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ORE MAGAZINE

SMA Saskatchewan Mining Association

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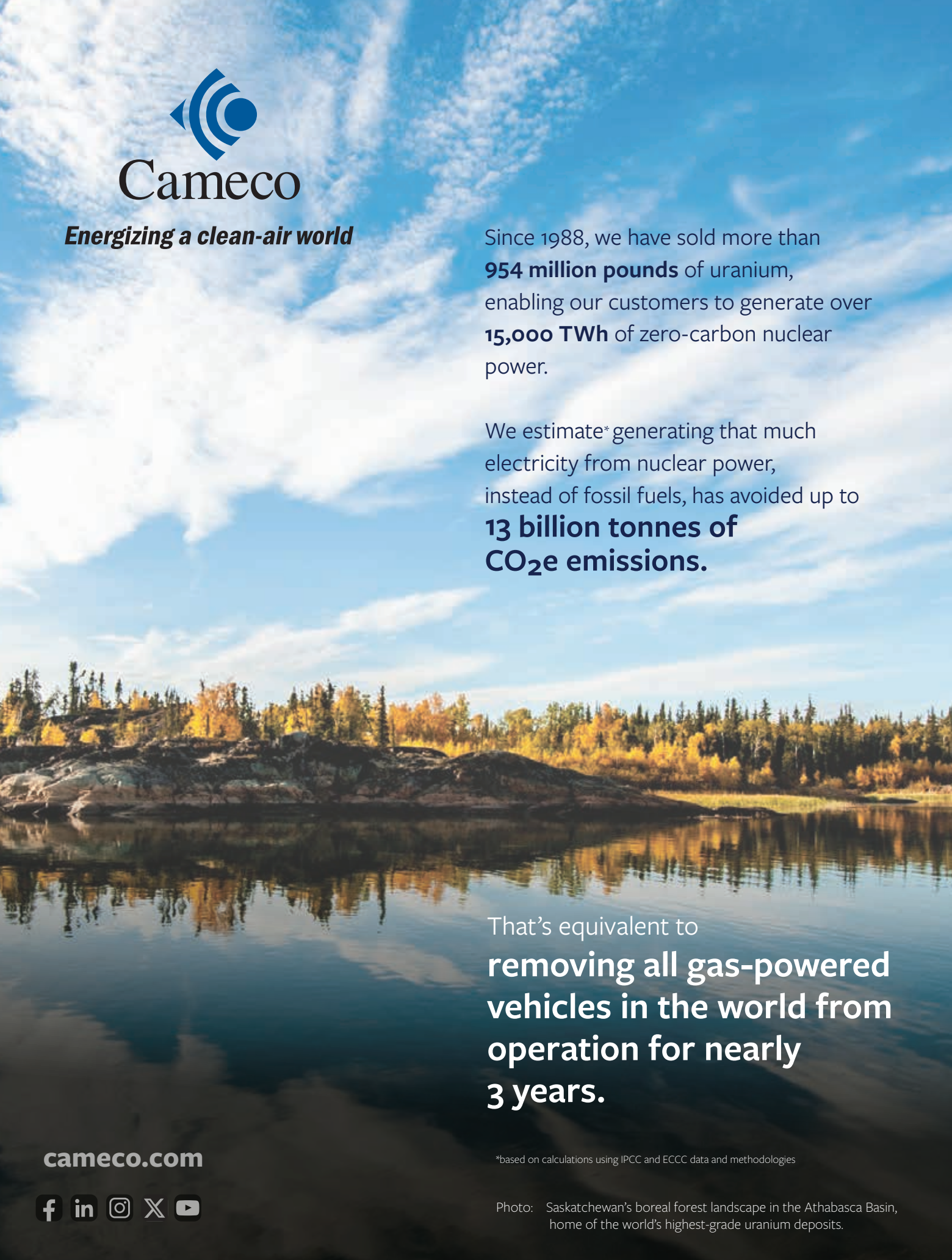
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We estimate* generating that much electricity from nuclear power, instead of fossil fuels, has avoided up to **13 billion tonnes of CO_2e emissions.**
That's equivalent to **removing all gas-powered vehicles in the world from operation for nearly 3 years.**
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*based on calculations using IPCC and ECCC data and methodologies
Photo: Saskatchewan's boreal forest landscape in the Athabasca Basin, home of the world's highest-grade uranium deposits.

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Cover
This issue highlights Saskatchewan's mining labour market analysis and offers perspectives on the challenges and opportunities for future growth.

SMA Saskatchewan Mining Association

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Strategic Planning to Meet Future Growth

One of the key highlights is the cover story on Saskatchewan's mining labour market, which stands at a pivotal crossroads. With growing demand for critical minerals like uranium and potash, the industry faces workforce shortages and recruitment challenges. The insights provided by our association's comprehensive labour market analysis reflect the strategic planning needed to meet future growth.

– PAM SCHWANN

I am genuinely excited to share this latest issue of *ORE Magazine*. This edition showcases the innovative spirit, resilience, and forward-thinking strategies shaping Saskatchewan's mining industry, all captured within our series of compelling articles with contributions from experts and leaders from the sector.

One of the key highlights is the cover story on Saskatchewan's mining labour market, which stands at a pivotal crossroads. With growing demand for critical minerals like uranium, potash, copper and zinc, the industry faces workforce shortages and recruitment challenges. The insights provided by our association's comprehensive labour market analysis reflect the strategic planning needed to meet future growth.

This issue also delves into the sector's remarkable strides in decarbonization. Our article on "Pathways to Decarbonization" demonstrates how companies like Cameco and K+S Potash Canada are spearheading efforts to reduce carbon footprints through technological innovations and sustainable practices, including energy efficiency projects and exploring new solutions such as small modular reactors.

In the realm of education and workforce development, we spotlight the vital collaboration between industry leaders, educational institutions, and Indigenous communities. The workforce pathways at institutions like Saskatchewan Polytechnic are not just empowering the next generation of mining professionals but instilling a sense of hope and optimism for the future of our industry, with a strong focus on diversity and inclusion.

This edition also celebrates the importance of safety and emergency preparedness, with a feature on the remarkable women leading emergency response teams across the sector. Their leadership and dedication to safety set an inspiring example for the entire industry.

I hope this issue offers fresh perspectives on the challenges and opportunities in mining today and the innovative approaches ensuring Saskatchewan's continued positioning as a leader in the global mining landscape. I sincerely appreciate your continued support of *ORE Magazine*, which allows us to bring these important stories to you and many others nationwide.

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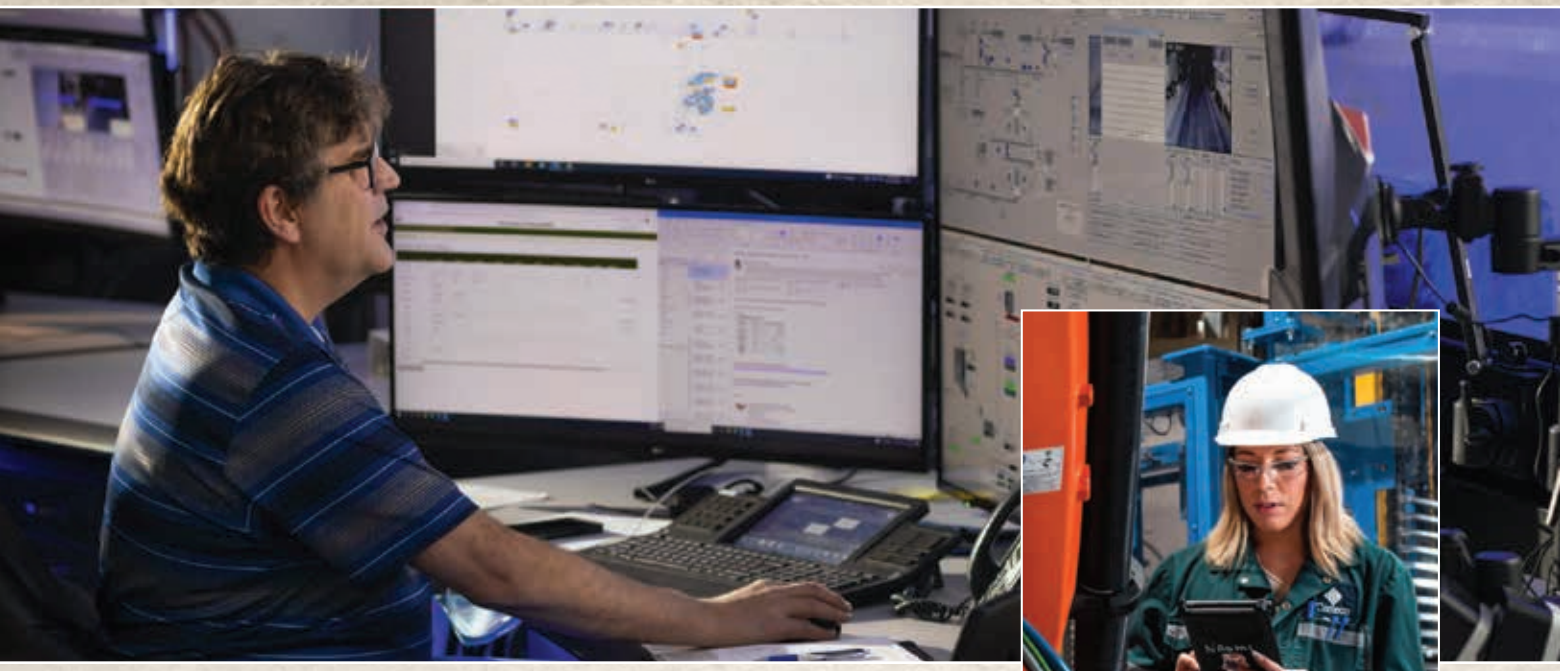
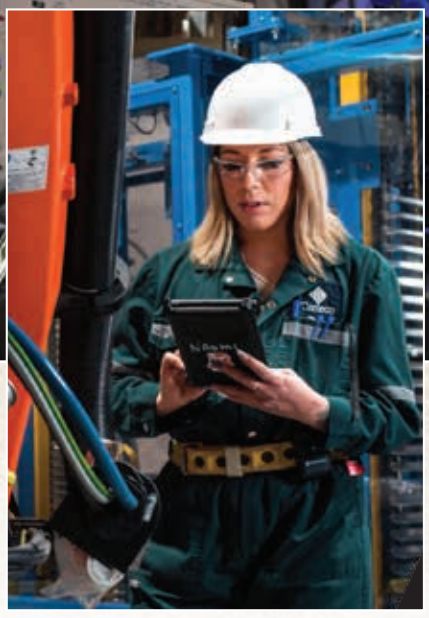




Saskatchewan's Mining Labour Market at a Crossroads

The mining industry in Saskatchewan, Canada, is critical to the province's economy, contributing significantly to employment, GDP, and the global supply of critical minerals such as uranium and potash, essential for clean energy and agricultural production. The sector is experiencing a dynamic period of growth and transformation, fueled by the rising global demand for critical minerals. While these minerals place the province in a robust economic position, the mining sector faces a crucial challenge: labour shortages. Sustaining the workforce required to meet future growth demands a thorough understanding of the current situation, the opportunities and market challenges that may lie ahead, and the ability to plan strategically for the future. The Saskatchewan Mining Association (SMA), in partnership with the Mining Industry Human Resource Council (MiHR) – the national sector council for Canada's mining sector, undertook a comprehensive Saskatchewan Mining Labour Market Analysis (SMLMA) to scrutinize the current state, model future needs over the upcoming decade, find ways to address gaps and take advantage of opportunities. Eleven SMA member companies involved in production, or near-term production, participated in the survey, including Nutrien, The Mosaic Company, K+S Potash Canada, Cameco Corporation, Orano Canada, SSR Mining, Westmoreland Mining, BHP, Foran Mining, Denison Mines and NexGen Energy Ltd.

The SMLMA analysis aligns with the Government of Saskatchewan's Labour Market Strategy. The government's strategy demonstrates their understanding that as the mining industry evolves, it's essential to look to the future to ensure the province has the workforce needed to meet employer demand. "the Government of Saskatchewan's Labour Market Strategy is a three-point plan to ensure Saskatchewan residents have every opportunity to participate in the growing economy, including a strong emphasis on removing barriers; ensure that workers who have earned credentials outside of Saskatchewan can have them recognized to work in the occupation for which they have been trained; and support employers with international recruitment to fill additional workforce needs," says Richelle Bourgoin, Deputy Minister, Ministry of Immigration and Career Training (ICT).

Addressing the government's collaboration with the mining industry, Bourgoin adds, "We have invested $100,000 in a partnership with the Saskatchewan Mining Association to build and promote awareness for mining and exploration careers with classroom and online teaching resources for students."

LABOUR DEMAND AND SUPPLY PROJECTIONS

Pam Schwann, SMA President, explains that a rapidly changing commodity market prompted the need for this study. "Our members identified the labour shortage as a business risk. It wasn't until 2021-22, with the sudden increase in potash and uranium prices, that labour market pressures became a critical concern for our members." SMA partnered with MiHR, offering national expertise in labour market analysis and forecasts specifically for the mining sector. "This was the fourth Saskatchewan Mining Labour Market Study that SMA has partnered with MiHR over the past 16 years". MiHR collected detailed data from SMA members on their current workforce to understand their current demographics, as well as additional information, including place of residence and years of service. This was supplemented by data from StatsCan and MiHR's prior studies.

Driven by the growing global demand for Saskatchewan minerals, the SLMLA

modelled that the Saskatchewan mining sector is expected to experience strong labour demand over the next decade. The baseline forecast predicts a 35% increase in mining employment from 11,043 workers in 2023 to 14,892 by 2034.

However, while demand is surging, the province faces challenges in ensuring an adequate labour supply. By 2034, the Saskatchewan mining workforce is expected to grow, but the increase in supply will not be sufficient to meet demand. The total labour supply is projected to rise by 19%, from 597,494 in 2023 to 708,435 in 2034. However, only 2% of the provincial labour force is projected to be absorbed by the mining sector, leading to a shortfall of local talent.

The SMLMA further highlights the growing labour gaps in Saskatchewan's mining industry. By 2034, ten prevalent (50% of the mining workforce) and ten critical (10%) mining occupations identified in the report (see related tables) will face significant shortages. For example, the demand for underground miners is expected to outstrip supply, creating a shortfall of 530 workers by 2034. Other occupations facing severe gaps include construction millwrights, heavy equipment operators, industrial electricians, and welders. The cumulative workforce deficit across all occupations will be around 4,556 workers, indicating a substantial reliance on external labour or a need for enhanced workforce development initiatives within the province.

FACTORS HINDERING LABOUR MARKET SUSTAINABILITY

Five key factors are contributing to the unsustainability of Saskatchewan's mining labour market, according to the report:

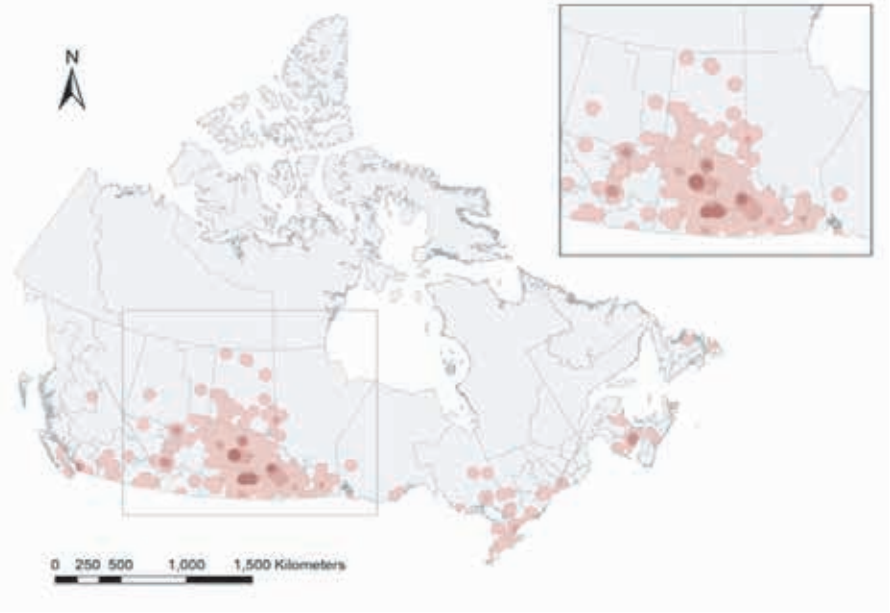
Dependence on Labour Mobility: The mining sector relies heavily on out-of-province workers, with 15% of the workforce residing outside Saskatchewan. Without interventions, this could rise to 25%, increasing vulnerability to external disruptions and limiting local labour availability.

Aging Workforce: The workforce is aging, with many nearing retirement. The share of mining workers aged 55 years and older is growing, while only 12% of new workers are under 30. The talent pool is simply too small to meet retirees' replacement and increased demand.

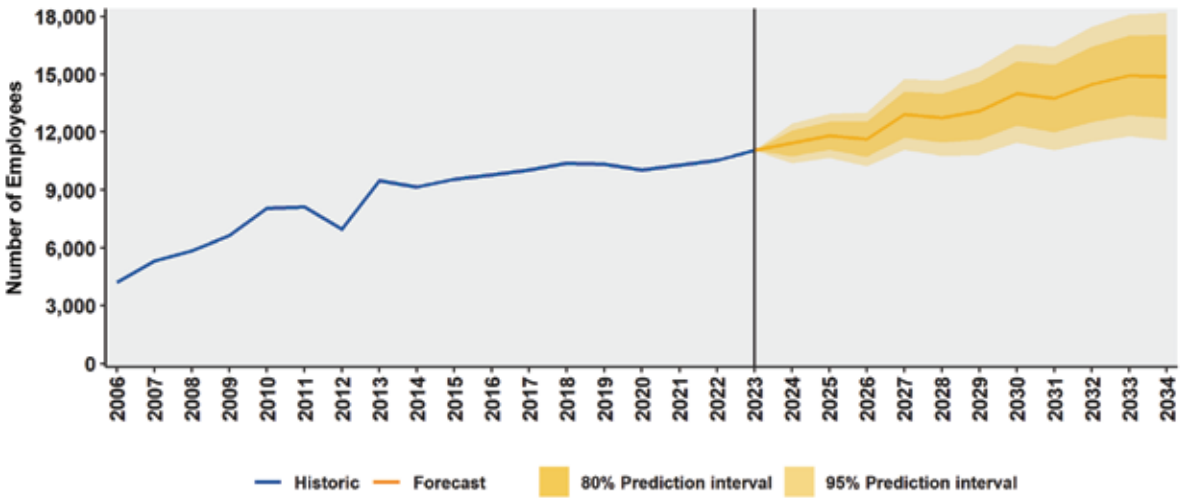
Age Breakdown of Saskatchewan's Mining Workforce (2023)

Age Category	Count	%
18 to 24 years	342	4%
25 to 29 years	708	8%
30 to 34 years	1,238	14%
35 to 39 years	1,555	17%
40 to 44 years	1,595	18%
45 to 49 years	1,232	14%
50 to 54 years	933	10%
55 to 59 years	701	8%
60 to 64 years	579	6%
65 + years	130	1%
No Data	2	0%
Total	**9,015**	**100%**

Geographic Distribution of Saskatchewan's Mining Workforce Across Canada (2023)



Historic (2006 – 2023) and Forecasted (2024 – 2034) Employment for Saskatchewan's Mining Sector



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Underperformance in Diversity: While Indigenous participation is improving, women and immigrants remain underrepresented. Women account for 11% of the mining workforce and immigrants 8%, compared to 47% and 20%, respectively, in other sectors. Increasing diversity is crucial to sustaining the labour force.

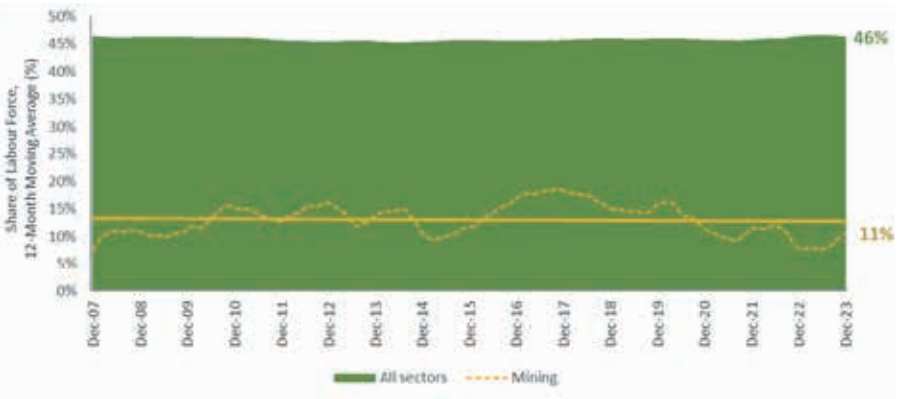
Shallow Occupational Labour Pools: Occupations crucial to mining operations, like industrial electricians and industrial millwrights, suffer from shallow labour pools. These pools will quickly be exhausted if the industry does not expand training programs and attract new talent. Out of 700,000 in Saskatchewan's labour force, only 25,000 work in the ten most prevalent mining occupations, with just 6,000 directly employed in mining. Competition with other industries makes these roles hard to fill.

Lack of Alignment in Occupational Choices: Many workers are choosing occupations that are not aligned with the needs of the mining sector. This misalignment creates a bottleneck in the supply of skilled workers needed for critical mining occupations.

ADDRESSING CRITICAL GAPS TOWARD LABOUR SUSTAINABILITY

To address these challenges, SMA has proposed several strategies. Key recommendations include improving career awareness, particularly among women, Indigenous groups, and newcomers.

Women's Representation in Saskatchewan's Labour Force in All Sectors and Mining Sector, 12-Month Moving Average (Dec 2007 – Dec 2023)

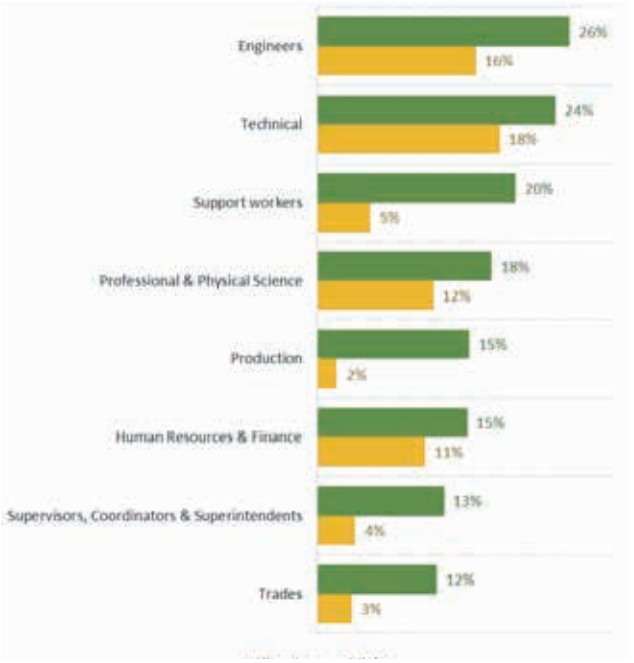


Another recommendation is enhancing collaboration with post-secondary institutions to align training programs with the mining industry's needs. Schwann highlights the ongoing work to attract these groups: "There is significant room for improvement, particularly in attracting underrepresented groups into trades and production roles and promoting more inclusive workplace cultures. We are developing targeted educational programs and efforts to promote careers in mining to these demographics as their participation will be essential for closing the labour gaps."

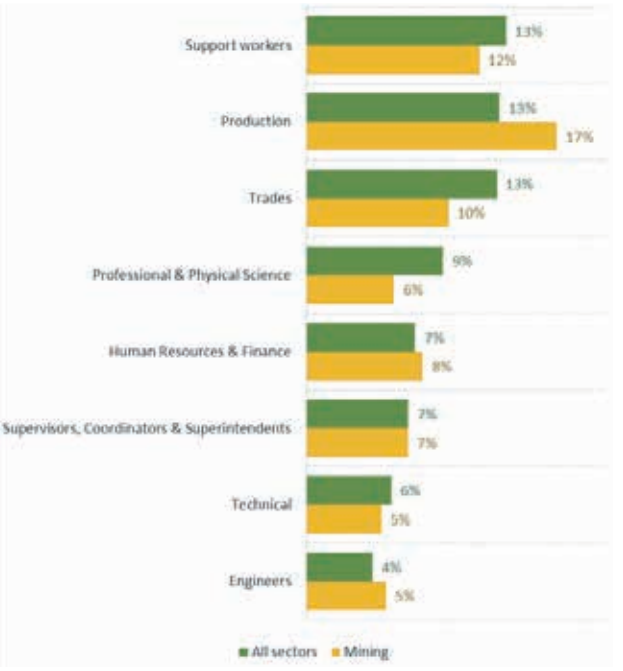
The report also calls for innovative solutions to address the occupational labour pool limitations, which are significantly challenging the sector's growth. As Schwann further states, "If we are going to meet the future labour demands of Saskatchewan's mining sector, we need to work together to grow the pool of talent across the diverse communities of Saskatchewan and attract these people into the many rewarding careers offered in mining."

Industry members are being proactive. SSR Mining's Seabee Gold Operation in Northern Saskatchewan exemplifies efforts to address labour shortages through community involvement and strategic workforce development. In addition to their dedicated recruitment position, they have integrated an applicant tracking system, which includes a public engagement tracking component to monitor career fairs, educational institutions' in-classroom

Immigrant Representation in Saskatchewan's Labour Force by Broad Occupational Categories in All Sectors and Mining Sector (2021)



Indigenous People's Representation in Saskatchewan's Labour Force by Broad Occupational Categories in All Sectors and Mining Sector (2021)



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presentation opportunities, internships and co-op programs' intakes and more. Glenn Lafleur, the company's Senior Community Relations Liaison, describes their multifaceted approach to engaging with local northern communities in decision-making to address employment and social concerns and invest in workforce development. "We've established various programs, such as our in-house apprenticeship training open to all employees, in which we encourage Northerners and Indigenous people to participate. We also have a driller assistant training program tailored for Lac La Ronge and Peter Ballantyne Band members. We understand the importance of involving traditional land users in our operations, so we have agreements and committees that include representatives from SSR Mining and local Indigenous groups," says Lafleur.

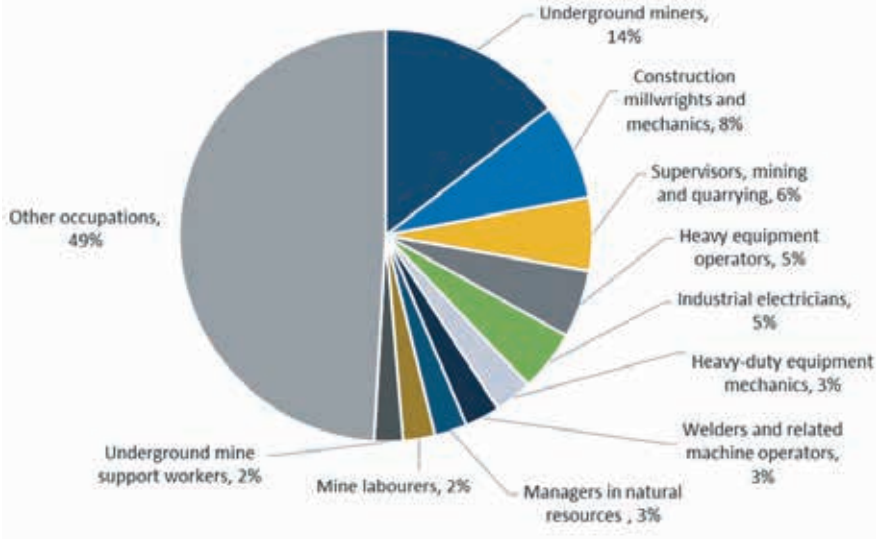
Beyond workforce development, SSR Mining also focuses on long-term northern sustainability by encouraging regional economic diversification. "We meet quarterly with Northern Economic Development Groups to discuss opportunities for their staff training and businesses to grow beyond the mining sector, ensuring their survival even during potential industry downturns. We help develop a local workforce to meet our current and future needs and who can also use their skills elsewhere," Lafleur explains.

Similarly, BHP is addressing workforce gaps through the establishment of the BHP Potash Academy in collaboration with Carlton Trail College. This initiative provides foundational and advanced training in mining, tailored to equip individuals for operational roles at their Jansen potash mine project. In 2023 alone, BHP helped support over 40 trainees, focusing on increasing the representation of Indigenous and rural community members in their workforce. The program offers hands-on training in technical and operational skills, such as mine safety, equipment maintenance, and automation technologies, ensuring that graduates are ready for the workforce upon completion.

BHP's initiatives don't just stop at Carlton Trail College. They are working closely with local Indigenous communities to offer tailored training pathways, providing opportunities for skills development and long-term employment. This partnership approach ensures that underrepresented groups have better access to employment opportunities in the mining sector, helping address talent shortages and supporting workforce diversity. In addition, BHP has committed to creating apprenticeships and traineeship programs for technical roles, which help bridge the gap between traditional education and the hands-on experience required in mining. These initiatives align with the company's long-term strategy to build a sustainable workforce that is adaptable to technological advancements in the industry.

Technological advancements, including AI and automation, are also reshaping the mining landscape, with companies ensuring their workforce can adapt. Nutrien has been a leader in integrating automation and AI to improve operations at its potash mines. At their Lanigan site, tele-remote technology allows operators to control equipment from a centralized location, enhancing operational efficiency and safety by reducing the number of workers needed in potentially hazardous underground environments. In addition to tele-remote systems, Nutrien is also exploring AI-driven predictive maintenance technologies that minimize downtime and optimize production by forecasting equipment failures before they occur. The move towards automation doesn't mean a reduction in the workforce but rather a shift in the types of skills required. Although it reduces the need for some manual roles, it creates new opportunities in tech-focused positions such as remote equipment operators and AI specialists, which could help fill the critical labour gaps that Saskatchewan's mining industry faces. Nutrien has been proactive in reskilling its workforce, offering extensive training programs to prepare employees for working alongside advanced technologies. This includes courses in data analytics, remote equipment operations, and maintenance of automated systems. Such efforts align with the industry's larger goal of maintaining a skilled labour force capable of operating

Occupational Mix in Saskatchewan's Mining Sector (2021)



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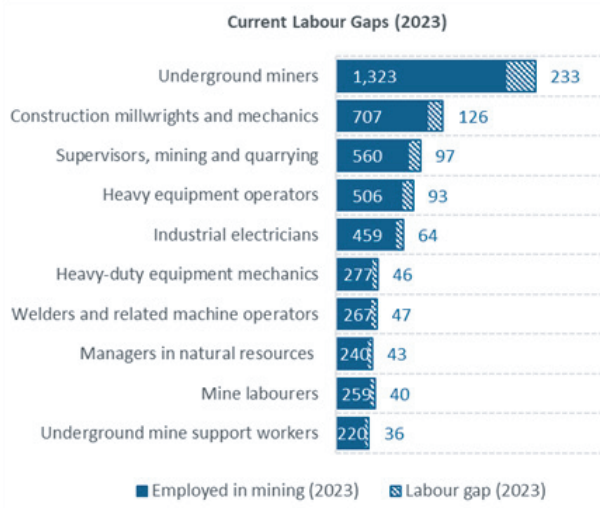
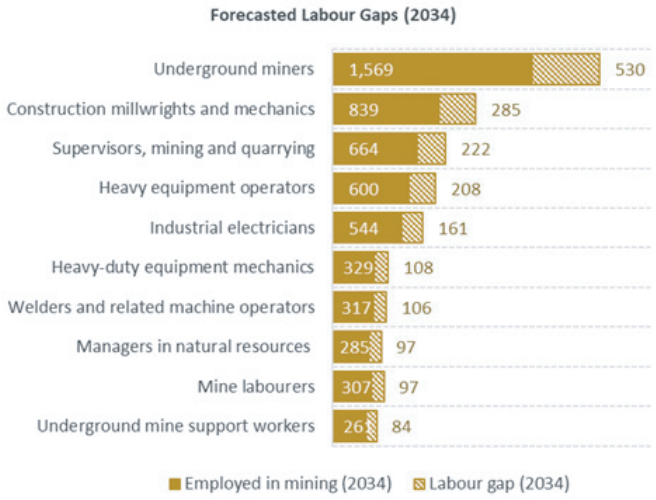
Current (2023) and Forecasted (2034) Labour Gaps for the 10 Most Prevalent Occupations in Saskatchewan's Mining Sector, Baseline Scenario





Current (2023) and Forecasted (2034) Labour Gaps for the 10 Most Prevalent Occupations inSaskatchewan's Mining Sector, Baseline Scenario

Occupation	Employed in Mining (2023)	Labour Demand (2023)	Labour Gap (2023)	Employed in Mining (2034)	Labour Demand (2034)	Labour Gap (2034)
All Occupations	**9,387**	**11,043**	**1,656**	**11,131**	**14,892**	**3,761**
Underground miners	1,323	1,556	233	1,569	2,099	530
Construction millwrights and mechanics	707	833	126	839	1,124	285
Supervisors, mining and quarrying	560	657	97	664	886	222
Heavy equipment operators	506	599	93	600	808	208
Industrial electricians	459	523	64	544	706	161
Heavy-duty equipment mechanics	277	324	46	329	436	108
Welders and related machine operators	267	314	47	317	423	106
Managers in natural resources	240	283	43	285	381	97
Mine labourers	259	300	40	307	404	97
Underground mine support workers	220	256	36	261	345	84

Source: Mining Industry Human Resources Council, Saskatchewan Labour Market Analysis, 2024.

in increasingly technology-driven mining environments.

In the same vein, the electrification of the mining sector will be an essential response to green policies as diesel equipment is replaced by battery-operated equipment. Energy and water efficiency are also areas where industry is being proactive in sustainability. The report indicates that environmental engineering and IT-related jobs are expected to be in higher demand.

Another significant player in Saskatchewan's mining sector, Cameco Corporation, is also facing workforce challenges, particularly in trades, engineering, and mining roles. Lynn McNally, Cameco's Vice President of Human Resources, acknowledges that the mining sector is not immune to workforce shortages for these in-demand occupations. "Being proactive and strategic will be key in addressing the supply-demand gaps in the labour market," says McNally.

Cameco has implemented various initiatives to invest in its workforce, for new and existing employees, to enhance their skills and knowledge. "We're utilizing trainee, apprenticeship, and employee development programs, along with company-supported pre-employment training and third-party training companies. We also offer increased student experience programs, career transition initiatives, and in-house course offerings," McNally explains.

One key initiative regarding training is Cameco's partnership with post-secondary institutions in Saskatchewan, which helps foster student learning opportunities through work placements and internships. "We recently signed a Memorandum of Understanding (MOU) with SaskPower and Westinghouse, which includes plans to develop a Saskatchewan-based nuclear

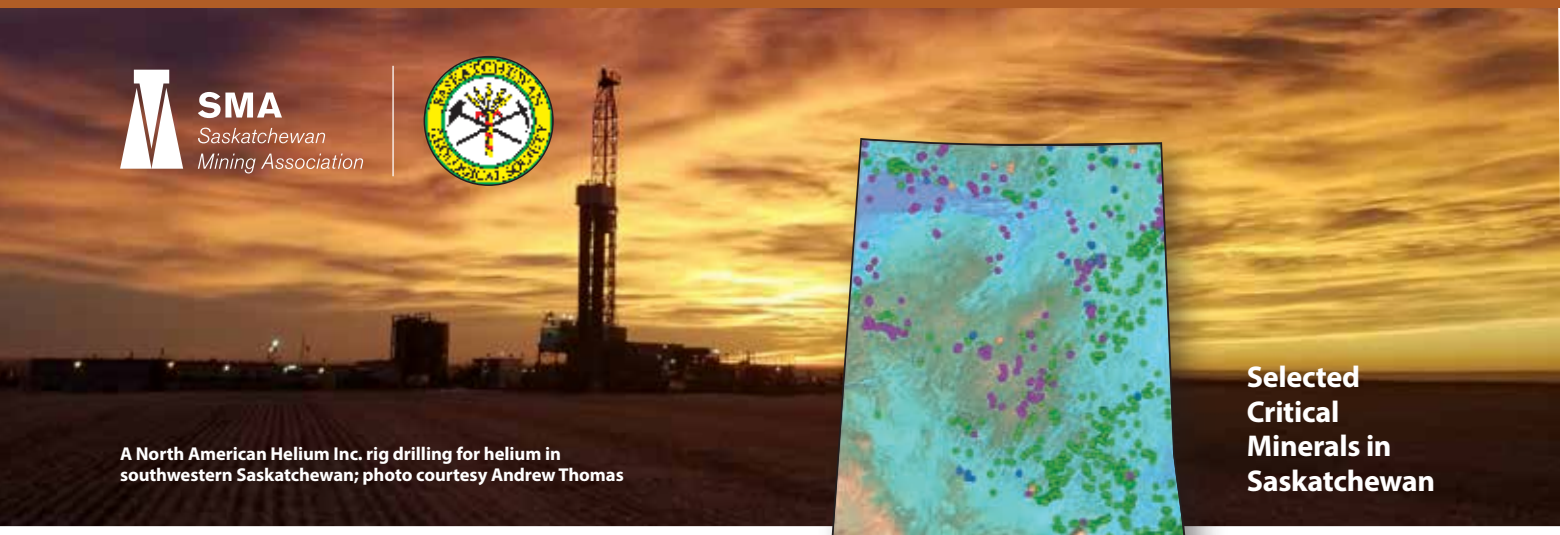
supply chain and workforce. This collaboration is a step toward preparing the workforce for future needs in both mining and nuclear sectors," McNally highlights.

Mining companies aren't alone in addressing the labour gaps. The provincial government is undertaking targeted labour recruitment initiatives in Saskatchewan, across Canada and worldwide to support Saskatchewan employers in acquiring the workforce they need to grow their business. ICT Deputy Minister Richelle Bourgoin explains, "We emphasize in-demand occupations in recruitment efforts to attract skilled workers to address immediate and critical skills shortages. International recruitment also plays an essential role in filling critical vacancies in Saskatchewan's labour market and contributes to Saskatchewan's population growth."

BALANCING GROWTH OPPORTUNITIES AND LABOUR MARKET CHALLENGES

Saskatchewan's mining sector is at a crossroads, facing immense growth opportunities and significant labour market challenges. Through community engagement, workforce training, and a commitment to diversity and inclusion, companies like SSR Mining and Cameco are demonstrating the industry's commitment to addressing these challenges. However, the path forward will require continued collaboration between industry, government, and educational institutions to build a labour market capable of sustaining the province's future growth. With the support of key initiatives outlined by the Saskatchewan Mining Association, there is optimism that the sector can navigate these challenges and continue to thrive. "There are over 120 careers in mining; there's something for everyone. Now is the time to invest in careers with a sustainable future," Schwann concludes.

Read the complete Saskatchewan Mining Labour Market Analysis



A North American Helium Inc. rig drilling for helium in southwestern Saskatchewan; photo courtesy Andrew Thomas

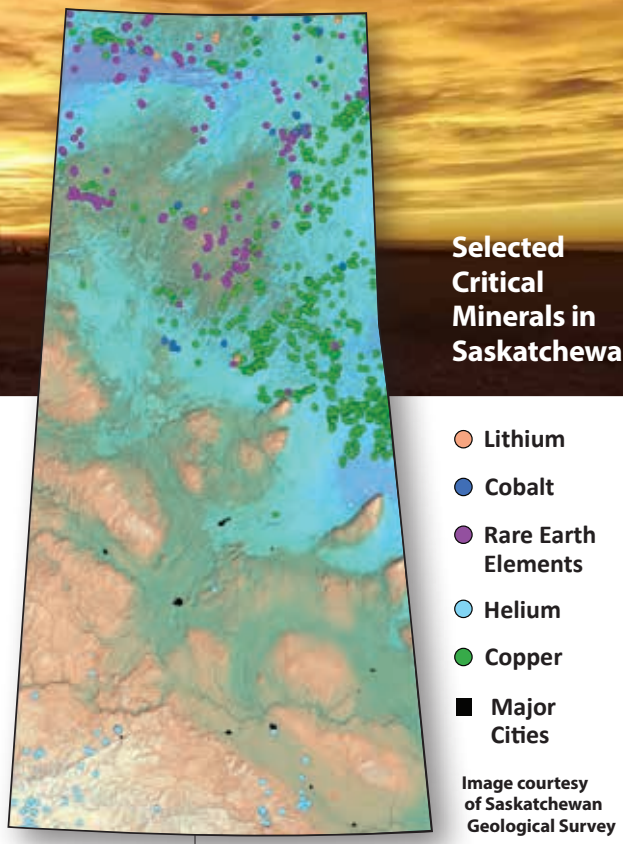


Image courtesy of Saskatchewan Geological Survey

CRITICAL MINERALS

Many places in the world, including Canada, are trying to reduce the emissions of greenhouse gases to minimize the impacts of a changing and warming climate. This will involve significant development of new green-energy operations and storage facilities, increased use of electric vehicles, and an even greater dependence on a strong digital infrastructure. However, this will require an increased supply of important elements and metals that must be mined and then processed for use. These are called critical minerals, as they are important in many green-energy and high-technology applications, but they are often found only in specific parts of the world and their supply may be disrupted. Canada has recently identified 31 minerals that are deemed important to our economy and lifestyle.

Monazite crystals (reddish brown) in a deformed Precambrian host rock; photo courtesy www.appiareu.com

For example, a number of elements are needed to produce the infrastructure to support a low-carbon future through electricity generation and electric vehicles. Electric vehicles require lithium and cobalt for batteries, copper for wiring, and an array of rare earth elements for the electronics. The latter are also used in permanent magnets for wind turbines. Solar panels contain elements such as indium and gallium. Consider your smartphone: the display panel, circuitry and battery require various elements such as silica, indium, copper, silver, tungsten, lithium, carbon and many others, that come from minerals. Helium, which is found as a gas, is used in its liquid form to cool superconducting magnets in MRIs, and in high-capacity hard drives in massive data centers (e.g., Netflix and Bitcoin).

The great variety of rocks in Saskatchewan, ranging from the igneous and metamorphic rocks of the Canadian Shield in the north, to the sedimentary rocks in the south, means that the province may be able to supply some of these critical minerals. For example, rare earth elements are found in the mineral monazite, in a location north of Lake Athabasca, and cobalt has been found associated with some of the large uranium deposits. In the south, lithium could be produced from some of the groundwater found deep in the sedimentary rocks, and helium gas is being extracted from other reservoirs in these rocks.

BRINGING THE CLASSROOM TO THE FIELD

The Saskatchewan Mining Association (SMA) is playing a critical role in supporting education through its Minerals Connected Program, inspiring both teachers and students to learn more about Saskatchewan's mineral resources. The Saskatchewan curriculum offers many pathways for students from grades 4 to 12 to explore mineral resources, but many educators may not know where to begin. That's where programs like GeoVenture and various free, curriculum-correlated resources and career engagement events come in, bridging the gap between the education curriculum, Saskatchewan's mineral resources and the real-world application of mining knowledge.

Since 2021, over 20,000 free, curriculum-aligned resources have been downloaded through the Minerals Connected Teachers Pay Teachers platform. This resource offers educators the tools they need to introduce topics like geology, mineral resources, and the role of mining in everyday life into their classrooms. These resources help students better understand the contributions of mining to Saskatchewan's economy and environment.

A cornerstone of SMA's Minerals Connected Program is the GeoVenture Teachers' Program, which takes educators on a week-long immersive, hands-on tour of the province's diverse mining sector. In 2024, GeoVenture participants visited several mining operations, including the Potash Interpretive Centre in Esterhazy, Mosaic's K3 conventional potash mine, Thyssen Mining's equipment shop, K+S Potash Canada's Bethune Solution potash mine, Westmoreland's Poplar River coal mine, Cameco's Cigar Lake uranium mine, Orano's McClean Lake uranium mill along with presentations from Nutrien, SSR Mining, BHP and SaskCodes. The GeoVenture Program also provides hands-on workshops using SMA resources such as the "Potash Kit" and Robotics Lessons. In addition to providing teachers with unique experiences like travelling down one kilometre from the surface to the potash layer or flying up north to tour uranium mine and milling operations, the GeoVenture Program enables teachers to see firsthand the diverse career opportunities, innovative technologies, and safety and environmental performances of Saskatchewan mining operations.

The value of this program extends beyond mere exposure. For many teachers, GeoVenture reshapes their perception of the mining industry. One teacher remarked, "Before GeoVenture, I was under the impression that mining was a dirty, bad industry, but I have now seen how environmentally responsible and safe mining is. I did not realize how automated mining has become, which helps make it more interesting for my students as a possible career choice."

Beyond GeoVenture, the SMA Minerals Connected Program also develops free, curriculum-correlated resources, hosts mineral resource workshops for teachers, attends career fairs in urban, rural, and Indigenous communities, and hosts events in partnership with the Saskatoon and Regina and District Industry Education Councils, the Royal Saskatchewan Museum, and the Saskatchewan Science Centre. These events introduce students to the technology used in today's mining environment, including robotics and automation.

By bringing education into the field, Saskatchewan's mining sector is demystifying the industry for students and educators and planting the seeds for future generations of tradespersons, technologists, engineers, and scientists.

Congratulations to the Rossignol High School Robotics Team:

1st place at the Saskatchewan Polytechnic Robot Rumble. They were selected to represent Team Saskatchewan for Robotics at Skills Canada Nationals in Quebec City, where they took 3rd place.

Fields like robotics and automation offer exciting career opportunities in the mining industry.

Learn more about SMA's GeoVenture and other educational programs.

We encourage teachers to subscribe to our newsletter and download free curriculum-correlated resources.

EDUCATION

Saskatchewan's Mining Industry: Powering a Low-Carbon Future with Nuclear Energy

John Gorman, CEO, Canadian Nuclear Association

Saskatchewan boasts a long and proud history of resource development. From coal to potash to uranium, the province has built its economy on the strength of its mining industry. Now, as the world shifts towards a low-carbon future, Saskatchewan is once again looking to mining, and particularly its expertise in uranium, to play a key role. This time, the focus is on nuclear power.


John Gorman

While the province embraces renewables like wind and solar, these alone can't achieve net-zero emissions. Electricity currently accounts for a mere 13% of Saskatchewan's energy demand. The vast majority comes from burning fossil fuels for transportation, heating, industry, and resource extraction – including mining operations themselves. This reliance presents a significant hurdle in the race towards decarbonization.

However, Saskatchewan is uniquely positioned to lead in nuclear energy. As a leading producer of uranium, a critical mineral for nuclear power generation, the province has the foundation to embrace this technology.

Looking ahead, small modular reactors (SMRs) offer a promising solution. These advanced reactors can provide reliable, emissions-free electricity and high-temperature heat ideal for energy-intensive industrial processes, making them particularly well-suited for the mining sector. From extraction and processing to transportation, SMRs can meet the diverse energy needs of modern mining operations.

What makes SMRs so advantageous? Their modularity allows for incremental deployment to match increasing energy needs, and their compact size makes them suitable for locations where conventional reactors can't be built, potentially bringing power closer to mining sites and reducing transmission losses. Furthermore, factory prefabrication can lower construction costs. But perhaps most importantly, SMRs offer a versatile solution, providing both electricity and heat tailored to the specific needs of each mining operation.

Imagine SMRs powering mine sites, replacing diesel generators and dramatically reducing emissions.

Picture them providing the high-temperature heat needed for mineral processing, enabling innovative extraction techniques and minimizing environmental impact. The potential applications of SMRs in mining are vast and transformative.

By embracing SMRs and other innovative technologies, Saskatchewan's mining industry can continue to thrive while playing a crucial role in building a cleaner, more sustainable energy future. The province's commitment to responsible resource development, combined with its skilled workforce and abundant resources, positions it as a leader in the global transition to a low-carbon economy.

cna canadian nuclear association

About the CNA

The Canadian Nuclear Association (CNA) has been the national voice of the Canadian nuclear industry since 1960. Working with our members and all communities of interest, the CNA promotes the industry nationally and internationally, works with governments on policies affecting the sector and endeavours to increase awareness and understanding of the value nuclear technology brings to the environment, economy and daily lives of Canadians.

Saskatchewan is uniquely positioned to lead in nuclear energy. As a leading producer of uranium, a critical mineral for nuclear power generation, the province has the foundation to embrace this technology.

WOMEN LEADERS IN MINE SAFETY

Sky Tsannie, ERT and Mine Rescue Captain, Cameco, Cigar Lake Mine

The Value of Diversity in Emergency Response

In Saskatchewan's mining industry, safety and mine rescue are critical aspects of the operations, with dedicated Emergency Response Teams (ERTs) at the heart of this commitment.

These teams assist miners in life-training situations, often working in some of the most isolated and challenging environments while maintaining a high safety standard. Through rigorous training and collaboration, they are prepared for any emergency that may arise, from fire outbreak to mine collapse.

A TRADITION OF SAFETY AND EMERGENCY RESPONSE TRAINING

Like its colleagues in Saskatchewan's mining sector, Westmoreland Mining's Estevan mine has long emphasized the importance of safety and emergency preparedness. Jessica Klarholm, a Safety Specialist and Mine Rescue Captain, speaks passionately about the impact of mine rescue training on her career: "One of my favourite aspects of the mine is the focus on safety and my involvement with the Emergency Response Team." After transitioning from a decade of operating heavy machinery to her current role in safety, Jessica found that the mine's investment in training has paid off significantly.

"Our site has a specialized group of individuals who train year-round so we can 'be there' if our fellow workers ever need us," she explains. Westmoreland's focus on continuous learning and training creates a safety culture where everyone feels empowered to contribute. Klarholm's leadership and training efforts have strengthened the ERT and fostered teamwork and mutual respect among her peers. "The efforts I put in have paid off tenfold in my personal and professional life," she shares.

Klarholm's journey from small-town farm kid to Zamboni driver to heavy equipment operator to her current prominent role in mine safety highlights the rewarding nature of careers in the mining sector. She encourages others, particularly women, to pursue opportunities in this dynamic field: "To all the women out there, pioneering a worthwhile career path for yourself might be more achievable than you think. Get out there and do the things!"

Likewise, at Cameco's Cigar Lake mine, Sky Tsannie, an Indigenous woman from the Wollaston Lake and Stanley Mission reserves, stands out as a symbol of resilience and leadership in mine rescue. Tsannie's involvement with the ERT began with her passion for helping people and mitigating emergencies. She has since become a key figure on the team, culminating in her role as captain during the 2024 Mine Rescue Competition.

"There is so much importance in being part of and having an ERT team that works efficiently in all aspects of emergency response at our northern sites, especially because we are secluded," Tsannie explains. The isolated nature of many Saskatchewan mine sites means ERTs must be highly skilled and self-sufficient.

SAFETY

Emergency Response Team, Cameco, Cigar Lake

For Tsannie, the most rewarding aspect of mine rescue is the teamwork and camaraderie that develop through training and real-life emergencies. Reflecting on the northern Saskatchewan 2021 Briggs Fire, she recalls the critical role that team chemistry played in overcoming the challenge: "Developing that chemistry with the team is essential and brings you closer to one another." As captain, Tsannie has worked to build that bond within her team, which included five first-time competitors during the 2024 competition.

Tsannie's leadership also challenges traditional gender roles in mining, particularly for Indigenous women. "I have always believed in myself and my capabilities as an Indigenous woman," she states. "If you believe in yourself, nothing will come between you and your passion."

The annual Saskatchewan Mining Association Emergency Response Mine Rescue Competition (ERMRC) is a crucial event for mine rescue teams across Saskatchewan. It allows teams to test their skills in realistic scenarios, ranging from firefighting to surface rope rescue. The competition is not just about winning; it's about learning and improving as a team.

Jessica Klarholm, Safety Specialist and Mine Rescue Captain, Westmoreland Mining

Tsannie believes that Saskatchewan's ERTs' success directly results from their members' dedication and resilience and views the ERMRC as a key growth opportunity. "Each year has been significant for the team," she notes. "We continue to improve every year and are committed to learning from our mistakes." The competition helps teams like hers identify areas for improvement and refine their skills to ensure they are ready for real-life emergencies.

Jessica Klarholm echoes these sentiments, expressing pride in her team's achievements and continuous progress. Both women credit their teams' success to rigorous training, strong leadership, and a shared dedication to safety.

As Saskatchewan's mining industry grows, safety specialists and mine rescue teams will remain crucial. The stories of leaders like Jessica Klarholm and Sky Tsannie highlight the importance of continuous learning and teamwork in maintaining a safe and secure working environment for miners and their communities. Their experiences also emphasize the value of diversity in emergency response. Tsannie and Klarholm have risen through the ranks, proving that anyone can become a leader in mine rescue with the proper training and support. Their journeys are a testament to the importance of self-belief, hard work, and a passion for safety.

54th Annual Emergency Response/Mine Rescue Skills Competition

OVERALL

SURFACE WINNER - K+S Potash Canada Bethune
RUNNER UP - Westmoreland Estevan
UNDERGROUND WINNER - Nutrien Cory
RUNNER UP - Nutrien Lanigan

The Individual Event winners of the 54th Annual Emergency Response/ Mine Rescue Skills Competition are:

BENCH TECHNICIAN

UNDERGROUND WINNER - Owen Gunther, Nutrien Lanigan

UNDERGROUND RUNNER UP - Tyson Devine, SSR Mining Seabee

FIRST AID

SURFACE WINNER - Mosaic Belle Plaine
RUNNER UP - Westmoreland Mining Estevan
UNDERGROUND WINNER - Nutrien Allan
RUNNER UP - Nutrien Lanigan

FIRE FIGHTING

SURFACE WINNER - Westmoreland Mining Estevan
RUNNER UP - K+S Potash Bethune
UNDERGROUND WINNER - Nutrien Cory
RUNNER UP - Nutrien Lanigan

PRACTICAL SKILLS

SURFACE WINNER - K+S Potash Bethune
RUNNER UP - Westmoreland Poplar River
UNDERGROUND WINNER - Nutrien Cory
RUNNER UP - Nutrien Lanigan

PROFICIENCY

SURFACE WINNER - K+S Potash Bethune
RUNNER UP - Mosaic Esterhazy Surface
UNDERGROUND WINNER - Nutrien Allan
RUNNER UP - Nutrien Cory

SURFACE ROPE RESCUE SKILLS

SURFACE WINNER - Mosaic Esterhazy
RUNNER UP - K+S Potash Canada Bethune

SURFACE FIELD PROBLEM

SURFACE WINNER - Mosaic Belle Plaine
RUNNER UP - Westmoreland Mining Estevan

UNDERGROUND MINE PROBLEM

UNDERGROUND WINNER - Nutrien Cory
RUNNER UP - Nutrien Vanscoy

Shaping Saskatchewan's Mining Workforce Through Education and Collaboration

The mining industry in Saskatchewan is a significant economic driver and a key player in the province's innovation and workforce development. Through collaborative efforts between industry leaders, post-secondary institutions, and government bodies, the province is nurturing a workforce equipped with the skills and knowledge required to meet the growing demands of mining operations. From Indigenous engagement programs to technological advancements in education, these initiatives are helping to shape the future of mining in Saskatchewan.

BRIDGING THE SKILLS GAP

As the mining industry evolves, companies face an ongoing challenge in finding and retaining skilled workers, especially in Saskatchewan's northern regions. Lynn McNally, Vice President of Human Resources at Cameco Corporation, highlights how these challenges have developed: "Recently, we extended the life of the Cigar Lake mine by five years to 2036. Also, we are looking at what it would take to expand our McArthur River and Key Lake operations to the licensed capacity of 25 million pounds per year. This will require more skilled workers to join our growing teams at these sites."

The integration of new technologies, such as digitization and automation, has further impacted the demand for skilled personnel and the need for continuous training. McNally notes, "The recent update of our systems at McArthur River and Key Lake created efficiencies in our work and increased safety for workers, but it also meant training employees on new technology and adapting to new processes."

To address these challenges, Cameco has developed programs focused on training and work placements for northern residents near its operations. Their focus on Residents of Saskatchewan's North (RSN) has resulted in numerous employment opportunities, with over 18 paid work placements in 2023, including 13 for women. Additionally, Cameco's commitment to diversity ensures a strong pipeline of Indigenous workers, with 50% of their northern workforce identifying as Indigenous.

EDUCATING THE NEXT GENERATION OF WORKERS THROUGH PARTNERSHIPS

One of the key players in the province's workforce development is Saskatchewan Polytechnic (Sask Polytech), which plays a pivotal role in equipping students with practical skills for the mining industry. According to Brenda Suru, Dean for the Faculty of Technology and Skilled Trades, Sask Polytech provides training for more than 90 percent of the careers needed in the mining industry. This includes disciplines from engineering to information technologists. "The Nutrien School of Mining, Manufacturing, and Engineering Technologies trains students on the latest technology and equipment, including robotics, in first-rate shop facilities to prepare them to enter the workforce," Suru states.

To ensure it meets the mining industry's needs, Sask Polytech relies on program advisory committees composed of industry experts. Suru explains, "They let us know where labour markets are headed, what skills graduates need to succeed in their mining careers, and help employers stay innovative."

Innovative teaching tools like Sask Polytech's virtual mine lab prepare students to handle real-world mining challenges. Funded by a grant from the International Minerals Innovation Institute (IMII), this lab allows students to immerse themselves in virtual mining environments, ensuring they are well-versed in safety protocols and operational procedures.

Sask Polytech is also profoundly committed to workforce diversity. It offers programs supporting Indigenous students, as evidenced by its newly launched Indigenous Student Success Strategy. This initiative aims to enhance Indigenous learners' recruitment, retention, and career readiness. Programs such as Radiation and Environmental Monitoring Technician

developed in collaboration with industry leaders like Cameco and Orano Canada, are designed to provide northern residents with the skills needed for environmental and radiation monitoring roles within the mining sector. Furthermore, 14 of its programs at the Nutrien School of Mining, Manufacturing, and Engineering Technologies are available to international students. "International students bring a global perspective to Saskatchewan, enrich our culture, and create bridges between their homes and ours," says Suru.

Collaboration between educational institutions and industry leaders is crucial to workforce development. Potash giant Nutrien has fostered such partnerships. Caitlin Sirois, General Foreperson at Nutrien's Vanscoy Potash Operations, emphasizes the value of the Indigenous Internship Program (IIP), which brings Indigenous students and graduates into STEM (sciences, technology, engineering and mathematics) and business roles at Nutrien. Since the launch of this program in 2015, Nutrien has welcomed over 130 interns. "Students bring a new energy and fresh perspective that helps to inspire innovation and offer new solutions to existing problems. They come to this site with a wide breadth of knowledge in up-to-date tools and practices, which directly translates into their ability to transition into roles at our sites easily," Sirois explains.

Nutrien's investment in education goes beyond internships. Their $15 million donation to Sask Polytech led to renaming the Nutrien School of Mining, Manufacturing, and Engineering Technologies. This collaboration ensures that future graduates are trained with up-to-date tools and practices and aligned with the evolving needs of the mining industry.

Indeed, mining companies across the province are partnering with professional development organizations to tailor their workforce training to their operations. In 2022, Potash producer The Mosaic Company (Mosaic) launched a partnership with Morris Interactive that offers an excellent example of how the industry embraces digital transformation and Indigenous workforce engagement.

"The recent update of our systems at McArthur River and Key Lake created efficiencies in our work and increased safety for workers, but it also meant training employees on new technology and adapting to new processes"

– LYNN MCNALLY, VICE PRESIDENT OF HUMAN RESOURCES AT CAMECO CORPORATION

Their program supports Indigenous youth in developing in-classroom and on-the-job experience and skills for the mining sector, incorporating digital tools and processes critical to modern mining operations. [Learn more in the 2022 edition of *Ore Magazine*]

Another key player in training Indigenous students for the mining industry is the Saskatchewan Indian Institute of Technologies (SIIT), an Indigenous-led post-secondary institution established in 1976 by Saskatchewan's Chiefs. With a mission to provide tailored programs and services to meet the unique needs of Indigenous students, over 90% of SIIT's student population identifies as Indigenous.

Thanks to its deep understanding of Indigenous communities and its collaboration with industry stakeholders for its programs, SIIT can connect Indigenous students with mining employment opportunities. Recognizing that "there is no point in training for the sake of training," SIIT focuses on programs that lead directly to employment. These programs are designed to build essential skills in communication, mathematics, and health and safety. Within just 12 weeks, students can secure placements with mining employers, often leading to immediate employment.

Further, through its personalized case management approach, SIIT ensures that individual students find the right career fit for them and are well-prepared for employment, addressing barriers such as transportation and pre-access requirements. With approximately 98% of SIIT graduates remaining in Saskatchewan after completing their programs, the institution's efforts have and continue to contribute significantly to increasing Indigenous participation in the mining workforce.

SUPPORTING SASKATCHEWAN'S MINING LABOUR MARKET

The Government of Saskatchewan recognizes the importance of a skilled workforce in maintaining the province's mining sector. As part of its Saskatchewan Labour Market Strategy, the Ministry of Immigration and Career Training is

Ashton Keyes,

Intern at Nutrien Vanscoy

Ashton Keyes, an intern with Nutrien Vanscoy's Shaft & Hoist Maintenance team, is gaining valuable hands-on experience in the mining industry. Currently enrolled in the Mining Engineering Technology program at Saskatchewan Polytechnic, Ashton is driven by his interest in geology and engineering. "Geology is fascinating to me," he says, "especially how we apply advanced equipment in the lab to real-world scenarios."

The internship has given Ashton unique opportunities to apply his classroom knowledge in the field. "What surprised me most was the scale of operations underground and just how hot and humid it can get," Ashton shares, reflecting on his initial tour at the Vanscoy mine site.

His role has allowed him to build critical skills in organization and planning while maintaining the mine's shafts and hoists. "I've gained so much, from planning daily orders for my department to participating in major projects," he says. This hands-on experience has only solidified his ambition to become a surveyor, a goal he set upon entering the program.

Ashton is set on being an example in his community; he says, "I want to show that young people like me have the potential to be successful in difficult fields of work." He encourages other Indigenous students to consider the Mining Engineering Technology program, noting its capacity to challenge and inspire. "Through this program, you can learn many work and life skills. It opens doors to challenging and incredibly rewarding opportunities.

> **"I want to show that young people like me have the potential to be successful in difficult fields of work.**
>
> **– ASHTON KEYES, AN INTERN WITH NUTRIEN VANSCOY'S SHAFT & HOIST MAINTENANCE TEAM**

focused on removing barriers and ensuring that workers have the skills necessary for emerging opportunities in the resource sector. This includes supporting initiatives like the brokering of Sask Polytech's Radiation and Environmental Monitoring Technician Applied Certificate through Northlands College and the newly launched Dziret'ái Pilot Training program, which offers commercial pilot training to Indigenous students in northern Saskatchewan and is also supported by fly-in/fly-out mining companies Cameco, Orano and SSR Mining.

"For example, the province recently supported a new PVC welding micro-credential administered by North West College in partnership with the Saskatchewan Research Council. The program teaches learners how to weld plastic, a skill essential to supporting the processing of rare earth elements and critical minerals in Saskatchewan," said Richelle Bourgoin, Deputy Minister, Ministry of Immigration and Career Training.

Bourgoin also highlights the importance of Indigenous people's participation in the industry, "Increasing Indigenous participation in the natural resource industry is one of Saskatchewan's Growth Plan goals. Saskatchewan's young, fast-growing Indigenous population offers the province a competitive advantage when addressing labour needs."

The Government of Saskatchewan has partnered with the First Nations Natural Resource Center of Excellence to identify the barriers Indigenous people face when entering employment in the natural resource sector and develop strategies to connect Indigenous people to jobs in the industry. Bourgoin adds, "The government is also helping create opportunities for Indigenous people in the mining sector through a partnership with the International Minerals Innovation Institute (IMII) to support the delivery of Indigenous pre-employment programs through Morris Interactive.

Another critical aspect of the government's plan is credential recognition for newcomers, ensuring that skilled professionals from other regions or countries can contribute to the local workforce. This strategy is particularly relevant as Saskatchewan's mining industry continues to expand, especially in sectors like potash, uranium, gold, and other critical minerals. "

COLLABORATING TO DEVELOP THE WORKFORCE AND ACHIEVE SUCCESS

As the demand for natural resources continues to grow globally, Saskatchewan's mining industry must innovate in training delivery to meet its future workforce needs. *The 2024 Saskatchewan Mining Labour Market Report* identifies some of these novel approaches. Pam Schwann, SMA President, says that "industry welcomes innovations in technology and education, including the adoption of non-traditional training methods, accelerated training options, and marketing of career options to students from a diversity of backgrounds."

The collaboration between industry, government, and educational institutions ensures that Saskatchewan's mining workforce is prepared for today's challenges and well-equipped to handle tomorrow's technological advancements and demands. From virtual mine training to hands-on internships, Saskatchewan is building a future-ready workforce to continue driving its mining sector forward.

BHP

Earn while you learn!
Join BHP's Potash Academy

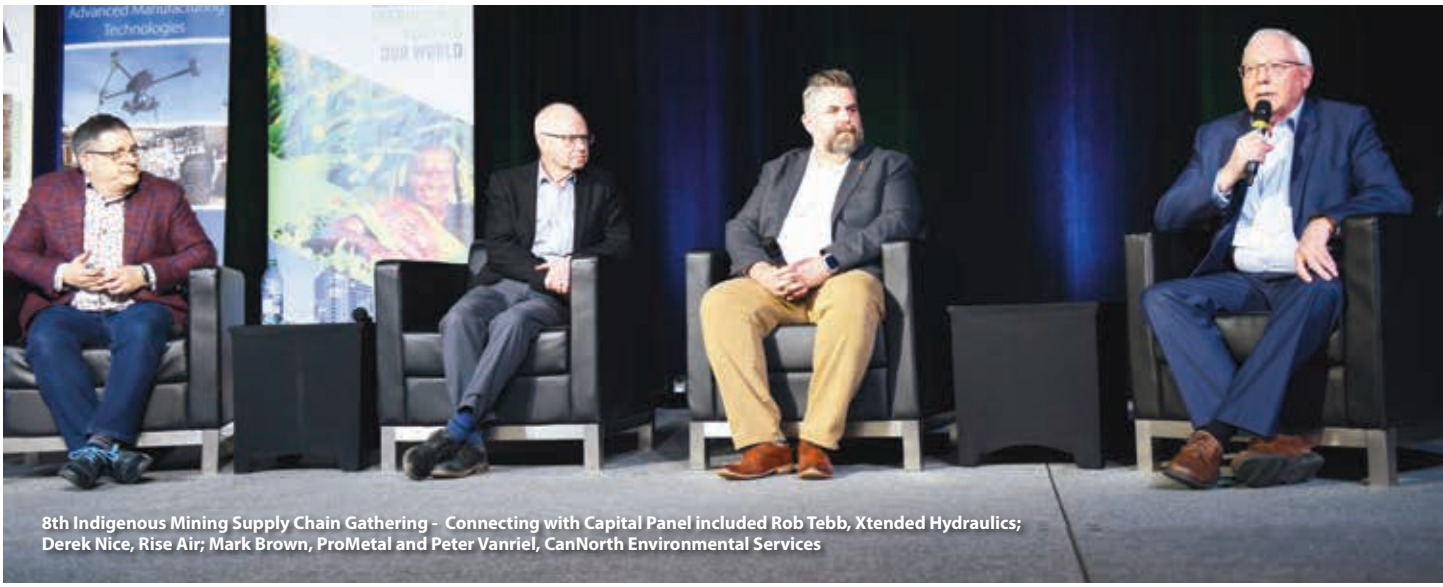
Our 8-month accelerated Potash Academy program, in partnership with Carlton Trail College, combines classroom learning with hands-on training in Humboldt. Graduates earn certificates in Mining Essentials and Applied Mechanics, preparing you for a rewarding career at the Jansen potash mine.

No experience? No problem!
Whether you're new to mining or have previous experience in manual hands-on roles, we'll provide all the training you need to succeed.

Ready to take the next step in your career?
Scan the QR code to learn more and apply today!

DIVERSITY IN SASKATCHEWAN'S MINING SUPPLY CHAIN

Indigenous suppliers are increasingly becoming vital to the mining industry's supply chain, offering services and products and fostering stronger relationships with local communities. Companies like K+S Potash Canada (KSPC) are actively working to integrate Indigenous businesses into their procurement processes, benefiting both the company and the communities they serve.



8th Indigenous Mining Supply Chain Gathering - Connecting with Capital Panel included Rob Tebb, Xtended Hydraulics; Derek Nice, Rise Air; Mark Brown, ProMetal and Peter Vanriel, CanNorth Environmental Services

Melissa Shepherd, Manager of Indigenous Relations at KSPC, underscores the company's commitment to these relationships, noting, "Through our procurement practices, we continuously look to build opportunities for Indigenous businesses." This proactive approach includes engaging with Indigenous-owned and partnered businesses across various services at their Bethune mine and the head office in Saskatoon. The company strives to create long-term, sustainable business opportunities that benefit Indigenous communities and KSPC. "We truly believe in building relationships and creating opportunities for Indigenous-owned and partnered businesses, which can have lasting economic benefits to communities and KSPC," she adds.

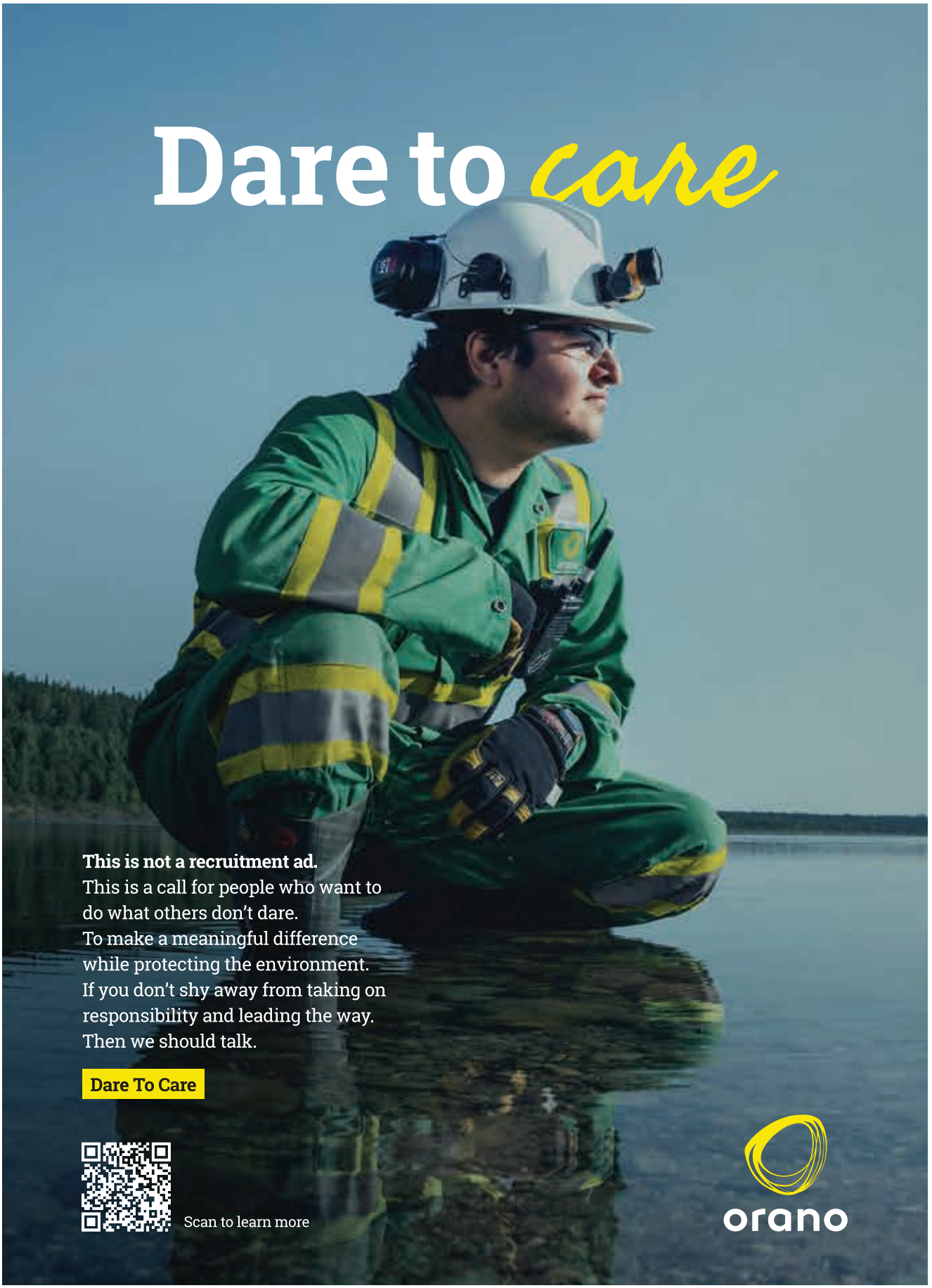
One organization helping bridge the gap between Indigenous suppliers and the mining sector is the Indigenous Manufacturing and Contracting Network (IMCN). IMCN offers valuable insights into Indigenous economic development. Nick Crighton, Executive Director of IMCN, highlights the importance of partnering with the Saskatchewan Mining Association: "It is great to see the participation in the annual Indigenous Supply Chain Gathering increase year after year, and hopefully, that continues. It shows that the industry is committed to Indigenous engagement."

"IMCN is a growing network that is Indigenous-led and governed, and we are striving to meet the needs of our members. We will continuously advocate for our members' needs in the private and public sectors. We will also continue to encourage industry to engage with Indigenous economic development corporations and seek their participation in major projects from the start before they are even announced," Crighton advises.

Beyond building a supply chain, the mining industry is becoming more attuned to Indigenous communities' cultural and economic needs. Companies like KSPC work closely with local Indigenous leaders to ensure their partnerships benefit the community. For instance, KSPC vets businesses partnered with Indigenous communities annually to confirm that these partnerships continue to generate positive impacts.

Across the board, whether considering potash, uranium, or metallic minerals mines, Saskatchewan's mining industry shows significant engagement with Indigenous businesses. In 2023, of the more than $2.8 billion of goods and services purchased from Saskatchewan suppliers by the mining sector, over $670 million were purchased from Saskatchewan Indigenous-owned businesses. These figures reflect the industry's dedication to supporting Indigenous economic development and ensuring mining operations positively impact local communities.

"Saskatchewan's mining sector has been a globally recognized leader in developing and diversifying the mining supply chain for Indigenous-owned businesses for many decades," observes Pam Schwann, SMA President. Today, businesses like Kitsaki Management Limited Partnership, Athabasca Basin Development, Des Nedhe Developments, Saskatoon Tribal Council Industrial Group, George Gordon Developments and Peter Ballantyne Group of Companies are all key partners of Saskatchewan's mining industry, with many expanding operations across Canada. As Indigenous businesses diversify their portfolios, their integration into the mining supply chain continues to grow, leading to mutual long-term benefits for mining companies and communities.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In each edition of ORE, we go beyond the official bios to give our readers insight into the leaders of Saskatchewan's mining and exploration companies.

KARINA GISTELINCK

BHP'S ASSET PRESIDENT POTASH, ON LEADERSHIP, COLLABORATION, AND LIFE IN SASKATCHEWAN

Karina Gistelinck, BHP's Asset President Potash, is no stranger to leadership in the mining industry. Overseeing the development of the Jansen Potash mine in Saskatchewan, Karina's role is as dynamic as the landscape she operates in. "There truly is no typical day," she reflects, highlighting the broad range of responsibilities that come with preparing for production at Jansen Stage 1, which is slated to commence in late 2026. From workforce planning to stakeholder engagement, Karina's job touches on every aspect needed to run a successful mine, with the overarching goal of ensuring safety and efficiency from day one.

According to Karina, one of the most exciting aspects of her position is the chance to engage with various external stakeholders, including Indigenous partners, local governments, and community members. "I love connecting with external stakeholders, including peers across the industry here in Saskatchewan and abroad," she says. This is a testament to BHP's focus on collaboration, with Karina often emphasizing the importance of working together to elevate industry standards, particularly in the areas of safety and sustainability. The scope of her work reflects BHP's broader vision of not just building a mine but establishing a legacy for the community and region that will last for generations.

Karina's journey to this leadership role is just as inspiring as her work today. Born in Brazil and raised across different parts of the world, she was practically destined for a career in mining. "My father worked in mining, and I like to say that mining runs in my blood," she shares with a laugh. After beginning her career in consulting, Karina switched to in-house roles with some of the most influential companies in the industry. Following stints at Vale and Rio Tinto, where she worked in Canada, her love for the country was solidified. In 2021, she joined BHP as Chief Strategy Officer, quickly becoming an integral part of the leadership team. Just a short time later, the opportunity to lead the Jansen project presented itself, and Karina leapt at the chance.

With its vast prairies and welcoming communities, Saskatchewan has become Karina's home over the past year. "My entire family is absolutely loving it here," she says. From ice fishing in the winter to canoeing on the province's beautiful lakes in the summer, Karina and her family are making the most of their time in Saskatchewan, fully embracing what she describes as the "prairie dream." However, it's not just the province's natural beauty that has made the transition smooth. "The people of Saskatchewan are so generous, welcoming, and warm," Karina notes, adding that their roll-up-your-sleeves mentality aligns perfectly with her values.

Balancing work and personal life is something Karina excels at, "my first job is to be a mom for my three kids," she says, but when asked about her driving force, her answer is clear: making a difference. "That's really what gets me out of bed every day," she adds. Karina is passionate about creating positive change, whether working with her team to solve complex challenges at Jansen, doing activities and supporting her kids, or helping uplift the local community through volunteering. It's no surprise that one of her key pieces of advice to others is to "invest in your teams," a philosophy she lives by. She also believes in investing in one's continuous personal development, "My target is to read at least one book per week or 54 books per year. I'm not quite there yet this year, but I'll catch up," she shares candidly.

For Karina, the future is bright. With Jansen Potash mine's first phase nearing completion, she's looking forward to watching the project take shape and continue contributing to the region's economic and social fabric. As she continues her leadership journey in Saskatchewan, one thing is sure: Karina Gistelinck is not just building a mine; she's building a future for all those involved.

Karina Gistelinck

Karina Gistelinck

"The people of Saskatchewan are so generous, welcoming, and warm," Karina notes, adding that their roll-up-your-sleeves mentality aligns perfectly with her values.

Pathways to Decarbonization in Saskatchewan's Mining Industry:

LEADING THE CHARGE TOWARD A GREENER FUTURE

As the world intensifies its focus on combating climate change, Saskatchewan's mining industry is at a pivotal moment. Companies across the sector are taking bold steps to decarbonize their operations. They are at the forefront of this transformation, implementing comprehensive decarbonization initiatives and pioneering new technologies to reduce their carbon footprint and promote sustainability for a greener future.

Operating in remote northern Saskatchewan, uranium miner Orano Canada faces unique challenges in decarbonization. The company addresses these by collaborating with local communities and stakeholders to implement sustainable practices, enhancing energy efficiency in its facilities, and investing in research and development of low-carbon and reduced environmental footprint technologies to mine the ore, such as the SABRE (Surface Access Borehole Resource Extraction) mining method. [See story in 2022 *Ore Magazine*.]

Also operating in the province's north, Foran Mining is designing the McIlvenna Bay Project to be as energy-efficient as possible. It will use clean power provided by two nearby hydroelectric dams, reducing operational emissions, a fleet of underground electric vehicles providing low-emission transportation, and a state-of-the-art tailings storage facility to reduce its carbon and environmental footprint.

With its operation of uranium mines and mills in Northern Saskatchewan, Cameco Corporation is committed to reducing its GHG emissions by 30% by 2030 (30 by 30), a goal deeply integrated into its climate strategy. Hadia Butt, Senior Engineer for Decarbonization, leads Cameco's efforts, emphasizing a broad and impactful approach to decarbonization.

"My role involves leading energy and emissions reduction initiatives to support our 30 by 30 public target," explains Butt. "In addition, my responsibilities include identifying climate-related physical risks, developing adaptation measures, and building resilience across our operations."

Cameco's decarbonization projects are innovative and span multiple sites. One such project is the Ventilation on Demand system at McArthur River, which automates underground ventilation to optimize energy use while maintaining safety standards. In addition, the company is undertaking energy efficiency improvements, including LED retrofits at all its sites and solar wall installations at its Port Hope Conversion Facility. These initiatives reduce Cameco's Scope 1 (direct) and Scope 2 (indirect – electricity usage) greenhouse gas emissions while contributing to long-term energy savings. "At our Port Hope Conversion facility, we are in the process of installing an economizer on our boiler systems to recover heat from the flue gases. This heat can be used elsewhere on site for process or building heat, reducing natural gas needs," adds Butt.

SMRs offer valuable experience for deploying next-generation reactors, which will be critical for achieving a net-zero economy in Saskatchewan."

Butt is particularly proud of the company's forward-looking approach, noting, "We have a concrete path forward to reduce our carbon footprint with our tailored decarbonization pathways for each site. As Cameco energizes a clean-air world by providing fuel to generate clean electricity to lower global greenhouse gas emissions, we are leading by practice by reducing our own emissions at home."

Meanwhile, in the south of the province, Mosaic's comprehensive sustainability strategy also focuses on water conservation and land reclamation, demonstrating a holistic approach to environmental management. In addition, it employs advanced technologies to improve efficiency in potash and phosphate production and is investing in renewable energy projects to diversify its energy portfolio.

K+S Potash Canada (KSPC) is also committed to decarbonization, though it faces unique challenges due to the significant heat requirements of its solution mining operations. Recognizing that fully sustainable technologies are still in development, KSPC has adopted proven methods while keeping an eye on future innovations.

"For our heat and power needs, we're utilizing proven technologies like cogeneration to efficiently use natural gas by generating heat and electricity simultaneously," says James Wirth, Director of Sustainable Energy Solutions at KSPC.

KSPC's investment in cogeneration allows for flexible power generation, further allowing the company to integrate renewables into its operations seamlessly. KSPC is already participating in SaskPower's Renewable Partnership Offering and working with an Indigenous partnership through the Renewable Access Service program, whereby KSPC, as an industrial customer, can purchase renewable power directly from the Indigenous partner as an Independent Power Producer. "Through these programs, dedicated renewable output can provide most of our electrical load capacity, including solar. Combined with cogeneration, this will significantly reduce our emissions," explains Wirth.

In addition to cogeneration, KSPC is preparing for the future by exploring carbon capture and storage (CCS) technology. Wirth notes that KSPC's cogeneration facility is configured to integrate CCS as the technology matures. "We believe collaboration with industry partners and Crown corporations on concepts like Carbon Hubs could de-risk these challenging projects and grow our workforce capacity."

Another potential avenue for decarbonization is using small modular nuclear reactors (SMRs). Wirth highlights that while the first generation of SMRs may not fully meet the heat needs of KSPC's operations, they could provide beneficial insights and training opportunities for future deployments. "SMRs offer valuable experience for deploying next-generation reactors, which will be critical for achieving a net-zero economy in Saskatchewan."

Both Cameco and KSPC exemplify Saskatchewan's mining industry's determination to decarbonize while maintaining operational excellence. By combining immediate, proven solutions with long-term technological exploration, these companies are setting the stage for a more sustainable future in mining.

With its unique challenges and opportunities, Saskatchewan's mining industry is poised to lead by example in the global decarbonization effort. Through targeted initiatives, forward-thinking collaborations, and a commitment to innovation, the province's mining companies are charting a path toward a net-zero future.

Skyler Hladun

TAGGING ALONG *with* SKYLER HLADUN

Professional engineer and fire chief, It's all in a day's work …

When you like taking things apart, fixing and improving them, and you've had the Mosaic Esterhazy mine nearly in your backyard growing up, a career as a Mill Maintenance Superintendent is a natural career path. It's Skyler Hladun's journey.

After graduating from the University of Regina with a bachelor's degree in applied science in industrial systems engineering, Skyler felt the pull to return to his roots near Esterhazy, Saskatchewan. "I worked as a contractor at Mosaic's Esterhazy K2 mill as a summer student and loved the complexity and variability of the work that goes into making different products. Being close to home and working in the potash industry was perfect," says Skyler.

As a new graduate, he joined Mosaic's K2 mine as a maintenance engineer underground eight years ago and, within four years, was promoted to a supervisor role within the maintenance unit. As if that wasn't challenging enough, Skylar also studied and obtained his Master of Business Administration. Fast forward to the summer of 2023, when he took on his current role as a maintenance superintendent.

Skyler explains that although there are daily tasks as the maintenance superintendent, every day is different. "Each day, I look at the daily production requirements and assess whether there is room to perform any maintenance without affecting plant productivity. Aside from overseeing budgeting, forecasting and capital allocation processes, I also engage with employees on the floor. As a team leader, being present with the team is important and is a big part of what makes my job enjoyable."

For Skyler, it's a good day when the team can work together to improve the equipment and its maintainability while maximizing production.

(continued next page)

> **"There are so many opportunities. Whether you want to be an industrial mechanic, electrician, engineer, or operator, there are so many roles that can help you grow your career.**

"With Mosaic's diverse workforce, there are always different thought processes and ideas that we can pull from to solve problems and improve our work. On the maintenance side, there are many pieces of equipment to learn from and from which to troubleshoot issues."

However, overseeing maintenance is not Skylar's only leadership role at K2. He is a K2 Fire Chief. He serves on the Emergency Response Teams (ERT) at K2 and K3 mines. "I prepare rescue plans, help organize training for our team and ensure that we have adequate resources. And when our K2 ERT is called upon, I lead the team in performing rescues. Having a well-trained team and being there when our colleagues need us most is very fulfilling for me," says Skyler.

Skyler lives and breathes mining, and it shows every time he volunteers to represent Mosaic at career fairs and during local high school visits to share what the potash industry has to offer. I tell them, "There are so many opportunities. Whether you want to be an industrial mechanic, electrician, engineer, or operator, there are so many roles that can help you grow your career. Trade roles are in great demand now, and there's no end in sight. They are so important to mining operations. If you want to be hired the day you graduate, get a trade!"


Skyler Hladun

Mining for the Future

At Cigar Lake, the innovative jetboring mining method loosens the ore with jets of high-pressure water. Courtesy of Cameco

Despite many people carrying an old-fashioned image of mining in their mind, often perpetuated by ancient stereotypes in blockbuster movies, if you take the time to talk with today's miners, they'll tell you that their job is genuinely high-tech. Technological advances and innovation aren't just buzzwords or theoretical research that happens in laboratories; they play a critical role in the mining industry. They help improve process efficiency and productivity. They assist in addressing safety and environmental concerns. They provide quality assurance and can even help reduce costs.

Today, exploration and mining companies use drones for large-scale, detailed surveys to obtain highly accurate, high-resolution maps, models, and data. Draganfly, a local drone manufacturer, works with the industry to develop commercial solutions that make collecting, processing, and using the aerial data they need easier. Other Saskatchewan manufacturers, like Prairie Machine, design and manufacture custom equipment using the latest 3D modelling and automation technologies to solve challenges and increase productivity at diverse mining operations.

"The mining and minerals industry in Saskatchewan utilizes vanguard technologies in its processes, such as automated or remote-controlled machinery and advanced monitoring systems to collect and analyze large amounts of data," says Al Shpyth, Executive Director of the International Minerals Innovation Institute (IMII) in Saskatoon. "Improving safety and productivity is a significant driver of innovation in the industry. The focus is removing workers from potentially hazardous activities through automation and using autonomous or remote-controlled equipment to mine more efficiently."

The jet-boring system (JBS) at Cameco's Cigar Lake uranium mine in northern Saskatchewan is a perfect example of using semi-autonomous technology to safely mine the high-grade ore deposit. Cameco and Orano developed the technology, which uses a high-pressure water jet to cut through the frozen ore before it is processed and readied to be transported to Orano's McClean Lake milling facility. Today, this one-of-a-kind mining technique has been perfected using AI.

"In 2019, Linda Bray, a Cameco employee, participated in one of our IMII events and saw the potential that big data and artificial intelligence (AI) could help solve some of the challenges they had mining at Cigar Lake. It didn't take long for her to convince Cameco's leadership team to invest in an AI research project. Our IMII team helped make the bridge with Saskatchewan Polytechnic's Digital Integration Centre of Excellence Technology Access Centre (DICE-TAC). In addition to IMII financial support, the project secured funding from Mitacs, a national non-profit organization supporting research and internships in partnership with academia, industry and government to secure student internships as part of this five-year project. This is a Saskatchewan problem being solved by Saskatchewan

DEMOday 2024. Courtesy of IMII

Recipient of 2024 Innovation Award for Most Novel Innovation. Courtesy of IMII

people, with national level attention and support," explained Al Shpyth.

Today, after providing billions of data points, including geology, rock mechanics, and ore freeze data, to the DICE-TAC team to feed their graph database program, which contains AI software, Cameco can estimate ore grades and other factors better and faster than using its conventional engineering methods and feed the information to its JBS to mine precise targets more accurately.

Potash mining operations also use their fair share of technological advances and digitization. They can rely on local companies to provide custom-made solutions to their specific needs. One such local company is Rayhawk, which supplies autonomous railcar loading solutions. "Our systems seamlessly integrate computer vision, machine learning, and autonomous operations to ensure safe, reliable and efficient rail loading operations," says Rayhawk's President & CEO Tom Boehm.

"Our systems provide various safety precautions. For example, we can delineate the autonomous area to eliminate operation when personnel are within the working area. We can program motor torque limits to protect against damage to motors and equipment and install emergency stops. Another example of the application of advanced technology is our multiple cameras intelligent vision system, which detects the state of each railcar's latches and lid and uses motion control algorithms to open the latches and lids. By automating the process of opening and closing rail cars, we're addressing safety concerns and allowing workers to put their time, brains and ability into more meaningful tasks that streamline the operation and strengthen their company; that's efficiency," Tom adds.

> **"Our systems provide various safety precautions. For example, we can delineate the autonomous area to eliminate operation when personnel are within the working area."**
>
> **– TOM BOEHM, RAYHAWK'S PRESIDENT & CEO**

In addition to offering many opportunities to innovate to increase worker safety and production efficiencies, the industry's search for and adoption of new technologies also promotes sustainable production, such as Foran Mining's McIlvenna Bay copper project proposed for development in northern Saskatchewan. The mine is being designed to take advantage of the latest technological advances, including using less water in its milling process, relying on clean power provided by two nearby hydroelectric dams to reduce operational emissions, and deploying a low-emission fleet of underground electric vehicles, among several other solutions to reduce the proposed mine's carbon footprint and environmental impact.

In support of the industry's environmental goals, in 2023, for its 5th DEMOday, IMII invited five innovative solutions providers to pitch their technologies during the 15th Annual Saskatchewan Mining Supply Chain Forum. The five invitees' novel technologies focused on advanced chemicals, emissions reductions, energy efficiency and water solutions.

"DEMOday opens the door to considering the proposed innovations for financial and in-kind support to help move them down the path to commercialization through further development, demonstration or deployment. Although the projects presented at DEMOday are not yet deployed widely in the industry, they are being tested within some mining companies' operations. This year, with ten invitees, our 6th DEMOday focused on corrosion mitigation/prevention, electrification, emissions, geology, production efficiency, safety solutions, and tailings management. IMII supports the industry as it moves forward and creates the mines of tomorrow by solving challenges through innovation and technology. Emerging technologies are helping future-proof the mining and minerals industry so they can continue to play an essential role in overcoming global challenges such as decarbonization, feeding a growing world population and meeting the clean energy needs of increased global urbanization," says Al Shpyth.

Saskatchewan is known for its abundant natural resources; with its mining industry's use of machine learning and intelligent technology, it is also emerging as an innovative jurisdiction to do business and grow a career.

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RESOURCE MAP OF SASKATCHEWAN

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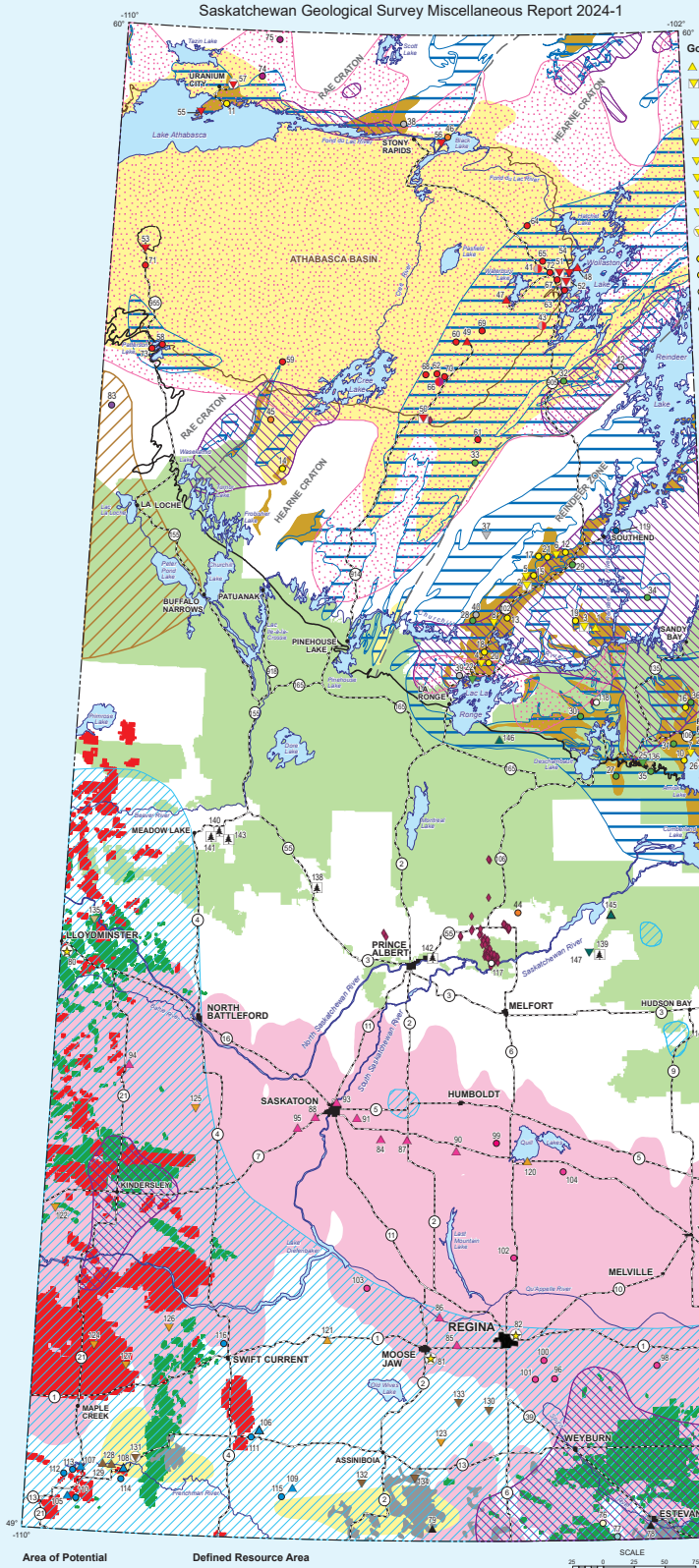

Metallic Minerals

Gold

1. Santoy mining complex
2. Jolu (mill, suspended 2014; mine, closed); Jasper–James (mines, closed)
3. Seabee
4. Contact Lake
5. Decade (Mallard Lake)
6. Komis, EP
7. Prince Albert (Monarch)
8. Roy Lloyd (suspended 2014)
9. Bootleg, Newcor, Henning–Maloney
10. Amisk or Laurel Lake
11. Box, Athona
12. Golden Heart
13. Greywacke
14. Ithingo
15. JoJay
16. Manson Bay (MAN-1)
17. Memorial
18. North Lake
19. Porky Lake
20. Preview–PAP
21. Tower Lake, Corner Lake, Birch Crossing

Copper, Zinc and/or Lead

22. Anglo Rouyn
23. Birch Lake
24. Flin Flon, Callinan
25. Western Nuclear (Hanson Lake)
26. Konuto Lake, Flexar, Coronation
27. Bigstone Lake
28. Borys Lake (Watts)
29. Brabant–McKenzie
30. Brownell Lake
31. FON, Abbott Lake
32. George Lake
33. Janice Lake
34. Knife Lake (Mokoman)
35. McIlvenna Bay
36. Schotts Lake

Copper, Nickel, Cobalt and/or Platinum Group Elements

37. Rottenstone
38. Axis Lake
39. Dunlop
40. Gochager Lake
41. Midwest (Main & A)
42. Swan Lake
43. West Bear

Iron

44. Kelsey Lake
45. Nyberg Lake or VH (Vern Hogg)
46. Triana Iron

Uranium

47. Cigar Lake
48. Eagle Point
49. McArthur River
50. Key Lake
51. McClean Lake
52. Rabbit Lake
53. Cluff Lake
54. Collins Bay, Collins Bay A
55. Gunnar
56. Nisto
57. Uranium City region (*e.g.*, Ace, Fay, Verna)
58. Arrow
59. Centennial
60. Fox Lake
61. Fraser Lakes B Zone
62. Gryphon

Energy Materials

63. Horseshoe, Raven
64. Hurricane Zone
65. Huskie, Tthe Heldeth Túé (formerly J-Zone), Roughrider
66. Maw Zone
67. McClean Lake (Caribou, McClean North, Sue D, Sue E)
41. Midwest (Main & A)
68. Millennium
69. Paul Bay, Ken Pen and Orora
70. Phoenix
71. Shea Creek (Anne, Colette, Kianna)
72. Tamarack
73. Triple R
43. West Bear

Rare Earth Elements

74. Alces Lake
75. Hoidas Lake/ JAK zone
66. Maw Zone

Lithium

76. Arizona Lithium

Geothermal

77. DEEP pilot well

Coal

78. Estevan
79. Poplar River

Petroleum

80. Lloydminster upgrader
81. Moose Jaw refinery
82. Regina refinery
83. Simonson Lake

Industrial Materials and Gemstones

Potash and Salt

84. Allan
85. Belle Plaine
86. Bethune
87. Colonsay
88. Cory
89. K-1, K-2 and K-3 Esterhazy
90. Lanigan
91. Patience Lake
92. Rocanville
93. Saskatoon processing facility
94. Unity
95. Vanscoy
96. Albany
97. Bredenbury
98. Broadview
99. Jansen
100. Kronau
101. Milestone
102. Southey
103. Tugaske
104. Wynyard

Helium[4]

105. Battle Creek helium gas plant
106. Cadillac helium gas plant
107. Cypress helium gas plant
108. Eastend helium gas plant
109. Mankota helium gas plant
110. Battle Creek area (5 wells)
111. Cadillac area (7 wells)
112. Consul area (2 wells)
113. Cypress area (3 wells)
114. Eastend area (1 well)
115. Mankota area (4 wells)
116. Wilhelm area (2 wells)

Diamonds

117. Orion South
118. Pikoo

Graphite

119. Deep Bay

Sodium, Magnesium and Potassium Sulphate

120. Big Quill
121. Chaplin
122. Alsask Lake
123. Horseshoe Lake
124. Ingebrigt South
125. Palo (Whiteshore Lake)
126. Snakehole Lake
127. Vincent Lake

Clay

128. Plainsman quarry
129. Ravenscrag quarry
130. Truax
131. Eastend region (*e.g.*, Knolly, Old Pit)
132. Gollier Creek
133. I-XL quarries, Dominion Firebrick, A.P. Green region
134. Midland, Estevan 72H region

Silica Sand

135. Canfrac
136. Hanson Lake
137. Red Deer River quarry

Forestry and Horticulture

Forestry

138. Carrier Forest Products
139. Dunkley Lumber
140. NorSask Forest Products
141. Paper Excellence (Meadow Lake)
142. Paper Excellence (Prince Albert)
143. Tolko
144. Weyerhaeuser

Peat and Leonardite

145. Ravendale peat bog
146. Wapa Bay lignite-leonardite deposits
147. Carrot River plant and bogs

Footnotes:

[1] Lithium potential north of the Phanerozoic Basin edge is mineral sourced and lithium potential south of the Phanerozoic Basin edge is brine sourced.

[2] Producing mine includes plants, processing facilities and quarries. Past-producing mine includes quarries.

[3] Exploration projects shown on the map are those with existing NI 43-101–compliant Mineral Reserve/Resource estimates, some with historical (non-NI 43-101–compliant) resource estimates and other selected projects.

[4] Single well helium purifiers have not been identified on this map.

Area of Potential

- Base metal potential
- Bitumen (oil sands) potential
- Gold potential
- Helium potential
- Lithium potential[1]
- Rare earth elements potential
- Uranium potential

Defined Resource Area

- Coal field
- Commercial forestry
- Gas pool
- Oil pool
- Potash and salt area

- Kimberlite
- Forest products mill
- Petroleum processing/refining
- Producing mine[2]
- Past-producing mine[2]
- Exploration project[3]
- Mill with past-producing mine[2]
- Grouping of past-producing mines within a region[2]

SCALE

25 0 25 50 75 Kilometres

25 0 25 50 Miles

- Exploration project with multiple commodities
- Phanerozoic Basin edge
- Athabasca Basin edge
- Cratonic boundaries
- Road
- City
- Town

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