THE BROOKINGS INSTITUTION

Shayna Wiwierski

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Welcome to the latest issue of *Critical Minerals Review*, your premier source for insights into the dynamic and rapidly evolving critical minerals sector. As the global demand for minerals essential to clean energy, technology, and national security surges, this industry stands at a pivotal crossroads. Our mission is to illuminate the opportunities, challenges, and innovations shaping this vital landscape, and this issue delivers a compelling exploration of the economic, cultural, and strategic forces at play.

The critical minerals sector is not just about extraction; it's about forging partnerships, balancing risks, and building sustainable frameworks that benefit all stakeholders. Two feature stories in this issue exemplify this ethos, highlighting bold approaches to financial innovation and Indigenous collaboration that are redefining the industry's trajectory in Canada.

One of our feature stories from the Canadian Climate Institute delves into the high-stakes world of financing mineral exploration and development. As the push for net-zero emissions intensifies, critical minerals like lithium, cobalt, and nickel are in unprecedented demand. Yet, the capital-intensive nature of mining, coupled with geopolitical and environmental complexities, poses significant barriers to investment. This feature explores how financial risk-sharing agreements—innovative models that distribute risk among governments, industry, and investors—are unlocking new opportunities.

Equally transformative is our feature from PADCOM, who signed a landmark deal between the Potash and Agri Development Corporation of Manitoba (PADCOM) and the Manitoba Métis Federation (MMF), setting a new standard for Indigenous-industry partnerships. Signed on February 27, 2025, the agreement recognizes the MMF as the National Government of the Red River Métis, affirming their right to self-determination while establishing a royalty payment system to support Métis communities. PADCOM's potash mine in Harrowby, Man.—Canada's first of its kind—promises economic prosperity, with projections of hundreds of millions in annual revenue for centuries. This partnership not only redefines industry-Indigenous relations but also aligns with Canada's broader reconciliation efforts, as outlined in the Truth and Reconciliation Commission's Call to Action 92. It's a powerful example of how mutual respect and collaboration can create shared prosperity.

Beyond these features, this issue dives into the broader implications of the critical minerals boom. From Ontario's ambitious Critical Minerals Strategy to the integration of Indigenous knowledge in resource development, we explore how policy, innovation, and community engagement are shaping a sustainable future. Articles also examine the geopolitical stakes, with Canada positioning itself as a reliable supplier amid global supply chain vulnerabilities.

As we look ahead, the critical minerals sector demands bold vision and pragmatic solutions. Whether through financial ingenuity or groundbreaking partnerships like PADCOM and MMF, the path forward requires collaboration, innovation, and a commitment to equity. We invite you to engage with these stories, reflect on their implications, and join the conversation about how we can responsibly harness the potential of critical minerals.

Thank you for reading *Critical Minerals Review.* Let's continue to explore the opportunities and responsibilities that define this transformative era.

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MESSAGE FROM THE PREMIER OF SASKATCHEWAN

The Honourable Scott Moe

Saskatchewan is proud to be a reliable and sustainable producer of the high-quality food, fuel, and fertilizer the world needs. This reputation has been built over many years of actively working together with industry and we are seizing the moment to strengthen our leadership position in critical minerals.

With an abundance of natural resources, Saskatchewan is uniquely positioned to meet the world's growing demand for critical minerals. Saskatchewan is already the world's leading potash producer, accounting for approximately one-third of global production, and the world's second-largest uranium producer. We are Canada's largest producer of helium and home to 27 of the 34 critical minerals recognized by the Canadian government.

In 2023, our government launched Securing the Future: Saskatchewan's Critical Minerals Strategy to help guide the expansion of the province's critical minerals sector. The strategy outlines four goals to be reached by 2030: increase Saskatchewan's share of Canadian mineral exploration spending to 15 per cent; double the number of critical minerals being produced in Saskatchewan; grow Saskatchewan's production of potash, uranium and helium; and establish Saskatchewan as a rare earth elements hub.

Our government is working towards these goals by building on Saskatchewan's world-leading stable and competitive business environment to encourage investment. To support the Critical Minerals Strategy, we increased the Saskatchewan Mineral Exploration Tax Credit from 10 to 30 per cent and expanded the Targeted Mineral Exploration Incentive to include drilling for all hard rock minerals. We also invested over $4 million into geoscience data management technology and another $10 million over 10 years to support critical minerals public geoscience.

Two new programs have also been created to drive diversification and investment in the sector. The Critical Minerals Processing Investment Incentive offers transferable royalty and tax credits for qualified value-added processing projects and the Saskatchewan Critical Minerals Innovation Incentive provides transferable credits for eligible innovation commercialization projects. These new incentives apply to 11 targeted emerging critical minerals.

With these new and enhanced incentives, it is clear we value our industry partners and understand the importance of creating the right conditions for investment and development. This approach is a key reason that, in the Fraser Institute's mining survey, mining executives from around the world rated Saskatchewan as the top in Canada and the third most attractive jurisdiction globally for investment. This is the ninth time over the last decade our province has achieved a top three global position.

The level of long-term confidence in Saskatchewan's critical minerals sector can be seen in how the province is expected to continue to lead Canada in total mining investment in 2025, with industry spending in the year projected to exceed $7 billion. In addition to the continued investments in optimization and innovation at their operations by mining industry leaders like Nutrien, Mosaic, Cameco, and Orano, this growth is being driven by new and ongoing investments such as the Foran Mining McIlvenna Bay copper and zinc project, the ramp-up of the K+S Potash Canada Bethune mine, and BHP Group's Jansen potash project.

Other exciting critical minerals projects in Saskatchewan include the advanced uranium projects from NexGen Energy, Denison Mines, and Paladin Energy, all continuing to diligently progress toward mine construction. Arizona Lithium's Prairie Lithium project is also getting ready for production in the near-term while North American Helium recently brought online its ninth helium purification facility in the province. The Saskatchewan Research Council is also building North America's first commercial Rare Earth Processing facility. In June 2024 it began producing neodymium and praseodymium metals at a commercial scale, with full operations expected by 2026. There are also many other critical mineral exploration projects at earlier stages of development.

With a wealth of essential resources that drive modern technology and economic development, Saskatchewan is well-equipped to support growing global demand. As we continue to develop our critical minerals sector, our province will play an outsized role in delivering food and energy security to countries around the world, driving investment, innovation, and long-term economic prosperity. ✘

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MESSAGE FROM THE
MINISTER OF MINING AND CRITICAL MINERALS

The Honourable Jagrup Brar

It is my pleasure, on behalf of the Province of British Columbia, to share how British Columbia is uniquely positioned to leverage its rich geological resources, abundant clean energy, and strategic access to tidewater. These advantages enable our province to play a pivotal role in supplying critical minerals that are essential for green technologies and transition to a low-carbon future.

In recognition of this generational opportunity, our newly formed Ministry of Mining and Critical Minerals is advancing the responsible development of these important commodities. B.C. is already a strong contributor to global critical mineral supply, representing 54 per cent of Canada's copper production and Canada's only producer of molybdenum. The province hosts over half of the critical minerals on Canada's critical minerals list and has advanced exploration and development projects with copper, nickel, molybdenum, zinc, REEs, and others.

In B.C. we are focused on strengthening the mineral exploration and mining sector to ensure a stable and transparent environment for global partners and investors. With our abundant resources and commitment to responsible resource development, we are taking proactive steps to attract investments that support sustainable growth and benefit both local communities and the global market. B.C.'s Critical Minerals Strategy is a great example of this work. The Strategy includes 11 actions to support critical minerals development, improve sector competitiveness, strengthen partnerships with First Nations, and drive sustainable economic growth in the province.

Through the Strategy, we have enhanced access to world-class public geoscience and released publications focused on critical minerals, including the BC Critical Minerals Atlas, to support explorers, First Nations, and the mining industry. Additionally, we are advancing our Environmental, Social, and Governance performance through the Mines Digital Trust, which has garnered recognition from the United Nations. We have also launched the Critical Minerals Office, while introducing a renewed focus to dramatically reduce permitting timelines. This effort involves close collaboration with industry and First Nations to establish fixed timelines for exploration and major mine projects. Building on previous success, such as reducing major project review timelines by over 35 per cent, this work aims to further streamline processes and drive greater efficiency.

The province is also streamlining permitting of major electrical infrastructure that will be required to support future critical mineral projects. This includes the January

14th announcement that the B.C. Energy Regulator is now enabled to act as a one-window regulator for the new North Coast Transmission Line and other high-voltage transmission projects.

For 2025, we are focusing on four major mine projects ensuring the government processes do not hold up decision timelines: Eskay Creek Gold/Silver project; Highland Valley Copper Expansion; Red Chris Expansion; and Mount Milligan Copper and Gold. Our priority will be on ensuring robust review with First Nations partners, while remaining focused on getting to permit decisions as quickly as possible. These are projects that are ready to move forward and have the potential to generate significant employment to support the B.C. economy in the face of tariffs.

True success comes from meaningful partnership. That is why Premier Eby tasked me with developing a long-term outreach strategy with First Nations, industry, unions, and other stakeholders. We have already partnered with the federal government to invest $195 million to upgrade Highways 37 and 51 in Northwest B.C., making travel safer and improving access for industry in a mineral-rich region.

Our efforts are working and this is recognized globally. In January, BloombergNEF chose Vancouver to host its inaugural Forum on the Future of Critical Minerals, showcasing British Columbia as a global hub of mining and innovation with significant critical minerals opportunities.

Our mineral exploration and mining industry plays a vital role in the economic development of British Columbia, providing more than 40,000 jobs for people in communities across the province. Last year, mineral exploration expenditures amounted to $552.1 million, the fourth-highest amount on record. And mining production value is forecasted at around $16.5 billion.

British Columbia is positioned to be a global leader in growing and regulating a safe and environmentally responsible mineral exploration and mining, with a firm commitment to environmental, social and governance principles, and collaborative partnerships with First Nations communities.

B.C.'s mineral exploration and mining sector has a rich and vibrant future. I am looking forward to seeing what we can achieve together. ✘

Highlighting Canada's critical minerals usages

Copper to Indium: Driving innovation and sustainability

Canada's critical minerals are the backbone of modern technology, sustainable energy, and industrial innovation. With the 2024 addition of High-Purity Iron, Phosphorus, and Silicon Metal to its critical minerals list, Canada continues to solidify its role as a global leader in supplying materials that drive progress.

In this second installment of our alphabetical series for the *Critical Minerals Review*, we explore the next six critical minerals after cobalt—copper, fluorspar, gallium, germanium, graphite, and indium. These minerals power everything from electric vehicles to touchscreens, showcasing their vital contributions to Canada's economy and the world's technological advancements.

COPPER: THE BACKBONE OF CONNECTIVITY

Copper's exceptional electrical and thermal conductivity makes it indispensable across industries. In electrical systems, copper is the go-to material for wiring, cables, and circuit boards, enabling efficient power transmission in homes, industries, and renewable energy systems like wind and solar farms. Its reliability ensures minimal energy loss, critical for Canada's push toward greener energy solutions.

In construction, copper's durability and corrosion resistance shine in plumbing, roofing, and architectural cladding. Its antimicrobial properties also make it ideal for high-touch surfaces in health care settings, reducing the spread of infections.

The transportation sector increasingly relies on copper for electric vehicles (EVs), where it is used in motors, batteries, and charging infrastructure. A single EV can contain up to 80 kilograms of copper, highlighting its role in the transition to low-carbon mobility.

Copper alloys, such as brass and bronze, are valued for their strength and aesthetic appeal in applications like marine hardware, musical instruments, and decorative fittings. Additionally, copper's recyclability—nearly 80 per cent of all copper ever mined is still in use—supports Canada's circular economy goals.

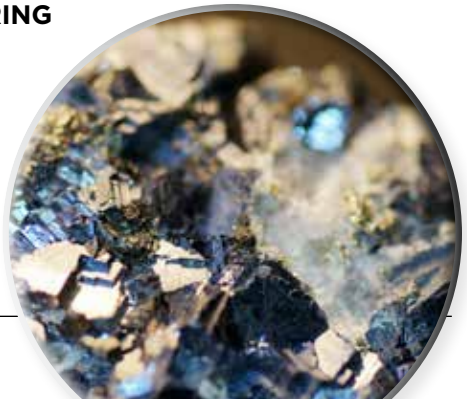
FLUORSPAR: THE ENABLER OF INDUSTRIAL PROCESSES

Fluorspar, or fluorite, is a key source of fluorine, critical for a range of industrial applications. Its primary use is in the production of hydrofluoric acid, a precursor for fluorochemicals used in refrigerants, pharmaceuticals, and agrochemicals. These compounds are vital for cooling systems and medical advancements.

In metallurgy, fluorspar serves as a flux, lowering the melting point of ores and improving efficiency in steel and aluminum production. Canada's fluorspar deposits, particularly in Newfoundland and Labrador, support these industries while fostering economic growth in mining communities.

Fluorspar is also used in optical lenses and ceramics due to its clarity and low refractive index. In the energy sector, fluorine-based electrolytes in lithium-ion batteries enhance performance, making fluorspar a quiet but essential player in the clean energy revolution.

GALLIUM: POWERING ADVANCED ELECTRONICS



Gallium's low melting point and unique semiconductor properties make it

a cornerstone of modern electronics. Gallium arsenide and gallium nitride are critical in high-efficiency solar cells, LEDs, and power electronics. These materials enable faster, more efficient devices, from smartphones to 5G infrastructure.

In aerospace and defense, gallium-based semiconductors are used in radar systems and satellite communications due to their ability to operate at high frequencies and temperatures. Canada's gallium production supports these high-tech industries, positioning the country as a key supplier in global markets.

Gallium is also used in medical imaging, particularly in gallium-based radiopharmaceuticals for cancer diagnostics. Its versatility underscores its growing importance in both technology and health care.

GERMANIUM: ENHANCING OPTICS AND CONNECTIVITY

Germanium's optical properties make it invaluable in infrared optics, fiber optics, and solar cells. In telecommunications, germanium is used in optical fibers to transmit data at high speeds, supporting Canada's expanding digital infrastructure.

Infrared lenses made from germanium are critical in night vision systems, thermal imaging cameras, and military applications. These lenses enable precise detection in low-light or high-heat environments, serving defense, search-and-rescue, and industrial monitoring.

Germanium also enhances the efficiency of multi-junction solar cells used in satellites and concentrated solar power systems. Canada's germanium resources contribute to these high-tech applications, driving innovation in renewable energy and connectivity.

GRAPHITE: THE FOUNDATION OF ENERGY STORAGE

Graphite is a linchpin in the energy storage revolution, particularly in lithium-ion batteries, where it serves as the anode material. With the global demand for EVs and grid storage soaring, Canada's graphite deposits, especially in Quebec and Ontario, are critical for meeting supply needs.

Beyond batteries, graphite's high thermal resistance and lubricity make it essential in industrial applications. It is used in refractories for steelmaking, lubricants for high-temperature environments, and as a moderator in nuclear reactors.

Graphite's conductivity also supports its use in fuel cells and graphene production, an emerging field with applications in flexible electronics and medical devices. Canada's investment in graphite mining positions it as a leader in sustainable energy solutions.

INDIUM: ENABLING TOUCHSCREENS AND SOLAR POWER

Indium's primary use is in indium tin oxide (ITO), a transparent conductor critical for touchscreens, flat-panel displays, and solar panels. Nearly every smartphone, tablet, and modern display relies on ITO for its clarity and conductivity.

In solar energy, indium is used in copper indium gallium selenide (CIGS) thin-film solar cells, which offer flexibility and high efficiency. These cells are increasingly adopted in building-integrated photovoltaics, supporting Canada's renewable energy goals.

Indium's low melting point also makes it valuable in low-temperature solders and alloys for electronics and aerospace components. Canada's indium production, though modest, supports these high-value applications, reinforcing its role in global supply chains.

From copper's role in electrifying the future to indium's touch in modern displays, these six critical minerals highlight Canada's strategic importance in global supply chains. As industries evolve and demand for sustainable technologies grows, copper, fluorspar, gallium, germanium, graphite, and indium will remain at the forefront of innovation.

In the next installment, we'll explore the next set of critical minerals, uncovering their contributions to Canada's economy and the world's technological advancements. ✘

HIGH REWARDS COME WITH HIGH RISKS: How financial risk-sharing agreements can attract investment in Canada's critical minerals

Canada's critical mineral opportunity is real — and big

By Marisa Beck, Research Director, Clean Growth at the Canadian Climate Institute

Critical minerals have quickly climbed to the top of the political agenda in recent months, largely thanks to the aggressive and erratic trade actions coming from south of the border. Canada has significant reserves of the six priority critical minerals that are essential for manufacturing the technologies that will drive national prosperity, competitiveness, and security in the decades to come, including clean energy technologies, and information and communication technologies.

The opportunity ahead is substantial: in some scenarios, the combined market value of these critical minerals—copper, nickel, graphite, cobalt, lithium, and rare earth elements—more than doubles by 2040 . Geopolitical tensions, including the escalating trade war between the U.S. and China, only increase the strategic value of bringing Canadian critical minerals to market—and fast.

The challenge is that capital is simply not flowing in Canada's mining sector at the pace and scale one could expect given the size of the economic opportunity. What is holding back investment in Canadian critical minerals?

Despite strong demand projections for these materials, investors face significant financial hurdles. While there are many factors creating risks and deterring investment (as we argue in our upcoming report for the Canadian Climate Institute), one specific barrier is worth extra attention—the high price volatility in some critical mineral markets. This volatility stymies much-needed investment to accelerate critical minerals production in Canada.

Fortunately, there are smart policies the government can adopt to boost capital flow by sharing price risk with investors. As we argue, financial risk-sharing is a necessary piece in a package of policies required to de-risk critical minerals projects for investors and capitalize on opportunities in the sector.

THE CURRENT INVESTMENT GAP WILL CREATE A PRODUCTION GAP IN THE FUTURE

Current investment in Canada's upstream mining of critical minerals is not keeping pace with both domestic and global demand growth. Our analysis indicates that Canada requires new investment between about $30 billion and $65 billion in

upstream mining projects between now and 2040 to tap into its full production potential. Without new investment at this scale, critical mineral production in Canada from existing mines is projected to drop significantly below even domestic demand over time, resulting in a production gap valued at around $12 billion by 2040.

We have a good sense of some of the factors that impede this investment. In 2024, we conducted an online survey to learn more about the barriers to investment in Canadian critical minerals. Respondents indicated that the high capital cost of critical minerals mining projects combined with long payback periods are the most important capital market barrier.

These characteristics make critical minerals projects vulnerable to significant volatility in global markets for these commodities. For example, lithium prices have swung wildly over the past five years, first falling by about 40 per cent below the January 2018 reference price, then peaking at close to five times that price before falling off drastically again.

The economic viability of Canadian critical mineral mining projects will hinge on future market prices. High price volatility makes it more difficult to secure financing while also delaying project development and interrupting operations. Unpredictable price drops can make projects (temporarily) uneconomic, further prolonging the time period until projects generate profits.

IMMATURITY, MARKET POWER, AND GEOPOLITICAL UNCERTAINTY = BIG PRICE SWINGS

One reason prices are highly volatile is that the markets for some critical minerals are immature and fairly opaque. For example, the London Metal Exchange (LME), the world's largest commodity exchange, first listed copper in 1877 and nickel in 1979, but to date, lithium is only listed in the form of futures, while the LME does not list graphite and rare earths at all. Buyers and sellers typically negotiate prices on a case-by-case basis in mostly opaque and unstandardized transactions.

This opaqueness makes these markets more vulnerable to the influence by a few powerful players. For example, when China's electric vehicle purchase subsidies expired at the start of 2023, domestic electric vehicle demand growth slowed by more than half, and the price of lithium dropped by 80 per cent over the course of the year, sending investment interest into a tailspin.

The escalating trade war between the U.S. and China is leading to further uncertainty and price swings in global critical mineral markets, especially for rare earths. In an era of mineral geopolitics, future prices are increasingly unlikely to be determined by the interactions of supply and demand alone.

GOVERNMENTS CAN DE-RISK PROJECTS BY SHARING PRICE RISK WITH COMPANIES

Immature markets and concentrated market power are market failures that justify focused government intervention to protect investment and encourage new market entrants.

Financial risk-sharing agreements can take various forms, but two may be particularly useful: contracts-for-difference and government-backed offtake agreements.

Contracts-for-difference are contracts designed to protect producers from price volatility by establishing a fixed reference price. When market prices fall below this threshold, a government pays the difference to the producer which makes it easier for projects to secure financing.

Offtake agreements with governments can significantly reduce demand- and price-risks for mines, and help projects secure financing. This instrument can have the added benefits of enabling Canadian governments to strategically stockpile certain minerals to build resilience.

FINANCIAL RISK-SHARING IS NECESSARY BUT NOT SUFFICIENT

Contracts for difference and offtake agreements are central elements in a package of policies that Canadian governments should implement to seize Canada's opportunities in critical minerals. But on their own, these instruments will not be sufficient to ensure a thriving critical minerals mining sector in Canada in the long run.

Rather, Canadian governments should implement smart policies that reduce investment risks and speed up projects by sharing financial risks, upholding Indigenous rights and strengthening environmental protections. The Canadian Climate Institute's upcoming report on Canada's critical minerals will identify a detailed policy package that can help accelerate investment in Canada and secure the country's place in the global critical minerals race. ✘

Critical and strategic: *Mining in Québec*

Québec has the most diversified mineral substances of all Canadian provinces.

Québec is a stable, reliable jurisdiction in which mineral development strategies break new ground in a quickly evolving global context.

Québec has the most diversified mineral substances of all Canadian provinces. Seventeen different minerals are mined, or projected to be mined: gold, iron, zinc, copper, titanium, niobium, lithium, feldspar, graphite, mica, salt, nickel, platinum group elements, rare earths, and phosphate are among the top of the list. Silver, cobalt, tantalum, magnesium, and other minor metals are also extracted from certain producers. The variety of minerals is in part due to Québec's vast area, 1.7 million square kilometres, as well as a diversity of geological environments.

Québec has over 20 producing mines, 49 mining projects, and well over 300,000 active mineral titles. Investments in the mining sector in Québec were $5.7 billion, and the value of all mineral shipments was $12.8 billion in 2023. In 2024, Québec amended its Mining Act.

In 2020, Québec became the first jurisdiction in Canada to publish a forward-looking critical and strategic mineral plan with four main orientations simply summarized as: explore, develop, recycle, and communicate. Our vision was to become a leading jurisdiction for the development of strong ESG projects, notably thanks to its production of low-cost green renewable hydroelectricity.

Québec also structured programs to enhance the circularity of products, by increasing the recycling of consumed raw materials and increasing the traceability of raw battery materials.

Québec has modern treaties with First Nations and Inuit, such as the James Bay and Northern Québec Agreement, and a suite of permits and tools that consider social acceptability with hosting communities.

To attract investors, Québec has developed a generous tax credit for mineral exploration, reducing the cost of capital for the entire cycle from exploration to development.

The results of our plan are significant: the number of critical and strategic mining projects has increased by 61 per cent between 2019 and 2024; mining

To attract investors, Québec has developed a generous tax credit for mineral exploration, reducing the cost of capital for the entire cycle from exploration to development.

investments have also increased for critical and strategic materials by 91 per cent, from about $3 billion in 2019 to $5.8 billion in 2024, according to our preliminary data.

Exploration expenditures also increased dramatically for critical and strategic materials, going from $142 million in 2019 to $477 million in 2024, thus increasing by 235 per cent, according to our preliminary data.

The success of the critical and strategic mineral plan was also made possible because of the visionary and coherent government policies, such as a complete integration with Québec's battery strategy, the 2030 plan for a Green Economy, the Northern Action Plan, and Québec's Green Hydrogen and Bioenergy Strategy.

Through innovative and collaborative initiatives, Québec has become one of the first commercial producers of lithium in eastern North America, the first scandium producer in North America, the only niobium producer in North America, and the top graphite producer in North America. Innovations to develop gallium from waste byproducts in Québec's aluminum industry are also underway. ✘

Protecting Ontario's critical minerals and energy sector

New legislation will safeguard Canadian mining resources and energy infrastructure from foreign interference

As part of the government's plan to protect Ontario, the province is introducing new measures to prevent foreign governments or corporations from claiming Ontario's critical minerals or participating in the province's energy sector.

On April 25, 2025, Stephen Lecce, Minister of Energy and Mines, along with Kevin Holland, MPP for Thunder Bay-Atikokan announced details from the Protect Ontario by Unleashing our Economy Act. The proposed legislation will safeguard Ontario's critical mining resources and energy infrastructure from hostile foreign actors and regimes, creating conditions that will attract investment and make Ontario's and Canada's economy more resilient and self-reliant.

"Canadian resources ought to benefit Canadians, not hostile, foreign regimes," said Minister Lecce. "In today's changing world, we need to be clear-eyed about the risks from those who want to exploit our resource bounty. That is why it is essential that Ontario is protecting our critical minerals and energy sector from getting into the wrong hands. Our government is taking action to secure our supply chains, from exploration to extraction, to ensure Canadian interests, jobs, and sovereignty always prevail."

Currently, there are no safeguards in place to prevent adversarial foreign governments or corporations or bad actors from claiming critical minerals or participating in the energy sector in Ontario. This means that foreign entities can stake claim to mineral-rich deposits without the intention of harvesting them for the benefit of Ontarians or Canadians.

"Ontario is taking important actions to protect our mining and energy assets during this volatile time," said MPP Kevin Holland. "This is especially important for Northern Ontario, as critical mineral and mining resources are an integral part of our economy. This legislation will ensure they remain a commodity that supports our workforce and livelihood."

The Protect Ontario by Unleashing our Economy Act seeks to preserve and prioritize access to the province's critical minerals and energy sector by creating new measures that will allow the government to suspend or remove a registrant from the Mining Lands Administration System (MLAS) or suspend the MLAS system itself. It would also give the government the ability to deny the transfer or lease of a mining claim, or when necessary, revoke a mining claim registration or terminate a lease.

New measures will also be taken to protect Ontario's essential energy usage by foreign state-owned or based companies by limiting the participation of specified foreign jurisdictions or entities in Ontario's energy sector. This aims to protect our energy systems from risks including malware, manipulation, tampering, surveillance, potential ratepayer harm, and other threats posed by foreign state-owned or based companies seeking to compromise essential services.

"The Government of Ontario's work in protecting our critical minerals and mining resources will help maintain and create high-quality jobs in Thunder Bay and Northwestern Ontario," said Thunder Bay Mayor Ken Boshcoff. "As mining and energy development continue to drive growth, we look forward to the additional protections and safeguards which will help Ontario companies enhance our role as leaders in the mining and energy sectors." ✘

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"OUR GREATEST ASSET IS OUR PEOPLE"

PADCOM signs unprecedented Royalty Agreement with the MMF: Recognizing the National Government of the Red River Metis

On February 28, the MMF and PADCOM signed an unprecedented Royalty Agreement, ensuring royalty payments will be made from PADCOM directly to the MMF, with the MMF having full discretion of the funds received.

History was made on February 28 when the National Government of the Red River Métis, the Manitoba Métis Federation (MMF), and Potash and Agri Development Corporation of Manitoba (PADCOM) signed an unprecedented Royalty Agreement.

The agreement showcases PADCOM's commitment to honouring and respecting the MMF as a National Government, as well as our inherent rights as Red River Métis to self-determination and self-governance.

"There is a direct relationship between the Manitoba Métis Federation and PADCOM. The extraction of resources is taking place on our homeland, and this agreement signifies a joint commitment to acknowledging the historical significance of Red River Métis rights, land, and continue amplifying our voice as the National Government of the Red River Métis in the decision-making process," said David Chartrand, MMF president.

Traditionally, mining companies and Indigenous groups will come to agreements based on the potential infringement of Section 35 rights. The agreement between the MMF and PADCOM acts as a proactive response, bringing Red River Métis recognition and interests to the forefront of conversations.

This unique agreement is independent from the province, ensuring royalty payments will be made from PADCOM directly to the MMF, with the MMF having full discretion of the funds received.

The royalties generated by the project will be allocated towards supporting key initiatives and services for Red River Métis citizens, as well as driving economic development in the region.

"With the state of the world, we need to focus on protecting our homeland and one of the key ingredients for this is working with leading environmentally conscious companies like PADCOM," said Chartrand. "As a government, we have fought to protect Red River Métis interests during these trying times and this new Royalty Agreement ensures our lands and rights as a Nation are protected. This is a game changer for our people."

PADCOM president Daymon Guillas acknowledged the significance of this historic mining deal.

"We are excited to be part of this historic event," said Daymon Guillas, PADCOM president. "The National Government of the Red River Métis has taken all the leadership in creating this unprecedented, but logical and important step. It complements our hope to be part of better solutions for relationships with the Red River Métis in the mining industry and represents our ongoing commitment towards the right relationships between business and governments, and between mining and Indigenous peoples."

PADCOM operates Manitoba's first-ever selective solution potash mine in Harrowby, about 16 kilometres west of Russell, Man. PADCOM owns and operates the project and has been granted the right by the Province of Manitoba to explore for, mine, work, recover, procure, remove, and sell potash, a critical mineral, derived by the project.

Due to the nature of the agreement and the efforts in environmental stewardship displayed by PADCOM, a pathway has been paved for potential future partnerships and investment opportunities.

"PADCOM has set a new standard for the mining industry and their relationship with the Red River Métis," said Vincent Mark Parenteau, MMF minister of mining. "This agreement with PADCOM marks a key deliverable under my mandate to explore and build partnerships in the mining sector."

The MMF encourages companies in the mining industry to follow the lead of PADCOM by placing a strong emphasis on environmental stewardship and Indigenous governance.

Visit mmf.mb.ca to stay up to date on all related Red River Métis news. ✘

Potash – the "North American" critical mineral

By Joshua Mayfield

In the first quarter of 2025, the U.S. government officially declared potash to be a critical mineral in an executive order entitled "Immediate Measures to Increase American Mineral Production". This means that potash is now a North American critical mineral, both in the U.S. and Canada.

In an eye-gouging statement, U.S. President Donald Trump said "Our national and economic security are now acutely threatened by our reliance upon hostile foreign powers' mineral production".

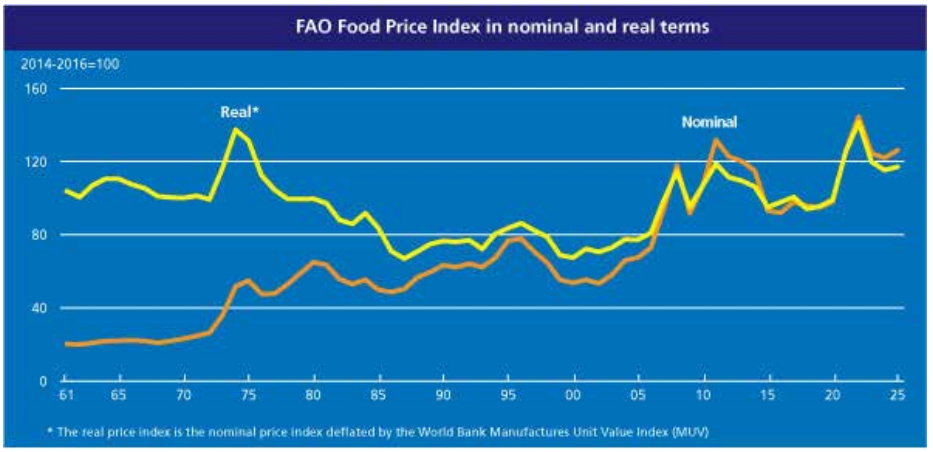
Trump is picking a fight with Canada, putting the country's potash supplies to the U.S. market on equal footing with adversarial potash suppliers by the likes of Russia and Belarus.

Canada's potash exports to the U.S. market got a significant boost to the start of this year due to Trump's tariff war on the global economy. Effective stockpiling of Canadian potash allowed for more time while the Trump Administration reconsidered its decision to put the U.S. agriculture community and national food security concerns at jeopardy. Consequently, the tariffs on potash imports from Canada were lowered to 10 per cent. This was included in the Trumpian liberation on non-USMCA compliant import tariffs.

This context will serve as the backdrop for future decisions on U.S. reciprocal tariffs. Other countries are playing ball with Trump. For example, a decision by the EU to place tariffs on $28 billion of U.S. imports could influence American agriculture exports, such as corn and soybeans, to one of the world's largest markets for agricultural commodities. Both the EU and Canada view the volatile decision-making on U.S. economic and foreign policy decisions as a time for "when in doubt, get out".

If they play their cards right with one another, Canadian potash supplies might get moved around from railroads to ships, while the EU imports more grains from South America under the Mercosur Deal. The latter is not necessarily a tailwind for potash prices, but it's a critical part of the grains and fertilizers strategy for Canada and the EU in the near term.

GLOBAL POTASH SHIFTS – ALL CHANGE



These angles reveal a prevailing trend in the global potash markets, with the EU market becoming a bigger focus for the shifts in grains and fertilizers because of geopolitical issues. Russia and Belarus have already engaged in the weaponization of food and fertilizers since Russia's initial invasion of Ukraine in 2022. The Russia-Ukraine war has affected the entire global supply chains for food and fertilizers, especially in the emerging markets and global south.

Many analysts have referred to Russia and Belarus as an "OPEC of Potash", but even Ottawa has wielded the big stick of "no soup for you" in response to Trump's tariff war on potash. While the U.S. agriculture associations are using kind words to describe the lowering of potash tariffs on Canada to 10 per cent, the impact of tariffs on Canada will have both near- and long-term consequences for the U.S. agricultural community. It is dubious to assume that the U.S. could supply its own market with potash, without resorting to Russia and Belarus as a backup option.

All this change is likely to be some kind of trickery by the Trump Administration to get cheaper potash supplies from Russia and Belarus, given that potash prices have been rising on geopolitical risk since 2021. What has Trump been saying all along—"America first"? It's clear that the U.S. thinks it can get a better deal on potash supplies from cheaper sources than Canada, not to mention the expensive cost of freight and environmental concerns associated with railroad shipments.

However, it is madness to assume that U.S. domestic production of potash, or any other mineral fertilizers, would come to the rescue of the U.S. agriculture community. The Trump Administration specifically called out U.S. ag tariffs in the White House press release: "President Biden squandered the agricultural trade surplus inherited from President Trump's first term, turning it into a projected all-time high deficit of $49 billion".

NEW SOURCES OF POTASH – BUT CANPOTEX GETS THE LAST WORD

The Mosaic Company has the potential to make up for the higher U.S. demand in potash supplies, but they also must play by the rules of Canpotex in the long term.

The company has a potash mine in New Mexico that has been stirred up in a cocktail of controversy. The Carlsbad deposit is North America's first potash discovery, dating back to oil drilling in 1925. However, the Mosaic Company halted production at the mine and it's stayed in limbo since 2014. In April 2022, the company launched an investigation into the actual groundwater contamination levels associated with potash mining at Carlsbad. It's up to the New Mexico Environment Department on how to proceed with the next stage of permitting. The Mosaic Company teased investors with its new plans for Carlsbad in one of the company's latest conference calls, even though U.S. permitting challenges have been a constant theme in the U.S. mining industry.

Millennial Potash (CSE: MLP) announced a new private placement to raise capital. Initially, the company planned to raise CAD$3.5 million, but with the stock price improving, the company decided to increase that figure to CAD$4.93 million. The Banio potash mine in Gabon could be one of West Africa's pioneer plays in the E&P space for potash. The output intends to serve African markets first, and with the strategic shifts happening in global potash markets, the company is likely to keep options available to everyone.

The severely battered (pricewise) Brazil Potash (NYSE: GRO) hit a milestone at its massive potash development project in Brazil when it signed a vegetation management contract for site preparation at its Autazes Potash project. This will allow the company to pursue more extensive site preparation for construction, such as critical ground preparation activities, transportation, and materials management in the short term. With these successful advancements in permitting, the company is on track to begin construction and hit its production target by 2029. Brazil Potash isn't concerned about its market strategy, because Brazil is already the biggest importer of potash in the world.

Brazil Potash is a clear Brazilian agriculture play, fitting with the government's National Fertilizer plan to increase domestic production sources of potash supplies for farmers. Brazil is ahead of the game—way ahead of the U.S.—in terms of plans to diversify domestic and international sources of potash fertilizers.

RUSO-UKRAINIAN ROULETTE

Fertilizers are having a moment again, thanks to the recent Black Sea agreement between Russia and Ukraine with a focus on Russia's fertilizer supplies and Ukraine's agricultural exports. Both Russia and Ukraine want to start trading in the EU market again, irrespective of the fact that commercial vessels are still at risk of coming under attack at the Odessa port.

To get fertilizer and food traffic fully ramped up on the Black Sea again, Odessa needs to be secured from both the air and maritime domains. Otherwise, foreign commercial vessels will be playing Russian Roulette, with their defenseless ships going up against missile attacks. In 2024, Belarus and Russia pivoted a lot of their potash fertilizers to the East of Suez due to sanctions and shipping concerns in the Baltic and Black Seas. Nutrien CEO Ken Seitz acknowledged this global trend in a comment about potash tariffs, noting that Brazil, India, and Southeast Asia are the key market drivers for potash going forward.

CONCLUSION

It's an auspicious time to be looking at the potash fertilizer sector. Investors won't even be able to digest the non-stop information about potash tariffs, sanctions, and stocks before the momentum is all said and done.

The Belarus-Russia axis has looked to the East of Suez to sustain their fertilizer export trade. China and India are still two of the largest markets for potash, with Japan also coming into the ring with its desires to increase domestic rice production. Let's see how all these global potash shifts play out. In the end, it's a fantastic time to be looking into the potash sector.

Joshua Mayfield can be reached by email at jmayfield@hallgartenco.com.

All opinions are of those of the author. ✘

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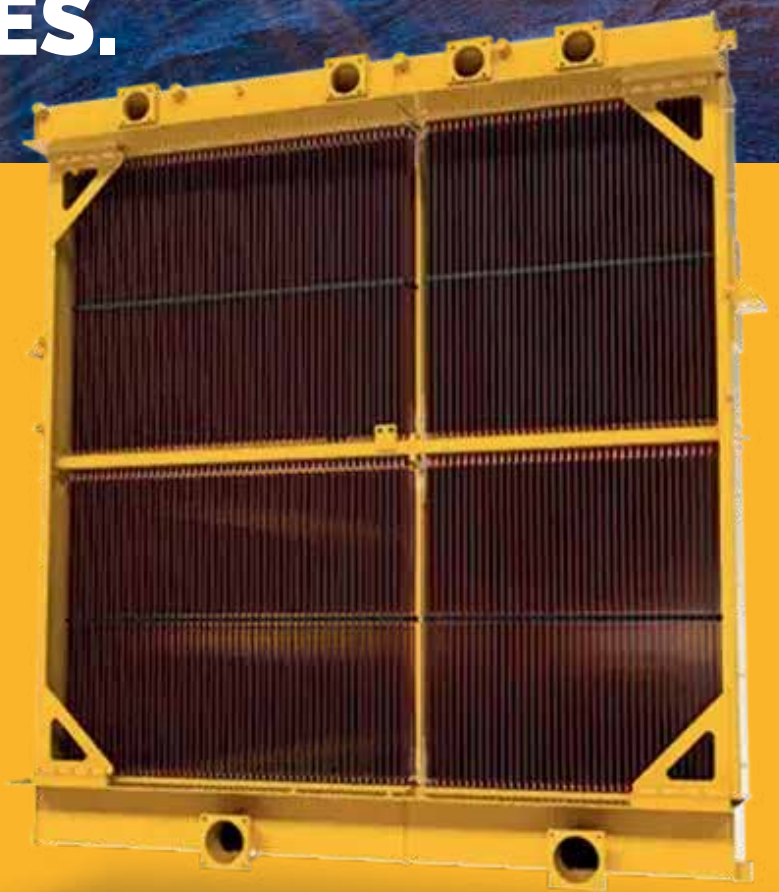

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Career awareness campaign aims to support Canadian critical mineral resource development

The mining industry is grappling with a growing talent crisis, driven by a combination of factors: an aging workforce and increasing retirements, a sharp decline in new entrants – particularly among younger generations – shrinking enrollment in post-secondary mining programs (with undergraduate mining engineering enrollment down 50 per cent from 2012 to 2023), a persistently low unemployment rate within the sector, and ongoing challenges in attracting and retaining talent from underrepresented groups.

A tight labour market is an increasingly significant obstacle for mining employers, driving up recruitment costs, wages, and increasing talent poaching among companies. Additionally, with changing geo-political and trading alliances, Canada needs to rapidly develop its critical mineral capacity to support itself and its allies. In fact, on March 4, 2025, Canada's federal, provincial, and territorial mines ministers issued a joint statement calling for the "acceleration of resource development to unlock new opportunities to meet the growing global demand for critical minerals." Canada is well positioned to produce some of these key minerals and metals but requires a highly skilled and mobile workforce to be able to capitalize on these opportunities.

Yet, with a tight Canadian mining labour market and a shrinking talent pipeline, efforts to engage young people in mining have not worked. In 2024, the Mining Industry Human Resources Council (MiHR) looked to take a different approach to engage youth and potential job seekers by aiming to establish a coalition of partners to fund a five-year national mining career awareness campaign anchored by its successful *Mining Needs You* initiative. *Mining Needs You* showcases modern mining to youth with the goals of raising awareness of mining and its profile, supporting industry human resource efforts, and making mining a career of choice for students.

Members of the Mining Association of Canada (MAC), the Prospectors & Developers Association of Canada (PDAC), the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), and the World Gold Council partnered with the MiHR to expand *Mining Needs You* in 2025 to more broadly showcase to youth where they can build a career that aligns with their skills, passions, and values.

Young people aged 15 to 24 today are searching for where they belong – and the new *Mining Needs You* and its messaging focused on "find your place in mining" is designed to showcase the mining industry as a dynamic, innovative, and fulfilling career choice. By reframing mining as a high-tech, diverse, and evolving sector, the campaign aims to dismantle outdated perceptions and demonstrate that mining offers a place for everyone.

The campaign will begin with a pilot project during May and June in Kamloops, B.C. and Saskatoon, Sask., where new ads will be displayed near schools through public transit and digital displays, along with geotargeted social media and audio streaming advertising.

The new campaign will begin with a pilot project during May and June in Kamloops, B.C. and Saskatoon, Sask., where new ads will be displayed near schools through public transit and digital displays, along with geotargeted social media and audio streaming advertising to shift the focus from the industry's needs to the potential of young people – empowering them to see how they can make an impact in a sector that fuels the modern world.

Results of the pilot project will be incorporated into a national roll-out of the campaign in September. In addition to the advertising and social media component, *Mining Needs You* will be featured at numerous career events and podcasts. It will also include a Career Ambassador Program, whereby industry representatives are recruited and trained to deliver presentations to elementary and high school students on their journeys in mining. The goal in 2025 is to have a minimum of 75 ambassadors who each deliver two presentations. The campaign's *I Chose Mining. Mining Chose Me.* scholarship program also aims to showcase post-secondary youth and assist them on their journeys to rewarding mining careers.

By addressing the lack of awareness and the negative perceptions among youth of mining, creating materials that link to and support industry recruitment initiatives, and aligning with the objectives of Canada's Critical Minerals Strategy and its Canadian Minerals and Metals Plan, the *Mining Needs You* campaign aims to increase the mining talent pipeline through a sustained campaign that stretches beyond 2025. Results of the first year of the campaign will be presented to current and potential partners in November and December 2025 with the aim to sustain funding into the new year. Visit www.MiningNeedsYou.ca for more information about the campaign and how to collaborate with MiHR on the initiative.

Mining Industry Human Resources Council's has launched a new awareness campaign encouraging young peoples to consider a career in mining.

MiHR is Canada's knowledge centre for mining labour market information. An independent, non-profit organization, MiHR leads collaboration among mining and exploration companies, organized labour, contractors, educational institutions, industry associations, and Indigenous groups to identify opportunities and address the human resource and labour market challenges facing the Canadian minerals and metals sector. Visit wwwMiHR.ca to learn more. ✘

Most recently, Nutrien introduced battery electric vehicles (BEVs), which are powered by rechargeable lithium-ion batteries and electric motors.

From borers to BEVs: Advancing mining with Nutrien's electric vehicle fleet

Electric-powered machinery has been used in our mines for more than six decades, and we're continuously seeking innovative uses for electric vehicles to expand our fleet.

For more than 60 years, electric-powered machinery has been used in Nutrien's underground potash mines. Borers were some of the first electrically driven machines used in our mines, and now approximately 75 per cent of our underground horsepower is electric.

We are continuously seeking opportunities to expand our electric vehicle fleet. Most recently, we introduced battery electric vehicles (BEVs), which are powered by rechargeable lithium-ion batteries and electric motors.

"In 2011, the first BEV was built and trialed underground at our Cory potash mine," says Joel Thon, senior electrical engineer, Nutrien. "The development of the first BEV at Cory is what really spurred innovation in the use of BEVs in Nutrien's mines. Many of our sites are extremely interested in increasing their electric vehicle fleet in the coming years, and we're looking into adding more personnel carriers and larger options of BEVs like scoops, haulers, bolters, skid steers, and forklifts."

Replacing diesel-powered vehicles with BEVs in our mines has air quality and safety benefits. BEVs produce zero tailpipe greenhouse gas emissions. This reduces direct harmful pollutants like nitrogen oxides and particulate matter, which improves local air quality and reduces respiratory health risks for mine workers. Additionally, BEVs are much quieter than diesel engines and the reduction of noise pollution creates a more comfortable work

Replacing diesel-powered vehicles with BEVs in our mines has air quality and safety benefits.

environment. BEVs also do not carry the risk of diesel spills and have no associated flammable fuel storage.

Since 2013, Thon has been supporting the Electrical Integrity program within Nutrien's potash business unit. This includes developing and leading electrical safety, maintenance and training programs, overseeing our electric vehicle policy, and consulting on new initiatives.

When it comes to electric vehicles, Thon is plugged in. He is currently advancing an electric vehicle specification document, developing a feasibility study for a full underground electric fleet, and working with the Canadian Standards Association on a national standard for electrically driven machines in underground mines.

"My favourite part of my job is being involved in most of the electrical projects across the potash business unit," he says. "Being part of innovative projects is an amazing experience, and I'm proud to be working in Saskatchewan for a company that has a deep-rooted history with the province and its people." ✘

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Harfang Exploration's efforts in Quebec: Advancing the future of mining and exploration

Harfang Exploration, a prominent player in the Canadian mining sector, has made notable strides in advancing exploration efforts in Quebec, one of the most resource-rich regions in the world. Based in the province, Harfang has been focused on exploring and developing mineral projects, especially in the areas of gold and critical minerals, which have seen rising demand in recent years. The company's efforts reflect a blend of innovative exploration techniques, strategic partnerships, and commitment to responsible mining practices, positioning it for long-term success.

A STRONG FOCUS ON QUEBEC'S MINING POTENTIAL

Quebec is known for its vast and untapped mineral wealth, with significant deposits of gold, silver, copper, and other critical minerals. It has long been a hub for exploration activities, attracting both domestic and international companies looking to capitalize on the region's potential. Harfang Exploration has keenly recognized this opportunity, focusing much of its attention on regions within Quebec that are known for their rich geology.

The company has strategically positioned itself in key exploration areas of Eeyou Istchee James Bay, one of the most prominent mineral-bearing areas in Quebec. This region is rich in gold, copper, base metals, and critical minerals, with both historical mining activity and ongoing exploration indicating vast untapped potential.

Harfang's acquisition of NewOrigin Gold, completed in November 2024, marked a significant milestone. This strategic consolidation combines Harfang's balance sheet and its expertise in mineral exploration, with NewOrigin's strong portfolio of gold projects. The transaction is designed to create a stronger, more diversified exploration company, enhancing their ability to capitalize on opportunities in the gold and critical minerals sectors. The combined entity aims to accelerate its exploration programs, benefit from a larger asset base, and increase shareholder value through a more robust and efficient exploration strategy. The deal positions Harfang to leverage greater financial and operational synergies while advancing its exploration projects.

EXPLORATION TECHNIQUES AND ADVANCEMENTS

Harfang's exploration efforts are characterized by their use of cutting-edge technology and a commitment to minimizing environmental impacts. The company employs a range of advanced techniques to pinpoint mineral deposits, including geophysical surveys, remote sensing, and data analytics. These methods allow Harfang to increase the efficiency and accuracy of its exploration work while minimizing the environmental footprint of its operations.

One of the key factors behind Harfang's success has been its ability to leverage modern data processing and machine-learning techniques. By incorporating geological and geophysical data into powerful predictive models, the company is able to identify high-potential areas with greater precision. This approach has not only streamlined the exploration process, but has also resulted in more accurate assessments of the mineral potential of their projects.

STRATEGIC PARTNERSHIPS AND COMMUNITY ENGAGEMENT

Another noteworthy aspect of Harfang Exploration's activities is its focus on building strong relationships with local communities and stakeholders. Quebec has a rich history of mining, but this history is also shaped by the region's Indigenous peoples, who have often been key players in the dialogue around resource development.

Harfang has made significant efforts to ensure that its exploration activities respect local communities and involve them in the process. By engaging with Indigenous communities early on, the company aims to foster transparent and mutually beneficial relationships.

These partnerships help ensure that Harfang's exploration projects contribute to local economic growth and provide long-term benefits to the region, all while respecting cultural heritage and environmental sustainability.

ENVIRONMENTAL AND SUSTAINABILITY INITIATIVES

In line with Quebec's strong environmental regulations, Harfang places a significant emphasis on responsible mining practices. The company recognizes the importance of minimizing its environmental footprint while exploring for minerals, particularly in a province where preserving natural ecosystems is a priority.

Harfang integrates sustainable practices into its exploration activities, using eco-friendly technologies and working to mitigate any potential environmental impact. This includes implementing best practices in waste management, water conservation, and energy use. The company's approach is not only aligned with Quebec's regulatory requirements but also with global trends in sustainable mining.

LOOKING AHEAD: THE FUTURE OF HARFANG EXPLORATION IN QUEBEC

As global demand for critical minerals and gold continues to rise, Harfang Exploration's efforts in Quebec position the company well for future growth. The company is focused on advancing its projects through further exploration and drilling programs, while continuously evaluating new opportunities in the region.

With its modern exploration techniques, commitment to sustainability, and strategic location in one of the world's most prolific mining regions, Harfang is poised to be an influential force in the future of Quebec's mining industry. Its success in the province will not only contribute to the global supply of critical minerals, but also play a pivotal role in supporting Quebec's growing role as a leader in resource development.

In conclusion, Harfang Exploration's efforts in Quebec demonstrate a commitment to innovation, sustainability, and responsible resource development. As the company continues to push forward with its exploration initiatives, it holds great potential to shape the future of mining in Quebec and beyond. ✘

The difficulties of *being critical!*

Critical minerals, or metals, are considered as such not because they are rare in nature, but because they are rare on the market. Due to a lack of processing and primary transformation facilities, any disruption in their supply chain can throw the high-tech industrial base into disarray. Since most strategic metals must be produced in small amounts with diverse, still stringent specifications, it means that process development is expensive and complex compared to the anticipated market. Best example is for rare earths, which are not rare. The market is dominated by China where they are byproducts of the Bayan Obo iron mine. Alternately, there are six rare-earth advance projects in Québec that are comparable in size with Bayan Obo. The issue is not to produce a rare-earth concentrate; it is the complex and noxious hydrometallurgy required to separate these metals.

Currently, the entire imports of U.S. for processed rare-earth is of about $190 millions per year, which would be equivalent to a small-scale mining operation. This hardly justifies the process development costs. Furthermore, these critical minerals and metals products needs to be customized for different clients and uses, each with their own sets of diversely stringent specifications. Think of graphite, which is associated with battery manufacturing, but still needed for dozens of other applications that have very different purities and flake-size specifications. Solely targeting the battery market may curtail the viability of a project.

Critical minerals from different deposits have their own characteristics in terms of purity, grain size, and morphology. They are not necessarily optimal for every application. These variations can only be partly mitigated by the beneficiation process, which needs to be finely tuned to meet the different clients' requirements. Furthermore, most deposits are not uniform, meaning that a robust or flexible tout-venant process is needed, and that a different portion of the deposit may be better suited for different market requirements. Comprehensive mineral characterization is needed to design the metallurgical process, which itself requires extensive and systematic testing. These issues change the paradigm of exploration, since the suitability of the minerals requires them to be evaluated early in the exploration process, even prior to the definition drilling and resource estimation. This may seem of sequence for most geologists and promoters.

Another issue is that most of these projects are not large enough to support infrastructure construction. As per example, typical graphite or spodumene projects aims at about 100,000 tons per years for a selling price of less than $1,000 per tons, for a revenue of $100 million per year. So, they cannot justify the capex incurred by construction of long access roads, natural gas pipeline, or power lines. These commodities being bulky and low value, long-distance trucking of the concentrate takes a severe toll on revenues, limiting the distance to nearest rail head, port, or manufacturing hubs to a few hundreds of kilometres. Remote projects are unlikely to be viable. Inversely, proximity to infrastructure often implies proximity to communities, and more complex social acceptability. Environmental and social impact study requirements for small projects are often just as complex and costly as those for much larger initiatives, adding significant constraints to development budgets.

Not all critical mineral projects are viable, and their development requires a true holistic approach. Evaluating the operation logistics is needed at the onset of the exploration program and property acquisition. Once a deposit is found or acquired, geometallurgical characterization and extensive bench-scale metallurgical testing is needed as soon as drill core is available. Drill programs need to be conceived with the premises that abundant large-diameter core will be needed for extensive testing. Since most revenues will be generated from first transformation, a vertically integrated operation, or an alliance with a strategic partner is needed. Expect numerous runners, but a handful of winners in this race, even if these winners are desperately needed by the high-tech manufacturing industry. ✘

SHOCK BLOCK® SB5000
FOR THE MINING INDUSTRY

PORTABLE EQUIPMENT:
- WELDER
- BORING BAR

SHOP BAYS:
- WELDER
- PUMPING SKIDS
- DEWATERING PUMPS
- SUBMERSIBLE PUMPS

Advancing Electrical Safety at the Mine with the Most Reliable GFCI Protection - up to 600 V

In the mining industry, providing power for lighting, conveyors, pumps, fans, and other equipment can create a situation where personnel can be exposed to electrical shock hazards. The Littelfuse SB5000 ensures safe distribution of electrical power in both surface and underground mining.

The Littelfuse Shock Block SB5000:

- reduces unnecessary tripping by following an inverse trip time and using DFT filtering
- is offered in a hygienic stainless steel enclosure, with NEMA 4X and IP69K ratings well suited for food-preparation environments
- has advanced ground-check features with Zener termination options, which can identify a crushed cable before the equipment is energized
- improves safety by reducing the risk of ventricular fibrillation for leakage current of 250 mA and above

Rock-Solid Business Defense

- Shock Block is an investment in employee health. Injury claims and potential lawsuits arising from electrical shock accidents are prevented
- Minimize excess training time, as Shock Block does the work behind the scenes to keep employees safe from electrical shock without human intervention

Description

Available with Class A, C, D and EGFPD options, the SB5000 can be used in a wide range of applications. It offers proactive ground check on every model and helps increase efficiency and safety with a no-nuisance approach to personnel protection. The 32 A and 60 A models are also available in a hygienic stainless steel enclosure, with a 10 degree sloped top and FDA-compliant silicone gasket, designed to improve sanitation in food processing facilities. It is UL-certified as a 3-phase industrial GFCI for 208 to 600 V applications with a maximum full load current up to 100 A.

Features & Benefits

Feature	Benefit
UL 943 inverse time trip curve	Inverse time detection circuit protects people while also reducing unnecessary trips
DFT (Discrete Fourier Transform) filtering algorithm	Eliminates nuisance trips due to harmonics
Minimum trip time < 20 msec	Reduces the risk of ventricular fibrillation for leakage current of 250 mA and above
Fixed 6 mA (UL 943) or 20 mA (UL 943C) trip level	UL Listed GFCI and personnel protection for industrial and commercial loads up to 100 A
Selectable trip levels (EGFPD) 6-100 mA	The settings below 20 mA provide extra safety. The settings above 20 mA can provide partial range personnel protection for loads with higher nominal leakage currents.
Two-stage ground monitor with Zener termination that meets UL 943C and CSA M421	Proactively protects from shock by tripping if continuity of ground wire between Industrial Shock Block and load is compromised
Flexible configuration	Selectable manual reset or auto reset for brownout, power up, and ground monitor interruptions to fit safety protocols
Conformal coating	Circuit boards are conformally coated to protect against corrosion and moisture
Auxiliary contact	Alerts your SCADA system if the Shock Block is energized or tripped
Automatic self-test	The Shock Block will continuously test itself and will trip if there is an internal failure
GFCI Class A, C, D and EGFPD options in one series	Simplified planning and operator familiarity for multiple applications/requirements
Hygienic stainless steel enclosure, with a 10 degree sloped top and FDA-compliant blue silicone gasket	Designed to support sanitation process in food processing facilities.

Powder engineering as a strategic lever in mineral processing

Aluminum powder.

By Benoit Desjardins, Senior Engineer, BBA

The race to electrify, miniaturize technologies, and decarbonize industrial processes is fuelling growing demand for high value-added materials. At the heart of this transformation is powder engineering.

HARNESSING POWDERS TO TACKLE FUTURE INDUSTRIAL CHALLENGES

Powder engineering involves all operations that transform metallic, mineral, or chemical materials into fine particles smaller than 100 µm, up to nano powders. This field has become a strategic area in the mining and metallurgy industries, helping extract as much value as possible from critical resources, while meeting the highest standards of performance, purity, traceability, and sustainability.

Meanwhile, new technological approaches are paving the way to produce complex, high-performance metal components with significantly improved material and energy yields. However, these new approaches also introduce added risks that must be managed as part of broader efforts to develop production capacity for powders made from critical, and strategic metals and minerals.

Designing these powders requires precise control over their size, particle size distribution, shape, and reactivity, all while complying with the health and safety standards specific to each powder and managing the technological risks of new approaches. This complexity represents a major technical and economic challenge, and makes BBA's integrated expertise more essential than ever.

PRECISION ENGINEERING FOR STRATEGIC MATERIALS

At BBA, we support clients at every stage of the value chain, from selecting specialized equipment to designing and building safe, efficient, and sustainable processing facilities. Our experts guide technological choices based on targeted properties (e.g., size, shape, porosity, or reactivity) and the type of facility needed (e.g., laboratory, pilot plant, or industrial facility).

The materials involved—such as lithium battery cathodes (NMC, LFP, NCA), graphite or silicon-based anodes, metal powders for 3D printing (titanium, Inconel, aluminum), catalysts, metal oxides, or other combustible, pyrophoric or toxic powders—all require specific technical approaches. Depending on the required properties, we master and adapt various processes, including:

• Mechanical processes: sieving, fluidization, classification,

At BBA, we support clients at every stage of the value chain, from selecting specialized equipment to designing and building safe, efficient, and sustainable processing facilities.

compaction, agglomeration, ultrafine grinding, spheronization, mixing and homogenization, and conveying

- Pyrometallurgical processes: gas or plasma atomization, metal evaporation, heat treatment in controlled atmospheres
- Hydrometallurgical processes: selective precipitation, controlled crystallization, filtration in reactive media

TAILORED EXPERTISE FOR CRITICAL MARKETS

Our clients operate in vital and strategic growth sectors, including batteries, chemicals, metal 3D printing, materials for the energy transition, and critical metal recycling. They all require a tailored approach that ensures precise process control, strict regulatory compliance, carbon footprint reduction, and ongoing competitiveness.

Each powder production technology comes with specific constraints, such as inerting atmospheres, dust explosion risks, real-time particle size control, cross-contamination management, and a selection of compatible engineering materials. Our expertise is rooted in an integrated understanding of industrial systems and a rigorous, multidisciplinary approach, suited to the demands of challenging production environments.

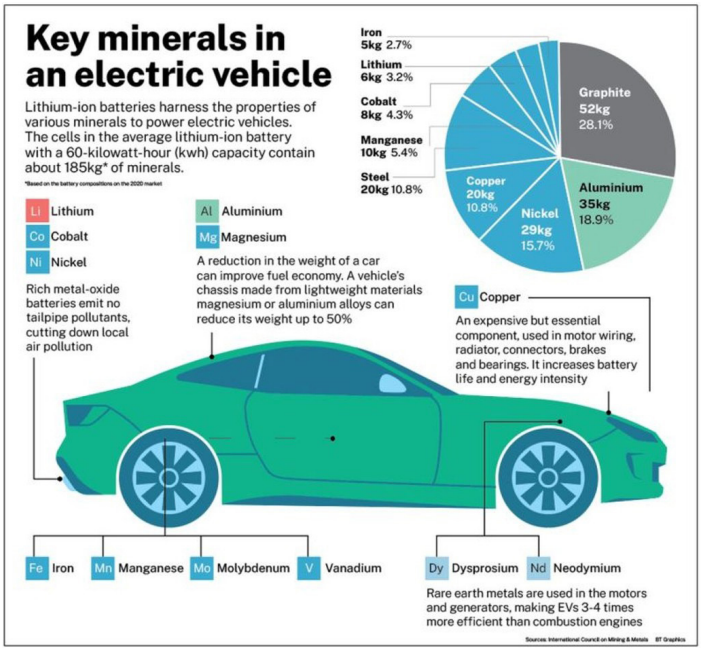
MATERIAL PROCESSING AS A LEVER FOR SUSTAINABLE PERFORMANCE

As the demand for strategic materials grows, producing high-value-added powders requires strict control over every manufacturing parameter. This makes powder engineering a key skill that supports innovation, optimizes industrial performance, fosters growth, and addresses the new challenges of sustainable transformation. ✘

C2M2A – Solid opportunities for Canadian-based critical mineral supply chains

By Ian M London PEng, MBA, Executive Director, Canadian Critical Minerals & Materials Alliance (C2M2A)
www.c2m2a.org

The Canadian Critical Minerals & Materials Alliance (C2M2A) advocates on behalf of emerging Canadian entities involved in critical material supply chains – prospective producers, processors, laboratories, universities, and materials application experts. Our overall goal is for Canada to more fully capture the economic returns from its critical mineral, human, and industrial resources and trading relationships. C2M2A and its alliance members are actively engaged with a range of national and international industry and government initiatives, including the likes of the Rare Earth Industry Association (REIA), the International Standards Organization (ISO), the Canadian Chamber of Commerce (CCC), Accelerate, Battery Materials Association of Canada (BMAC), Canada Cleantech Association (CCTA), and others.



Graphic courtesy of the International Council on Mining & Metals.

Minerals themselves do not capture solid value until they are transformed into higher-value materials. While major commodity metals (e.g., copper, aluminum, nickel, gold) 'supply-push' strategies have traditionally served Canada well, non-commoditized critical materials (e.g., REEs, gallium, lithium, graphite) that power energy-transition economies, electrified mobility, robotics, advanced communications, AI & digital enabling platforms, medical applications, and other next generation technologies are specialized, highly engineered, and privately transacted. These latter materials are purchased by specific customer 'demand-pull' agreements with stringent technical specifications.

Rare earth permanent magnets are essential for electric motors, while gallium and helium are critical to semiconductor technologies that power energy control systems, e-mobility, aerospace, and defense applications. These sectors also stand to benefit significantly from lightweight aluminum-scandium and aluminum-manganese alloys. What many may not realize is that Canada, thanks to its thriving aluminum industry and abundant low-cost energy, has emerged as a global leader in aluminum production—despite not having a single aluminum mine. This underscores the transformative potential of investing in and developing robust midstream processing capabilities.

The energy transition goes far beyond solar panels and wind turbines. It encompasses power generation, grid-scale distribution, and the advanced electronics and smart systems that manage—and ultimately consume—electricity. Each stage presents valuable economic opportunities. To seize them, we need resilient, reliable supplies of critical materials—both for manufacturing the end-use technologies, and for producing the equipment, machinery, and infrastructure that make the transition possible.

Canada has many of the critical material-containing resources needed by its global partners. The first question generally asked is "where does Canada mine these raw materials?", a rather narrow perspective as raw materials

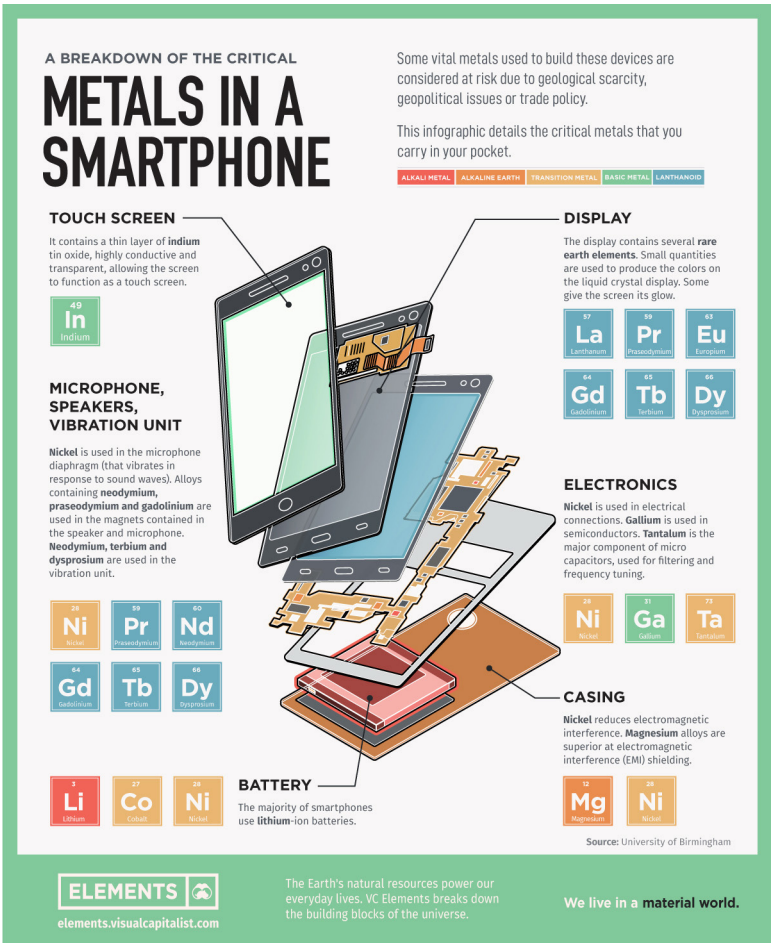
The energy transition goes far beyond solar panels and wind turbines. It encompasses power generation, grid-scale distribution, and the advanced electronics and smart systems that manage—and ultimately consume—electricity.

play only a small part of the value to be captured. Canada must resist framing critical minerals opportunities as a 'mining story'. A key imperative in advancing a purposeful Canadian re-industrialization strategy lies in the midstream—the critical stage where minerals are refined and transformed into alloys, powders, chemicals, and components. This segment holds substantial economic opportunity, both within Canada and in partnership with our international trading allies. Any industrial strategy must be aligned with demand and include priorities. What with the broad suite of critical materials and applications, attention should be placed on the 'lower hanging fruit' for Canada so we can leapfrog competitors, and resist what trading partners do much better than us.

A well-thought-out longer-term re-industrialization strategy, as framed by several calls for action such as Restart, Recover & Reimagine – Prosperity for All Canadians (Industry Strategy Council, 2021), offer focus and would allow Canada to leverage our well-developed mining and manufacturing sectors. It would also deliver on social and environmental performance – a globally competitive advantage.

As illustrated in the aluminum example cited earlier, Canada does not have to wait for new mines to be opened. Midstream capability and capacity can be built in parallel to mine development, by kick-starting process development with imported and recycled feed stocks. The latter also supports the building of the circular economy in Canada and the jobs that go with it. Building the midstream... and mining will rise!

For decades, Canada has slowly, and perhaps blindly, offshored our industrial base. This has meant the erosion of manufacturing capacity, the hollowing out of value chains, and the belief that pulling rocks out of the ground is an economic strategy. The world is now deep into a global energy and technological transition – an opportunity for Canada's reindustrialization that must not be missed. Reindustrialization is not about nostalgia, but about strategic security and economic leadership. Coordinated



Graphic courtesy of https://elements.visualcapitalist.com/critical-metals-in-a-smartphone/

national and provincial strategies are needed that prioritize the building of midstream processing and downstream manufacturing, developing tomorrow's needed talent pools, and supporting small- and medium-sized enterprises (SMEs represent over half of the jobs in Canada).

Canada must tie public investment to our national interest outcomes. Any federal or provincial support to domestic or foreign companies must come with clear commitments: build midstream processing capacity here, seed natural spinoff industries, and use Canadian materials in the supply chain. Canada mustn't squander this multi-generational opportunity by treating critical minerals as just another commodity boom. The true opportunity lies in what we make and the value we add. If we commit to a bold, coherent reindustrialization strategy now, we can position Canada as a global leader that produces the materials which will define 21st century economies.

C2M2A, with its members and international partner initiatives, clearly focuses and champions innovation, investment, and the human resource development on adding value to Canada's critical material supply chain, and industrial future and success. It's time to build value. ✘

National Instrument 43-101: What issuers need to know about production decisions without a feasibility study or a pre-feasibility study

By Alexander Pizale, Gregory Hogan, Christopher Harasym

The decision to commence production at a mineral project is a pivotal milestone for any mining issuer. Typically, a production decision will be made with the support of a technical report prepared in accordance with National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101) that contains a mineral reserve estimate and meets the Canadian Institute of Mining, Metallurgy and Petroleum's CIM Definition Standards for Mineral Resources & Mineral Reserves (CIM Definition Standards) definition of a "preliminary feasibility study" (PFS) or a "feasibility study" (FS). This is because the development of an operation and the decision to commence production involves significant capital expenditures and a high degree of risk and uncertainty, and the support of a comprehensive PFS or FS helps mitigate this risk and uncertainty. To proceed to production without the comprehensive information that would be required for a PFS or an FS precludes the rigorous planning that most issuers undertake to reach such a stage. However, there are situations where a mining issuer may decide to proceed with production without a mineral reserve estimate supported by a PFS or an FS. Such situations will give rise to additional economic and technical risk and, accordingly, this commentary outlines key considerations that should be addressed by a mining issuer before proceeding on this basis.

DISCLOSURE CONSIDERATIONS

Announcing the production decision

A news release announcing a production decision that is not supported by a PFS or an FS which includes established mineral reserves is at heightened risk of providing misleading disclosure, and therefore requires extra caution. Section 4.2(6) of the Companion Policy to NI 43-101 provides guidelines for this scenario, and indicates that a mining issuer should disclose that the production decision is not based on an FS of mineral reserves demonstrating economic and technical viability and should include adequate disclosure on the increased uncertainty and the specific economic and technical risks of failure associated with its production decision.

To warn the public, the news release should include a statement that the project does not have defined mineral reserves and that the mineral project has a much higher risk of economic or technical failure. Further, disclosure regarding the production decision should include clear disclaimers that there is no guarantee that production will begin as anticipated, or at all, or that anticipated production costs and volumes will be achieved. Issuers should also identify risks specific to their mineral project and their production decision, which may include risks related to increased uncertainty as to the level of recovery, costs of production, lack of detailed engineering, and how those risks may impact the issuer's business. To the extent the production decision is based on a preliminary economic assessment that includes or is based on inferred mineral resources, mining issuers are required to include the disclosure set forth in section 2.3(3) of NI 43-101, including the disclaimer that "the preliminary economic assessment is preliminary in nature, that it includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary economic assessment will be realized."

MD&A AND ONGOING DISCLOSURE OBLIGATIONS

In addition to the disclosure requirements of NI 43-101, paragraph 1.4(e) of Form 51-102F1 – Management's Discussion & Analysis requires that mining issuers identify any significant milestone, including a production decision, and whether the milestone is based on a technical report. Mining issuers who make a

production decision without a PFS or an FS are therefore also required to disclose in their MD&A that the production decision was not based on a technical report that contains established mineral reserves. Further, such issuers should consider how the risks associated with their production decision should be disclosed in other parts of their continuous disclosure record, particularly in the risk factors sections of their MD&A and annual information form, if one is filed.

TECHNICAL REPORT CONSIDERATIONS

NI 43-101 does not require an issuer to file a technical report to support a production decision. However, the decision to commence production, and ongoing continuous disclosure, will impact the issuer's future technical report obligations.

For example, once a production decision has been made, the issuer may face expectations from investors or other capital markets participants to disclose production forecasts or mineral reserves that cannot be supported by the current technical report for their mineral project. Mining issuers who are considering commencing production without completing a PFS or an FS should consider how they will communicate effectively with investors about their production expectations and forecasts once production is announced and should exercise caution in disclosing any technical information regarding production to ensure such technical information can be supported by a current technical report. Providing guidance without a PFS or an FS is often a very difficult task without stepping offside NI 43-101 and, accordingly, technical report triggers for ongoing disclosure will need to be considered closely.

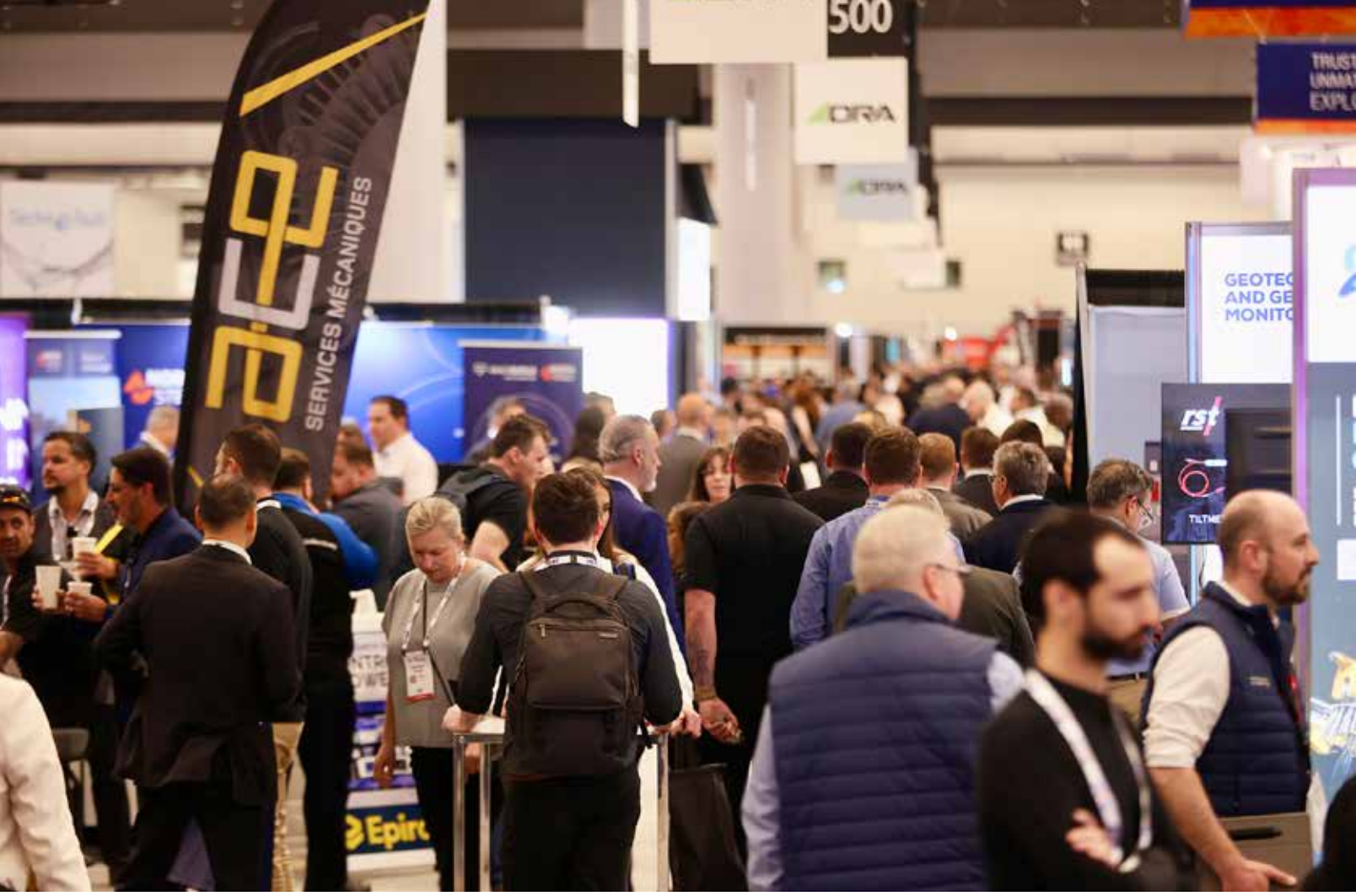
While NI 43-101 allows issuers to rely on previously filed technical reports, issuers should carefully consider if production results constitute new material scientific or technical information concerning the subject property. Further, Form 43-101F1 – Technical Report (43-101F1) includes instructions that technical reports include disclosure on the material scientific and technical information concerning mineral exploration, development, and production activities on a mineral property. If a mineral property has entered production after the date of the most recent technical report, that technical report may no longer meet the standard set out in 43-101F1.

When filing a new technical report for a mineral project that is in production, issuers should also consider if the new technical report should include the disclosure required for an "advanced property" as defined in NI 43-101. Regulators may take the view that the additional technical report items required for advanced properties should be included, particularly those related to mining methods, project infrastructure, market studies and contracts, and capital and operating costs, regardless of whether the mineral project meets the definition of an advanced property, to ensure such report is current and complete.

CONCLUSION

Production decisions in the absence of a PFS or an FS pose significant risks and challenges for mining issuers. The additional disclosure requirements are nuanced and different situations may result in different requirements. Issuers should always remember to consult qualified legal counsel to ensure they are not offside NI 43-101 or publishing disclosure that is misleading or insufficient.

This article is provided by Cassels Brock & Blackwell LLP. For more information, please contact the authors of this article or any member of Cassels' Mining Group. ✘



Record-breaking CIM CONNECT 2025 unites the industry in Montreal

CIM CONNECT 2025, CIM's flagship annual convention and expo, returned to Montreal from May 4th to 7th, with the theme "Minerals, Innovation, and the Energy Transition," and drew record-breaking attendance and unmatched industry energy. Held in rotation between Montreal and Vancouver, this year's edition gathered approximately 7,600 participants – including 1,600 conference delegates – and delivered the largest expo in CIM history.

A STANDOUT EXPO: NEW EXHIBITORS, BIG LAUNCHES

The expo floor was a hub of innovation and connection, featuring 600-plus exhibiting companies, 840 booths, and 150 first-time exhibitors, including startups and emerging tech players. New product launches, hands-on demos, and nonstop networking made it a can't-miss destination for attendees.

"CIM CONNECT ended in Montreal after three days of intense discussions on innovation, emerging technologies, and the energy transition in the mining sector," said Oseda, a first-time exhibitor. "We are proud to have showcased our expertise at Canada's largest mining gathering."

DEEP TECHNICAL PROGRAM, FRESH IDEAS

This year's technical program was delivered with 280 presentations and 17 panels, covering everything from process optimization to decarbonization and AI implementation.

"Being able to share what I've learned over the years with such a thoughtful and engaged group truly felt like a full circle moment," said technical program presenter Mark Symon, Hydrocarbon Management from Innoflo Solutions

Inc. "Here's to continued growth, learning, and sharing knowledge with the next wave of curious minds."

The Innovation Exchange, introduced for the first time this year, brought dynamic, quick-hit presentations, and panel discussions on how visionaries are turning ideas into real solutions. From digital twins to autonomous operations, these sessions highlighted strategies that are already reshaping the mining landscape.

POWERFUL KEYNOTES WITH REAL IMPACT

From Rohitesh Dhawan's call for ethical transformation and tech integration, to Christine Healy highlighting Canada's clean energy leadership potential, to Ammar Al-Joundi pushing for better investment practices – this year's keynote sessions tackled the realities of operating in a shifting global environment. Lucy Potter of Rio Tinto closed with a resonant message: transparency and communication are just as vital as innovation for future growth.

"This year's convention also had a huge focus on technology," said Shelby Yee, co-founder and CEO of RockMass Technologies "New solutions are taking shape and being used across industry, and we're proud to be part of that movement."

INVESTING IN THE NEXT GENERATION

This year also saw strong student turnout, with an energized career fair, speed mentorship sessions, and a dedicated student program connecting emerging talent with industry leaders. Many attendees commented on the sense of shared purpose across generations, and the meaningful conversations that took place both on and off stage.

LOOKING AHEAD

The connections made, the ideas exchanged, and the innovations launched at CIM CONNECT 2025 will echo throughout the year.

Join us next year when CIM CONNECT 2026 returns to Vancouver from May 3rd to 6th. ✘

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