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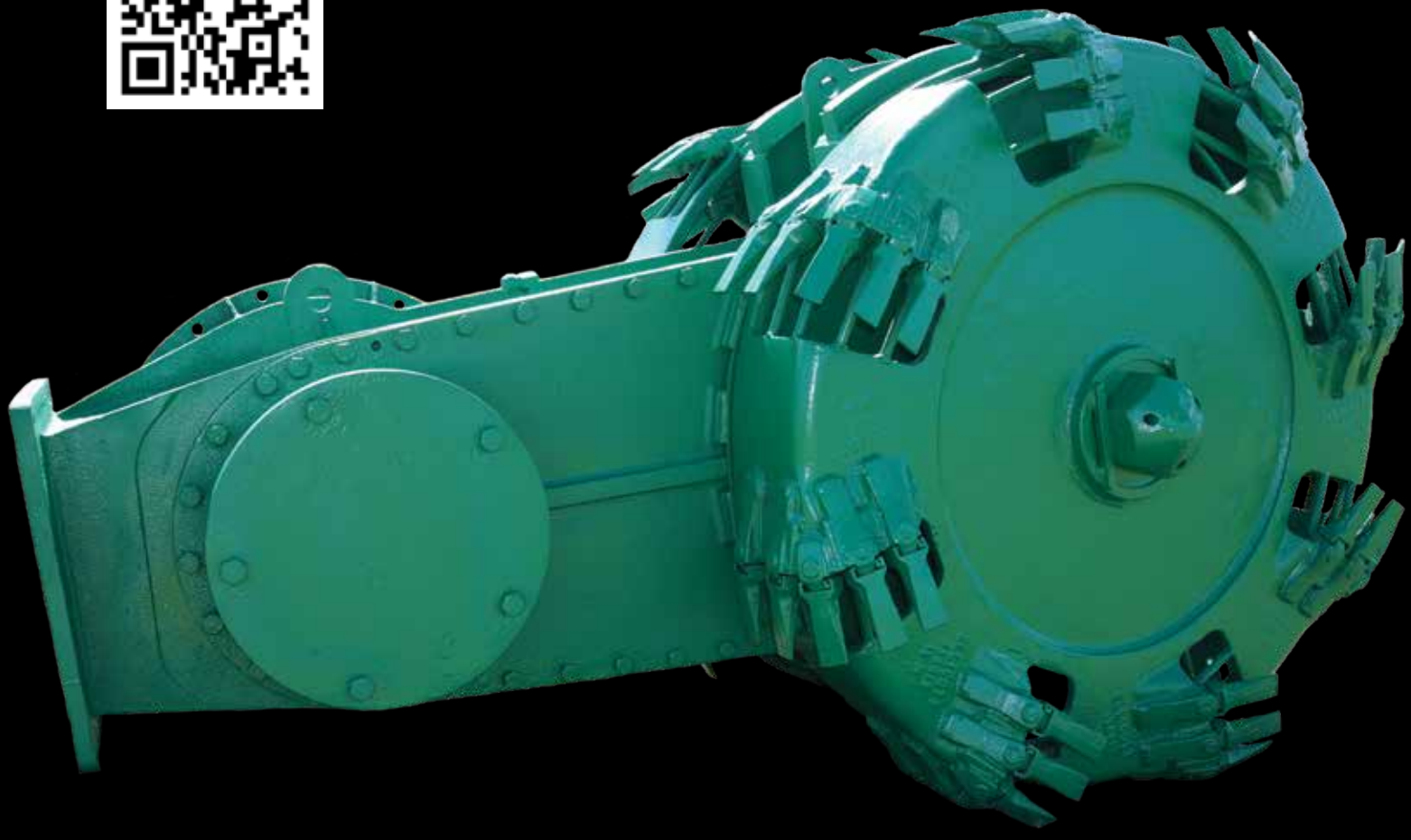

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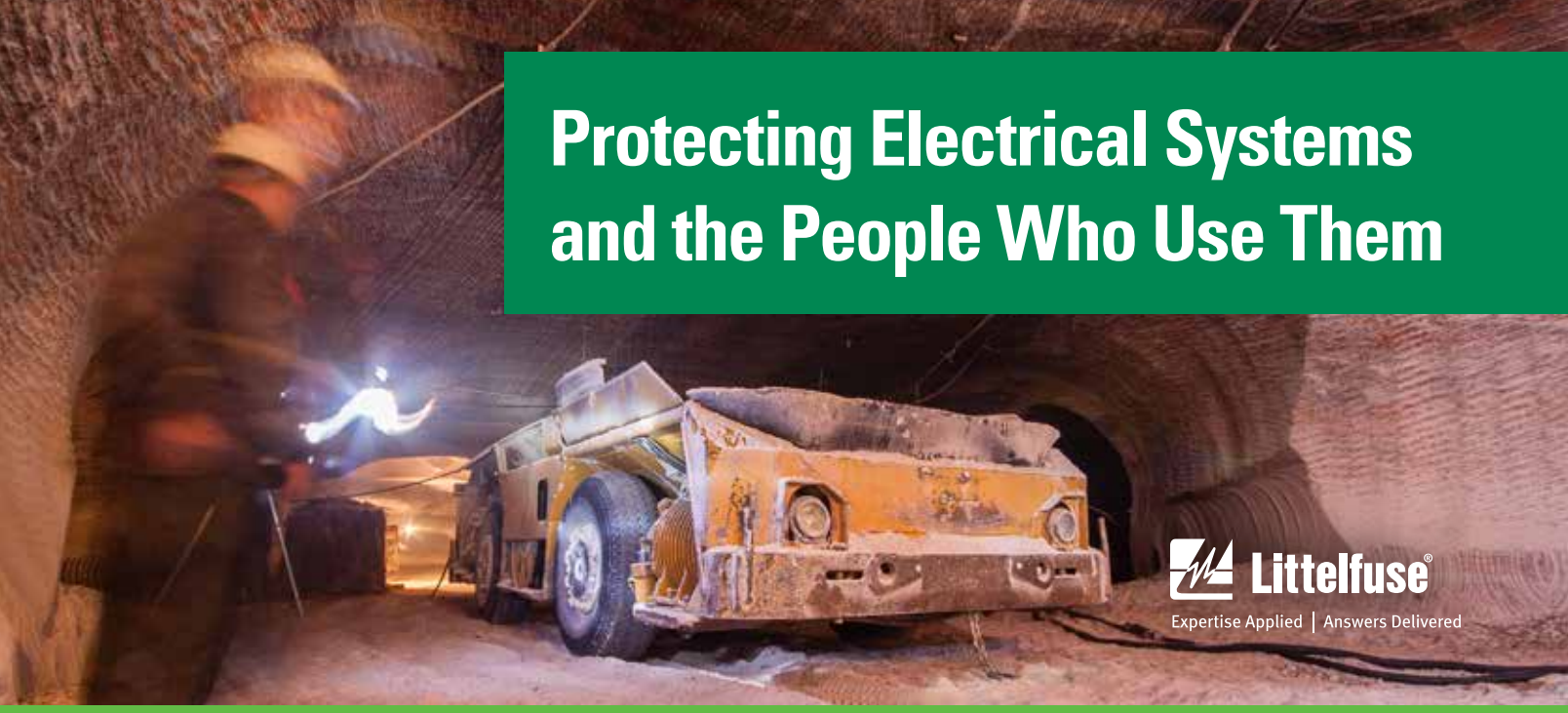

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MESSAGE FROM THE EDITOR
SHAYNA WIWIERSKI

Welcome to the latest edition of *PotashWorks* magazine, where we delve into the rich tapestry of the potash industry, highlighting remarkable individuals and cutting-edge technological advancements that continue to shape this thriving sector.

In this issue, we proudly showcase stories that exemplify the essence of dedication and innovation within the potash community. One of our feature stories takes us on a journey celebrating the remarkable 55-year legacy of Nutrien's Lanigan mine site. This milestone not only marks a significant period in the industry's history, but also serves as a testament to the enduring commitment and expertise of the workforce behind this iconic operation. We dive into the story of a long-standing employee whose unwavering dedication has been an integral part of Lanigan's success, encapsulating the spirit of perseverance and excellence that defines the potash industry.

Furthermore, we bring you an insightful exploration into the realm of technological advancements with a detailed look at sensor-based sorting test work conducted for potash operations. The groundbreaking research submitted by the Saskatchewan Research Council (SRC) unravels the potential for enhancing efficiency and precision in potash mining processes. This innovative approach underscores the industry's continuous quest for excellence, pushing boundaries to optimize operations and maximize resource utilization.

The stories within these pages highlight not just achievements, but the people behind them—the miners, engineers, researchers, and visionaries whose unwavering commitment and ingenuity drive the evolution of the potash industry. Their collective efforts not only ensure the sustainability of operations, but also pave the way for a more efficient, environmentally conscious, and technologically advanced future.

As we navigate the ever-evolving landscape of the potash sector, it's essential to recognize the interconnectedness of tradition and progress. The rich heritage of mining practices and the expertise passed down through generations blend seamlessly with cutting-edge innovations, fostering a dynamic environment ripe for groundbreaking discoveries and continuous improvement.

At *PotashWorks*, we take pride in being the conduit for sharing these compelling narratives, serving as a platform to celebrate achievements, share knowledge, and inspire progress within the potash community. We invite you to immerse yourselves in these stories, to learn, to celebrate, and to be inspired by the remarkable individuals and advancements shaping the future of potash.

As we embrace the challenges and opportunities that lie ahead, let us remember that it is the collaborative efforts, unwavering dedication, and relentless pursuit of excellence that fuel the engine of progress within the potash industry.

I'd also like to extend a special invitation to explore our *Potash Producer* e-newsletter, an exclusive publication delivered directly to your inbox three times a year. Serving as the online companion to *PotashWorks* magazine, the *Potash Producer* offers a deeper dive into captivating stories and features spotlighting the dynamic potash industry.

For a closer look at even more compelling narratives and insightful content, I encourage you to sign up for the *Potash Producer* via our official website at potashworks.com. Stay connected with the latest developments and immerse yourself in the vibrant world of potash through this invaluable resource.

Thank you for joining us on this enriching journey. We hope the stories within these pages ignite your curiosity and leave you inspired by the remarkable achievements and ongoing innovations in the world of potash.

Shayna Wiwierski
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MESSAGE FROM THE PREMIER OF SASKATCHEWAN **SCOTT MOE**

On behalf of the Government of Saskatchewan, I am pleased to provide an update on our provincial potash sector.

The best place in Canada to develop natural resources is Saskatchewan, thanks in large part to our world-leading potash mining industry. The future is bright for this sector, last year it surpassed $9 billion in annual sales, one of the key targets of our 2030 Saskatchewan Growth Plan.

Our ability to reach this target is due to the long-standing commitment industry partners have made in our province. Since 2005, the Saskatchewan potash industry has committed over $30 billion of capital investments to expand operations and develop new mines. This includes major projects like Nutrien's Rocanville expansion, Mosaic's K3 Esterhazy expansion, K+S Potash Canada's Bethune solution mine, and BHP's Jansen mine, which is currently under construction.

These substantial long-term investments reflect the stability of our potash mining industry and the value it brings to agriculture and food security around the world. This dependability is crucial to the sector as buyers are looking for more products from jurisdictions that are secure, politically stable, and reliable.

Amidst global uncertainty, potash producers in Saskatchewan increased operations to fill supply shortfalls, resulting in record production and value of sales for the province. Production in 2020 reached 13.7 million tonnes K_2O, followed by an increase to 14.2 million tonnes K_2O in 2021. In 2022, total production reached 14.4 million tonnes K_2O and helped contribute to Saskatchewan's overall mineral sales value of $19.4 billion, another provincial record.

I am proud to say that Saskatchewan is an indispensible supplier of food, fuel, and fertilizer to millions of people around the world. As the global population grows, food demand is on the rise, putting additional pressure on farmers to be more efficient and increase crop production.

Saskatchewan is ready and willing to step up and meet that demand by supplying more potash for the long-term. We can achieve this, as our province is fortunate enough to have the largest and richest potash deposits in the world.

The growth of this sector contributes significantly to our economy, employing thousands of people and accounting for 11 per cent of the provincial GDP. And this growth allows our government to invest in the people, programs, and projects that will make life better for everyone in our province.

The future for this industry is bright. Congratulations on your successes, and let's keep mining.

Scott Moe
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MESSAGE FROM THE MINISTER OF TRADE AND EXPORT DEVELOPMENT THE HONOURABLE **JEREMY HARRISON**

Saskatchewan has the food, fuel, fertilizer, and critical minerals the growing world needs. As the world's number-one producer of potash, the province is ready to be the stable supplier needed to ensure food security across the globe. Further to that, we are proud to be doing it all sustainably— helping to feed the world while producing 50 per cent fewer emissions than competing jurisdictions.

Saskatchewan stands firmly committed to advancing its priorities focused on growing the economy and protecting the people that call this province home. Saskatchewan is dedicated to creating a competitive business environment that stimulates both growth and innovation. The province continues to establish global connections to showcase our potential and attract investment into our province. We are connecting Saskatchewan with the world to find new ways to innovate while also allowing for new partnerships that benefit both Saskatchewan and our global partners. Saskatchewan places great emphasis on the continued expansion and development of its mining and potash sector, recognizing their crucial roles in sustaining economic prosperity and contributing to the province's growth trajectory. Saskatchewan aims to not only strengthen its economic standing, but also ensure the well-being and security of the diverse individuals and communities in our province.

Saskatchewan is fortunate to have some of the most innovative and successful potash companies in the world. They are truly exceptional, and we are proud of the work they do. They value innovation and diversity so that Saskatchewan can be world leaders in the potash sector. Because of them, Saskatchewan is able to feed the world while reducing emissions, which sets the bar for the world to follow. There is no plan to slow down either, the growth of the potash industry in the province continues.

Over the past 10 years (2013 to 2022), Saskatchewan exported over $69.2 billion of potash around the world, which accounts for 47 per cent of world exports. The Mosaic Company, K+S Potash Canada, and Nutrien Ltd. have each planned to increase potash production in a time of uncertainty surrounding global supply.

BHP is developing the Jansen potash mine, which is quickly becoming one of the largest potash mines in the world. They anticipate that the mine will be the most sustainable potash mine globally, once in operation. BHP has recently announced Phase 2 of their mine which will see an investment of an additional $6.4 billion and will officially transform Jansen into one of the world's largest potash mines, doubling its capacity.

Newer potash companies are also developing in the province. For example, Western Potash has a project that is expected to start production in early 2024.

Saskatchewan's potash industry has made some big strides, especially over the last year. In 2022-23, we surpassed the Saskatchewan Growth Plan target of annual value of potash sales to $9 billion, with a total of $17.4 billion.

Saskatchewan has an opportunity to expand its essential role in the global potash market in the years ahead. In response to the growing demand and escalating concern around global food security, Saskatchewan's potash sector is ramping up production and positioning itself to fill the major market gaps created by sanctions.

Our government continues its support of the potash industry. The industry has invested over $30 billion into expansions of existing mines and advancing

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exploration projects over the past 15 years. That includes the development of the province's first new potash mine in over 40 years. The industry continues to rapidly advance, and the Government of Saskatchewan continues to support the potash industry so that we can grow our communities and create sustainable long-lasting jobs in the province.

Saskatchewan's reputation in potash continues to foster investment and allow for resource companies to choose our province as their preferred place to do business. We lead the world in sustainable potash production, and it is something that the people of Saskatchewan can be proud of. As we continue feeding the world, we set the standard for the industry. Saskatchewan is very excited about the prospects of potash in the province and cannot wait to see what the future holds. ▲

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LOOKING BACK AT 2023

A YEAR (AND DECADES) IN REVIEW

BY STEVE HALABURA P.GEO., HALABURA POTASH CONSULTING LTD.

Readers of this magazine will know that I prepare a quarterly overview of what I see out there in the potash world.

This is also a time when I prepare a year in review, when I sift through the various news developments in potash and offer some form of prediction for the future. However, when I look back at my previous two columns, I don't have much to add, other than a promise to look back on markets and prices in Q1 2024 when my stalwart benchmark, the Province of Saskatchewan, releases its end-of-year data.

So maybe it's time for a broader deep dive... For instance, can we discern the future long game by examining the broader trends of the past several decades?

I came into the industry in the mid-1980s, well into the "great freeze" of 1971 to 2005. I call it that because during those years, there were no new potash mine developments. Why? Because overly optimistic market forecasts, coupled with ill-conceived government stimulus programs, led to an over-investment into the sector, resulting in over-capacity.

The great freeze lasted some 34 years. In Saskatchewan, it was a period of industry consolidation


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when the government of the day decided to consolidate the industry, resulting in the creation of the Potash Corporation of Saskatchewan, a government Crown corporation. The industry went from 10-plus separate mine owner/operators down to five.

The freeze began to thaw when several global factors came into play. First was the breakup of the Soviet Union, and with it, the collapse of the East German potash sector. Second, the privatization of PotashCorp (now Nutrien) and the return of free-market business processes. Third, the inexorable increase demand created by population growth.

In 2005, these forces led to an unprecedented rush for potash opportunities not only in Saskatchewan, but worldwide. It seemed everyone wanted their own patch of real estate, and tied to each, a three-million-tonne-per-year mine. Unfortunately, the "rush" was not so much about visionary entrepreneurs trying to close a supply market gap as it was about frothy capital markets and a general belief that potash was a mining play like gold or base metals.

The "great potash rush" ended when prices plummeted in 2013 due to a falling-out between Russian and Belarusian producers. In Saskatchewan, only two greenfield projects made it through to actual construction – BHP's Jansen conventional underground mine and K+S's Bethune conventional solution mine. Also surviving this collapse were a handful of smaller mining hopefuls who hung on to their lease holdings.

This mini-freeze lasted from 2014 to 2020. The collapse of potash as a speculative land play left many investors sour to the sector, and the revision of the Saskatchewan Mineral Tenure Act in 2016 eliminated the speculative aspects of a potash permit. Permits taken during the "great rush" were either dropped as anniversary dates approached or were converted to leases.

Over the period of several years, the commercial potash belt became a largely empty space of white, except for the long-time miners, new entrants BHP Billiton and K+S, and a smattering of smaller legacy projects.

In 2020, interest in potash returned, driven largely by market demand. A sense of stability returned to the sector, and one could more accurately make

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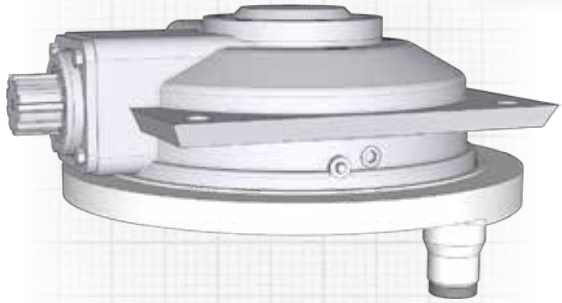

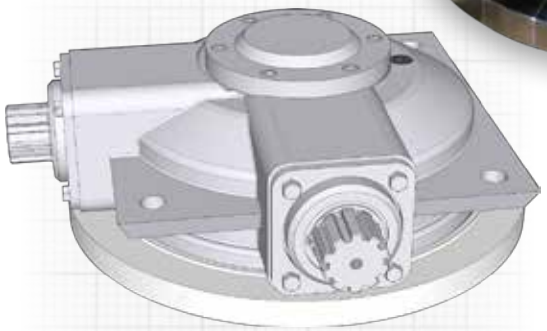

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some sense of the longer-term trends. But predictability was upended when Russia expanded its invasion of Ukraine in February 2022. The remainder of 2022 and the first part of 2023 was a tumultuous period, where potash prices rose more than CAN$1,000 per tonne as markets speculated that sanctions against Russia and Belarus would once again bring forth a burst of expansions.

This did not occur. After a short-term run-up in share prices, all the potash majors suffered significant declines in share price. Global inflation and a shrinkage of capital made it extremely difficult to advance projects.

Nevertheless, there were significant developments in 2023 that may point the way forward. All potash followers should take note of these, as I believe each point to where the industry may be going in the future.

While most investors have been chasing energy transition commodities, such as lithium, copper, etc., the potash space is showing the deployment of new mines in response to robust and favourable long-term potash market fundamentals. The "macro" behind these investments is combating global food insecurity.

The key newsmaker in 2023 has been BHP, especially with its announcement in Q4 2023 that it is investing C$6.4 billion to expand its Jansen mine to include a forecasted Stage 2, thus doubling its output to 8.5 million tonnes per year. Jansen is a greenfield mine, meaning it requires all the infrastructure required for a facility such as access to water, electrical tie-in, natural gas, road, and rail connections.

The second development happened in 2023 when Saskatchewan saw its first new mine since the commissioning of K+S Bethune when the Mosaic K3 conventional underground mine (started in 2009, roughly the same time as BHP Jansen) began production. Its "externally verified" production is 7.8 million tonnes of potash (which I assume referred to product tonnes MOP) at a cost of US$2.9 billion.

The K3 mine is within conveyance distance from the existing K1 and K2 mills, so its huge advantage

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is that it was built at a fraction of the cost required to build a new greenfield mine and mill. It also achieves cost savings due to synergies with the existing K1/K2 infrastructure, including personnel, operating experience, and long-standing supplier relationships.

The third newsworthy item is the continued development of the Woodsmith mine and mill by Anglo American. Woodsmith is different from the Saskatchewan mines because it will mine the mineral polyhalite (potassium sulfate) rather than the mineral sylvite (potassium chloride). Woodsmith was launched by Sirius Minerals, which was then purchased by Anglo American in 2020. Underground development continues and the mine, costing some 2.8 billion pounds, is expected to begin production in 2027, achieving production of five-million tonnes by 2030.

The above projects developments are large, substantial investments and in looking at these, I see three distinct strategies, each of which comes from a unique requirement, which is scaling production well into the next century.

Strategy 1, adopted by BHP, is to build a big, new, greenfield mine that can be scaled to meet market demand well into the future. How far ahead? This is hard to say; however, if one builds the infrastructure to sufficient scale so tonnes can be easily and cheaply added, it may be at least a century's worth of expansions.

Strategy 2 is to build new brownfield capacity at existing mine sites, Mosaic's new K3 Esterhazy mine being a perfect example. If most of the infrastructure is already there, such as a mill and underground conveyance, and if one controls a century's worth of mining rights surrounding the existing mine, it is relatively simple to add brownfield shafts to the existing production site.

Strategy 3 is to completely upend the existing mining and production paradigm and focus upon new technologies to allow for the deployment of smaller, modular solution mines. New modules are added as demand increases, so there is no risk of overcommitting capital during the

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All three strategies are based upon a single, immutable fact that has been in play since the beginning of the 20th century: potash demand will grow as the world's population grows.

early most construction phase. This strategy results in multiple mine developments that look, operate, and earn, more like a typical oil and gas operation than a traditional mine.

All three strategies are based upon a single, immutable fact that has been in play since the beginning of the 20th century: potash demand will grow as the world's population grows. This will not change unless there is a sudden decrease in demand for food, which I think is highly unlikely.

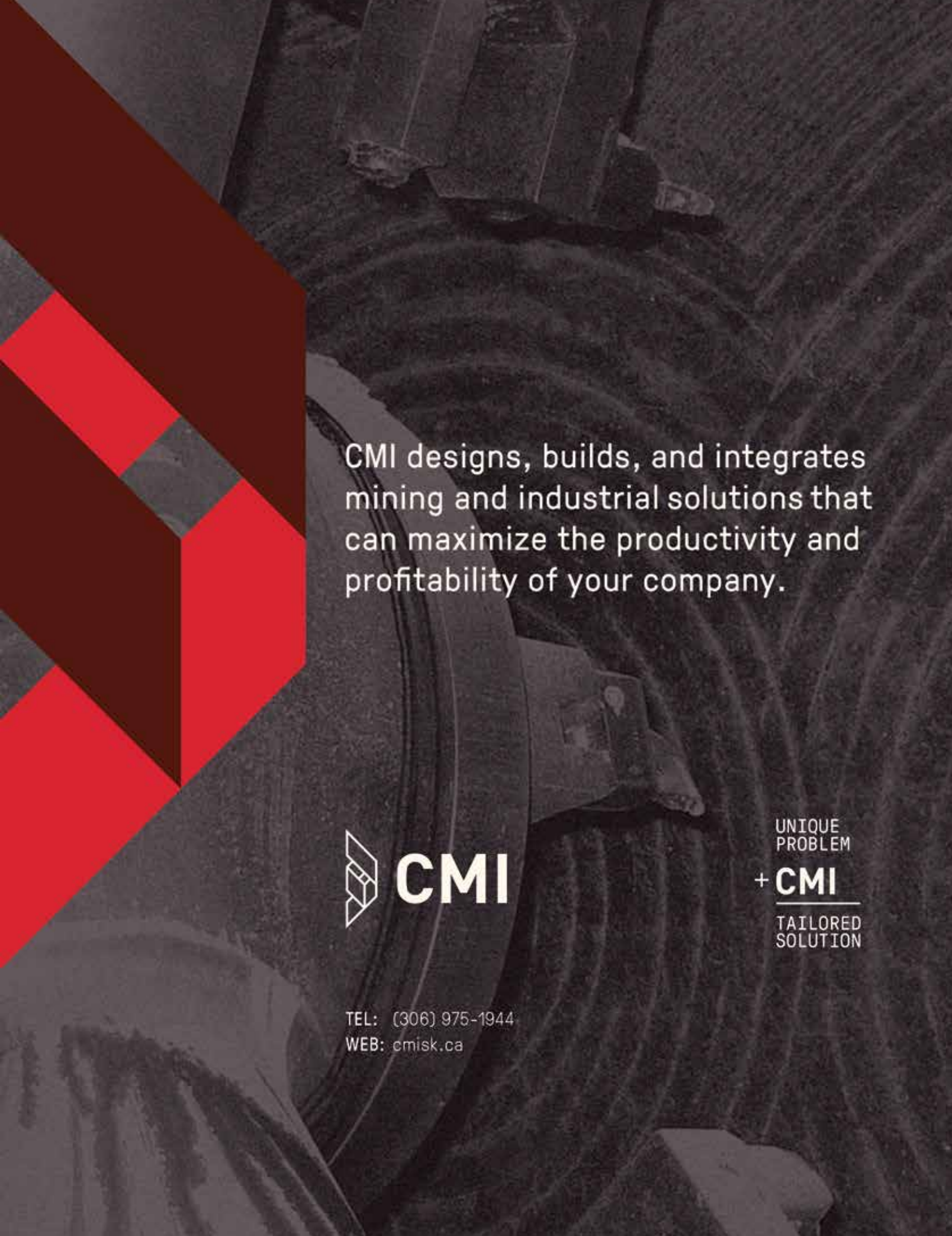
As the new year approaches, what can we discern from the above observations? I have three take-aways...

One, examining the potash sector's behaviour over the last 50 years demonstrates that it is foolish to rely upon any other metric than fundamental demand growth to base future projections upon. Potash is not a speculative play, nor is it really a mining play.

Two, given high capital costs associated with conventional underground and solution mines, it is not a sector that can nimbly react to what may be short-term responses in price due to global events. To base a longer-term development strategy upon near-term price points, either positive or negative, may not be wise corporate governance.

Three, major bets are being placed upon building production capability that will last well into the next century. This is being done by a small group of existing companies. If the mines proceed as planned, consolidation of available supply will continue. While good for shareholders of the miners, it may not be good for the end consumers.

Any other observations? Just this, Happy New Year everyone! ▲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As Nutrien Lanigan celebrates 55 years of production mining, we're featuring one of the mine's longest-standing employees, Howard Lamont

Howard and son, Carter.

Annual Firefighter's Rodeo champions.

Howard Lamont, mill production general foreman, has been an employee at our Lanigan, Sask. potash mine for over 40 years, but his family's connection to the mine started before he was even born.

The history of Nutrien's Lanigan mine is deeply rooted in community connections and strategic land acquisitions. Neil Lamont, Howard's grandfather, and owner of Lamont Agencies – involving real estate and insurance – played a crucial role in the mine's development in the late '50s and early '60s. Before the mine site was established, Neil engaged with local farmers, acquiring the necessary land and mineral rights needed for future development. He also fostered relationships by selling crop insurance to farmers in the area. This connection proved instrumental when Alwinsal Potash of Canada Ltd. reached out to him when they sought to purchase land for its potash mine, which now many years later is owned and operated by Nutrien.

Fast forward to 1980 when Howard started working at the mine just a short three weeks after he finished high school. Starting as a laborer, he progressed through the various mill operator levels with increased responsibility. He also worked in the load-out department learning track, storage bin operation of heavy equipment, and then scale operation. He accepted the role of mill production supervisor in 2007 and became the mill production general foreman in May 2023.

"We are extremely fortunate to have several long-term employees, like Howard, who dedicate themselves to emergency response, perform high-quality work and provide mentorship to new employees," says Rob Jackson, general manager, Lanigan. "These individuals are a huge asset to the mine and community."

Howard has witnessed many milestones and advancements to the mill and mine during his 40-plus years at Lanigan, including:

- The site workforce has doubled to 600+ employees since Howard started his career.
- In the 1980s, the site changed from car and loader operation for underground production to utilizing an extensible conveyor system allowing for longer rooms and major productivity improvements. The Phase 2 mill was built.
- In mid-2000, the site gutted the Phase 1 mill and rebuilt it with new equipment and technology.
- In 2007, the site completed a test room in the A zone using

Howard at work.

the chevron mining technique that led to a multi-year program to transition mining from long room and pillar mining to A zone chevron mining for the site.

- In 2017, the Lanigan underground team started work to install tele-remote equipment on a chevron production mine and has since led the Nutrien potash network in this area with many machines completed at Lanigan and at other sites.
- The site has also successfully restarted the Phase 1 mill in September 2022, and as of September 2023 over 200 million tonnes of raw ore have been mined.
- Safety culture evolved, from inadequate PPE and casual attitudes in the 1980s to stringent safety measures today.

"Our safety culture today has changed for the better, 100 per cent. The PPE that we wear is top quality and readily available to the employees. Our lockouts and confined space procedures are exceptionally prepared and planned for safe work to be accomplished every time," says Howard. "During toolbox and safety meetings, workers are very much involved in safety concerns and decisions of safe work practices of all kinds. Nutrien focuses on key daily safety actions and the last action, to care and look out for each other, is what we do every single day."

Howard was a proud member of the Lanigan Fire Department for 20 years and Lanigan's mine rescue team for 15 years before retiring from both. The same strong desire for safety in both the community and at his workplace runs in his family too. His son, Carter, mill mechanical supervisor, is currently captain of the mine rescue team at Lanigan.

"Carter joined the mine rescue team following in my footsteps," says Howard. "Carter's team placed first at this year's Firefighter's Rodeo in Lanigan and became the 2023 provincial champions of the Mine Rescue Competition held in Saskatoon. It makes me very proud to see him compete and help others in their time of need here at work and at home in his community."

Howard's four-decade journey (and still counting) at Lanigan, alongside Lanigan's milestone of 55 years of production mining, shows the deep roots that Nutrien has in Saskatchewan. With numerous projects underway, Lanigan stands as a testament to multi-generational dedication, providing careers and opportunities to support generations of workers to come.

"I am very proud of the team and all the great work they have done and continue to do around safety, integrity, inclusion, and results," says Rob. "Our employees are our most important resource, and our success is due to their commitment to continuous improvement in all aspects of operational excellence." ▲


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SCHREYER AWARD FOR K3 SOUTH SHAFT HEADFRAME PROJECT

Mosaic K3 south shaft headframe.


The 2023 Canadian Consulting Engineering Awards Ceremony in Ottawa, Ontario on October 19, 2023. Left to right: Adam Bale, engineering manager, Hatch; Jason Butler, lead maintenance planner, Mosaic; Abu Rafi, engineer of record, Hatch; Bernie Boutin, director of strategic capital, North America Operations, Mosaic; Chris Congram, project manager, Hatch; Dan Bennett, construction manager,Hatch; James Kavanagh, planner, Hatch; Levi Thoner, project engineer, Hatch.

For the engineering, design, and construction of Mosaic's K3 south shaft headframe, Hatch won the prestigious Schreyer Award and the Award of Excellence in the category of Natural Resources, Mining, Industry, and Energy from the Association of Consulting Engineering Companies for the 2023 Canadian Consulting Engineering Awards.

The Schreyer Award recognizes the project that best demonstrates technical excellence and innovation. Hatch's groundbreaking design included pre-assembling steel modules for the headframes and strategically lowering the large structural components down the shaft. The headframe for K3's south shaft ranks as one of the most complex slip forms ever created, and the team continuously poured the form over 22 days.

"We are thrilled to see the outstanding recognition that Hatch has received for their exceptional work on the K3 south shaft headframe," said Kelly Strong, Mosaic's vice-president of mining – North America. "The innovative design and meticulous execution showcase technical excellence and a forward-thinking approach to challenges. Hatch's ability to streamline the construction process with the pre-assembly of steel modules and the strategic lowering of structural components down the shaft is a testament to their ingenuity."

During the slip forming of the headframe, crews installed 2.5 tonnes of reinforcement every hour. The south shaft headframe contains over 1,400 tonnes of rebar, over 5,000 cubic metres of concrete, and over 1,800 tonnes of structural steel. The team completed all work ahead of schedule throughout the COVID-19 pandemic.

"We were impressed with the way the consulting engineers thought ahead and came up with a never-before-executed solution that would eliminate hazardous work for everyone involved in the project," said Jennifer Drake, jury chair for the 2023 Canadian Consulting Engineering Awards. "The jury saw the applicability of this new technique, the modular installation approach used for other projects. So, this is a cutting-edge new development." ▲

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American potash for American farmers

Sage possesses an extensive portfolio of mineral rights in the resource-rich Paradox Basin, located in Southeastern Utah.

As Americans, we recognize that our nation's agricultural success is the foundation of our economy and the well-being of our citizens. Potash, as the lifeblood of agriculture, plays a crucial role in achieving abundant crop yields. Astonishingly, the United States imports a staggering 95 per cent of its potash, despite possessing one of the world's largest reserves. This reliance on foreign imports for a mineral vital to domestic crop growth raises concerns about the impact that costly transportation and import fees can have on the American agricultural industry and national food security.

Recognizing this dilemma, industry veteran Peter Hogendoorn and his team have taken proactive steps to address the issue by establishing Sage Potash Corp., a publicly listed company dedicated to advancing domestic potash production within the continental U.S. Through the use of proven solution mining techniques and a short timeline to production, Sage Potash plans to meet the growing demand for a local potash supply.

Sage possesses an extensive portfolio of mineral rights in the resource-rich Paradox Basin, located in Southeastern Utah. Sage's initial exploration well, the Johnson 1 Well, confirmed the presence of high-grade, thick, and flat-lying potash beds, resulting in an initial inferred resource of almost 280 million metric tons of potash sylvinite. The Sage Plain Project is potentially the largest undeveloped potash resource in the U.S., boasting a large-scale, high-grade potash deposit. With the U.S. government committing an impressive $1 billion to enhance American potash and fertilizer production, Sage Potash Corp. stands poised to seize this opportunity and successfully bring their potash resource into production.

The demand for potash, and subsequently its price, recently skyrocketed due to sanctions imposed on Russia and Belarus, as the two countries contributed to 40 per cent of global potash production. Although the price has since stabilized, recent supply chain disruptions caused by global politics and COVID-19 lockdowns have underscored the urgency of reducing reliance on foreign potash sources. In these uncertain times, America can no longer afford to depend on essential resources that come from outside its border.

Guided by a proven management team with industry expertise in solution mining, surface processing, operations, and distribution, Sage has rapidly advanced engineering and permitting activities. They have an ambitious plan to commence test cavern development later this year and pilot production by mid-2024. Successful cavern development allows for staged engineering and construction, initially serving regional supply to mitigate risk before expanding to larger national markets. By implementing this strategy, Sage Potash can generate significant revenues and achieve a strong return on investment with manageable capital requirements. This positions them as a regional supplier and paves the way for becoming a major supplier on a national scale.

By supporting local production, investors can contribute to a transformative shift that strengthens America's agricultural backbone. Sage's commitment to "American potash for American farmers" deeply resonates with the need to prioritize self-sufficiency and, ultimately, national food security.

Discover more about the Sage Potash opportunity today, and be part of supporting the security of the American agricultural industry. Learn more at www.sagepotash.com. ▲

IMII — Working to expand the technological base for clean power and heat in the minerals industry

BY AL SHPYTH, EXECUTIVE DIRECTOR, IMII

First SolarSteam demonstration unit in Ponoka, Alta.
PHOTO COURTESY OF IMII AND SOLARSTEAM.

Acceleware's 2 MW Clean Tech Inverter (CTI). The CTI converts electricity to radio frequency energy, allowing for the electrification of industrial heating.
PHOTO COURTESY IMII AND ACCELEWARE.

The IMII is the innovation supporting network for Saskatchewan's minerals industry, including its world-class potash industry. Since 2021, IMII has been part of the industry's efforts in finding low-carbon solutions to meet its energy needs, and such efforts have included finding and developing innovative new technologies that could be brought into use.

IMII's efforts recognize that the potash industry, like other minerals producers, has a need for both clean electricity and heat as it seeks to achieve decarbonization plans. Industrial process heat needs include preheating for boiler feedwater, hot water for various processes, hot air for drying, steam production, and direct heating. Many industrial processes require sustained levels of heat that are today difficult to generate physically and economically without burning fossil fuels. According to the International Energy Agency (IEA), industrial heat makes up two-thirds of industrial energy demand and almost one-fifth of global energy consumption. The IEA also notes that while different technology and fuel options are available depending on the required temperature level, these are often not interchangeable. For example, low-temperature heat from a heat pump cannot be substituted for high-temperature heat from a gas boiler.

Recognizing this, IMII has come to the view that a somewhat all-inclusive technology approach appears to make sense as the potential for deployment of the different technologies is dependent on several factors. To this end, IMII has supported special studies with its members as to technologies that could become available for use by the end of this decade and the next, held an alternative energy systems innovation challenge, and put out calls for innovative solutions to energy needs through its DEMOday process.

Following on from DEMOday 2022, IMII embarked on two technology exploration and demonstration projects with its potash industry members in 2023. The first phases of both projects successfully concluded in 2023. The first was with a firm called Acceleware (see Decarbonizing Industrial Heating via Clean Tech Inverter Electrification – Acceleware Ltd.). With this project, IMII, together with BHP, the Mosaic Company,

Following on from DEMOday 2022, IMII embarked on two technology exploration and demonstration projects with its potash industry members in 2023.

and Nutrien, is exploring and seeking to validate the potential to use radio frequency energy from a clean tech inverter to dry mill products. IMII has also advanced the first phase of a Demonstrating Innovations project with SolarSteam Inc. (see Lowest Cost Renewable Heat – SolarSteam) on the potential for utilizing their renewable heat generation technology which could harness Saskatchewan's solar resources with a concentrated solar thermal system. Such a system has the potential to be deployed to support a variety of process and building heating needs in minerals operations. Both firms have been invited to submit proposals for subsequent phases to support the development of their technologies for potential deployment in the potash industry.

IMII has also invited two other firms to submit energy-related proposals. Coming out of DEMOday 2023, IMII has invited Extract Energy Inc. and Solex Thermal Science Inc. to submit Demonstrating Innovations proposals to help advance the industry's consideration of their innovative technologies. Extract Energy – which was also IMII's Innovation Award winner for 2023, has a novel application of a shape memory alloy heat engine in the waste heat to electric power space. Solex Thermal Science has two heat-exchanging technologies which could be used to replace the use of natural gas in the potash drying process.

All four of these technologies have the potential to make industry more energy efficient, consume less fossil fuels, and reduce greenhouse gas emissions.

IMII believes that expanding the technological base for, and the number of pathways to, clean heat and power is important to the future of the minerals industry, and to all those who rely on Saskatchewan's potash industry to provide the fertilizer that helps feed the world sustainably. ▲

Why Saskatchewan has the world's best potash supply chain

Saskatchewan has the world's best potash supply chain for several reasons. The simple reason is, "Take a look at how much potash we produce!" The deeper reason, which is the actual why it's the best, takes a bit of unpacking.

If we go back to the beginning, we began producing potash here in 1958, with the 1960s seeing things really take-off. And, by the way, the mines' construction costs back then ranged from $60 to $90 million. So, we have over 60 years of experience and have had a lot of time for our supply chain to be developed – that helps. But, that does not guarantee success.

One reason for our success – beyond time and great deposits – is that while we sometimes do not think of ourselves as innovators, we always have been. The process that keeps repeating is; when we see a problem we fix it, or we always work to make things better. The innovation is in the problem solving itself and the tweaking of systems. This series of actions and our humble thoughts about it, combined, lead to ongoing success. So, we are problem solvers relentlessly pursuing improvements.

We also work towards solutions together without even realizing it at times. Direct competitors will share a laydown site – that's an easy one to spot. The subtle one is when competitors sit together with a buyer to discuss business and share ideas.

The Saskatchewan Industrial and Mining Suppliers Association (SIMSA) regularly host Roundtable events where the procurement arm and executives from a major potash producer meets with SIMSA's members for a day. These events casually see competing suppliers sit next to each other and discuss solutions with the potash producer. The format works and the proof is in SIMSA's continued membership growth, stemming directly from these events.

As an example, the event pictured below occurred with Nutrien – the world's largest fertilizer producer. At this event, hundreds of competitors sat with each other to discuss Nutrien's various sites in Saskatchewan, with 50 people from Nutrien. This type of event has become a tradition between Nutrien and SIMSA; one based upon mutual success.

As another example, there was an event that occurred in November 2023 with BHP – the world's largest mining company. Once again, there are hundreds of competitors sitting with each other to discuss the multi-billion-dollar Jansen project. Additionally, the arrival of and commitments by

The crowd gathered when SIMSA met with Nutrien.

BHP meets with SIMSA members.

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BHP demonstrates a trust in our supply chain to have the mine built on budget and on time, and then a further trust to be able to maintain it.

This format has also been applied to events with potash firms from other countries, such as Kazakhstan. So, in addition to Kazakhstan coming to Saskatchewan's suppliers for help – a sign in itself of our leadership – the way it occurred is the "why" we lead.

At this event, SIMSA organized an event where suppliers and producers from Saskatchewan met in person and virtually, with Kazakh potash and government persons. Once again, collaboration and information sharing played a key role.

More recently, SIMSA has begun initiatives into Brazil and Argentina – both of which were met with immediate enthusiasm from those countries.

SIMSA's session with Kazakh potash persons.

All of this is in addition to the annual Saskatchewan Mining Supply Chain Forum, which SIMSA runs in partnership with the Saskatchewan Mining Association and the Government of Saskatchewan. This two-day event draws over 300 procurement people and has over 300 tradeshow booths.

Labour force development is another key to a successful supply chain. SIMSA is working with several groups to ensure its continued success, such as The Regina District and the Saskatoon Industrial Education Councils, Women Building Futures, Skills Canada, David Crowell, the IMII, U of S, U of R, and Saskatchewan Polytechnic.

The initiatives towards carbon reduction see our potash mines produce with half the carbon as competing jurisdictions. In addition, SIMSA's Industrial Concierge is working to see further carbon reduction within the supply chain. Further, the same person is also working to coordinate the development of innovations required by the sector.

And in an efficiency effort, work is being done by SIMSA and others to simultaneously reduce red tape and promote safety within the sector. The focus is adding leading indicators to the lagging indicators tracked by groups such as WCB and ISN.

Our world's best potash supply chain has been blessed with the world's best deposits. And, our cooperative work ethic, continuous innovation and improvement initiatives, and willingness to work together have built the world's best potash supply chain. ▲

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Sensor-based sorting testwork for potash operations

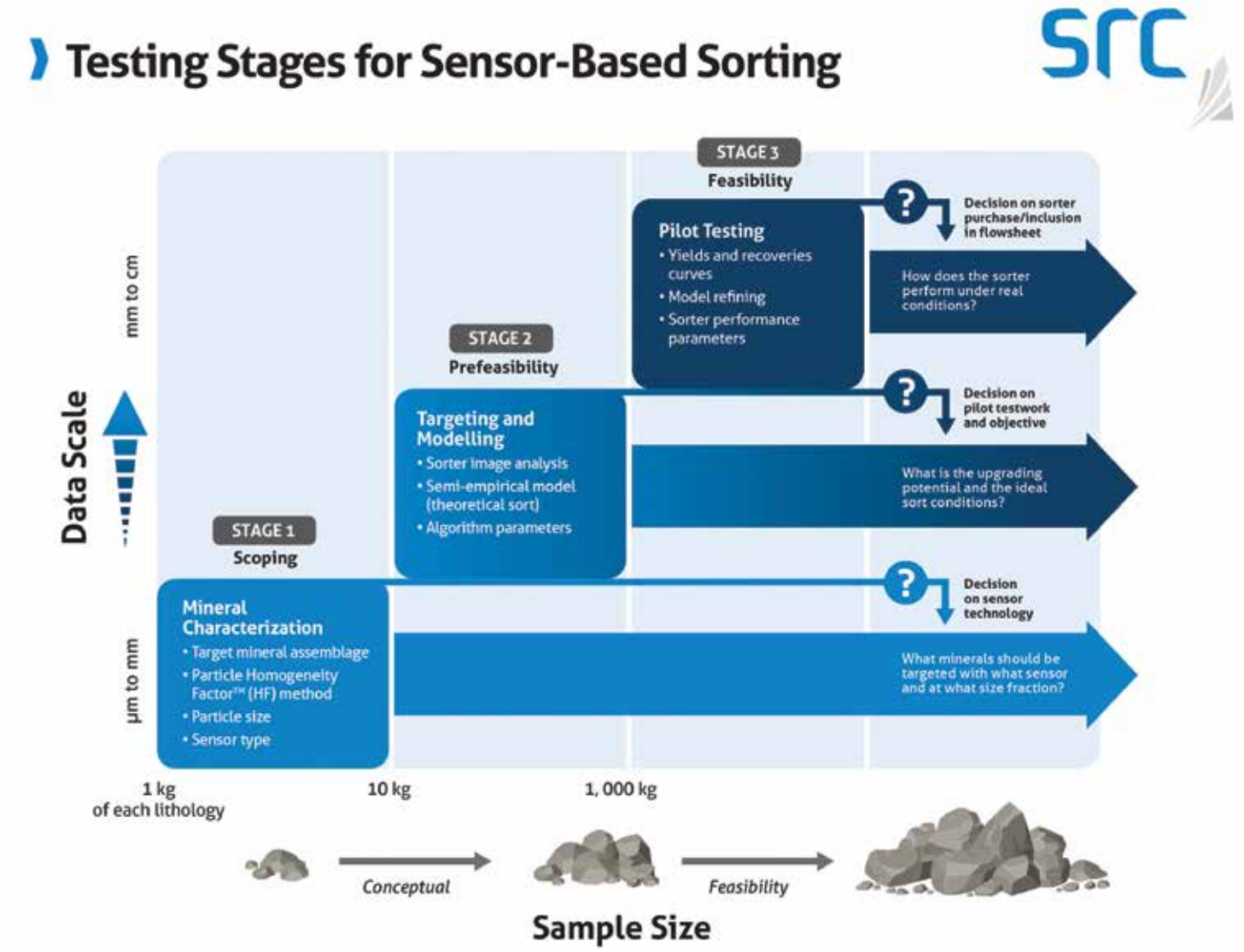
BY ERIN MATTHEWS

Sensor-based sorting (SBS) technologies and testwork are evolving, offering the mining industry another tool in the mineral processing toolbox. SBS is a collection of technologies that use sensors to separate ore from waste, either on a particle basis (particle sorting) or "parcel"-of-ore basis (bulk sorting).

Using different sensor techniques — such as X-ray transmission (XRT), near infra-red (NIR), colour and laser scattering — the Saskatchewan Research Council (SRC) provides SBS testing solutions that help industry clients select the most ideal sorting technologies and applications to upgrade their ore and reduce waste.

Used for decades in the recycling and food industry, as well as in the diamond industry, SBS technologies have begun to rapidly expand into other mining sectors in recent years due in part to the increased speed and accuracy at which sensor data can be processed. This has enabled sensor-based measurements to be applied to ore-processing streams and downstream separation mechanisms in near real-time.

Sorting can potentially remove waste or provide valuable



upgrading possibilities for the potash industry. Knowing mineral properties in near real-time can enable effective and efficient preconcentration or separation of ores before expensive grinding, beneficiation, and hydrometallurgy.

How do you know if sorting is for you?

SRC has developed a testing regime to assist industry clients with choosing the right sensor-based sorting technology for their needs. This regime has evolved over the years through SRC's work with industry clients, helping to select, adopt and test effective sensor-based sorting applications. Using a data-driven approach, SRC's testing regime helps to maximize early decision-making. It also helps to minimize the sample required and streamlines the metallurgical testwork needed for design and adoption.

SRC's testing stages for potash sorting starts with sensor-based mineralogical characterization, which assesses the type of sensor technology and the amenability of the ore, which is based on specific sensor responses and mineralogical characteristics. Using this data, target minerals can be identified and the potential for upgrading or waste removal is determined.

SRC uses a mineralogical sample preparation method for potash that was developed in-house and is proprietary. SRC also tests sensor responses for all commercially available sensors, including XRT, XRF, NIR, colour, laser scattering, radiometric, electromagnetic, and more.

Understanding insolubles

Understanding the individual minerals within the waste (called "insolubles") is one of the important factors in applying sensor-based sorting to potash. This includes the proportion of potassium-bearing minerals to other soluble salts. Sensor-based sorting targets minerals (such as clays) within wastes differently and is important for understanding the types of insolubles and how they present within the ore.

In the second stage, targeting (selecting the target mineral, particle size, and corresponding sorting technology) and modelling help potash clients decide on a desirable sorting strategy – upgrading or waste removal. Before deciding on a pilot testwork strategy, SRC develops a sorting model from sensor response data. Clients can then use this valuable modelling tool to test out various scenarios — including sizes, grades, and sorter parameters — while designing their final flowsheet.

Finally, SRC's pilot testing stage allows industry clients to obtain real-world sorting performance data and an understanding of sorting yields and recoveries under these conditions, as well as general performance of the full circuit. This phase is important in determining the feasibility and capital costs of a sorting project. SRC currently possesses two XRT sorters for these purposes and is evaluating options for introducing other sorting sensor technologies.

Why is testing so important for potash?

Through our testing regime, SRC's sorting team plays a key role in the optimum application of SBS technologies for potash. We help the potash industry to identify, integrate, and optimize the right sorting solution for their operation in the most cost-effective and streamlined way. Using a unique combination of mineralogical work, sensor testing, and data, SRC helps navigate the application of sorting technologies. ▲

The MiHR offers three wage subsidy programs in benefit of job-ready youth, post-secondary students, workers, and employers.

Shaping Canada's mining workforce through wage subsidy programs

BY THE MINING INDUSTRY HUMAN RESOURCES COUNCIL

A skilled workforce is clearly vital to mining's sustainability and growth, yet mining faces a tight labour market. Mining Industry Human Resources Council (MiHR) data shows that the unemployment rate in mining is historically low, with labour shortages further challenged by an aging workforce, negative youth perceptions of mining careers and a decline in enrolments into post-secondary mining programs. Along with the longer-term rise in demand for minerals and metals, Canada's transition to a clean economy will only compound labour shortages.

As a result, the mining industry faces unique challenges for its learning needs and recognizes the critical importance of work placement opportunities as a component of effective skills development and a highly skilled and competent workforce.

To address these obstacles, MiHR offers three wage subsidy programs in benefit of job-ready youth, post-secondary students, workers, and employers.

The Canadian Mining Work Placement Program: Solutions to meet forecasted mining labour demand

MiHR recently developed the Canadian Mining Work Placement Program (CMWP) to provide wage subsidies to hiring organizations that offer meaningful job opportunities that support a productive, safe and highly skilled supply of labour.

Subsidies up to 70 per cent of a participant's wage to a maximum of $15,000 are available to hiring organizations and contractors who provide jobs in support, operation, and production-level positions to newly trained talent or existing workers to upskill and explore advancement in new careers.

Gearing Up: Developing mining talent through post-secondary work-integrated learning

To help shape the next generation of Canada's mining workforce, MiHR's Gearing Up project helps ensure the mining sector's sustainability and competitiveness by supporting work-integrated learning (WIL) opportunities for post-secondary students. Mining employers who create new WIL opportunities for students enrolled in science, technology, engineering, or math (STEM) or business programs are offered a wage subsidy of up to $7,000.

Green Jobs: Helping job-ready youth gain meaningful mining work experience

MiHR's Green Jobs program provides mining employers with a wage subsidy up to $30,000 to hire job-ready youth aged 15 to 30 for paid placements or training opportunities that have a focus on clean technology and innovation. This enables youth to gain the skills and work experience they need to make a successful transition into the labour market.

Take advantage of a wage subsidy today

MiHR's wage subsidy programs help recruit, retain, and develop Canada's mining workforce by enabling employers to provide work opportunities to build competency in new talent, allow workers to practice newly acquired skills on the job and expand the skilled labour pool for industry to meet labour demands.

Interested organizations and participants can access MiHR's complete wage subsidy program information, eligibility criteria and application forms at mihr.ca/wage-subsidy-programs/. For more information, contact wagesubsidies@mihr.ca.

About MiHR

MiHR is Canada's knowledge centre for mining labour market intelligence. An independent, non-profit organization, MiHR drives 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. ▲

Mining employers who create new WIL opportunities for students enrolled in science, technology, engineering, or math (STEM) or business programs are offered a wage subsidy of up to $7,000.

BY TABETHA STIRRETT AND SAMUEL VOEGELI

Integrating clean ammonia production into potash operations allows companies to diversify products and meet rising demands for sustainable fertilizers.

Positioning for the future energy landscape

Companies worldwide are searching for ways to reduce their carbon footprint and contribute to a sustainable future. In the potash industry, innovative approaches are emerging to align with global sustainability goals and lead in the future energy landscape.

Sam Voegeli's recent *Potash Producer* newsletter article, "Transitioning to the Energy Transition: The Hydrogen Revolution Begins Underground", highlights the potential of converting unused, depleted potash caverns into hydrogen storage spaces. Storing hydrogen, however, is only one potential option to reduce carbon footprints. Potash producers can expand their operations to further sustainability initiatives, specifically with clean ammonia production and carbon capture, utilization, and storage (CCUS) infrastructure.

Clean ammonia production

Integrating clean ammonia production into potash operations allows companies to diversify products and meet rising demands for sustainable fertilizers. Because potash solution mining facilities have the potential to store large amounts of hydrogen (the key feedstock for ammonia) in the subsurface, a unique synergy exists between potash and ammonia production. Using potash solution mines as resources for clean ammonia production and storage maximizes the value of these assets and enhances overall operational efficiency.

Shifting toward clean ammonia production reduces traditional carbon-intensive production methods. Clean ammonia can be produced by combining renewable energy with electrolysis or splitting methane (CH_4) and capturing the resulting carbon, which is then injected underground, ensuring a carbon-neutral or low-carbon

ammonia production process. Embracing this approach not only meets the rising demand for clean fertilizers but also mitigates environmental impact, attracts responsible investment, and secures a sustainable future by lowering carbon footprints.

Carbon injection sites

After clean ammonia is produced, carbon dioxide injection into suitable reservoirs near potash facilities can help companies meet carbon reduction goals by offering alternative infrastructure for CCUS, especially as more industries compete for pore space utilization. With carbon credits, carbon taxes, and government incentives on the rise, injecting carbon dioxide into nearby reservoirs for CCUS can be an excellent financial decision that will pay off in the future. It's a win-win-win situation where economic growth aligns with a lower carbon footprint that meets sustainability goals.

But getting there requires efficient expertise. RESPEC's experts focus on maximizing the efficiency of hydrogen and carbon storage and minimizing the release of greenhouse gases to reduce the operation's carbon footprint. With potash and underground storage backgrounds, we are well-equipped to guide companies through this change. We can model carbon dioxide plume development and brine injection rates, execute drilling, and complete all testing required to identify suitable disposal formations and designs. RESPEC can assist in understanding the impact that competing industries might face with the complex requirement for pore space for waste brine disposal and CCUS.

Preparing for sustainable initiatives better positions potash companies as leaders in the future energy landscape, actively reducing carbon emissions and accomplishing key environmental, social, and governance targets. With RESPEC's support and expertise, companies can feel confident in meeting global sustainability goals. ▲

Drones in mining

BY LOVELY ES AMUAN

Hovermap pilot training.

As the world's population grows, the demand for products and services increases accordingly. Businesses constantly seek ways to enhance operations and improve production efficiency to meet demands. In today's market, many companies are turning to technology to achieve this goal, and one such technology that is gaining popularity is drones.

Drones, also known as unmanned aerial vehicles (UAVs), were primarily built for military use but have become increasingly prevalent across various industries. Drones come in multiple sizes, ranging from the size of an aircraft to the size of a palm. Drones have proven valuable in mining operations, serving various purposes such as surveying and mapping, monitoring and inspection, and exploration.

Mining operators have traditionally used expensive and inefficient surveying and mapping methods. To overcome these limitations, corporations like Nutrien, a globally renowned potash producer, have purchased the DJI Matrice 300 RTK drone, which is equipped with AI technology and Emesent Hovermap leverages simultaneous location and mapping (SLAM) technology and Light Detection and Ranging (LiDAR) to ensure safe navigation in areas where GPS signals may be obstructed above the surface.

It is also essential to prioritize the safety of workers in the mining industry, given the inherent hazards present, including rock falls, gas leaks, dust explosions, and high humidity. Regular monitoring and inspections of the environment are critical in achieving this goal. Nutrien successfully addressed these challenges by incorporating innovative drone technology, leading to more frequent and comprehensive safety checks.

Nutrien uses submersible drones to inspect and monitor structures like tanks, pipelines, rake structures, and pond intakes. To perform underwater work, Nutrien chose a Deep Trekker remotely operated vehicle (ROV) for its excellent quality, availability, and service. Initially, Nutrien purchased the Pivot ROV base model but upgraded it in 2022 with ultrasonic thickness measurement capabilities, a sediment blaster, a grabber claw, and sonar to enhance navigation in cloudy or murky conditions. This inspection and safety strategy has proven to be a cost-effective and efficient solution.

Nutrien has also acquired Mavic 2 Enterprise and Elios 2 drones to capture high-quality 4K images and videos and inspect hard-to-reach areas. For instance, during the 2020 fire incident at the Vanscoy mine site in Saskatchewan, the Mavic 2 Enterprise was deployed for

Vanscoy potash mine.

outdoor structural assessment, while the Elios 2 was flown indoors to assess the damage and perform an initial evaluation before allowing workers into the building. The Elios 2, upgraded to Elios 3, has also been used for underground inspections requiring more specific and confined space assessment.

Lastly, exploration is crucial for mining companies to locate minerals before extraction. Therefore, drones have become an indispensable tool to cover extensive land areas in an efficient amount of time. By analyzing the data obtained from these drones, mining companies can quickly determine areas suitable for extraction and those that require further exploration. Drones also play a critical role in ensuring the safety of mining sites by detecting gas leaks and other potential hazards on the surface and subsurface. Miners can be alerted using advanced sensors, such as infrared cameras, giving them the necessary time to take prompt action and prevent potential incidents.

Unmanned aerial vehicles, commonly known as drones, have many uses, such as surveying, mapping, inspection, and exploration. Drones play a crucial role in providing valuable insights and data, which helps improve productivity and efficiency. Nutrien, a leading potash producer, has successfully integrated drones into its mining operations, a testament to the technology's effectiveness. As the demand for drone technology increases, we look forward to witnessing further innovative applications in the industry. ▲

Selective solution mining, a paradigm shift in potash production

BY HARVEY HAUGEN, CEO, BPPC

Selective solution mining has been seen as the future for new potash developments. The first selective mining using horizontal drilling was Intrepid Potash. They began drilling horizontal holes at their mine at Moab some time after 2002. Western Potash drilled three horizontal wells at Kronau with cold testing commencing in October 2019. PADCOM drilled horizontal holes for the Harrowby project in December 2021, but are still not into commissioning. Extensive design work has been completed for at least half a dozen other potential selective mines in Saskatchewan, all prosing Moab-like designs (with Karnalyte being the exception).

So far, the results are less than impressive, with one exception. Every new mine designed for selective mining has been designed by the "old school" consultants with former potash managers and executives as technical advisors. They have been designed to be a "proven design" by cherry-picking features out of the existing industry to simulate some combination of a "Moab" design, and a "secondary mining" plan like Belle Plaine (with some resemblance to Patience Lake).

Production data from Moab by selective mining is not impressive. The mine was purchased from PCS in 2000 with first-year production of 64,000 tonnes. Two additional holes were drilled into Bed 5 to the old mine that brought production up to about 100,000 tonnes per year. The first horizontal holes were drilled into Bed 9 in 2004. It is unclear, but apparently as many as seven horizontal holes were drilled per cavern in each of three new caverns into Bed 9 from 2004 to 2013. The total cost was about $20 million. Remarkably, production is still in the range of roughly 100,000 (to a possible maximum of 140,000 tonnes). This does not look like success.

The secondary mining at Belle Plaine has been successful but operates out of massive caverns developed as a part of the "total dissolution" primary mining system. This is a very different scenario than development from horizontal holes. Secondary mining is seasonal and uses cooling ponds that are known for best performance below -20. I'm not sure how relevant a cooling pond is for low continuous flow from horizontal wells.

The designs all assume a conventional Belle Plaine approach to extraction ratios, producing brine from one-third of the area from one or more potash members, with a cut-off grade of 15 per cent K_2O, but leaving all the salt in the cavern. The most common statement is that they remove the potash and leave the salt matrix in place, which is very unlikely. Design dissolution rates are deduced from laboratory tests on whole core samples, but these dissolution rates are not achieved.

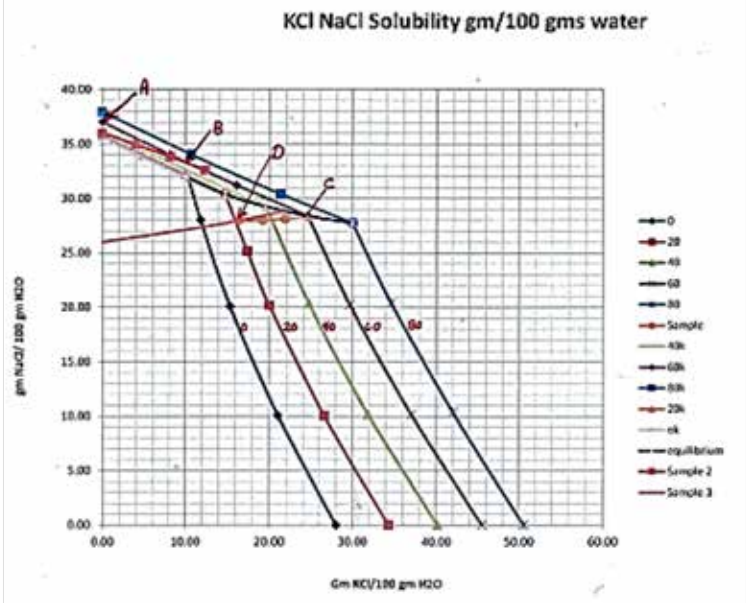
In 2014 and 2016, I presented two papers for SMRI, "The Application of Polythermic Solution Mining Techniques and Curved Flow Design to the Solution Mining of Potash" and "A Review of Historic Developments in Potash Mining, a Scientific Approach to Correcting Assumptions Used in Current Mine Designs, and Identification of New Principles for Solution Mining of Potash". Both papers detail our concern with the widespread ideas about selective solution mining, pretty much as they exist today. Some things just don't work and a plan is needed.

There are four requirements for selective solution mining to work.

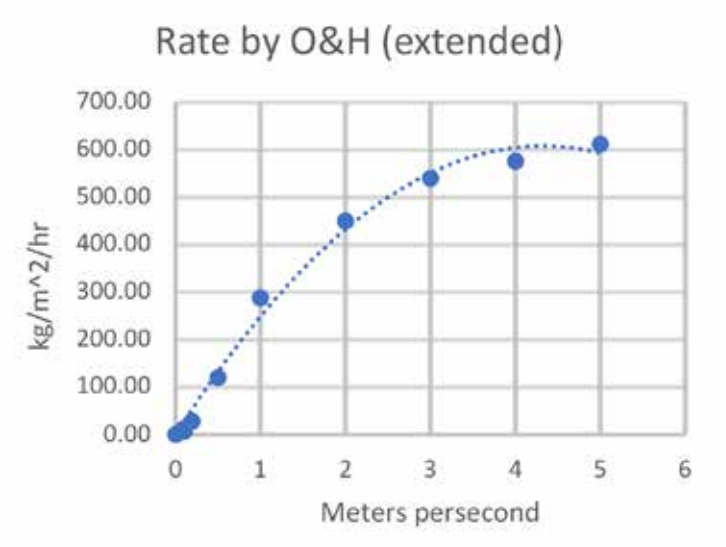
1. ***Selective solution mining can only occur in "high grade ore".*** Caverns are formed by dissolving the potash, leaving the salt crystals unaltered. There is no vertical advance in the cavern in a pure salt zone, or in low-grade potash. In 60 per cent potash, the potash is dissolved around the salt crystals allowing the "400-million-year-old" salt crystals to fall to the cavern floor and exposing more potash crystal. This will also happen at 50 per cent potash. Maybe at 40 per cent, but now we might need more time since potash dissolution could produce salt hoodoos

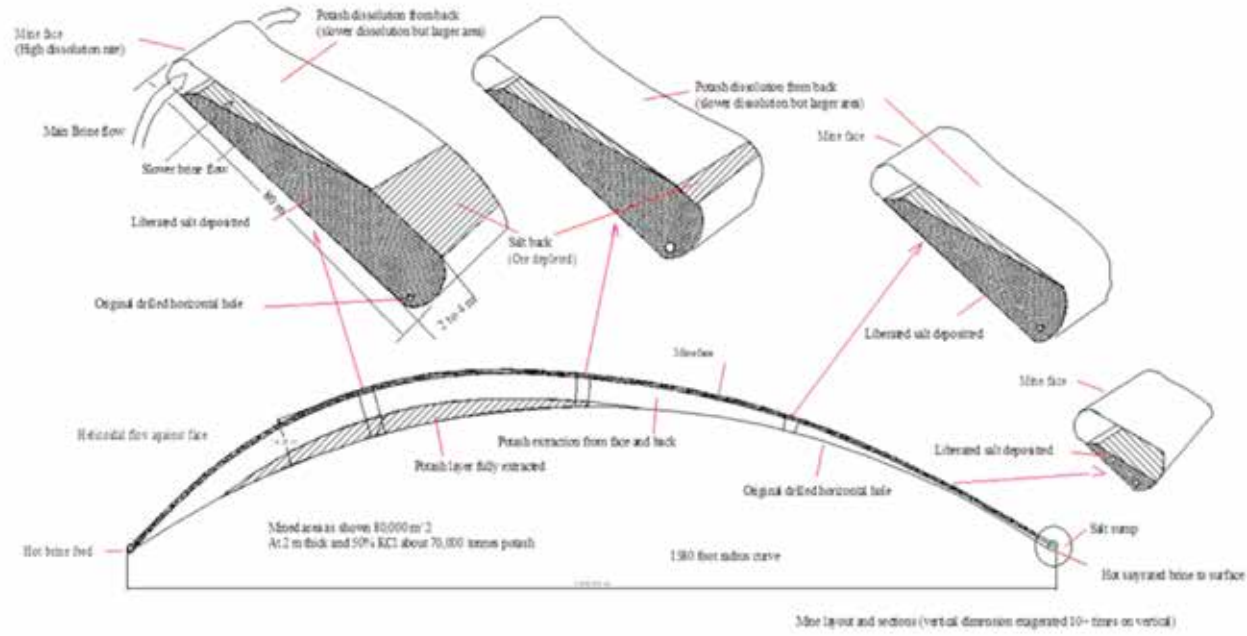
and other multiple salt crystal structures that will obstruct flow, depending on the nature and particle size distribution of the crystals. As the cavern develops, crystals in the wall will be under load. We expect that, even in lower grade ore, partially liberated salt crystals will spall off the wall adding to availability of potash and increasing production.

2. ***Salt concentration in the feed brine must be controlled.*** A saturated NaCl brine would be 37 g NaCl per 100 g water at 60 degrees C (point A). As this brine dissolves potash, salt will have to precipitate. For instance, if the KCl goes up from 0 to 10 g/100 g water, the NaCl has to drop to about 32 g/100 g water, with 5 g precipitated (point B). Energy is absorbed as potash is dissolved and released as the salt precipitates, so energy differences are small leading to the possibility of creating a supersaturated NaCl brine. Under low-flow conditions, this can lead to plating of the cavern as the first single crystal formed, which triggers massive precipitation of salt on everything (a phenomenon highlighted in a U of S study), which slows down access to the KCl in the ore.



3. ***Flow velocity over the face dramatically increases dissolution rate.*** Flow velocity is the most important factor affecting dissolution rate. This has been largely ignored in the industry. Often difficulties in dissolution rate suggest adding to the number of caverns, typically reducing flow velocity, a serious error. A 0.2 m/sec dissolution rate is about 25 kg/m^2/hr. At this rate, a single horizontal could, after a little development time, feed a large mine. Further increasing velocity has dramatic benefits (at 1 m/sec, 300 kg/m^2/hr).





4. Liberated salt must be managed in the cavern to direct flow against the face and allow access to potash. One method to do this is the Beechy patented curved flow design. The high-velocity flow is directed against the outside of the curve with solids deposited inside the curve. See example.

These principles define quite a different mine than has been generally recommended and explains why current designs do not work. This is a very simple mine design. The principles are absolutely required for a horizontal drilled design.

Dozens of laboratory tests confirm that a saturated equilibrated brine can be produced at any selected temperature with proper controls. Brine returning to surface can be cooled in crystallizers to produce pure KCl crystal (every other published design assumes only partial saturation, presumably based on Moab results). Cooling saturated brine from 60 degrees to 20 degrees precipitates pure KCl, reducing KCl in the brine from 22.5 to 13 g/100 g H_20. The NaCl remains constant at 28 g/100 g H_2O, a brine well undersaturated in NaCl (see point C and D on the phase diagram), and an ideal brine to reheat as mine feed.

The Beechy patented wiped surface crystallizers use simple design, with low cost and high heat recovery. These are best coupled with a heat pump to reheat crystallizer mother liquor to be returned to the mine.

A dryer and centrifuge complete the basic surface process.

Capital cost for a basic 250,000 tpa mine should be less than $40 million. Operating cost should be under $50 a tonne.

While the process is simple, this process is a first. There is a need for good technical direction in plant design and in analyzing results and making adjustments in the commissioning stage. This requires a trained process expert, not a retired exec or a plant foremen or operator.

Gamma logs and assay results need to be examined. Samples of core should be tested in lab simulation to determine a liberation profile over the selected target zone. Two-inch quarter-core sections should be tested, especially in lower-grade areas to confirm mine reserves. These tests can be completed in our lab in a few hours.

The plan redefines ore reserves with a single one-metre deposit at 50 per cent potash representing a million tonnes of product per square kilometre, or 2.6 million tonnes per square mile. The plan is for 80 to 90 per cent extraction in a “long wall design”. Depth to product has a minor effect.

While there are few areas in Saskatchewan that do not have at least one suitable high-grade zone, access to leases in Saskatchewan has been limited

by government policy that has allowed the three major companies to "checker board" the whole Saskatchewan deposit with single section leases.

This selective solution mining design is very adaptable and could produce large tonnages in many areas of the world. Massive deposits in Utah's Paradox Cycle 18, close to the American market or even in New Brunswick, on tide water, could become very economical.

A study was done on the flooded mine at Esterhazy. Initial indications, based on our modelling, show that this could quickly be turned into a large selective mine at minimal capital cost.

This selective mining plan represents a paradigm shift. High analyses potash product is produced at low capital and operating cost without surface tailings, and close to zero carbon (when using heat pumps and electric product drying). The project is scalable, as viable at 250,000 tonnes per year, as at a million plus. Lead time to production could be less than two years.

Pliothermic selective solution mining is ready for a developer. ▲

All eyes on RAS

NEW OPPORTUNITIES FOR SASKATCHEWAN BUSINESSES TO BUY RENEWABLE ELECTRICITY


BY CHRISTOPHER J. MASICH, MCKERCHER LLP PARTNER, AND TYSON ACOOSE, MCKERCHER ASSOCIATE

RAS stands for Renewable Access Service, which is SaskPower's new program that will allow participating companies to purchase clean electricity directly from qualified Independent Power Producers.

Potash companies and other industrial companies who aspire to achieve environmental, social and governance (ESG) goals should be excited, or at least curious about SaskPower's RAS program.

Why? Because RAS will allow companies operating in Saskatchewan (customers) to buy electricity directly from Independent Power Producers (IPPs) instead of SaskPower. In doing so, customers will have certainty that their electricity is from a renewable source rather than from a mix of SaskPower's various fuel sources – coal (24 per cent), natural gas (40 per cent), renewables (34 per cent), and other (two per cent). In doing so, customers ensure their electricity use aligns with their corporate ESG goals and sustainability objectives by determining how their electricity is generated, who they buy from, and securing environmental attributes to offset their carbon emissions from other industrial operations.

On the same note, customers determined to promote Indigenous partnerships may, through carefully crafted project ownership structures and other project agreements, encourage or require IPPs to involve Indigenous groups in projects through equity, contracting, or employment opportunities. In stark contrast, companies that do not participate in RAS will have no say in how, where, or who their electricity is sourced from, nor secure the environmental attributes produced from renewable generation when purchasing electricity under conventional SaskPower utility accounts.

Effectively, a renewable energy project qualified under RAS, whether it be solar or wind, is developed for the primary purpose of supplying clean electricity to carbon-intense customer-operated sites, which may include mines, oil and gas refineries, or manufacturing sites. In simple terms, the IPP will generate and then transmit electricity through SaskPower's grid (for a fee via Intra-Provincial Transmission Tariff) to the customer's site for consumption. This arrangement will be documented in a corporate power purchase agreement (CPPA, but it also goes by other names).

From a legal perspective, the CPPA typically hinges on several critical terms that are essential for a clear and enforceable contract, the most important being pricing and performance guarantees, duration and termination events, as well as construction, commissioning, and *force majeure* events. Under RAS and Saskatchewan carbon regulation, other issues also require careful consideration, namely the creation, ownership, and transferability of environmental credits or attributes, load matching, and curtailment. Addressing both load matching and curtailment, and mitigating associated risks will be essential, in addition to managing and mitigating the usual regulatory, permitting, construction, and financing risks.

Resourceful

McKercher LLP has a specialized team of lawyers and professional staff dedicated to providing advice to Saskatchewan's natural & renewable resource sectors. Our Resources Advisory Team provides value-added business and legal services including specialized mining agreements, acquisitions & dispositions, financing, regulatory & environmental issues, First Nations & government relations, and litigation.

With offices in both major cities in the province, we are strategically positioned to take advantage of all that Saskatchewan has to offer. We are proud of all that we have accomplished and consistently work towards serving our clients with innovation and integrity. With roots tracing back to 1926, we know our province and the intricacies of thriving in the business landscape of the prairies.

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Though CPPAs will change how customers source electricity, customers will remain connected to the same reliable power they've always had. SaskPower will be a mandatory partner, providing oversight and technical guidance to customers and IPPs participating in RAS. SaskPower's role will include constructing transmission facilities, developing joint operating procedures and the commission plan, authorizing transmission, and monitoring the project to ensure performance requirements are met. SaskPower will also charge a fee for their services and the Intra-Provincial Transmission Tariff for moving electricity through their grid.

While RAS is currently only offered to select heavy industrial customers, SaskPower has announced with optimism that it "tentatively" plans to open RAS to all its large industrial clients in 2024. Based on the current intake process, RAS projects will need to produce at least 10 MW in generating capacity and are expected to take two to three years to operationalize.

While Canada has set 2035 as its net-zero target date (which would negate the need for directly sourcing clean electricity), Saskatchewan's path to net zero is planned for 2050, 15 years later than the federal target. As a result, the benefit of a long-term CPPA beyond 2035 is viable in Saskatchewan, but the intersection with federal regulation and policy cannot be ignored. At this point, there may be more questions than answers. How will the Clean Electricity Regulations impact renewable projects post-2035? What if SaskPower accelerates its trajectory to net-zero electricity before 2050? What about carbon pricing compliance and one-off regional exceptions granted on political whims? Or the effect of change in government policy with the election of new governments? These are questions IPPs and RAS customers will want to consider when settling the terms of their CPPA and related project agreements.

Despite the uncertainty, RAS has the immediate potential to reconcile public, private, and government interests while making positive steps to achieve shared sustainability goals in Saskatchewan.

McKercher LLP's Renewables Advisory Team, led by Saskatoon-based Partner Chris Masich, is a leading law firm for Saskatchewan renewable energy projects. McKercher lawyers have proven expertise in bringing practical legal and business advice to large, innovative clean electricity energy projects. ▲

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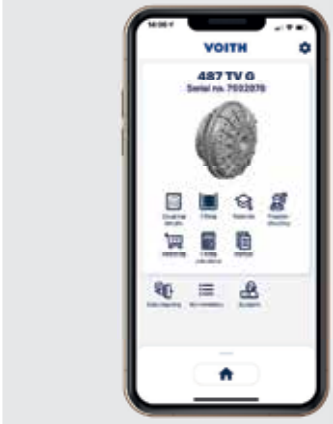

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VOITH

The importance of proper-fitting PPE for women in trade and technical roles

Picture this: a group of highly skilled and highly educated individuals are hard at work, taking on the challenge of the day. But amidst all their remarkable achievements, there's one aspect that often gets overlooked—the importance of proper-fitting personal protective equipment (PPE), particularly for women. Let's explore the significance of proper-fitting fire-resistant (FR) clothing and celebrate the power of women in high-risk fields.

Breaking stereotypes and shattering barriers

In traditionally male-dominated industries like powerline work, mining, and engineering, women are rising to the occasion. However, when it comes to safety gear, women face unique challenges due to ill-fitting PPE designed primarily for men. It's time to shatter barriers by demanding proper-fitting FR clothing that ensures comfort and safety for every worker, regardless of gender.

A perfect fit: The foundation of safety

Imagine a powerline technician climbing poles or an operator working with heavy machinery underground. In these high-risk environments, safety is paramount. Ill-fitting PPE can lead to distractions, reduced mobility, and compromised protection, which can be detrimental to the well-being of workers. Proper-fitting FR clothing is the foundation of safety, allowing women to move freely and perform their jobs without hindrance.

Comfort leads to confidence

Imagine working in uncomfortable, poorly fitting clothing for long hours. It can be frustrating and ultimately impact performance. On the other hand, wearing FR clothing tailored to fit women's bodies enhances comfort, boosts confidence, and improves overall well-being. When workers feel comfortable in their PPE, they can focus on their tasks more efficiently and with undeterred determination.

Empowering women: A win-win situation

When we prioritize proper-fitting FR clothing for women in high-risk industries, we not only ensure their safety, but also create an environment that empowers and encourages them. By investing in PPE that recognizes and accommodates the diverse needs of female workers, we foster an inclusive workplace that attracts and retains talent, promotes gender equality, and drives progress within these industries.

It's clear that the revolution is underway. By recognizing the unique challenges faced by women and advocating for well-fitting FR clothing, we can create safer, more comfortable, and empowering work environments for everyone.

Let's celebrate the power and redefine what it means to thrive in high-risk industries. Remember, safety knows no gender, and it's time to embrace the strength and resilience of women in the workplace. ▲

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Leading at the forefront

CHARTING THE PATH TO NET-ZERO MINING: INSIGHTS, INNOVATIONS, AND THE NUCLEAR FRONTIER IN SASKATCHEWAN'S POTASH INDUSTRY

March Consulting Associates Inc.
Engineering Excellence for 25 Years

BY MARCH CONSULTING ASSOCIATES INC.

As Saskatchewan mining operations strive to adopt eco-friendly practices and reduce greenhouse gas emissions, the adoption of clean process heat and electricity stands at the forefront of the many conversations we are leading with our clients and industry. We are seeing a growing interest in the application of Small Modular Reactors (SMRs) as one of the most intriguing opportunities to decarbonize industrial operations.

While the application of SMRs for potash mining operations is compelling, mine operators and companies serving the potash industry need to consider and understand how the heat or combined heat, and the power produced by SMRs would be used and what processes might need to be adapted. With the different SMR technologies available, along with operations readiness, applicability to mining energy requirements, and the path to deployment, there are many considerations for mine operators as they determine the integration of this technology in their operations.

Working with our clients and industry partners, March applies systems thinking to energy transition challenges. Systems thinking involves taking a more holistic view of complex issues and acknowledging areas of interconnectedness. We examine major key issues, such as waste production and waste management, energy production, and supply chain management in the early stages of energy projects. In addition, evaluating energy reliability is an important consideration. For industrial operations that run continuously, the intermittency of renewable options needs to be mitigated by using energy storage such as battery banks, which further adds to the environmental footprint of the solution. The analysis can become complex, and applying a systems thinking approach helps our clients consider all aspects to aid in better decisions for their operations.

Celebrating our 25th year as Saskatchewan's largest multi-discipline engineering consulting firm, we take great pride in our collaborative partnerships with local mine operators. Our extensive experience in potash mining processes, coupled with our knowledge of the nuclear energy sector, positions us to assist clients and partners in exploring innovative applications for these technologies. There is no one-size-fits-all solution to decarbonizing energy systems. Different geographic regions and distinct potash mining and milling operations have different considerations and options.

Nuclear energy is a leading solution, and SMRs will play an important role in the energy mix to achieve net-zero for Saskatchewan potash producers. We look forward to leveraging industry collaboration to assist our clients with deploying innovative solutions for a net-zero future in Saskatchewan's potash mining industry. Contact us to learn more at 306-651-6330, info@marchconsulting.com, or online at Marchconsulting.com. ▲

Our extensive experience in potash mining processes, coupled with our knowledge of the nuclear energy sector, positions us to assist clients and partners in exploring innovative applications for these technologies.



What is the engineering outcome you need

Your problem is ours to solve.

March is a multi-discipline engineering company. We look at all of sides of a problem to uncover practical solutions to suit your potash operation. And we've been doing it for 25 years. As a Saskatchewan-based company, our experience in the potash industry is unmatched.

We are your outcome-driven engineering partner.

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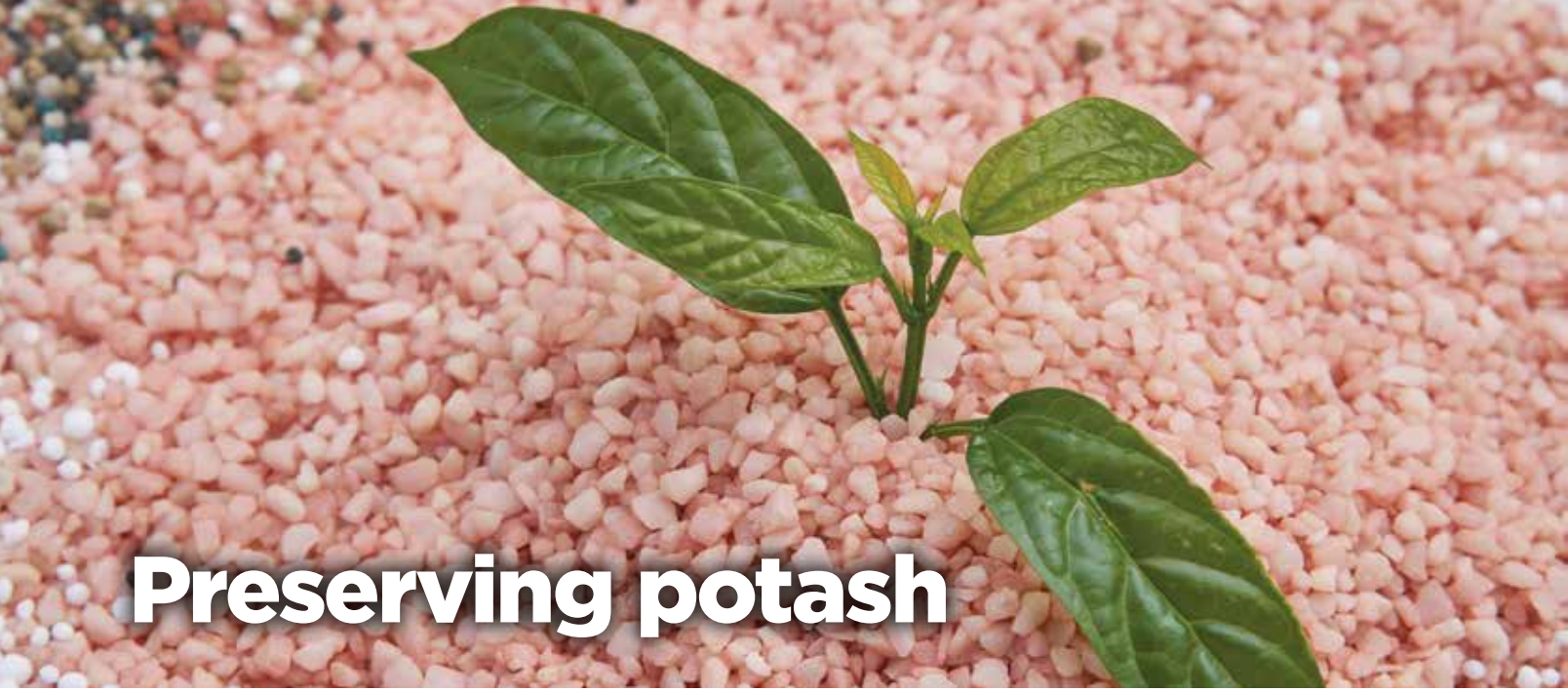


Preserving potash

COATING SOLUTIONS FOR POTASH FERTILIZER STORAGE AND TRANSPORT

WRITTEN BY ANAND SUNDARARAMAN PHD, TECHNICAL MANAGER OF CROP NUTRITION AT ARKEMA

Annually, millions of tons of potash fertilizer products are exported globally, necessitating intricate logistics for transport and storage. This operation encompasses prolonged storage of potash within facilities and transfer under non-controlled environmental conditions. Bulk potash transport primarily leverages rail cars and maritime vessels in combination with conveyor belts.

One prevalent issue during conventional storage and transportation is the frequent occurrence of potash fertilizer agglomeration, often referred to as “caking”. Caking arises primarily due to cyclical fluctuations in humidity, influenced by day-to-night temperature changes. When humidity increases, moisture either condenses from the air or migrates out of the granules, initiating the dissolution of the fertilizer. Conversely, as humidity decreases and temperatures cool, re-crystallization leads to the formation of crystal bridges, creating salt bonds that bind granules together. These lumps and agglomerates typically form in fertilizer storage facilities or because of exposure to harsh environmental conditions during transit. The existence of solid clumps within the fertilizer adds complexity to the handling process during loading and transit. Furthermore, these lumps can impede equipment spreading, leading to uneven nutrient distribution and increased wear on the equipment.

In addition, the agglomerated fertilizer tends to generate dust during packaging or transportation due to the mechanical abrasion caused by the movement of the fertilizer particles and/or the migration of moisture through the fertilizer. This dust complicates handling and land distribution, as it can become airborne during application in the field. Consequently, it leads to uneven nutrient distribution and potential health and safety concerns for users.

It is important to note that the phenomenon of moisture accumulation within bulk potash occurs at the air-potash interface throughout various stages, commencing with mining processing and persisting until the final application of potash to the soil in conjunction with other fertilizers and additives. Figure 1 illustrates the effect of standard potash (KCl) fertilizer after exposure to 85 per cent RH at 30°C for eight hours.

Although various methods can be adopted to address these challenges, applying a protective coating on granular fertilizers emerges as an effective strategy.

Figure (1): Potash (KCl) fertilizer before and after exposure to 85 per cent RH at 30°C for eight hours x25 magnification.

Before.

After.

Table (1): Comparison of moisture absorption behaviour.

Sample Description	(RH%)		
	75%	80%	85%
Moisture gain (%) uncoated potash	4.30	9.20	16.50
Moisture gain (%) GALORYL® coated potash	2.03	5.60	11.50
Average percentage reduction in moisture uptake for Galoryl coated versus uncoated potash	52%	39%	33%

Figure 2: Comparison of caking reduction behaviour.

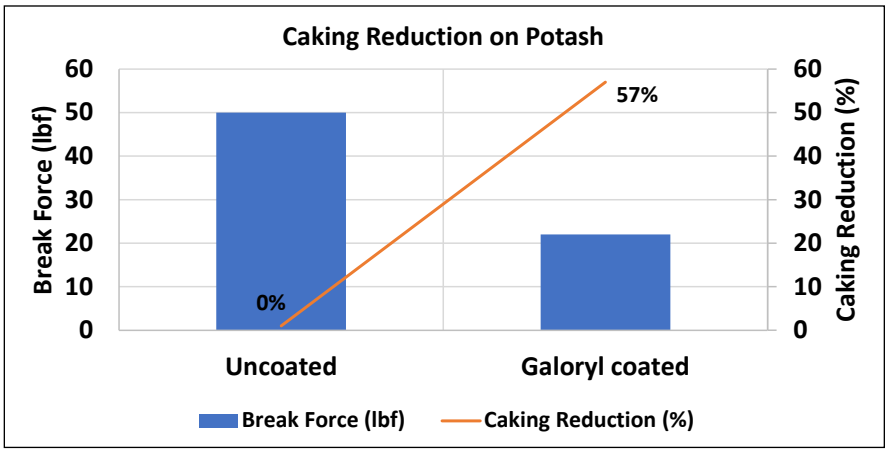
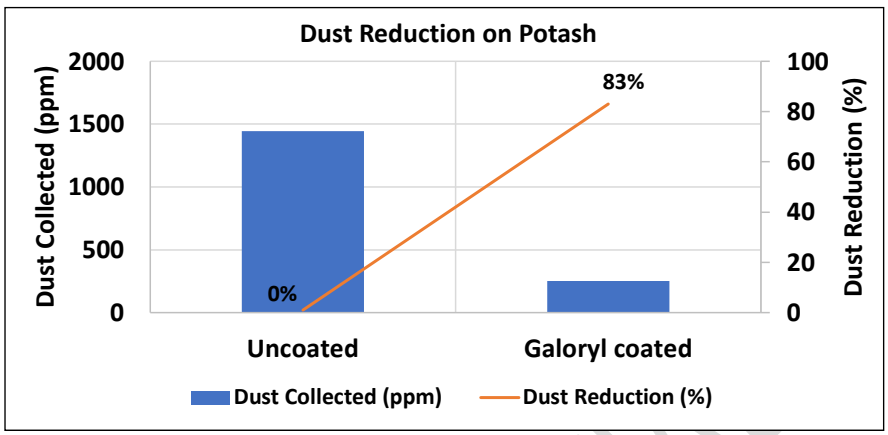


Figure 3: Comparison of dust reduction behaviour.



In this context, the coating serves as a barrier layer, preventing the adsorption and/or ingress of moisture from the environment into the potash fertilizer and vice versa.

Arkema offers a variety of coatings under the GALORYL® product line that provide significant anti-caking and dust control properties for a range of granular fertilizers, including potash. Table 1 compares the moisture absorption behaviour of an uncoated potash to that of a GALORYL® coated potash fertilizer. Notably, the data shows a significant reduction in moisture absorption at high relative humidity (RH%) when the fertilizer is coated with GALORYL® and maintained at 30°C.

To understand the improvement in caking reduction performance, an accelerated caking test is performed on coated potash fertilizers to simulate surface caking of fertilizer piles stored in warehouses. The plot in Figure 2 clearly illustrates the superior anti-caking performance of the coated potash in comparison to the uncoated material. For instance, the force energy required to break a GALORYL® coated potash cake is 57 per cent lower than that of uncoated potash. These large improvements in caking reduction help protect the fertilizers from clumping, and the low break force provides convenient handling from manufacturing to field application.

In addition to the anti-caking behaviour, the coated fertilizers provide short-term dust reduction properties to the fertilizers. The plot in Figure 3 compares the dust reduction performance

of the coated potash fertilizers to the uncoated material. The GALORYL® coated potash shows an 83 per cent reduction in dust compared to uncoated potash. From the graph, it is evident that the dust reduction performances of the coated potash fertilizers are superior in comparison to the uncoated potash. The better dust control behaviour of the coated fertilizers results in minimal loss of fertilizers for more sustainable farming.

In conclusion, the Arkema GALORYL® coatings provide a reliable barrier that enhances moisture resistance and reduces the caking and dusting behaviour in potash fertilizers. This ensures smooth storage and transport of potash fertilizers in challenging environmental conditions without compromising their ultimate field performance.

Acknowledgments: Sincere thanks to Anna McLeroy and Christina Konecki for their contributions to this article.

When you need more with less

HD ENGINEERING & DESIGN

As customers are trying to increase productivity and profits to maximize shareholder value by reducing costs, a common theme has been emerging over the last few years. A theme of needing to get more with less. A customer needs to get more productivity out of their manpower to reduce fixed costs and to get more productivity from their equipment through better selection, easier maintenance, and increased reliability. If this strategy is not implemented properly, the result could easily be less as employees become burnt out or inefficient by not focusing on their strengths.

CMI is uniquely positioned to maximize customer value to get more with less

CMI has been in business for over 30 years and our team has over 150 years of experience directly in or supporting operation and maintenance needs for both underground and surface mining operations. CMI's focus is to provide solutions that maximize our customer's overall profitability and we do this through a combination of tailored OEM equipment and distribution of various mining equipment and products.

CMI provides tailored OEM equipment that meets 100 per cent of our customers' needs. This typically involves maximizing equipment reliability (functionality and performance) while minimizing costs though standardization of equipment spare parts and training. By providing equipment as a system versus a component, CMI assumes the overall responsibility to ensure the system meets the needs of the customer. The customer manages one interface with CMI while we manage the hundreds and possibly thousands of interfaces between each component. Service and warranty are easier as customers only need to worry about one vendor, CMI. We are currently working on a project where this strategy offered significant reduction in customer workload. CMI was already fabricating the structure for multiple conveyor systems and were already managing the schedule for multiple packages to be delivered to site packaged and labeled properly to support optimum construction. CMI then provided an option to manage the rest of the supply, allowing the customer to manage the additional scope as part of the original package. This eliminated the need for over 120 additional purchase orders, approximately six new contracts, six weekly schedule updates, six bi-weekly project review meetings, not to mention the expediting and technical requirements of each component. By bundling this additional supply with CMI, the customer saved all this additional work and could get more with less.

CMI has 30 years of vendor relationships to leverage on which allows this bundling strategy to be provided at a reasonable cost. We also leverage a collaborative

approach with local vendors that our customers are familiar and comfortable with. This is a critical strategy to meeting the site requirement as the local vendors have the knowledge when site information was not maintained 100 per cent accurate. CMI and other local vendors provide value as the glue to help bridge these gaps for the operations.

Maximizing equipment reliability while minimizing costs is another major focus to get more with less. CMI's technical expertise allows us to understand the equipment requirements and connect this with technological advancements within the industry. We provide equipment that meets the standardization strategies and provide options for the newer technology or increased reliability to maximize value. This allows our customers to make informed decisions by understanding the cost of standardizing on existing or upgrading to new improved options. Our relationships and knowledge allow our customers to get more out of the equipment with less cost.

The last key area where CMI can support our customers is through our service groups. CMI and HD Engineering & Design provide our customers with opportunities to ramp up manpower for specific tasks or projects without increasing their overall fixed manpower costs. We have supported projects like site troubleshooting support and repair, project management and drafting services, maintenance planning and development of equipment hierarchy structures in the EAM systems and developed maintenance PM strategies. This allows customers to utilize their resources where they are most efficient and leverage their detailed site knowledge to generate the most value to get more with less.

Therefore, if you are getting asked to or you need to get more with less, give CMI a call to look at unique strategies to maximize your success. ▲

Potash from lab to field

THE INNOVATION CENTER GIVES PRODUCERS A TECHNICAL EDGE

BY FEECO INTERNATIONAL

Potash before and after agglomeration.

Potash granules in the Innovation Center's pilot rotary dryer.

Potash's importance as a crop input has continued to grow in recent years, prompting a rise in research and development work focused on producing ever-more specialized products, evaluating novel sources of potassium-bearing materials, and maximizing product quality and process efficiency. This has made facilities such as the FEECO Innovation Center invaluable to producers in their efforts to meet the ever-changing needs of the market.

With extensive testing capabilities and potash expertise, testing in the FEECO Innovation Center opens a world of opportunities to fertilizer manufacturers.

With options at both batch and pilot scale, the Innovation Center can meet producers exactly where they're at in their R&D journey. From demonstrating proof of concept, to optimizing the continuous process under simulated commercial conditions, producers are able to test on a single piece of equipment or combine equipment for a continuous process loop. This includes the ability to generate small samples of product for field testing and further evaluation.

"Our testing programs give producers options at every step of the development process," says Ron Eichhorn, FEECO Innovation Center manager. "They can work out their formulation or trial different binders at batch scale, and then move on to our pilot plant where we can establish the combination of parameters required to produce the product quality they're looking for on a commercial-scale basis."

Available tests & equipment

The Innovation Center offers testing for a range of potash processing techniques, including:

Wet Granulation (Pelletizing)

Producers are able to test different approaches to wet granulation, including the singular or combined use of pin mixers, pugmill mixers, disc pelletizers, and granulation/agglomeration drums.

FEECO INTERNATIONAL

POTASH PROCESSING
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SINCE 1951

Drying

The Innovation Center can accommodate dryer testing in isolation or as part of a larger wet granulation process. Customers have the option of testing in either a rotary dryer or fluid bed dryer. A flight simulator for optimizing material lifter design in rotary dryers and coolers is also available.

Coating

Whether working with anti-caking, de-dusting, or beneficial additive coatings, the ability to consistently achieve a uniform coating on fertilizer granules requires precision design, taking into account the physical and chemical properties of both granule and coating. In this effort, the Innovation Center offers a pilot coating drum with a flexible configuration, allowing numerous variables to be adjusted to establish the optimal combination of factors.

Glazing

Also referred to as conditioning or polishing, glazing potash granules as a finishing step lends a crystallized granule surface that is less likely to experience degradation and attrition. The Innovation Center offers multiple approaches to testing the glazing of granules.

"Because we are able to test so many production techniques and have the expertise to know what will work and what won't, customers are able to return to the Innovation Center throughout their development journey to test different aspects of their process," Eichhorn comments. "This ability to prove their concept at every stage and optimize their process under simulated commercial conditions really helps reduce any risk in scaling up the process."

Granule properties

The Innovation Center boasts an extensive technical laboratory to evaluate a host of product parameters throughout the testing process to ensure product meets desired objectives for appearance, handling, and performance. This includes:

- Particle size distribution, size guide number (SGN), granulometric spread index (GSI), and uniformity index (UI)
- Green strength
- Crush strength
- Loose bulk density
- Packed bulk density
- Moisture content
- Attrition potential

As the needs of the potash market continues to evolve, process development testing services, such as those conducted in the FEECO Innovation Center, will continue to gain importance. In addition to demonstrating proof of concept, testing in the FEECO Innovation Center allows producers to zero in on the production parameters needed to meet their product quality requirements on a continuous commercial scale.

Those interested in testing should contact FEECO International at FEECO.com, or by calling toll-free at (800) 373-9347. ▲

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Empowering potash mining

INTEGRATED POWER SERVICES EXPANDS CAPABILITIES WITH SURPLEC ACQUISITION AND ENHANCED ASSET MANAGEMENT CAPACITY

The newly added 24,000-square-foot climate-controlled storage warehouse with 60-ton crane capacity (bringing its total to 65,000 square feet) reinforces IPS's asset management program.

In the dynamic world of potash mining, the reliability and efficiency of equipment are paramount for seamless operations. Integrated Power Services (IPS) has long been a trusted partner, offering critical support to ensure uninterrupted performance for potash mining operations. With its recent acquisition of Surplec and the integration of additional warehouse storage capacity into its asset management program, IPS has increased its capabilities, reinforcing its commitment to the industry's success.

A trusted advisor preparing for the future

IPS has been a cornerstone for potash mining companies seeking expert support for their electrical equipment. The recent acquisition of Surplec, a leading provider of transformer solutions, further bolsters IPS's comprehensive offerings. This strategic move enhances their ability to deliver a wider range of specialized services, solidifying their position as a preferred partner in the industry.

Expanding repairs, maintenance, and storage solutions

IPS understands the urgency of timely repairs and offers rapid response times to minimize downtime. With Surplec's transformer expertise now integrated, IPS broadens its electric motor repair and maintenance capabilities, providing a more comprehensive suite of solutions. In addition, the newly added 24,000-square-foot climate-controlled storage warehouse with 60-ton crane capacity (bringing its total to 65,000 square feet) reinforces IPS's asset management program. This enables clients to securely store, manage, and deploy critical components and spare parts when needed.

Tailored solutions for peak performance

IPS goes above and beyond standard repairs, customizing solutions to enhance equipment efficiency. Through precision balancing, vibration analysis, advanced testing techniques, and proprietary rewind technology, IPS optimizes electromechanical equipment. This results in reduced energy consumption and a prolonged equipment lifespan. IPS offers an expanded range of specialized solutions, ensuring that potash mining operations operate at maximum profitability.

Innovative technology for proper maintenance

Staying at the forefront of technology, IPS integrates state-of-the-art asset tracking and maintenance programs. By leveraging IPS repair and stored asset tracking software, mines can access better data to make informed decisions. This proactive approach minimizes unplanned downtime, maximizing production output. Mining teams can get access to failure analysis reports, rebuild reports, and stored asset maintenance information, all at their fingertips.

Safety excellence and comprehensive training

Safety remains the cornerstone of operations in the mining industry. IPS adheres to rigorous safety protocols and industry standards, ensuring all repairs and field service work are conducted with meticulous care. Moreover, IPS now offers an expanded range of training programs, equipping mining personnel with the knowledge and skills to manage electrical equipment with confidence.

Vast reach, local expertise

With its locations in Saskatoon and Regina, Sask., IPS provides on-the-ground support to the top potash mining operations in the world. This localized presence, coupled with a deep understanding of technical requirements, allows IPS to deliver engineered solutions for any situation. The IPS network, with over 70 locations in North America, has the capacity to handle any job no matter the size or complexity.

Integrated Power Services, fortified by the recent acquisition of Surplec and the integration of additional warehouse storage capacity into its asset management program, stands as an unwavering partner in the potash mining industry. Through their expanded offerings, innovative solutions, and steadfast dedication to safety, IPS continues to earn the trust of the mining industry. As the demand for potash continues to rise, IPS remains poised to lead the industry towards redefining reliability and sustainability.

With Integrated Power Services at their side, the future of Saskatchewan potash mines is more promising than ever. ▲

With its locations in Saskatoon and Regina, Sask., IPS provides on-the-ground support to the top potash mining operations in the world.

Pathway to journeyperson

Following successful completion of JNE's Pathway to Journeyperson program, participants will have not only learned their trade, but will also have a story and experience to share with other community members.

A common thread that Saskatchewan businesses experience today is the challenge of recruiting and retaining skilled labour. We are experiencing a critical time in history where the Baby Boomers, who make up approximately 20 per cent of Canada's workforce, are retiring. This group of the workforce have spent 30 to 50 years providing immense value to Canada's economy. As our province prepares to increase production in response to the global demand for potash, the competition for skilled labour remains extremely high.

With the increase in capital projects planned for the province along with the much welcome news of BHP's approval of their $6.4 billion second stage of the Jansen potash project, engagement and inclusion of Saskatchewan's Indigenous people will be critical in the success of these economic development activities in the province.

As a 60 per cent Indigenous-owned partnership with English River First Nation and Peter Ballantyne Cree Nation, JNE Welding recognizes the significant barriers Indigenous people face when entering the workforce. JNE has developed a program, Pathway to Journeyperson, which is designed to support the people of our ownership communities. Through employment and apprenticeship opportunities, participants will be provided with the education, experience, and support required to progress through apprenticeship to become a journeyperson welder or fabricator. Ultimately, the addition of newly skilled people will become part of a growing provincial economy and enable participation in the economic uptick Saskatchewan is experiencing.

With receipt of long-term commitments from clients for projects such as BHP's Jansen Potash Mine, JNE has a solid baseload of manufacturing lined up for the next several years that is suitable for entry-level welders and metal fabricators to build their skillset. These long-term commitments are critical to enable JNE to create a long runway of the appropriate type of work to successfully facilitate this apprenticeship project and build newly skilled tradespeople beyond entry-level positions. The support from Saskatchewan's potash industry will allow this grassroots initiative to become part of JNE's ongoing pipeline of skilled workers.

To launch JNE's Pathway to Journeyperson program, JNE hosted an introductory day for members of our partner communities to learn about the apprenticeship opportunities that are available to them. The day included a presentation from Saskatchewan Polytechnic to outline the educational journey, along with the Gabriel Dumont Institute and Saskatoon Tribal Council to share the supports that are available to Indigenous people relocating to Saskatoon to pursue a career in welding and metal fabrication.

Perhaps the most impactful part of the day was hearing from Hunter Janvier, a member of English River First Nation who is currently employed at JNE Welding. Janvier is working through his second year of apprenticeship towards earning a Red Seal Certification in welding. Janvier shared his apprenticeship experience so far, painting an inspiring picture for our guests in which they can see themselves working toward the same achievements.

Following successful completion of JNE's Pathway to Journeyperson program, participants will have not only learned their trade, but will also have a story and experience to share with other community members. JNE's hope is that these individuals will become mentors, both within JNE and their community who will share their success story and encourage others to pursue their own aspirations, so that together we rebuild a stronger, more resilient workforce of Saskatchewan. ▲

Saskatoon company develops a GPR solution for potash mining

Kinemek's GPR-RTV Hydraulic Lift.

Kinemek's GPR-RTV Arm folded up when not deployed.

Ground penetrating radar (GPR) is routinely used in potash mines to image the roof of mining rooms to understand the geology and hazardous conditions that may exist. However, the largest hurdle for GPR acquisition is the deployment of a coupled antenna directly to the roof. Various manual methods have been deployed over the years, including an operator holding a pole-mounted sensor up to the mine back. This was labour-intensive and difficult to obtain continuous data, hence a better solution was desired.

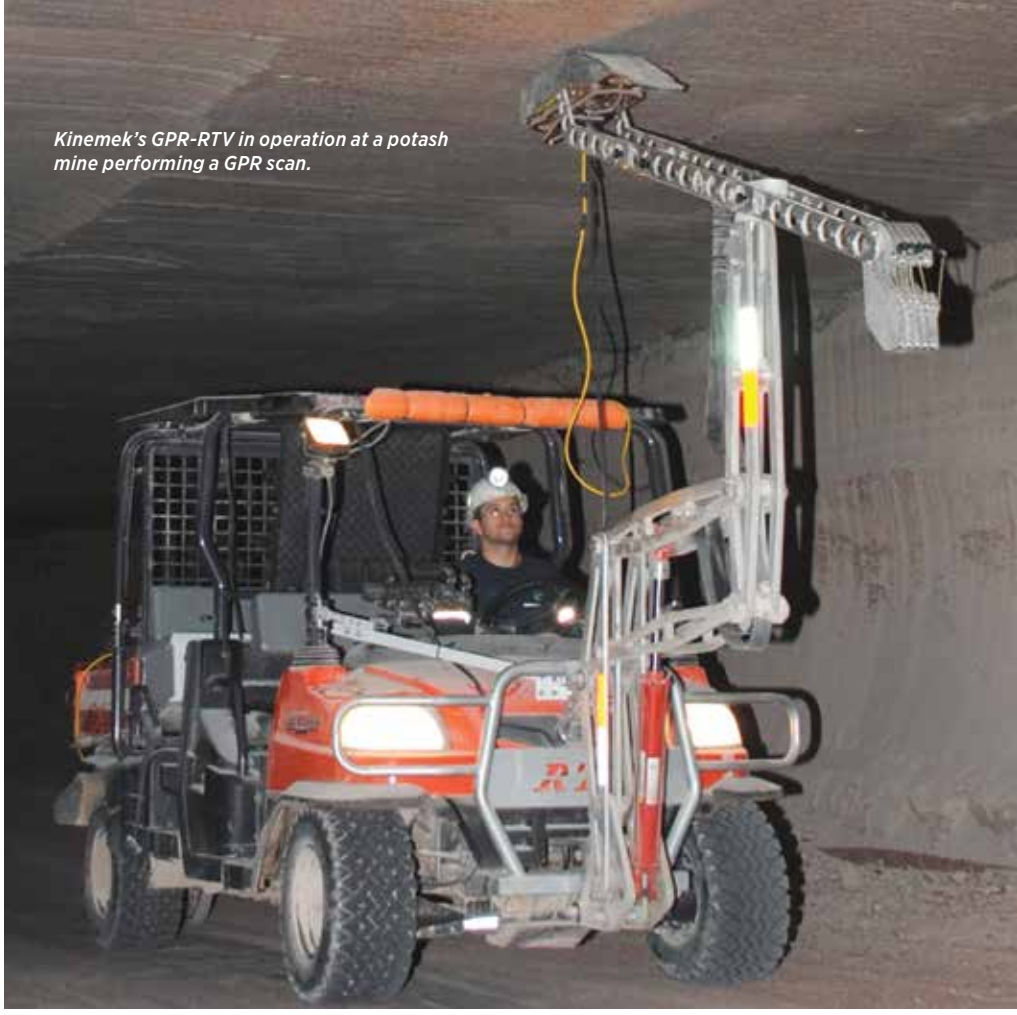
In 2012, PotashCorp (now Nutrien) engaged Kinemek to develop a solution that would improve upon an existing design and adapt to a Kubota RTV. Kinemek visited an operating potash mine to learn about the problem first-hand and understand the harsh environment that the solution would need to be designed for.

After the mine visit, Kinemek went to the drawing board. Armed with an understanding of the potash mining environment and feedback from Nutrien, an original solution was developed. The GPR-RTV system consisted of a hydraulic lift, a counterweight arm, and a protective housing for the GPR antenna.

The lightweight aluminum hydraulic lift installs into the Kubota's front receiver. It was designed to be responsive to quickly change in height, not obstruct a driver's view of the road, has zero maintenance, and was robust and corrosion resistant. The aluminum counterweight arm was also designed to be portable, lightweight, and mount directly onto the lift's universal pin. When not deployed, it folds up to be one-third its length so it can fit in the back of the Kubota. To keep the GPR housing against the mine back, an innovative idea was used: creating the arm to be counterweighted with removable

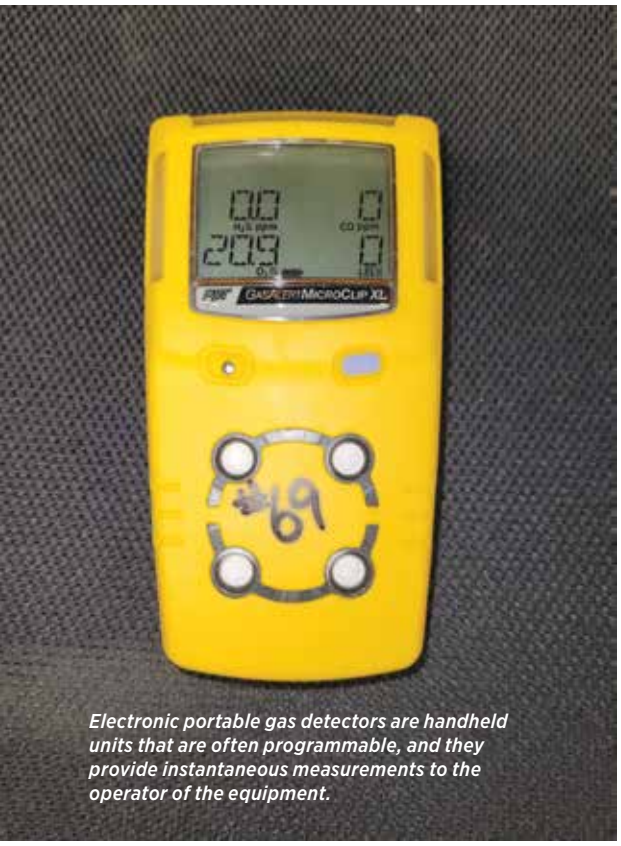
counterweights. These weights allowed the housing to float along with a constant force to the mine back. The UHMW polyethylene GPR housing itself was designed to be ultra-tough, wear-resistant, and simply skid along the mine back. Its robust design would withstand impacts from rock bolts, while protecting the sensor. After nearly a decade of service, these housings still protect the GPR antennas from rock bolts penetrating the housings.

As Kinemek's GPR-RTV prototype design was a success, Nutrien proceeded to deploy a unit at each operating site. These GPR-RTV systems are still an important tool in a spectrum of ground-control tools that Nutrien used to ensure safe production at its sites. ▲



Kinemek's GPR-RTV in operation at a potash mine performing a GPR scan.

Testing and monitoring hazardous atmospheres



Electronic portable gas detectors are handheld units that are often programmable, and they provide instantaneous measurements to the operator of the equipment.

Colorimetric tubes are used to detect a single toxic gas.

proactive
Consulting Services Limited

Many industrial sites contain vast quantities of flammable and toxic materials. In order to ensure the health and safety of all employees, contractors, and the public at large, determinations must be made as to whether any of these materials may be present and the quantities of each.

Knowledge is one of the key ingredients in developing safe work practices. The ability to test and monitor the atmosphere for any hazardous concentrations is a critical component to any organization's safety management system.

Gas testing and atmospheric monitoring are often viewed as the same activity. However, this is not the case as each term actually refers to a very different activity. Gas testing is a task where measurements are taken for a specific hazard or group of hazards in a specific location. It is typically performed prior to beginning a task and the results will dictate what control measures need to be taken to ensure the health and safety of the employees.

Atmospheric monitoring is an activity where the general work atmosphere is continually measured to ensure that there are no changes in the area during the task. Monitoring is typically completed as a result of the gas testing.

When performing atmospheric testing and/or monitoring, there are typically three key items to measure in the atmosphere:

1. Oxygen content

2. Presence and amount of flammable gasses

3. Presence and amount of toxic gasses

Gas detection equipment is for use by trained and qualified personnel. It is designed to be used when performing a hazard assessment to assess potential worker exposure to oxygen deficiency or enrichment, as well as combustible and toxic gases and vapours. Training on the actual use, maintenance, limitations, and proper selection of this equipment is critical. More than one type of gas can give the same or similar reading, which can confuse the untrained tester and lead to erroneous decisions and controls.

There are two distinct equipment types commonly used to test and monitor atmospheres:

1. Electronic portable gas detectors

2. Colorimetric tubes

Electronic portable gas detectors are handheld units that are often programmable, and they provide instantaneous measurements to the operator of the equipment. They have the capability to detect and measure numerous gases and vapours depending on the sensors that are installed in the unit.

Electronic units are direct reading and display the content of gasses being measured constantly on screen. They also incorporate alarms to immediately warn users to atmospheric changes that present a danger.

Colorimetric tubes are used to detect a single toxic gas. Ambient air sample is drawn into a gas tube that houses a specific absorbing material that changes colour if the gas it measures is present.

Direct readings are made with calibration markings right on the tube, so measurements can be made as simply and precisely as reading a thermometer. A sample tube is inserted into the hand-held pump, and the pump is squeezed. A precisely measured volume of ambient air is drawn inside the tube where it contacts the reagent. Instantly, the reagent changes colour, reacting quantitatively to provide a length-of-stain indication. The farther the stain travels along the tube, the higher the concentration of gas. Note the scale mark on the tube where the stain stops and that's the measurement.

There is a variety of equipment that is available to perform gas tests. A competent gas tester will know the limitations and operating procedures for each type. They must also understand the work area and the exact nature of the work to be performed as this will dictate the type of equipment needed and assist in determining where the testing is needed.

If performed properly, gas testing and atmospheric monitoring should help to ensure the safety of all personnel. ▲

Welco employee with potash in hand.

The power of potash

WELCO

As a company providing sales and service to the potassium chloride (potash) industry for over 50 years, Welco understands the incredible resource potash is to the Canadian economy and the positive impact it has on communities across the globe.

Primarily utilized in the production of fertilizers to support plant growth, increase crop yields, and enhance water preservation, Canadian-produced potash is an essential resource, especially with severe-weather events like droughts, which are occurring on a more frequent basis.

Welco warehouse with parts.

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Welco has been providing quality products and expert solutions to potash processors for over 50 years.

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We offer a full line of quality products from industry-leading manufacturers. We actively track, monitor and ensure critical components are ready and available when and where our clients need them.

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Avoid downtime! Welco has the tools and expertise to analyze and evaluate your current equipment for repair or replacement before potential problems occur.

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An essential resource

Crops around the world rely on potash for healthy growth. As a critical ingredient in fertilizer, potash improves crop yields by increasing resistance to disease and improving water retention. Without potash, crops would suffer resulting in decreased food production. 95 per cent of the world's potash is utilized in farming to fertilize global food supplies. In addition, potash is a vital component in feed supplements used for the development of healthy livestock and enhanced milk production.

An economic driver

Potash production is a critical part of the Canadian economy. Along with being an essential resource, Potash provides Canada with career opportunities and educational investment while fueling economic growth.

Canada was the leader in worldwide potash production in 2021 with over 22.5 million metric tonnes of potash produced that year, according to the Government of Canada, which accounted for 31.3 per cent of total global production which makes Canada the world's largest exporter of potash.

As a result, operating businesses employ thousands within the Canadian potash sector and invest millions in research and development of energy-efficient and low-carbon technologies, education and training, and diversity and inclusion initiatives while providing grants and scholarships to those entering the industry.

The province of Saskatchewan directly employs over 6,000 people in the industry and offers the largest potash resources in the world. In fact, Saskatchewan has enough potash to meet global demand for hundreds of years. In addition, people across Canada research, engineer, develop, and create technologies utilized within the industry, from carbon-reducing technologies to material production for equipment and manufacturing, Canada as a whole benefits extensively from potash production.

All systems go

Welco plays an integral role in support and service of the potash industry. With a deep understanding of operational requirements, Welco supplies and services mines in Canada backed by technical experts and engineers with critical components on site, ready to ship when and where needed. In addition, Welco employs Canadians across western Canada and actively invests in trade shows, annual meetings, educational training, and more. We understand the benefit of the Canadian mining industry and the importance of sustainable resource development and we're here to support it.

Potash and the future

By working together, investing in, and supporting the future of the potash industry, we, as Canadians, can continue to lead the globe in responsible and reliable production. The importance of potash can't be understated as an essential resource and economic driver, and Welco is proud to be a part of this incredible industry.

We can't survive without food and water and potash is a critical ingredient in the production of those commodities... that's the power of potash. ▲

FL200TC (2), FL100TC, and FL50TC Tank Cell flotation Units with the Westpro manufacturing team ready for delivery.

Westpro's Proven Potash Flotation technology: Efficiency and sustainability

Flotation technology has played a crucial role in mineral processing since the early 1900s. Over the years, while there have been evolutionary changes, the fundamental principle of mineral hydrophobicity, whether natural or induced, continues to underpin the separation process. This principle is the cornerstone of flotation technology, enabling the efficient and cost-effective separation of a wide range of minerals.

The mineral processing industry is dynamic, continually embracing innovation from various market players. In recent years, a noticeable trend in flotation equipment has been the emergence of larger flotation cells capable of handling lower-grade feeds. While the focus remains on efficiency, sustainability and cost-efficiency have taken centre stage. There has also been a move toward treating lower-grade and more finely disseminated ores, as well as reprocessing tailings, driving the trend of larger individual flotation cells.

Interestingly, the potash industry has charted its own course. The value of potash products is directly linked to particle size, with coarser products selling at a premium. Potash flotation isn't a one-size-fits-all operation. Applications range from rougher flotation to different stages of cleaner and scavenger stages. Although most plant flotation circuits share similarities, each is customized to suit the specific ore being treated. Given the operations' diversity and scale, Westpro's Proven Potash Flotation technology has shown to be effective and economical. Westpro's Proven Potash Flotation Cells are tailored to meet the specific process requirements of each project. Westpro considers these cells among the best options for potash flotation. Notably, the FL300 cell series has gained significant popularity in potash

Above: FL300 Flotation operating in Chile with Westpro employee on-site.

Left: FL4600, FL1400, FL1100- W19 Rotors in shop.

Below: Westpro 8.5 m3 FL300DO Flotation Cells in a potash plant in Saskatchewan.

applications, with installations in numerous projects all around the globe.

Additionally, Westpro Flotation has been at the forefront of coarse and fine particle recovery through its innovative W19 flotation technology in recent years.

This new technology has significantly enhanced the mixing capacity of the rotor, accommodating a wider range of particle sizes and leading to substantial power savings. Implementing the W19 mechanism in tank cells has resulted in clearly well-defined mixing, quiescent, and froth collection zones along the tank's height. This has reduced sanding issues and maximizes particle-bubble interaction thanks to improved mixing and air dispersion at consistent aeration rates.

For nearly 40 years, Westpro has been supplying a range of equipment to the mineral processing industry around the world. Tailored solutions, such as Westpro's Proven Potash Flotation technology and versatile tank cells, cater to diverse mineral requirements. Westpro's equipment is manufactured to the highest Canadian standards in components that require minimal on-site assembly. Supply has ranged from individual components to complete modular circuits to underscore the industry's commitment to progress, ensuring that flotation remains integral to the efficient and sustainable extraction of valuable minerals. ▲

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Kristian Electric keeps potash welding

Left: Kristian welder service technician, Steve Carruthers, smiles in the Welder Service Engine Bay as he starts working on a Miller Bobcat engine-driven welder generator.

Above: Kristian Electric Saskatoon's showroom is fully stocked with welding and overhead lifting equipment.

After nearly 60 years repairing welding equipment for customers across Western Canada, Kristian Electric knows firsthand the vital role that optimal performance plays in the field. With their expansion into Saskatoon in May 2014, Kristian has established itself as a trusted service provider and distributor of welding equipment and supplies to many of the major players in the Saskatchewan potash mining industry. Offering a range of services, including equipment repairs, consumables, and equipment sales, Kristian aims to help mines across Saskatchewan ensure that their welders remain productive and efficient.

Welding equipment in the potash industry is subject to intense working conditions, not only due to the high demands of potash production, but the unique material characteristics of potash itself. As a resource with a mildly abrasive and corrosive nature, welding equipment used in potash processing is particularly subject to material buildup that can quickly inhibit equipment performance.

"Potash fines enter through the open wind tunnel and accumulate within the machine," says Kurtis Dyck, welder service foreman for Kristian Electric Saskatoon. "While some welders have better containment of internal components than others, we see potash deposit cause failure from accumulation on the motor fans right down to corroding power, IGBT, and display boards."

As Saskatchewan's authorized service centre for welding brands including Miller, Lincoln Electric, and Fronius, Kristian regularly receives units from across the mining industry. Like all industrial equipment used in potash production, regular preventative maintenance is key to producing consistent high-quality results and avoiding downtime. Following the impact of the COVID-19 pandemic on the electromechanical supply chain, hard failures such as failed PC boards and fried components inside welding equipment can severely impact repair timelines.

"We understand the urgency in the potash industry and do our best to offer timely and efficient service to minimize downtime," says Dyck. "But the best way to maintain equipment lifespan is

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Kristian's Murtaza Bhandari snaps a quick picture with one of multiple Miller Big Blue 600 Air Pak engine-driven welders sold to a local Saskatchewan customer.

Kurtis Dyck, welder service foreman, finishes up testing a repaired Lincoln Electric Idealarc CV-305 MIG welder.

a maintenance schedule that prioritizes regular cleaning to avoid accelerated component wear."

While welder repair is a substantial part of Kristian Electric's support to the mining industry, their expertise extends from the shop into providing trusted equipment solutions in the field. Kristian Electric offers new and used welding supply and sales from brands including Miller, Hobart, Hypertherm, and Fronius. Specialty knowledge from decades of servicing welding equipment gives the Kristian team a hard-earned advantage when it comes to recommending and procuring equipment specific to each customer's application and usage.

Kristian Electric's dedication to excellence in welding equipment repair, maintenance, and sales makes it a trusted player for the Saskatchewan mining industry in the years ahead. By keeping potash welders welding, Kristian Electric is proud to be an indispensable partner for the evolving needs of the thriving potash sector. ▲

THE GREENBRIER COMPANIES

4650 POTASH COVERED HOPPER

This 4,650 cubic feet capacity covered hopper railcar has a curve sided design with three compartments and gravity outlet gates specifically designed for potash service. This Centerflow® railcar features the higher load limit provided by a stub-sill design. Various interior linings, roof hatch configurations and outlet gates are available.

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You've got places to go and people to see. You get in your truck, start it up, and drive to where you need to go. You don't often think about the guts of the machine doing the work to get you there when it's all working like it should. But when that truck doesn't start, it's a problem, and you're stuck.

It's really not too different in the world of potash mining. When a critical component like an electric motor fails on a key piece of machinery, in that moment, it means you're stuck. What can follow after is expensive downtime, loss of production, and general frustration.

Fortunately, there's a powerful partnership that's been forged over 20 years to tackle that issue in the mining industry. Saskatoon's Precision Electro-Mechanical and WEG Motors Canada have teamed up to deliver high-end, customized electric motor solutions, with unmatched maintenance and service, for some of the biggest underground mining applications in western Canada.

"When it comes to quality, reliability, and customization – all the things you want in electric motors – WEG stands out above the rest," says Marc Taillon, CEO of Precision Electro Mechanical. "Before I got into the electric motor repair business, I worked at a potash mine for 17 years. I saw the motors that came in and the motors that came out. I saw what lasted and what didn't, what saved us money, and what cost us in the long run. And most of all, I knew the value of a partnership that could deliver the right solutions and quality service to our mining industry."

As a major global distributor of electric motors, WEG has built a reputation of continuously improving efficiency and innovation in the marketplace. And for Saskatchewan's potash industry, which has seen its fair share of change, evolution, and new projects coming online, that couldn't be a better fit.

"We're pleased to see WEG motors growing to become one of the most recognized names behind electric motor solutions in Saskatchewan's potash industry," adds David Wassyng, vice-president of VJ Pamensky Canada Inc./WEG Canada. "But we're just as pleased to be working with a local partner like Precision Electro Mechanical to make that happen. It couldn't have happened without a partnership like this."

Through this teamwork, Precision Electro Mechanical and WEG have jointly deployed thousands of customized motor solutions to sites across the province. But the work doesn't stop after a new solution is installed. For Taillon, the value of quality, service, and

Two Precision Electro-Mechanical employees performing a quality control check on an outgoing motor.

WEG miner head motor set up for a loaded test on PEM's regenerative dynamometer.

predictive maintenance from a dependable local partner can't be overstated, especially when things don't go according to plan.

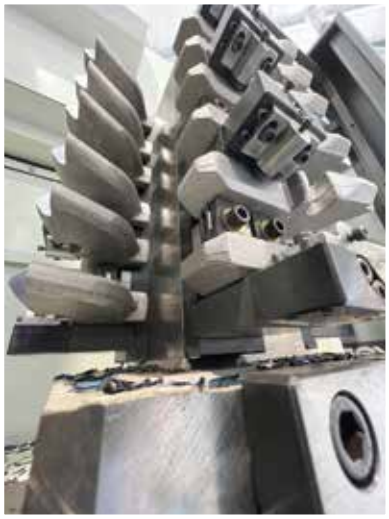
"When someone asks me why they should care about Precision's commitment to quality and service for our customers, I ask them to compare it to how they would look after their truck," says Taillon. "A good mechanic will take care of you, treat you fairly, and make sure you get the right solutions that keeps your truck on the road for a long time. A bad mechanic will do none of those things. Which one would you pick?"

He adds that they continuously strive to be that 'good mechanic' for electric motors in the mining industry. Because when you stick to your values and put your customers first, you can't go wrong.

Robust, tailor-made solutions with WEG electric motors, with the local knowledge and quality service from Precision Electro Mechanical. Now that's a partnership that can't be beat. ▲

Continuous improvement

BIT SERVICE COMPANY LTD.



Left: Batch of carbide bits after production.

Above left: Machining raw bit forgings.

Above right: One view of new manufacturing plant.

Manufacturing carbide and specialty-cutting bits for underground mining since 1965, Bit Service Company Ltd. experienced a growth and expansion of services to answer the needs of the underground potash industry. Adding design and fabrication of tooling systems and cutting assemblies for boring machines, continuous miners, and roadheaders provided supporting services to ensure the mines were able to continue to grow and mine efficiently with the dedicated local support we are able to provide.

Supporting the growing potash sector over the decades with troubleshooting, as well as introducing new product solutions to improve productivity and reliability led Bit Service to develop new conveyor chains and other related components needed for the evolving mining methods.

Continuing on the path of continuous improvement and strong local support of the potash industry, Bit Service is proud to have recently completed a new advanced manufacturing facility in Saskatoon to support our production of carbide bits for Saskatchewan potash. Years in the making, this provides an elevated level of process control and flexibility in production, while vastly increasing the ability to answer the evolving requirements of our clients.

Leveraging current technology in plant automation, robotics, and data control, we are able to maintain a highly stable and reliable process from machining raw forgings, material preparation, through sintered carbide brazing, heat treating, and final processing.

Controlling all steps in the process in one continuous line, with communication between steps to control and link variables, provides an environment which not only creates incredibly reliable products for our end users, but speeds ramp-up time for new products. This enables a highly nimble manufacturing process which answers the needs of our clients to make required changes quickly to the end product specifications while minimizing the need for iterations.

Carbide brazing in process.

As this move to expand the level of production is a large step, it is only the start in the journey to continue our investment in sustaining our position supporting the Saskatchewan potash mining sector. This is being supplemented through significant research and development efforts in order to continue attempts to stay ahead of the curve in terms of the increased loading conditions, production rates, and requirements for cutting efficiency that our end users are experiencing.

Growth and innovation is a Saskatchewan trait, and continuing to foster these traits and grow our local manufacturing capacity is good for our mining sector, and good for the local economy. Reinforcing our company's vision to "use innovation to help our clients operate efficiently and responsibly", we are continuing along the path to increase our competitive position on the global stage. As we have outlined in the past, the team at Bit Service looks forward to a bright future in the industry and the ability to tackle the many challenges the ongoing evolution will bring. ▲

Fabricating partnerships through innovation

The PythonX by Lincoln Electric, which is a latest addition to I&M Welding and Fabricating.

Quality, service, innovation, value… these are the driving factors at I&M Welding and Fabricating, motivating us in all the interactions we have with our valued customers. They also push us to be constantly investing in our equipment, processes, and people so we can better serve our clients and exceed their expectations. We are not only building with carbon steel, stainless steel, and aluminum; we are also building partnerships.

Investing in people is critical to ensuring a strong diverse workforce that is ready for our future growth. To support and grow our workforce we understand the need to tap into under-represented demographics such as First Nations and women in the trades. We support this through our focus on education and employment. Ongoing apprenticeships allows us to develop new capacity in the trades, which is critical to our success but also the success of Saskatchewan's potash industry.

Investing in technology is crucial to improving efficiency and remaining competitive. As a result, we have added several pieces of equipment to our lineup to improve our throughput and accuracy for the benefit of our customers.

The latest additions is a PythonX by Lincoln Electric. This CNC-controlled plasma beam line will enable us to streamline our workflow and get more done in less time with better accuracy to meet and beat the most demanding delivery schedules.

The Virtek Laser Projection system is a powerful tool we have added to make short work of the assembly of complex items by projecting the assembly outline in 1:1 scale onto the assembling surface. This will reduce our fabrication costs and improve our accuracy so our customers receive excellent quality and great value.

Our Machitech Diamond Cut plasma plate processing table allows us to reduce our lead times on processed plate so we can respond quickly to rush projects without the premium prices. Highly accurate and with Tru-Hole technology, this machine incorporates the latest advances in plate processing for the highest quality parts.

Adding all these pieces to our lineup will help us serve our customers now and into the future.

I&M started as a small shop in Saskatoon with a small group

of employees. With attention to detail and quality, we have provided the confidence to our customers to keep coming back and allowed us to grow out of that small shop into a larger facility with the room to take on larger and more complicated projects. With this growth we have also added to our workforce while ensuring that our safety processes remain strong. We are committed to a safe and healthy workplace for our employees that is diverse and inclusive.

Our growth is due much in part to the relationships we have formed with our partners; those partners being other local fabricators, suppliers, and design and engineering firms. This collection of partner companies allows for the unique opportunity to offer a complete solution to the most challenging customer issues. Being able to provide designing, engineering, and fabrication, we can offer a complete synergistic solution to your issues. Working together and collaborating through all phases from design to delivery we can keep new designs simple, efficient, and cost effective to bring your projects to completion under budget and on time.

We are excited for the future and look forward to building new partnerships, the continued support of our existing customers, and providing solutions to help them achieve success. ▲

The ON-Track® Belt Tracking Idler in service.

Correcting belt misalignment before it begins

Many attempts have been made to correct belt misalignment with pivot and tilt mechanisms, sensing rolls, or guide rolls. In order for a trainer to respond, the belt must have already misaligned. The training idler then compensates, pushing the belt in the opposite direction where it often over-travels and the process repeats itself. The result is a belt that continually walks from side to side.

If you are attempting to guide the conveyor back into its path, you have likely already lost the battle. The belt's tendency is to find the place of lowest tension, or equilibrium – so it stays centered on the structure. For this reason, in a wide variety of applications, the ON-Track® Belt Tracking Idler has proven to be the reliable solution to this common problem.

With new technology found in the ON-Track® Belt Tracking Idler from Richwood, the design focuses on the prevention of belt sidetracking and misalignment rather than correcting misalignment after it occurs.

"What makes the ON-Track® different is the fact that it does not need the belt to misalign because it keeps it from ever going off-track to begin with, by applying tension to both sides of the belt. The belt's own tendency to find equilibrium keeps it in the right place," says Scott Smith, senior applications engineer at Richwood.

Should the belt attempt to misalign, the gentle tension differential created by the ON-Track® unit keeps the belt in place in the centre of the conveyor structure. The ON-Track® uses a multiple-roll design that creates a smooth arc, which helps guide the conveyor as tension gets progressively greater toward the edges. This system works by safely controlling where the belt travels instead of reacting to belt misalignment.

This alternative has demonstrated reliable success in the field.

FIELD APPLICATION
72-inch belt width / 6000 tph / 1200 fpm

This location experienced severe belt-tracking issues. Their first experience with ON-Track® was on a 72-inch belt running 6000 TPH and moving at 1200 FPM. A Richwood representative directly involved with this project provided the details.

"One of the biggest problems was with the belt going off-track through the tail section, it was running under the seal and ruining their skirt rubber, not to mention

creating a constant mess," says the representative.

The initial survey showed the belt traveling eight to nine inches back and forth on the tail pulley even though they were using a traditional belt trainer. Once the ON-Track® was installed and the old trainer removed, this issue was resolved. They are very pleased with the results and no longer deal with belt mistracking.

According to CEMA, the fundamentals of proper tracking include a conveyor structure frame that is aligned and leveled, and tail and head pulleys of the conveyor that are square and aligned on the conveyor frame. In addition, the belting must be straight, and splices must be square, belting should be in good contact with troughing rolls, all troughing and return idlers should be square with the conveyor frame, belting must be properly tensioned, and material should be loaded centrally on the belt. In real-world applications meeting these ideal conditions can be challenging. Even when these requirements are checked off as well as can realistically be expected, the problem of off-centre tracking often still remains.

ON-Track® Belt Tracking Idler application.

When faced with an application where conventional methods of belt training are not working, consider the solution that comes from a new point of view. Instead of fighting belt misalignment with repeated attempts at belt training, simply keep your belts ON-Track® with Richwood's proven performance. ▲

A SubCom® Magnesium Chloride Brine Evaporator for Utah.

From innovation to influence

SUBMERGED COMBUSTION'S ENDURING LEGACY AS A SUPERIOR HEATING AND EVAPORATION SOLUTION

In 1973, 15 years after founding Inproheat Industries Ltd., Eric Panz patented a direct-contact evaporation and liquid heating technology called SubCom®, short for Submerged Combustion. Panz believed that the innovative design of SubCom® and its high capacity for thermal efficiency could change the industrial landscape.

50 years later, SubCom® endures as Panz's finest professional achievement – encapsulating Inproheat's broad reputation for trust, innovation, and expertise in Canada and beyond.

In essence, Submerged Combustion heats and evaporates aqueous solutions and slurries, including those that can scale, corrode, or erode and present challenges to equipment.

The process involves direct contact between combustion gases burned in a submerged combustion chamber and the liquid. This can achieve thermal efficiencies beyond 99 per cent (HHV basis), all with reduced fuel consumption and lower greenhouse gas emissions than standard methods. Submerged Combustion operates within CSA, NFPA, FM, and CEN safety parameters with added process control and monitoring provided by flame detectors, scanners, and mass-flow measuring devices.

Direct-contact heating applications for SubCom® include potash brine, process water with high chloride, and sulphuric acid heap leach solution, while evaporation applications include iodine brine, cowhide curing brine, produced water from oil and gas operations, landfill leachate, and reverse osmosis rejects.

SubCom® is versatile and durable in potash mining.

For example, in Patience Lake, a Potash Corporation of Saskatchewan solution mining operation was at risk of shutting down due to pregnant potash solution precipitating into nearby surface lakes. A 130 MM Btu/h SubCom® system built in 1990 with a thermal heating efficiency of 98 per cent (HHV basis) proved to be

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Above: An oil-fired 30 MM Btu/h Iodine Brine Heater.
Inset: A 17 MM Btu/h Produced Water Heater in Wyoming.

the remedy to heat the corrosive brine solution. A 1991 CGA Award for Innovative Use of Natural Gas followed, as did a 2011 upgrade with increased heating capacity and enhanced operational control.

Elsewhere, in Ogden, Utah, a Compass Minerals facility producing sulphate of potash (SOP) and magnesium chloride required an upgrade of its package boilers and direct steam injection system due to high rental costs and low efficiency. As a replacement, Inproheat designed a 30 MM Btu/h SubCom® system with an internal heat recovery unit to heat up to 1100 USgpm of process water from 50 to 130 °F. The initial 2015 installation was upgraded a year later with a new 60 MM Btu/h system.

Back in Saskatchewan, Inproheat joined the Milestone Project, a novel solution mining operation from Western Potash Corporation designed to eliminate surface salt tailings while reducing water consumption and surface disruption. Project consultant SNC-Lavalin commissioned a high-efficiency SubCom® system to reach 110 °C and dissolve the potash existing in underground salt caverns, while meeting strict environmental guidelines. A three-burner SubCom® unit was built with a gross heat input of 51 MM Btu/h to heat brine with a thermal efficiency of over 90 per cent (HHV basis). To reach 110 °C, a Sigma Thermal glycol heater, a Tranter Inc. titanium plate and frame heat exchanger, and a KSB pump were integrated. The initial horizontal solution hot mining operation began in 2020.

These examples illustrate how SubCom® succeeds where conventional alternatives fall short. While options like steam and heat exchangers can be used for industrial heating, the risk of reduced efficiency and reliability in challenging system conditions is apparent. This reinforces the value of SubCom® for its efficiency, cost savings, and environmental responsibility.

How can SubCom® help you? We welcome the opportunity to learn about your projects and discover how SubCom® can offer a lasting impact on your potash mining activities.

For more information contact Osama Shenouda, CEO of Inproheat Industries Ltd., at oshenouda@inproheat.com. Visit them online at Inproheat.com. ▲

PDAC announces 2024 award recipients

PDAC 2024 THE WORLD'S PREMIER MINERAL EXPLORATION & MINING CONVENTION

The Prospectors & Developers Association of Canada (PDAC) is honoured to announce that five outstanding groups have been selected to receive 2024 PDAC Awards. Since 1977, the annual PDAC Awards have recognized exemplary individuals, teams, and companies for their significant accomplishments in mineral exploration and development.

"The 2024 recipients continue the 46-year tradition of excellence in the PDAC Awards," said Raymond Goldie, PDAC president. "Their successes are an inspiration and demonstrate the expertise, ingenuity, and determination needed to find the minerals that are essential to modern life. Our awards recipients also show that, both in Canada and worldwide, mineral explorers and developers are practicing innovative and effective approaches to community engagement and sustainability."

Recipients will be celebrated at the Awards Gala & Nite Cap at the Fairmont Royal York Hotel in Toronto on March 5, during the PDAC 2024 Convention. Ticket sales opened in December on the PDAC website.

PDAC 2024 Award Recipients

John Burzynski and the Osisko Mining Inc. Exploration Team – Bill Dennis Award

For the discovery and ongoing expansion of the Windfall deposit's Lynx gold zone located in the Abitibi greenstone belt, Eeyou Istchee James Bay, Québec.

Wabun Tribal Council – Skookum Jim Award

For developing a consistent process of engagement (The Wabun Model) that reasonably matches the lifespan of projects from mineral exploration to development.

O3 Mining – Sustainability Award

For exceptional Environmental, Social and Governance (ESG) performance, including the achievement of ECOLOGO Certification.

The Lundin Group Vicuña Exploration Team – Thayer Lindsley Award

For the discovery of the Vicuña district in the Central Andean copper province in Argentina and Chile.

John McConnell and the Victoria Gold Team – Viola R. MacMillan Award

For innovative financing of the Eagle Gold Mine development and production in Yukon.

Awards Gala and Nite Cap

Recipients will be celebrated at a prestigious Awards Gala and Nite Cap at the Fairmont Royal York in Toronto on Tuesday, March 5, during the PDAC 2024 Convention. Tickets can be purchased at pdac.ca.

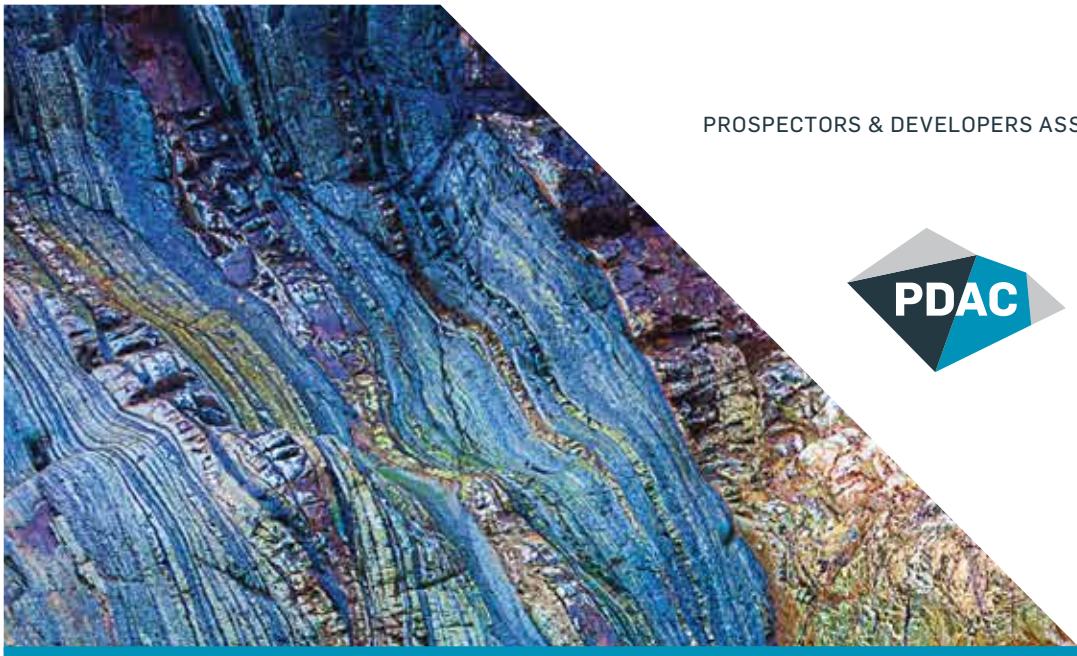
Awards selection process

PDAC's Board of Directors select award recipients based on recommendations of the association's awards committee. Learn more about the PDAC Awards, including how to nominate candidates for our 2025 awards, at www.pdac.ca/about-pdac/awards.

About PDAC

The Prospectors & Developers Association of Canada (PDAC) is the leading voice of the mineral exploration and development community, an industry that employs more than 664,000 individuals, and contributed $132 billion to Canada's GDP in 2021. Currently representing over 7,000 members around the world, PDAC's work centres on supporting a competitive, responsible, and sustainable mineral sector.

PDAC 2024, our 92nd annual convention, will take place in person in Toronto, Canada from March 3-6, 2024. Please visit www.pdac.ca for more information. ▲



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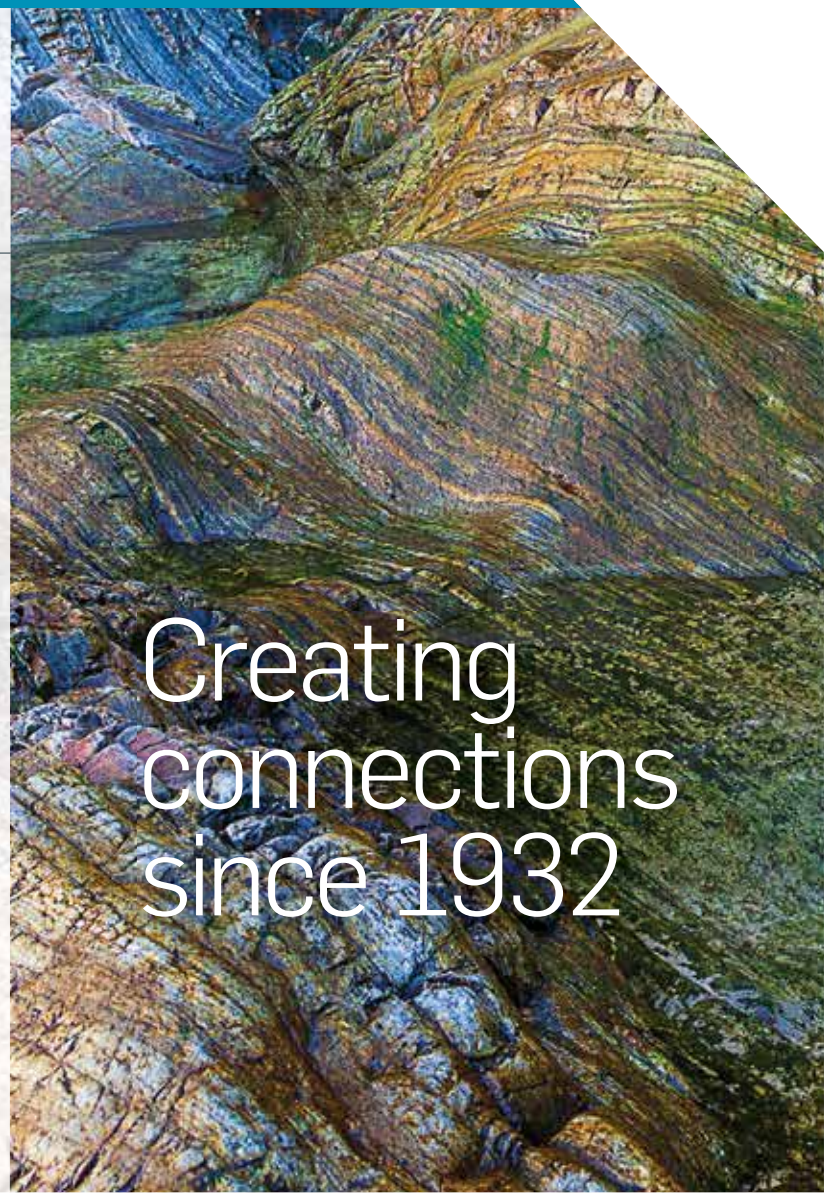

Utilizing all the tools in the shed for a successful project outcome

BY KENT SHARP, CALTECH GROUP INC.

Caltech's commitment to innovation and industry knowledge provides advanced solutions that make us the go-to partner for potash mining operations.

A recent project awarded to Caltech through an RFP process required the use of every tool and advanced technology Caltech has to offer.

When it comes to providing solutions to clients in the potash mining industry, Caltech's geomatics technologies provide the most accurate results to optimize exploration efforts while allowing for mining operations to construct precision mining infrastructure, monitor operations for maximum productivity, and ensure responsible land restoration.

With more than 33 years of experience offering land surveying and geospatial services in Western Canada, Caltech's commitment to innovation and industry knowledge provides advanced solutions that make us the go-to partner for potash mining operations.

A recent project awarded to Caltech through an RFP process required the use of every tool and advanced technology Caltech has to offer. The accuracy requirements were very specific and allowed us to choose the right technology to meet the requirements in an efficient way.

The first part of the project required us to verify the existing site survey control. This required us to use a blend of Static GNSS, total station observations, and precise leveling. A final report was generated, establishing the validated control parameters for all future survey work across various scopes. This verification process ensures the reliability and accuracy of the survey control, laying a foundation for ongoing and future surveys.

An important aspect of the project required us to use our unmanned aerial LiDAR system. This technology played a crucial role in efficiently and accurately acquiring a Digital Terrain Model (DTM) over an extensive area earmarked for engineering design. Using this advanced technology, our geospatial technicians identified specific terrain features, later combining them with

data captured from traditional surveying methods like GNSS RTK and total station topographic surveys. In areas that required precision and detailed insights, we integrated GNSS RTK and total station survey technologies to capture more detailed data. The combination of these efforts resulted in the delivery of a highly accurate and detailed digital terrain model that aligns with all project accuracy requirements. By using these technologies and solutions together, we provided a comprehensive sitewide orthomosaic image that enhanced the overall project deliverables.

The client also tasked us with conducting a comprehensive inventory of culverts across the entire site. Our survey teams documented the as-built culvert inverts, capturing details such as size, type, and condition, supplemented by visual imagery. Caltech's GIS team integrated the data collected in the field into our enterprise GIS system. This allows for our client to access the data for collaborative viewing and engagement with team members. This culvert inventory not only met the client's specific requirements, but also enhanced the overall accessibility of the geospatial data so that the client can make an informed decision about the project.

The final technology that was utilized in this project required us to deploy our terrestrial laser scanning technology. Our survey teams conducted laser scanning operations in two expansive areas. The first area focused on capturing detailed data of existing structural steel, tanks, and piping, facilitating future modifications and expansions. In the second area, laser scanning was indispensable due to restrictions on physical access imposed by ongoing operations and safety protocols. Once again, the deliverables not only met but exceeded the precision and scope criteria stipulated by the project.

The successful completion of our survey project, employing an array of cutting-edge technologies including unmanned aerial LiDAR, GNSS RTK, total station, and laser scanning, marks a significant milestone in the field of geospatial data collection. The integration of these advanced tools not only streamlined the surveying process, but also elevated the precision, efficiency, and overall quality of our results. ▲

Addressing potash's carbon challenge

HOW HEAT EXCHANGE TECHNOLOGY OFFERS A PRAGMATIC APPROACH TO DECARBONIZATION

BY IGOR MAKARENKO, SOLEX THERMAL SCIENCE AND CHRIS PAYNE, ECONOTHERM

The potash industry has an important role to play in the global pursuit of net-zero targets. As the scale of many operations continues to grow relative to soaring demand, so too has the expectation for the industry to properly manage and mitigate environmental impacts.

Potash producers have been taking steps to improve their carbon profiles for decades. For example, Canadian potash, which annually accounts for more than one-third of the global total, is produced with an approximately 50 per cent lower greenhouse gas (GHG) intensity when compared with competitors, according to 2020 data from Cheminfo Services.

Despite this, industry figures show current decarbonization efforts will not be enough to reach certain targets. Fertilizer Canada, for example, estimates adoption of technologies that offer a needed 50 per cent reduction of GHG emissions or greater will still require at least five to 10 years to implement and could cost upward of $1 billion per facility.

Meanwhile, the International Fertilizer Association acknowledges that while the efforts of its more than 450 members to reduce emissions are noteworthy, the industry must rapidly adopt new technologies to reach targets set in the Paris Agreement.

Addressing the natural gas challenge

The single largest source of GHG emissions traces back to the combustion of natural gas – most commonly during product drying. A recent study by University of Alberta researchers found the combustion of natural gas at this processing step represents nearly one-third of total emissions in conventional and solution mining combined.

The application of heat pipe heat exchangers (HPHXs) in potash applications represents a novel opportunity to recovering energy from otherwise-wasted process streams and, in turn, reducing both primary energy consumption and GHG emissions.

HPHXs recover thermal energy from exhaust heat by taking the latent heat of vapourization from the working fluid in the heat pipe – for example, from a liquid to a gas – to absorb the heat contained in the hot exhaust gas or liquid. The vapour subsequently rises to the top of the heat pipe where the pipe is in contact with a cold fluid – air or water – that causes the vapour to condense and release its heat. This heat is then absorbed by the cold fluid.

As an example of their application within potash applications, HPHXs can recover thermal energy from particle-laden air that is exhausted from the drying process. The exchangers accomplish this by taking this "one-pass air" and extracting heat from it that can then be used to pre-heat ambient air that goes back into the dryer.

In doing so, potash producers can reduce the natural gas consumption needed for product drying, while also reducing the temperature of the air that's being sent to the scrubbers to reduce scrubbing capacity.

Alternatively, the recovered energy from the dryer can be used to pre-heat water that is used in solution mining processes. Research has shown that the combustion of natural gas to heat water that is pumped through the ore body to dissolve the potash is another significant source of GHG emissions.

Conclusion

Potash-based fertilizers will continue to play a crucial role in global food production systems. Yet the industry itself needs to ensure its efforts complement the world's sustainability goals.

A key pathway to accelerating the sustainability transformation of the potash industry is to accelerate innovation, which includes the adoption of new technologies and processes.

Heat pipe heat exchangers, common in many other industries around the world, represents a novel approach to supporting the decarbonization efforts of potash producers. Their adoption offers a pragmatic avenue to reducing operations' primary energy consumption and GHG emissions – and in doing so, demonstrates a measured step toward a more eco-friendly approach to global agriculture. ▲

A decarbonized solution for potash production

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Above left: Over the last 18 years, ServcoCanada has proudly served Saskatchewan, working with clients who are in the energy, water, potash, and food processing industries. Right: ServcoCanada specializes in mechanical and electrical installations for new builds and expansions, maintenance turnarounds, and plant relocations.

Powering growth

HOW SERVCOCANADA SERVES THE SASKATCHEWAN INDUSTRIAL SECTOR

ServcoCanada, formerly DMS Industrial Constructors, is making strides across Canada with the addition of a new office in Fort McMurray, Alta. which opened its doors in February 2022. This new addition came only eight months after the expansion of the company's new Regina office – complete with a 10,000-square-foot fabrication shop.

The rapid growth underscores the company's commitment to better serving its clients as a versatile and multifaceted player in the industrial construction industry. Today, ServcoCanada can be found executing projects across Canada with over 1,000 employees based out of three offices in Saskatchewan, Manitoba, and Alberta.

Their wide-ranging experience has enabled the development of a deep-rooted knowledge base of practical solutions that are implemented early across multiple work scopes to mitigate risks, delays, and commercial concerns.

ServcoCanada specializes in mechanical and electrical installations for new builds and expansions, maintenance turnarounds, and plant relocations. They offer a comprehensive range of engineering, fabrication, construction, procurement, scaffolding, inspection, and project management services in sectors such as oil and gas, mining, petrochemical, hydropower, carbon capture energy, and food processing.

Serving Saskatchewan

Led by a core group of local managers and tradespeople, ServcoCanada is 100 per cent privately and Canadian-owned. Their experienced management team is hired locally as part of an important commitment to better understand, serve, and give back to the communities in which the company operates. This means the management team knows and understands the challenges in each market and collectively have proven track records.

Over the last 18 years, ServcoCanada has proudly served Saskatchewan, working with clients who are in the energy, water, potash, and food processing industries, including Siemens Energy, Water Security Agency, K+S Bethune Potash Mine, SaskPower, Nutrien Potash, and Richardson Oilseed.

In Saskatchewan alone, the company often employs up to 80 millwrights at any given time, with a minimum of 10 millwrights permanently on staff. The company's long history of providing mechanical, piping, and structural services ensures all their trade groups work seamlessly together. ServcoCanada works closely with various trade unions across Canada, allowing them to negate labour shortages and ensure they are hiring top-quality tradespeople for every project.

Indigenous involvement

ServcoCanada has developed a reputation as an industry leader in Indigenous inclusion by developing strong partnerships and joint ventures based on trust. They deeply respect the communities and land where their teams work and always aim to provide economic prosperity and social well-being. Their team has taken the time to earn trust by following through with commitments and working collaboratively with community leadership. ▲

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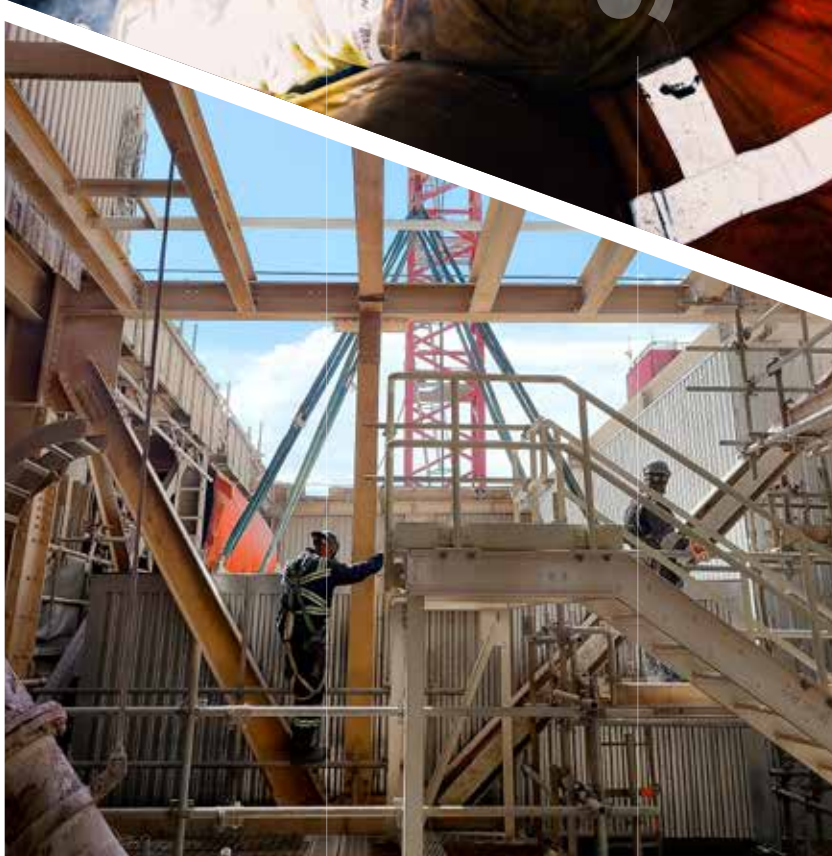

servcocanada

Supplying an education for a brighter future

NUTRIEN EMPLOYEE'S CAREER JOURNEY POWERED BY SUPPLY CHAIN CANADA'S EDUCATIONAL OPPORTUNITIES

Far left: For Dana Hough, getting his SMT was the first step toward where he is today as an inventory controller at Nutrien, a position he has held for the last six years.

Dana Hough receives his SCMP designation from board president, Harley Camsell at the SCMP graduate celebration in August 2023.

Dana Hough has almost literally worked his way up to where he is today at one of Canada's largest agricultural and resource firms.

Having started with Nutrien at its Allan potash operation southeast of Saskatoon working underground in the mine, he eventually moved above ground to work in shipping and receiving, where he learned many aspects of the supply chain and warehousing. Yet, after a few years, he recognized the need for more education to advance his career in supply chain management.

"So, I started to take night classes to work toward my diploma in the field," says Hough about the Supply Chain Management Training (SMT) program.

Offered by Supply Chain Canada Institutes, the SMT program offers early-stage to mid-level practitioners working in warehousing, logistics, procurement, and shipping and receiving the necessary skills to advance their careers in this important facet of operations for many different sectors of the economy, mining and agriculture included. Learners completing the training earn a diploma in supply chain management, which often leads them in the future to take a more advanced training from Supply Chain Canada and earn a Supply Chain Management Professional designation (SCMP).

Available online, both programs offer learners the flexibility to work through course materials while continuing to work in their current supply chain-related occupations.

For Hough, getting his SMT was the first step toward where he is today as an inventory controller at Nutrien, a position he has held for the last six years.

The SMT program covers many aspects of supply chain management, providing comprehensive knowledge of all aspects of the field. Courses cover, for example, procurement, logistics, and transportation and operations management. As well, the SMT course provides soft skills

Many SMT diploma graduates often then pursue a SCMP designation from the institute as they progress into management roles.

training so individuals graduate as better communicators, are able to foster better workplace relationships, and become more adept negotiators on procurement and other contracts.

"The SMT program is an excellent foot-in-the-door for individuals early in their roles in supply chain seeking to advance their careers," says DonnaLyn Thorsteinson, chief executive officer of the Saskatchewan Institute for Supply Chain Canada.

Many SMT diploma graduates often then pursue a SCMP designation from the institute as they progress into management roles.

It's a path Hough followed while taking night classes at the University of Saskatchewan's Edwards School of Business to gain many of the prerequisites to enrol in the SCMP program, which requires a business-related post-secondary degree or diploma, or five years of supply chain work experience.

Individuals taking the course receive in-depth education on global, public sector, and major capital project supply chain management. As well, they participate in facilitated workshops providing hands-on knowledge in leadership, negotiation, and contract law.

"The SCMP designation is Canada's leading designation for supply chain professionals," Thorsteinson says.

Hough can certainly attest to that.

"Without a doubt, what I learned through these programs helped me excel at Nutrien, applying acquired skills and concepts daily as a supply chain management professional," says Hough.

Other individuals working in supply chain positions in the province can look forward to a similar trajectory upon receiving their SMT diploma and SCMP designation, Thorsteinson says.

"While Hough's story may differ from yours, there are numerous paths to successfully complete our programs, and we look forward to working with you to explore your options," says Thorsteinson.

To learn more about the Supply Chain Management Professional (SCMP) and Supply Chain Management Training (SMT) programs, visit supplychaincanada.com, email info.sk@supplychaincanada.com, or call 306-653-8899. ▲

Pioneering excellence in electric motor servicing

GMR ELECTRIC MOTORS LTD.

Mel Hitchings, former CEO and president, as well as co-founder, of GMR Electric Motors Ltd.

BY SHAYNA WIWIERSKI

In the heart of Saskatchewan's industrial landscape resides GMR Electric Motors Ltd., a testament to resilience, dedication, and unyielding commitment to serving the needs of the potash and oil and gas industries. Founded in 1979, GMR Electric Motors (which stands for company founders Gary, Mel, and Rick) has grown from its modest beginnings to become a leading force in Canada in electric motor servicing and repair.

Mel Hitchings, former CEO and president, has been an instrumental figure in the company's journey. His story is one of passion, hard work, and unwavering dedication to the craft. Hitching's journey into the industry began during his high school years, influenced by his father's involvement in a similar field. He embarked on this path early, joining Industrial Motors, a then-newly established shop in Saskatoon, during his senior year. His dedication and rapport with the shop's owner led to a 13-year tenure, where he honed his skills and nurtured a love for the industry.

The genesis of GMR Electric Motors was a response to an unmet need in the burgeoning potash industry. Alongside Gary and Rick, Hitchings embarked on a journey to establish a shop capable of servicing small motors, a niche largely overlooked by existing establishments. The trio's dedication and foresight laid the foundation for a company that would grow and adapt over the years.

"There was an excessive amount of work that was available. There had been another shop open, but there seemed to be a need to start [a new one]," says Hitchings, adding that Rick left the company after a couple years to start another shop and Gary retired due to health-related issues in 1995. "We started to do small motors since there was a niche there, which was something that a lot of other shops didn't want to bother with. We started doing that with the intent of growing, and grow we have."

From its inception in 1979 until 1995, GMR Electric Motors faced challenges and opportunities that shaped the company. Their growth trajectory was not without hurdles, particularly during periods of economic downturns when high interest rates posed significant challenges. However, their emphasis on service over sales proved to be a prudent strategy during lean times. GMR's commitment to repairing rather than replacing electric motors resonated well with clients seeking cost-effective solutions.

The company's distinguishing factor lies not just in its technical expertise, but also in its agility and local roots. Hitchings highlights how being a local company afforded them the ability to make swift decisions, responding promptly to industry needs without bureaucratic and board room red tape. This nimbleness in decision-making set them apart from larger corporations and solidified their standing within the community.

"I feel the personal service makes us different. We're local and there all the time. We run GMR to be the best-equipped and best-trained shop in Canada, not just in Saskatchewan," says Hitchings, who adds that they also do work from St. John's, N.F., and Victoria, B.C. with their field service team. "We are wide-spread in terms of where we deal, and because of that and the range we deal with, we spend a lot on the latest and greatest equipment and proper sizing for doing the work that's in our market."

GMR's success is also attributed to its continuous investment in cutting-edge equipment, extensive training, and unwavering dedication to providing

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GMR Electric Motors started from small beginnings and, over the last 45 years, has grown into one of North America's leading electric motor repair facilities. Our customers are coast to coast in Mining, Oil+Gas, Power, Marine and Agriculture. We work with our customers to find solutions with long-term partnerships in mind; we are here for the long haul. With our current facilities in Saskatoon and Estevan, we are proud to be part of the diversified and vibrant supply chain in Western Canada. Our customers, suppliers and, most importantly, our employees have gotten us where we are today; we are excited and looking forward to another 45 years of growth.

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unparalleled service. The company's evolution from a local shop to a nationally recognized entity with clients across Canada speaks volumes about its commitment to excellence.

GMR Saskatoon is housed in multiple buildings making up a total of 80,000-square-feet. The Saskatoon shop boasts several industry firsts, including their large dynamometer testing capability and state-of-the-art test centre for motors and gearboxes. GMR's Estevan branch has been in business for over 10 years servicing the oil and gas industry in southern Saskatchewan and Manitoba. They also are proud to be the first shop in Canada to earn the SKF-certified Rebuilder-Electric Motors certification and they were one of the first to become EASA accredited. In addition, they are also a certified ISO 9001:2015 shop, COR certified for safety, and a signatory to the Mission Zero Health and Leadership Charter for Saskatchewan.

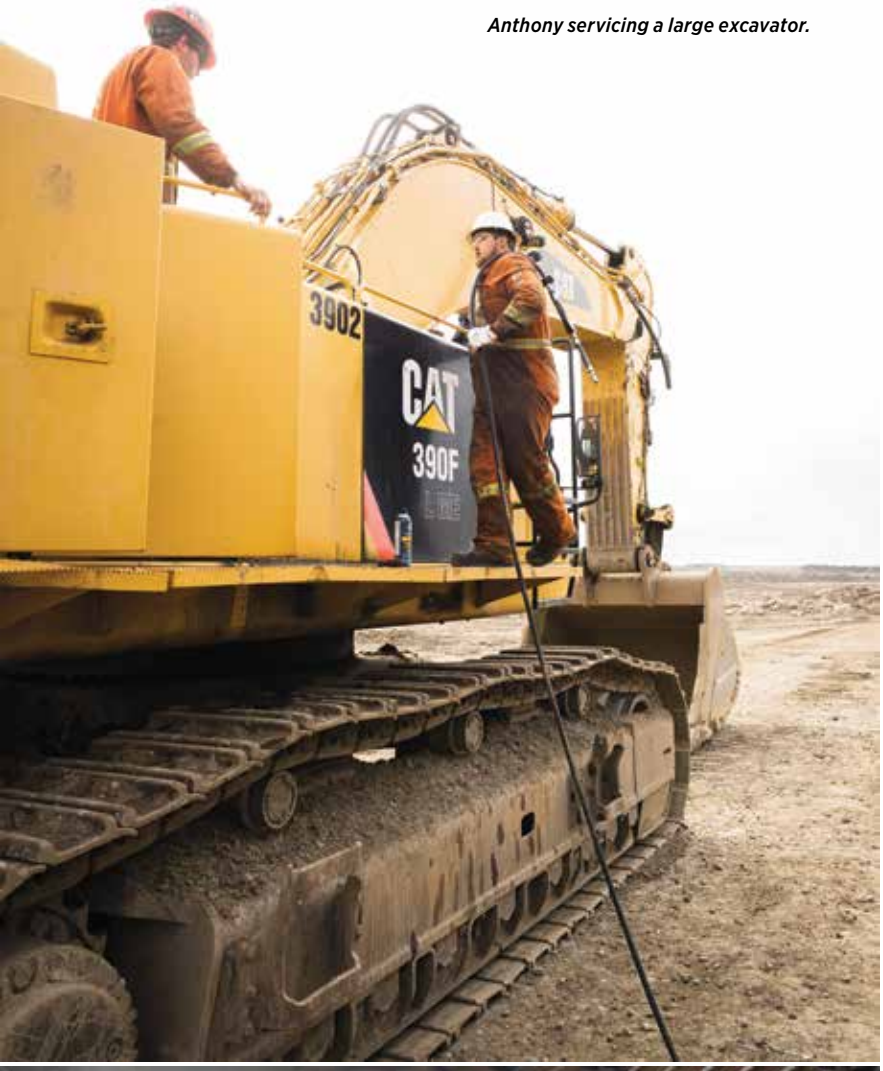
Looking towards the future, Hitchings remains optimistic about the potash industry's prospects. The impending arrival of BHP in the market presents an element of unpredictability, but his confidence in the industry's demand, driven by the world's growing population and need for sustenance, remains unwavering. He sees Saskatchewan as a thriving hub, poised for further growth and opportunity.

After many years of running the company, Hitchings, who is now retired, takes pride in the seamless transition of leadership to the next generation. With three sons and two sons-in-laws at the helm, the company's continuity and accelerated growth are testaments to their vision and capability. Hitchings' foresight in initiating the transition early ensured a smooth handover, ensuring that clients experienced no disruptions in service.

"One day I was talking with my son and son-in-law and I asked them when they were ready to take over and they said 'two years ago'," says Hitchings. "It's good business to transition early or to have a good transition plan; it makes it so the customers wouldn't notice anything different if you transition properly. We started early to transition it and what you do when you transition in a business is you are setting out to eliminate your job if you are doing it right. So, we did, and I have three sons and two sons-in-laws who are doing amazing jobs. They have continued and accelerated the growth."

For more information on GMR Electric Motors Ltd., visit them online at www.gmrelectric.com. ▲

Building a diverse and inclusive culture



Anthony servicing a large excavator.

Alyssa working on site.

As a diversified and equal opportunity employer, Kelly Panteluk Construction Limited (KPCL) recognizes the importance of building a diverse and inclusive workforce. In support of this initiative, they have embraced workforce diversity and inclusion, and formalized their approach to prioritize the hiring of Indigenous, women, and visible minority persons within our workforce. In speaking to the relevance of this initiative, KPCL's VP of operations Riley Panteluk said "the reason is simple, it's just good business".

Panteluk says KPCL has experienced firsthand the many benefits of a diverse and inclusive workplace including increasing their ability to recruit from a larger talent pool that better aligns with shifting workforce demographics, a more stable workforce with higher employee retention, and improving their performance, leading to stronger business results. Moreover, they have learned that by listening to and respecting the needs and perspectives of a diverse workforce, the company has earned a deeper trust and higher commitment from their employees.

"It's a win-win scenario," says Brennen Miles, KPCL's manager of human resources. "Incorporating diversity and inclusion in our company's business practices broadens our access to some of the best talent while enabling us to effectively engage and commit to that talent."

Panteluk noted that while diversity and inclusion are interrelated, they shouldn't be seen as interchangeable and there is a distinct difference between them. Diversity centres on the representation of different people in an organization, whereas inclusion focuses on employees and the opportunities employees have to contribute, shape, and make a difference to the organization.

Stone conducting survey tasks on site.

They recognized that it's not enough to implement diversity and inclusion initiatives without establishing targets and measures to track and confirm that these initiatives are achieving the intended outcomes. To this end, KPCL developed Key Performance Indicators (KPI's) for the desired outcomes. Diversity KPI's are relatively simple to formulate as the workforce can be easily categorized into gender, race, hours worked, etc., and measured against established KPI's. While inclusion is harder to measure, it is not impossible. The environment for inclusion can be assessed by looking at equitable employment practices, integration of differences, inclusion of decision-making, and through the facilitation of employee surveys that focus on gauging employees' sense of belonging and trust.

We found that creating an inclusive culture instills a sense of belonging amongst employees, letting them know that they are valued and essential to the success of the business. Valued employees tend to perform at a higher level resulting in increased motivation and morale. As well, their inclusive culture has built up trust among their employees knowing that they will be treated fairly, regardless of race, gender, sexual orientation, or age. With the creation of an inclusive culture, KPCL believes their employees feel supported, and work in an environment where they can excel and do their best work.

Featured employees

Anthony started working for KPCL in the spring of 2019 at KPCL's maintenance shop in Estevan, Sask. Starting out as a mechanic's helper, he quickly discovered that diagnosing and repairing heavy equipment was a career path that he wanted to pursue. After spending time working under other experienced mechanics and welders at the shop, he was given more responsibilities and opportunities to grow his career. These opportunities have brought Anthony to a wide array of projects across the province with KPCL, where he has done everything from fuel and lubricate equipment, to being an on-site mechanic. After spending the 2023 winter in KPCL's shop working on the maintenance and repair of heavy equipment, Anthony's supervisor, Oakley, placed him in charge of servicing operations for a large fleet of equipment at KPCL's Rocanville mine site project.

Anthony's Indigenous background and presence across the company provides an excellent example to Indigenous people looking for a career in heavy construction that success can be achieved through dedication, hard work, and a willingness to learn. KPCL is very thankful for Anthony's contributions to our company and the trust he has placed in them. His contributions and input into the company are the stuff that enable them to continue to deliver high-quality project outcomes to their clients.

Alyssa began her career with KPCL working as a summer student in 2021 on a highway project near Lake Alma, Sask. Starting out as a labourer, she quickly proved herself to be very accountable and conscientious to her supervisor. Consequently, KPCL gave her additional safety and traffic accommodation training so she

could take on the role of a work zone flagging person, controlling, and directing traffic safely through the construction zone. Following graduation from high school in 2022, Alyssa returned to KPCL to work as a summer student at the Rocanville Mine Site Brine Pond project where she successfully operated a large haul truck. At the end of August, she left KPCL to attend welding school at the Saskatchewan Polytechnic – Saskatoon Campus. Upon successfully completing her eight-month pre-employment welding course in June of 2023, she rejoined KPCL at the Lanigan Mine Site Brine Pond Project where she was placed on the heavy equipment maintenance team to start her welding apprenticeship. Working under the supervision of a journeyperson, she currently completes various fleet maintenance tasks such as heavy equipment services, ground engaging tool (GET) welding/ repair, and other fabrication tasks.

After attending KPCL's first Career Fair day held in April 2023, Stone started working for KPCL in the spring of 2023. Originally from Kinistin Saulteaux First Nation near Tisdale, Sask., he was hired as a labourer working at KPCL's Lanigan mine site brine pond project. Stone showed himself to be a quick learner and a valuable addition to the labour crew, and after spending time working under the direction of other experienced labourers, he was open to exploring further opportunities. These included a wide variety of tasks such as operating heavy equipment, installing geo-textile and HDPE pipe to surveying. After spending most of September with KPCL's on-site survey team and gaining experience, his supervisor determined that he would be an excellent candidate to fill the survey vacancy on site.

With Stone's Indigenous background and presence across site in a number of roles, he has been a great role model not just to other employees, but other members of his community. He has demonstrated that success can be achieved through an open mind and a willingness to learn. KPCL is very appreciative of Stone's contributions to the company, contributions that ultimately allow them to deliver outstanding projects to their clients. ▲

A new chapter in compaction opens in Canada

From left to right: Sides of two Ludman Industries Model #4440 Roll Compactors displaying a right-handed drive machine and left-handed drive machine, respectively. Front of two Ludman Industries Model #4440 Roll Compactors displaying a right-handed drive machine and left-handed drive machine, respectively. Front of one left-handed drive Ludman Industries Model #4440 Roll Compactor.

Ludman Industries is well on its way to producing multiple Model #4440 Roll Compactors dedicated for the extensively large, new potash mine in Canada.

Ludman Industries is a world-renowned North American original equipment manufacturer (OEM) of compaction and crushing machines used in a variety of potash and salt applications. It acquired the product lines from Allis-Chalmers' Mining and Food Divisions in 1986, following almost two decades of machining and fabricating the machines within those divisions.

The Model #4440 Roll Compactor contains two rolls, each with a 44-inch roll diameter and 40-inch roll face. The Canadian-bound compactors for this project utilize two 800 HP (600 kW) motors. The hot temperature of the feed material requires compactors to be equipped with water-cooled rolls to prevent roll face glazing. One roll-removal table supplied to the project can be attached to any of the compactors to remove or install rolls horizontally.

Ludman offers compactor options based on the requirements of the application and the maintenance preferences of the customer. Options include roll synchronization to produce a corrugated flake with uniform thickness. Uniform thickness increases flake strength; curing is more consistent and excludes shallow weak points. Consistent flake thickness results in less fines, delivering higher yields downstream in the precision crushing and granulation process. Electronic synchronization offers the most control, when paired with independent planetary gear reducers and variable-frequency drives (VFD). If tramp metal falls into the compactor feed, the electronic synchronization method lowers risk of damage to the machine by reducing initial shock and mitigating stress on gearing. While not a match for the most powerful compactors, mechanical synchronization alternatively uses single-input-dual-output (SIDO) gear reducers.

Customers choose between rolls with replaceable wear-resistant shells or a solid one-piece design with a replaceable weld overlay. The weld overlay is a proprietary design offering an excellent combination of toughness and wear resistance. Compaction requires increasing mineral density near its specific gravity. Likewise, the compaction process forces air out of the feed; depending on the mineral application, Ludman's roll options include proprietary grooving, which allows air paths to de-aerate the feed.

Ludman rolls pair with spherical roller bearings or self-aligning Babbitt bearings, depending on a customer's preference and useful life. Some users consider Babbitt bearings as an outdated technology, but several customers have compactors in use with a life of eight to 10 years for Babbitt bearings, compared to an average life of three to five years for spherical bearings; not to mention, Babbitt bearings

have robust support in the marketplace. Traditionally, compactor bearings employed oil lubrication; Ludman utilizes external bearing lubrication systems that circulate, filter, and cool the oil. Oil was the standard to lubricate large compactors; however, due to advances in grease technology, grease may be considered as a viable option.

Ludman offers a variety of accessories, such as Hydraulic Pressure Units (HPU) to control compaction force, in addition to gearbox cooling units, standalone water-cooling units, gear reducers, oil-cooling systems, heat exchangers, and state-of-the-art Programmable Logic Controller (PLC) software and control panels.

Instrumentation and controls currently are one of the most-debated industry technology topics. The goal of instrumentation and controls is to improve productivity and to reduce maintenance costs, thereby justifying the investment. This feat requires reliable and proven instruments in the harsh environment of a potash mine. Ludman learns from customer experiences regarding instrument successes and difficulties, translating these findings into achievements down the road. Control logic not only should monitor alarms, but also look for inputs that could indicate instrument failure. Maintenance departments rely on predictive control logic, as they learn to operate with less-experienced lower staff levels amidst the current labour environment. ▲

Apprenticeship training is the engine that powers Croatia Industries

Croatia Industries has supported apprenticeship training of machinists and millwrights to build tomorrow's workforce. Croatia Industries is a local machine shop serving potash, uranium, forestry and industrial clients for 48 years.

Manufacturers around the world are struggling with both labour shortages and a skills gap that directly affects their ability to service customers while limiting GDP growth of their economy.

A local company in Saskatoon is addressing these shortages in partnership with Saskatchewan Apprenticeship and Trade Certification Commission (SATCC). Croatia Industries has supported apprenticeship training of machinists and millwrights to build tomorrow's workforce.

Recent expansions and ongoing greenfield developments within Saskatchewan's mining sector have created a huge demand for skilled workers in technologically advanced work environments. Croatia Industries is a local machine shop serving potash, uranium, forestry, and industrial clients for 48 years. Apprenticeship training in combination with new CNC machine tools, safety and quality programs, and enhanced work environments provide the recipe for success.

Currently, 45 per cent of all tradespeople at Croatia Industries have been hired directly out the Saskatchewan Polytechnic's pre-employment program and entered into an indentured apprenticeship at Croatia. Ken Cenaiko, president of Croatia Industries, highlighted the need to continue with on-the-job training.

"Typically, our apprentice machinists are responsible for the disassembly, evaluation, and repair or manufacture of replacement hydraulic cylinder components. The apprentice learns the importance of fits, they do external and internal work, lathe work, and milling work in a variety of materials. Finally, our millwrights measure each component before final assembly and testing," says Cenaiko. "Eventually, our millwrights recognize the increasing abilities and quality of workmanship of a particular apprentice and indicate when he/she is ready to expand their horizons with more sophisticated machine tools and/or products. In this manner, the repair of hydraulic cylinders is extremely important to Croatia Industries' training program."

Croatia Industries maintains a certified COR safety program for the safety and protection of these young employees. They also maintain a quality management system to ISO 9001:2015 standard to ensure customers receive quality components in meeting with their expectations.

Young staff with highly developed skills and experience are in big demand these days. Croatia Industries employs several staff retention programs such as the daily food program with an on-site cook. They have also expanded the four-by-10-hour shift schedule to provide a flexible lifestyle that young families need to engage their children in the many activities available. It's important that successful employers are able to provide quality products to their customers while also meeting the expectations of young staff. Croatia Industries may have just found the recipe of success with apprenticeship training, safety, technology, and lifestyle serving as the ingredients. ▲

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Potash mining operations rely heavily on an efficient approach to equipment repair. Potash mining equipment is subjected to rigorous conditions and breakdowns are inevitable. A well-structured repair plan is crucial for decreasing downtime of a circuit or specific area of the plant. Proactive maintenance and timely repairs are fundamental for keeping equipment in peak condition. By addressing issues promptly and following a systematic approach to repairs, mining operations can maintain efficiency, reduce downtime, and extend the lifespan of critical assets.

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Standard Machine operates as a one-stop shop capable of meeting our customer requirements on many different aspects of repair. As a designer and manufacturer of our own Hamilton Gear reducers and specializing in custom application drive systems, it is only natural that we would support gear reducer rebuilds with our well-equipped Gear Reducer Rebuild Program and gear manufacturing facility.

We work with our customers to meet their requirements by offering complete rebuild services or a quick-bearing changeout to get them back in service. We are capable of reverse-engineering gear reducers or components to help support customers' needs.

Repairing a gear reducer demands expertise, precision, and a commitment to quality. Attention to detail is essential throughout the assessment and inspection process. Disassembly is carefully documented at each step to identify parts that can be repaired, or if necessary, manufactured new. An equipment repair report is used to thoroughly detail the parts list and is provided to the customer. There is the opportunity to implement improvements or include customer-specific modifications. Once assembly is completed, the reducer is then put on a test bed to ensure peak performance and then packaged to allow for safe travel back to site.

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When Mine Supply Company vice-president Marc Collette was introduced to PAUS in 2016, he saw the value they could provide to many of Mine Supply's mining and industrial clients. PAUS machines are a great option for operations wanting to minimize maintenance costs and reduce environmental impact through investment in equipment with extended lifespan.

"Across the board, our clients are looking to reduce impact and minimize waste, which means rethinking procurement to integrate a view of the total life cycle of any asset purchased," says Collette. "Companies that take a long-term, sustainable view of their operations will see measurable benefits with PAUS machines in their fleet that go beyond reduced downtime."

PAUS – Quality, innovation & history

Since Mine Supply became a PAUS dealer, Collette has had the opportunity to train on the equipment at the PAUS factory in Emsbüren, Germany on multiple occasions, where he has seen the company's hands-on development and manufacturing in action.

"Spending time at PAUS has shown me how their 'the people who care' slogan is more than just talk," says Collette. "This is a company dedicated to producing the highest quality product, and to continual learning when it comes to innovation and change. They listen to the operators at each site and use this information to improve process and design. These client-focused values align with ours at Mine Supply."

Designed to meet the challenges of underground operations

Founded by Hermann Paus in 1968, PAUS' robust, purpose-built machines have earned a name for quality, innovative engineering at operations in Europe, Asia, South America, and Mexico, with annual production averaging around 500 units. While North America is a relatively new market for PAUS, it has invested in supporting a new and diverse client base by establishing PAUS North America in Cleveland, Ohio to better serve the region.

PAUS develops, designs, and manufactures a range of machines, including utility vehicles, personnel transporters, mine rescue vehicles, haul trucks, LHD loaders, scalers, graders, explosives chargers, and roadheaders.

Mine Supply Company – On-demand, regional service

Known for quality, long-term support services and dependable parts supply, Mine Supply Company is Western Canada's PAUS dealer.

"PAUS equipment is durable and safe," says Paul Cranford, GM at Mine Supply. "The quality, longevity, reliability, and performance of PAUS machines is unmatched – these machines last longer and require less maintenance. We look forward to continuing to support them in action out in the field."

With more than a century of combined operations, sales, and procurement experience, Mine Supply Company's team stays connected with manufacturers and the end-users, working with clients and suppliers to solve problems and enhance operations.

To find out more about Mine Supply Company's premium product lines, visit minesupplyco.com. Connect with the team at sales@minesupplyco.com, or 306-653-1056.▲

See more at www.paus.de/en.

MinCa 5.1

- Durable, compact personnel carrier
- Full suspension system
- Higher safety
- Lower life cycle costs

TSL 853 Telescopic-Swivel Loader

- Robust chassis
- Hydrostatic all-wheel drive
- Articulated steering (+/- 40 °)
- Swivelling boom (+/- 90°)
- Quick change adaptor with auto-lock
- Numerous front/back attachment options

PG 10 Grader

- High manoeuvrability
- Strong tractive force/precise grading
- Excellent visibility
- Low operating costs

Celebrating over nine decades in excellence

VENEBLES MACHINE WORKS

Above left: For an impressive 90-plus years, Venables Machine Works has played a fundamental role in supporting the growth and success of the mining and potash industry. Right: Beyond equipment rebuilding, Venables Machine Works extends its hand to craft custom solutions, perfectly tailored to the demands of the potash mining realm.

Step into the realm of mining equipment repair and custom manufacturing, and you'll find a legacy that spans generations. Venables Machine Works, a name synonymous with quality and reliability, has been a cornerstone of the industry since 1931. Starting as a blacksmith's shop and becoming one of the first establishments of its kind, Venables Machine Works has consistently set the gold standard for equipment repair, rebuilding, and custom manufacturing.

A pillar of the mining community since 1931

For an impressive 90-plus years, Venables Machine Works has played a fundamental role in supporting the growth and success of the mining and potash industry. Their journey is a testament to timeless dedication and unrelenting commitment. What sets Venables apart from others is their unmatched expertise, steadfast commitment to customer happiness, and a wide range of services that have proven their value over time. Countless restored projects and their knack for crafting custom solutions have etched Venables as the foremost expert in the field.

Restoring excellence: Surpassing original pioneers

Opting for equipment rebuilding at Venables means embracing a time-tested choice that far surpasses the ordinary options. Here's why Venables' rebuilt equipment stands head and shoulders above the rest:

1. Uncompromising quality: Venables boasts an assembly of highly skilled employees and cutting-edge machinery. The result? Restored machinery that doesn't just match the OEM but often outperforms them, ensuring unwavering reliability and longevity.

2. Cost-effectiveness: Opting for Venables means more than just a refurbished machine; it's a sensible financial decision. Your resources are allocated more wisely, all while maintaining operational quality.

3. Crafted to perfection: Venables understands the intricacies of the mining world. They fine-tune rebuilt equipment to your exact specifications, incorporating the latest technological innovations to enhance performance, efficiency, and safety.

Beyond equipment rebuilding, Venables Machine Works extends its hand to craft custom solutions, perfectly tailored to the demands of the potash mining realm. Whether it's specialized components, machinery enhancements, or entirely new creations, Venables delivers precision-engineered solutions that align seamlessly with your requirements. Here's why Venables' custom manufacturing prowess stands as a benchmark:

1. Expertise and synergy: Venables collaborates closely with potash mining companies, forging a partnership that revolves around understanding needs and surmounting challenges. Their team knows how to design and craft adapted solutions that work in perfect harmony with your objectives.

2. Flexibility and adaptability: Venables wields a diverse palette of materials, including specialized alloys and wear-resistant components. This guarantees durability and top-tier performance even in the most demanding of mining environments.

3. Unyielding quality assurance: Venables maintains a steadfast commitment to quality across the board. Every custom creation undergoes rigorous quality control protocols and inspections to guarantee compliance with or surpassing industry benchmarks.

A community of experts: The backbone of Venables

As we celebrate over 90 years of service, it's our dedicated team of experts who deserve the spotlight. Many of our employees have been with us for decades, each contributing their unique skills and unwavering commitment. The average tenure of our employees is an impressive 12 years, a testament to the sense of belonging and fulfillment that Venables offers. Long-term employees, with their wealth of experience, mentor and collaborate seamlessly with newer team members, promoting an atmosphere of continuous learning and growth.

A culture of excellence, every day

In this remarkable work environment, we maintain our commitment to delivering top quality. It's not just a job; it's a shared mission. Whether it's rebuilding equipment to surpass OEM standards, crafting tailored solutions, or innovating for the future, our team does it with pride, precision, and a genuine passion for what they do.

In a world of constant change, Venables remains a mainstay of stability and expertise, thanks to our dedicated team and the remarkable work environment they have nurtured. Together, we forge ahead, committed to serving the mining industry with excellence, innovation, and the timeless spirit that has defined us since 1931. ▲

30 years of diversification and change

Parkland Manufacturing has steel fabrication in its blood that goes back to the 1960's in rural Saskatchewan with a young trades apprentice taking sheet metal and the welding trade certifications and working hard to support his young family. Eventually he worked his way up the ladder to manager and then partnered to start Parkland Manufacturing in 1992, a small fabrication shop servicing the local mining industry and community in southeast Saskatchewan.

In the 30 years under the Parkland Manufacturing banner, there have been significant changes. A second generation working for the company; new equipment; industry booms and busts; generational change in industry; Diversity, Equality, & Inclusion; and climate change, just to mention a few.

It hasn't always been easy as the company have fought not only the changes of time, but we have pushed through some of the toughest times our world has seen, including global pandemics, international conflicts, and political headwinds.

We found ourselves unprepared to deal with the issues of a changing world.

Just like family households, we have found a way to adapt and overcome these challenges by being innovative and progressive in our decision-making process.

Sometimes it is difficult to explain to our founder the changing needs of a business. Conversations often go "No dad, a complex program to tell us when to start a project is valuable", or "honestly dad, human resource software that analyzes people to improve team collaboration will greatly improve the effectiveness of our fabrication teams". The reply is regularly, "that's not how we used to do it".

As we change, so do our customers' needs and expectations. They have evolved to include purchasing

Scrubber ducts.

from a global market, quality assurance measures, and Environmental, Social and Governance initiatives.

Progressive progress is difficult to keep up with. Many changes in AI, CNC, ESG, and regulations have prompted us to change our practices. We have adapted our thinking to include technology-based approaches to our practices such as analytical hiring processes, environmental tracking of carbon footprint, robots, and our new research and development team, which provide the best solutions for our clients' needs.

The changing workforce has been difficult to navigate but has been one of our flagship priorities in 2023. Parkland has implemented the four Support Beams Hiring Policy (Young Workers, New Canadians, Women, and Indigenous) as we believe in our ability to provide quality employment and training opportunities to our surrounding neighbours.

Parkland's service line includes structural steels, miscellaneous metals, custom steel fabrication, OEM fabrication and linings/coatings, and the ability to transport our product from coast to coast.

A tank at Parkland Manufacturing.

Our customers are now bigger than ever, with ever-changing and sometimes complex needs. Parkland has not only been able to keep up with the complex needs and changes, but we welcome the changes to provide a better product for our client base.

Parkland Manufacturing is poised to innovate and excel through another 30 years with diversification, teamwork, integrity, and commitment. ▲

IWL Steel Fabricators now ISO and TSASK certified

IWL STEEL FABRICATORS WAS ORIGINALLY ESTABLISHED IN THE 1950S IN SASKATOON, SASK.

We are proudly 100 per cent Aboriginal owned by the Clearwater River Dene Nation of LaLoche, Sask. The Clearwater River Dene Nation is the fourth generation of ownership at IWL, and is committed to growing and expanding the company to meet its full potential. In return, profits are returned to the ownership to be used at the band level to fund community needs including housing, infrastructure, and social programs.

Through the core competencies of the Clearwater River Group of Companies, we are able to provide full-service, cost-effective customer solutions for a wide array of projects, large or small. With two fabrication facilities, we have a multitude of options to best facilitate project execution.

IWL is certified to Canadian Welding Bureau CSA Standard 47.1 – Division 2. We employ Level 2 and Level 1 CWB welding inspectors, as well as CWB-certified welding supervisors. All welding personnel hold valid CWB tickets for various procedures and material alloys.

IWL is registered with TSASK and authorized under ASME Sections VIII Div I (Pressure Vessels); B31.1 (Power Piping); B31.3 (Process Piping); B31.1 (Boiler External Piping); and CSA B51 (Category D, E & H Fittings). We are also certified to ISO 9001:2015 for Quality Management.

By being signatory to Mission: Zero we support the goal of a workplace with zero injuries. With a focus on safety first to prevent injury, as well as the elimination of unsafe work practices, we provide our employees with a safe work environment. In addition, we are ISNetworld certified as a subcontractor, consistently maintaining an "A" rating with our clients.

With professional engineers on staff working in conjunction with external engineering firms, we provide an integrated approach to project solutions. Our CAD/CAM department uses 3D modelling technology to provide detailed fabrication drawings for both shop and field use, as well as input data for our robotic fabrication equipment.

3D modelling provides a seamless transition from the design concept to the reality of fabrication. The direct interface of modelling software to automated fabrication ensures the additional benefit of increased productivity, integrated project management, scheduling accuracy, reduced field cost, and maximum site efficiency.

To maintain competitive advantage, the latest investment is a BeamCut BC50 – a fully automated robotic machine with larger intake capabilities and the ability to process all profiles of material. With new technology comes environmentally-friendly initiatives and a safer work environment for all.

A fully automated five-axis processing machine is able to cut, bevel, and cope pipe and tubing up to 12-inches in diameter. The accuracy and efficiency

PROUDLY 100% FIRST NATION OWNED BY CLEARWATER RIVER DENE NATION

Through cellphone technology, we are able to facilitate barcode scanning on site to further assist in material receiving, tracking, and site storage.

of this process ensures decreased delivery times for processed material. In addition to pipe processing, the new technology is able to bevel, weld prep, and countersink plate up to a maximum of two inches.

Material is traceable throughout the fabrication process. At time of drawing issue, all pieces are assigned a unique barcode. This barcode forms the basis of all documentation, moving forward. Barcode scanning ensures accurate shipping documents and eliminates the possibility of delivery delays or missing components. Through cellphone technology, we are able to facilitate barcode scanning on site to further assist in material receiving, tracking, and site storage.

We can perform work as a supplier to a project owner or general contractor; or act as a general contractor and manage several subtrades.

We are a multi-dimensional fabricator with capabilities to do a wide range of steel fabrication projects:

- Structural steel, pipe supports, pipe skids, and modules;
- Platework – tanks, chutework, pump boxes, surge bins, hoppers, and launders;
- Material handling – conveyor galleries, belt conveyors, cross conveyors, mechanical soft drop system, and bucket elevator casings;
- Splitter gates, grizzlies, material gates, motor bases, and pipe spools;
- Platforms, stairs, handrail, and mezzanines;
- ASME welding, sandblasting, painting, galvanizing, and installation services are available through our qualified subcontractors;
- ISO 9001:2015 ;
- TSASK registered. ▲

Canadian-made aftermarket radiator reduces downtime by 70 per cent

When it comes to servicing potash equipment radiators, it typically becomes an "all hands on deck" type of job for the team at West End Radiators.

Though they're experts in heavy-duty cooling systems, they say these potash radiators require careful attention and care in order to properly deal with the debris and corrosion potash mining causes; something few other shops can provide.

But by specially designing their three shops in Winnipeg, Estevan, and Saskatoon to be able to easily manage radiators of any size, a potash job becomes smooth and painless.

This was the case for a recent radiator West End Radiators did for a haul truck belonging to a potash mine in Saskatchewan. The customer brought in their existing radiator that required a complete rebuild with new tubes and seals.

This radiator had reached the end of its service life. The haul truck in which the radiator came out of was due for a complete rebuild, which happens approximately every two years if it's being used 24/7 and in extreme conditions, says Justin Feeleus, owner and director of plant operations.

As a preventative measure, West End Radiators' shop technicians identified that the radiator needed to be completely rebuilt to withstand the next extreme tour of duty. By providing a quick turnaround time for this job, West End Radiators was able to reduce their customer's potash equipment's downtime by up to 70 per cent, saving them thousands of dollars of lost revenue.

Their quick turnaround isn't the only thing that sets West End Radiators apart from its competitors.

They are also the only copper-brass and aluminum-core manufacturer in Canada, manufacturing a range of heavy-duty cooling system parts at their production plants in Winnipeg, Man.

"Manufacturing parts in-house allows us to provide customers with a faster turnaround than if they were to purchase new from the OEM, and it allows us to manufacture a heavier-duty product built for extreme conditions like potash mines," says Feeleus.

Plus, West End Radiators is one of the only shops in the Canadian Prairies that coats all potash equipment radiators with a Heresite coating — a corrosion-preventative sealing that improves radiator performance and extends its service life.

And for those mines with older models of radiators, West End Radiators can custom engineer a replacement in just a few hours.

"We are fully equipped to do on-site repairs for our potash mine customers, meaning we can come to you with the components needed to service your radiator directly at the mine in just a few hours," Feeleus adds.

This is exactly what the team

Mesabi radiator rebuild.

recently did for an underground mine in Northern Manitoba. The equipment this radiator was in was critical to daily operations, so their team of technicians headed on-site and were able to turn the radiator around in just four hours, which allowed the piece of equipment to be back in service in less than 12 hours of downtime.

With West End Radiators' growing presence across Saskatchewan, the company has built strong relationships with key players who have been using the team's DPF cleaning services.

If there's one message their team preaches, it's that no heat exchanger is too big or too small for their team to tackle.

West End Radiators has locations in Winnipeg, Estevan, and Saskatoon with full abilities to service potash mines across Western Canada. ▲

Sampling valves: The key to safer sample analysis

Oil sampling with valves has been proven to be a significant timesaver. Sampling with a valve will typically take approximately two minutes versus 20 minutes using the vacuum pump method. Often overlooked is the safety advantage in using a valve.

A valve that is conveniently located past machine guarding using a bulkheaded steel line or hose to access the equipment is perfect to avoid a shut down and lost production. Equipment located behind guarding is often neglected. By not submitting a sample on schedule, the trending component of the oil analysis to monitor the vital operating health of the equipment is lost.

A single oil analysis becomes just a snapshot and not the multiple real-time video which is needed to assess and properly maintain equipment.

Neglected equipment often results in loose line connections or possibly seal breakdowns, leading to spills that can cause slips and trips. Even when equipment is not guarded often, it is important to recognize excessive heat or moving components such as near engines, especially turbos and fans.

Machine guarding is not the only risk factor when oil sampling. Climbing to heights also contributes to accidents involving slips and trips. It is so much easier to create a ground-level access point.

Single or multiple manifold blocks, live or static, are available to sample at ground level from one centralized location. Specifying the correct valve and probe system is important when choosing the system. Understanding the difference between a low-pressure and high-pressure port is important. Pressure checking should be done before specifying the port as a sampling port, keeping in mind lower pressure ports usually provide more meaningful results.

Sampling ports have also strategically been used as a means of relieving built-up pressure in sections of a hydraulic system that may trap pressure and need to be de-energized before servicing. Reducing the time spent sampling can be an important safety consideration when working in high noise conditions such as in high-pressure hydraulic loading stations. Consider the valve speed to limit the time exposed to airborne environmental contamination, such as when sampling an ammonia compressor.

Even in temperature extremes like high heat in furnace conditions or low or freezing temperatures, valves should be used to minimize exposure time. Any retakes when not using valves, especially in difficult conditions, will result in doubling of any safety risks.

Valves typically require much less procedural training than other methods, but adequate training is always an important first step when sampling.

Safety should always be the first consideration. ▲

Even in temperature extremes like high heat in furnace conditions or low or freezing temperatures, valves should be used to minimize exposure time. Any retakes when not using valves, especially in difficult conditions, will result in doubling of any safety risks.

CAB® Products: Serving the mining industry and the community

CAB® Products are proudly manufactured in the USA by persons with disabilities at the Cambria County Association for the Blind and Handicapped (CCABH).

CAB® is a familiar name in the mining industry. Many miners know the name, the infamous CAB Man, and the brightly coloured hooks and hangers. These products have become staples in the mining industry over the course of the past 50 years. Because of this, many people recognize the name CAB® Products, however, not everyone may know the mission behind the name.

CAB® Products are proudly manufactured in the USA by persons with disabilities at the Cambria County Association for the Blind and Handicapped (CCABH). CCABH is a 501(c)(3) non-profit with a dedicated mission for their community in Western Pennsylvania.

The mission of the CCABH is to develop and support an environment for persons with disabilities which promotes vocational and employment training, independence, and community involvement through rehabilitative, recreation and low-vision services, and education for the prevention of blindness. The CCABH unites vocational training and a manufacturing business producing quality products that offers employment for persons with disabilities while ensuring worldwide customer satisfaction.

Established in 1927 with only a handful of employees, the CCABH started with sewing, food service kits, and sub-contract work. They provided vocational opportunities and vital community services, such as education and provision of aids for persons with blindness and low vision. In 1973, the CCABH started manufacturing hangers for the mining industry and they became the industry standard. CAB Products, such as the Bosserman Hangers, or otherwise known as “CAB clips”, have been used for decades in underground mines and are the benchmark of value in the mining industry.

Throughout CAB’s history, services to individuals with disabilities continued to grow just as much as the manufacturing side. Today, CAB provides services to over 500 persons with disabilities and includes vocational rehabilitation, personal work adjustment training, and a school to work program helping high school students with disabilities learn vital job skills for their future.

CAB® employees produce a variety of products for the mining, tunneling, pipeline, marine, and solar industries. Every order of CAB® Products fulfills the unique mission of the CCABH and supports their community.

To learn more, visit www.cabproducts.com. ▲

Eyes on safety

CHOOSING THE RIGHT PROTECTIVE EYEWEAR FOR YOU

BY PAUL JOHNSON LO/LCLP, MANAGER, SAFETY EYEWEAR DIVISION

Looking for comfortable, protective, and stylish safety eyewear? FO Safety wants you to know that we're here to help with that. No one wants to have permanent vision loss or work-related injuries due to not wearing the proper eye protection, right? We're going to share with you what our safety eyewear is all about.

Safety glasses have been known to be heavy, uncomfortable, and not attractive. Today's frames from FO Safety eyewear are stylish, comfortable to wear and lightweight.

There are levels of protection required, basic frame with side shields is for a person that requires minimal protection. Their work environment might be at an assembly line or operating vehicles or anywhere there is little chance of projectiles.

The next level are frames designed to fit close to the face with a high-angle wrap. These frames have integral side shields, and the lenses wrap around the side to offer superb protection from the front and side but still may have gaps at the top and bottom where debris can enter.

The next level will be a wrap-style frame with a dust bar or half seal. These foam or rubber bars protect from articles coming from above and are replaceable when they become damaged. The slight opening between the cheek and the lower rim of the frame allows ventilation. These are popular in places like warehouses, electricians, or for anyone that does a lot of their work overhead.

Full-seal eyewear is becoming increasingly popular and these frames include the best of everything.

Frames from FO Safety eyewear are stylish, comfortable to wear and lightweight.

They are comfortable designs with wrap-style lenses and integral side shields, as well as a gasket that encircles the eyes which are extremely popular with our mining and industrial leaders.

Frames with high-wrap angles and increased forward tilt can cause complications with some prescriptions. The most common complaint is where the wearer experiences a "fishbowl" effect where the vision feels out of focus in the periphery, and some suffer with mild headaches.

To combat these issues, optical laboratories use a process known in the optical industry as "free form", where specially made lenses compensate for this from the centre toward the peripheral edges to keep visual acuity as sharp as possible.

I recommend that company management and safety managers consult with the safety eyewear experts for assistance in selecting the best line of products to address the level of protection needed for their employees. ▲

For your manufacturing needs

From humble beginnings over 50 years ago, Sellick Equipment Limited has built a reputation as a custom manufacturer of material handling. This ability to build customized machinery has enabled Sellick to meet the needs of the mining industry. With a close proximity to salt mines in both Windsor and Goderich, Ont., Sellick was called upon early in the company's history to be involved in developing various underground equipment. This included personnel carriers capable of carrying 12 workers and doubling as an emergency vehicle, and various adaptations of a rough terrain forklift to deliver ANFO material used for blasting.

Sellick has also supplied many of the potash mines in Saskatchewan with a variety of both surface and underground material-handling solutions.

The company also found success in the United States supplying mines in Louisiana, Kentucky, Ohio, and Nevada with equipment.

In recent years, Sellick, along with distributor Brandt Tractor, have developed low-profile, 8,000- and 10,000-pound capacity four-wheel drive forklifts for use underground. These machines are equipped with ROPS overhead guard protection, fire suppression systems, LED lighting, fully automatic transmissions, and optional hydraulic fork positioners.

On surface, the Sellick line up of rough terrain forklifts range in capacities from 5,000 to 16,000 pounds. Machines can be equipped with fully enclosed air-conditioned cabs, four-wheel drive, and lift heights to 22 feet. ▲

SLP-100 4x4, 10,000 lbs. capacity low profile (75-inch) ROPS canopy.

S120-4x4, 12,000 lb capacity, low profile – 85 inch.

S120 4x4, 12,000 lbs. capacity, full ROPS Cab, Surface.

Sellick model PC-120 Personnel/Ambulance Underground.

SLP60 4x4 chassis conversion to a rock bolter.

The role of potash in the emerging low-carbon economy

LOCAL BENEFITS FROM INTERNATIONAL OPPORTUNITIES

BY SCOTT BARNES, PH.D., P.AG., PRESIDENT, LIMNOS ENVIRONMENTAL LTD.

As Canadians, we are all well aware of the recent impacts of inflation, a large component of which is related to food costs. A significant proportion of this is related to direct carbon pricing on agricultural inputs. As the world grapples with food security and carbon management, we foresee a path forward for potash mining that addresses both issues.

We are seeing the globalization of carbon management. At COP 28, the generation and regulation of carbon offset credits was a significant issue, and although there was some resistance to establishing more formal bilateral carbon offset trading systems, we expect future moves towards the opening of new agreements. Countries such as Switzerland and Singapore have signed deals to acquire carbon offset credits from Peru and Papua New Guinea respectively, and large foreign-based carbon credit trading firms have been active in sectors such as forestry.

How does this intersect with potash production in Canada? The two most used fertilizer types worldwide are potash and ammonia. It is difficult to get a global estimate, but in Canada, direct and indirect emissions from potash production is approximately 38 per cent of that of ammonia production. The differential is largely due to the direct release of carbon dioxide as part of the chemical reaction to create ammonia. Potash is mined and has no direct carbon dioxide produced in the mining process.

Canada also has a robust carbon offset market system, which a significant part of that was created through accounting for carbon soil storage under the now-ended Conservation Cropping Protocol. This process allowed individual farmers to sell offset credits produced on their land to aggregators, which then resold credits in Alberta's regulated market.

Offsets are either regulated, meaning they are utilized by entities as part of a legislated carbon management system, or in the voluntary market, which requires only a buyer and seller operating on an exchange. Regulated offsets form a small proportion of the overall market. Additionally, voluntary credits may eventually be accepted for compliance requirements such as in California.

An argument could be made that displacing ammonia fertilizer with potash could form the basis for the creation of offsets. Moving to exclusive potash

Canada also has a robust carbon offset market system, which a significant part of that was created through accounting for carbon soil storage under the now-ended Conservation Cropping Protocol.

use would provide lowered carbon emissions, would meet additional needs as potash use is not legislated, and is permanent as it creates a one-time shift from one type of fertilizer to another.

One could foresee a number of opportunities arising from exploring the creation of potash-based offsets throughout the supply chain. For example, bilateral international partnerships could be made between individual potash producers to displace ammonia-based fertilizers. The total carbon emissions profile for any producer would already be known and easily verified, meeting the compliance requirements for offsets. The purchasing country could then use the emissions reduction as part of their climate plan by legislating potash use, or acting as the distributor.

Another potential opportunity would be for the verification of potash fertilizer use in Canadian agriculture. A producer-based aggregation approach could be developed similar to the Conservation Cropping Protocol, yielding offsets that could be attractive to large food processing forms, or sold on a contract basis into the voluntary market. ▲

Compass Minerals named one of 100 Companies Championing Women in Utah

Compass Minerals has been recognized as one of 100 Utah Companies Championing Women.

The company was recognized for its supportive policies and benefits, workplace inclusivity, and representation of women in leadership positions.

The honour comes from In Utah, an initiative of the Utah Governor's Office of Economic Opportunity collaboratively supporting Utah's economy. Through its Inspire In Utah campaign, In Utah aims to motivate women to explore new opportunities in the workforce by sharing women's experiences in various industries.

"We're committed to providing an inclusive and equitable working environment for our employees," said Kevin S. Crutchfield, president and CEO. "We strive to be a company where every person is treated with respect, feels like they belong, and where there are ample opportunities for professional development. It's an honour to be recognized for our efforts in championing women."

Compass Minerals offers a range of benefits to employees, including pay equity through regular pay audits, gender-neutral parental leave, paid volunteer time off, and professional development opportunities through partnerships with organizations such as the Society of Women Engineers, Women in Mining and Central Exchange.

"I'm grateful to work at an organization that offers opportunities to grow and develop new skills, and where I feel I can truly bring my whole self to work. As an active member of several employee resource

groups, I've expanded my network and found channels to share my personal experiences," said Monica Archuleta, senior maintenance planner in Ogden, Utah.

Compass Minerals' diversity, belonging, inclusion and equity (DBIE) program is an important element in recognizing the rich diversity represented at our company and in celebrating different cultures and groups. As part of the DBIE program, employees have the option of participating in various employee resource groups (ERGs), including a Women and Allies ERG. The company's ERGs provide a sense of belonging, create opportunities for development and help drive business results. ▲

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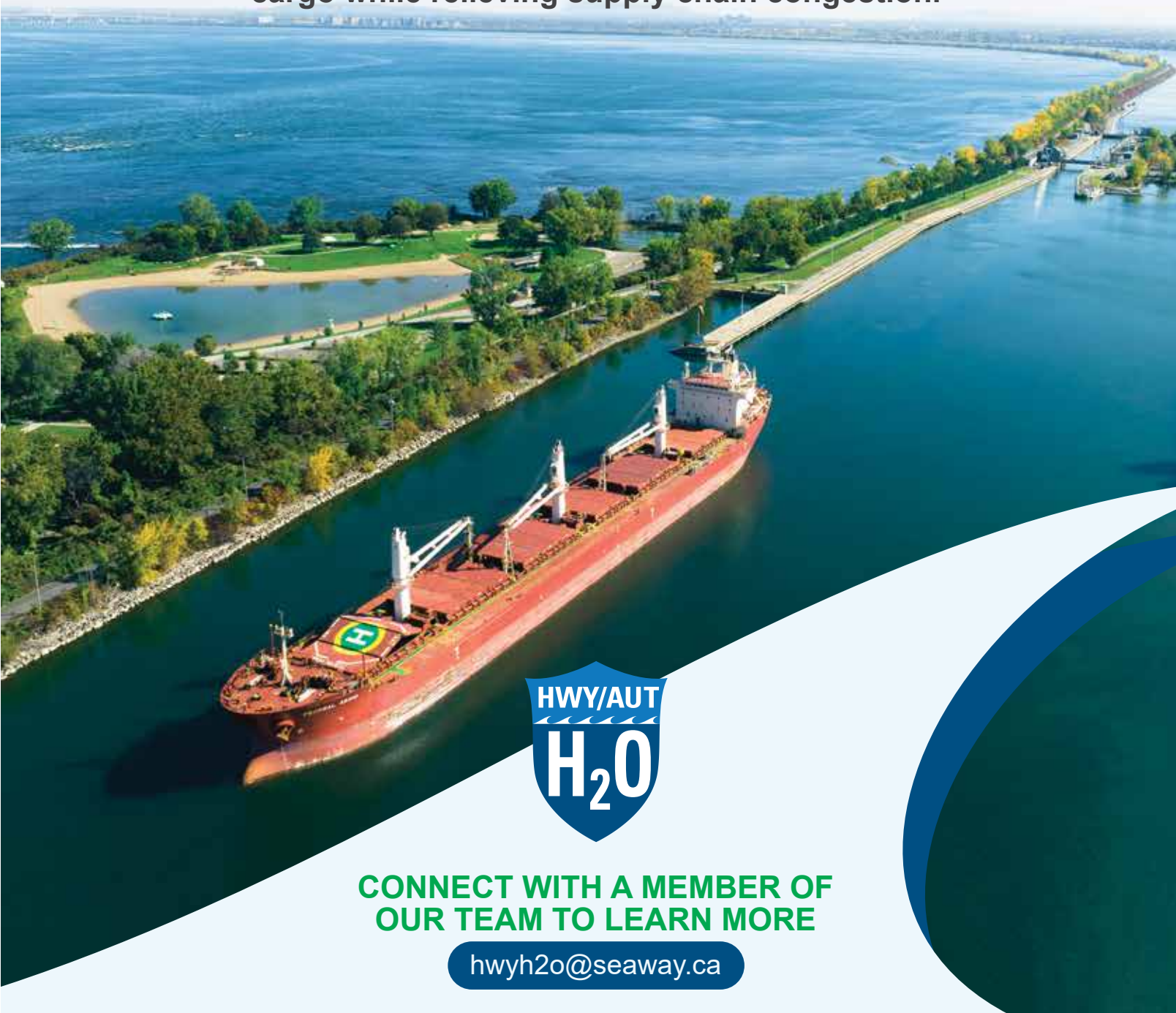

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