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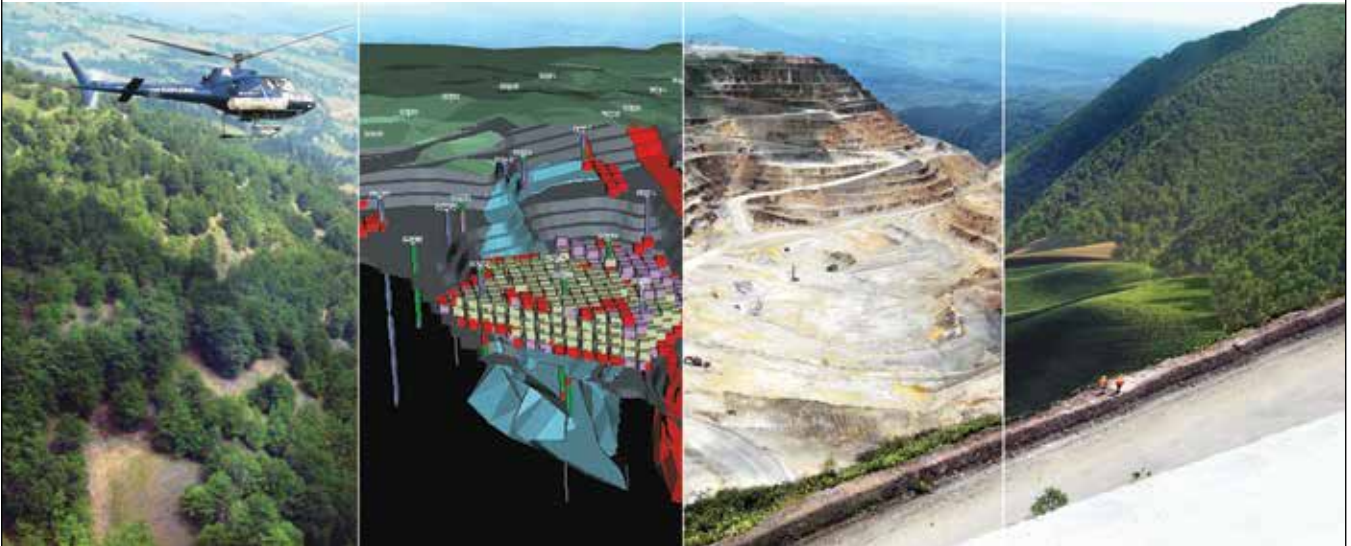
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Message from the editor

Shayna Wiwierski



The Fraser Institute's Annual Survey of Mining Companies, 2016 ranked Saskatchewan No. 1 out of 104 jurisdictions in their Investment Attraction Index earlier this year.

Competitive tax regimes, efficient permitting procedures and certainty surrounding environmental regulations and land claims all had to do with why the province ranked so high. With so much mining activity going on, it's no wonder that Saskatchewan got the top spot (up from second place the year before) in this international survey.

There's a lot going on in the potash world in both the province of Saskatchewan and around the world. In late summer, PotashCorp announced that the Canadian Competition Bureau had granted unconditional regulatory approval for a merger with Agrium. If the transaction goes through, it will present the industry with a new company called Nutrien, making it the largest global provider of crop inputs and services, as well as the third-largest natural resource company in Canada.

The Mosaic Company, another potash giant, recently hit potash in Esterhazy at their new K3 project, and BHP Billiton is still progressing their Jansen Potash Project, approximately 140 kilometres east of Saskatoon. Oh, and let's not forget the K+S Group. The German-based company with Canadian headquarters in Saskatoon recently celebrated the opening of a state-of-the-art potash handling and storage facility at Pacific Coast Terminals' Port Moody terminal. The port facility is the western port destination for potash from the company's multi-billion-dollar Bethune mine in southern Saskatchewan, which celebrated its grand opening on May 2, 2017.

And that's just Saskatchewan. There is tons of potash development and news happening across Canada and the world, which is what we dive into in this issue of *PotashWorks* magazine. From coast to coast and across the globe, we take a look at the various potash developments happening, as well as the suppliers who help bring the potash to market. As you'll see when you flip through our pages (I also invite you to check out our publication online at potashworks.com), we cover potash projects around the world and also talk about the technology and services that so many companies offer the industry.

I hope you enjoy the 2018 issue of *PotashWorks* magazine, and as always, if you have any comments or story ideas, please feel free to pass them my way.

Shayna Wiwierski

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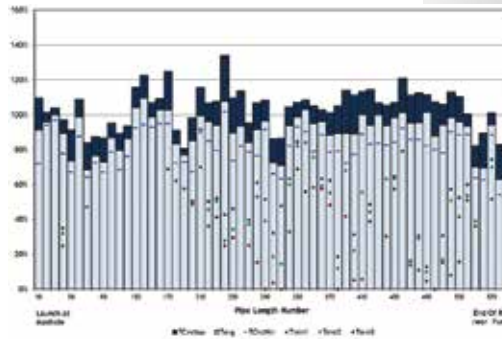
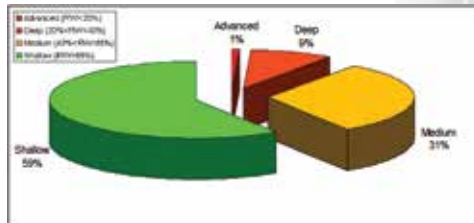
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Message from the Premier of Saskatchewan **Brad Wall**



On behalf of the Government of Saskatchewan, it is my pleasure to welcome readers to the 2018 edition of *PotashWorks* magazine.

Potash has played an integral role in our economy for over 50 years. Saskatchewan is the largest producer of the mineral in the world, accounting for 30 per cent of global production. The industry employs more than 5,500 people directly and contributes to the livelihood of thousands more, while supporting Saskatchewan's enviable quality of life.

Saskatchewan has been recognized as a reliable and stable long-term source of potash since 1962. And the future looks bright. To meet growing demand, most of Saskatchewan's potash operations have expanded over the past decade, increasing production capacity by 90 per cent. K + S Potash Canada has opened the first new potash mine in Saskatchewan in more than 40 years, a \$4.1 billion operation that will create more than 400 full-time jobs. Meanwhile, BHP Billiton has committed US\$3.8 billion to its Saskatchewan potash resources, primarily at its Jansen property, with production forecast to begin as early as 2023. By conservative estimates, Saskatchewan could meet world demand for potash at current levels for several hundred years.

Our government works closely with the industry to ensure a healthy future for potash mining in Saskatchewan. Our efforts include encouraging investment, sales and development on international trade missions, and at national and international mining events, and ensuring our province maintains a competitive tax and regulatory environment. As well, the government provides companies with access to quality geological information to allow them to make informed decisions on development. Another important aspect of keeping the potash industry thriving is minimizing our environmental impact through technology, research, stewardship initiatives, and management systems.

We also take pride in the safety record of the companies that comprise this industry. They have displayed a commitment to best practices, innovation and sustainability in their operations that is reflective of deep and sustained community engagement. In short, our potash companies are great corporate citizens, and we are grateful for their many and varied contributions to our province.

Our government will continue to support a healthy, competitive mining sector to ensure our economy remains capable of supporting a high quality of life for our citizens. Together, we are building opportunities for families, businesses, and communities across our great province, all while helping the industry feed a growing world.

A handwritten signature in blue ink, appearing to read 'Brad Wall'.

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Message from the Minister of Energy and Resources

The Honourable Nancy Heppner



A significant part of our responsibilities in government involves doing our best to enable businesses to invest in Saskatchewan which helps to create sustainable jobs in our communities and, accordingly, keep our economy dynamic and growing.

In fact, when we talk about the potential opportunities that exist in our province, quite often we are talking about opportunities in mineral resource development. Potash is one of the biggest stories we are able to tell.

We are the largest potash producer in the world, possessing almost half of the world's potash reserves. Our provincial potash industry has experienced a renaissance of sorts over the past decade, driven by significant expansions of existing mines, as well as new interest and development—all of which has resulted in roughly \$20 billion in total investment during this time. The past year in particular has been an eventful one, with the proposed merger of PotashCorp and Agrium, as well as the first production by K+S at their Bethune Mine, the first new potash mine in the province in over 45 years.

In its 2016 Annual Survey of Mining Companies, the Fraser Institute ranks 104 jurisdictions around the world based on a combination of two things: their geologic attractiveness for minerals and metals, and their policy attractiveness. Saskatchewan is number one on that list. Saskatchewan is where mining investors can find some of the world's best prospects for development. Saskatchewan is where global investment dollars are most likely to be headed in search of mineral potential combined with a reliable operating environment. When it comes to mineral resource opportunities, this province is arguably the place to be.

Simply put, an important reason for our success in this area is the fact that we appreciate that it is not enough to possess the resources our society needs; it is vital that we also help to enable fair access to these resources. The importance of predictably managing our resources while encouraging responsible and competitive investment is something that informs our policy and decision-making rationale at every level.

The Government of Saskatchewan is committed to remaining a jurisdiction the mining industry can rely on. We are achieving this in several ways:

- By maintaining competitive and stable royalty regimes;
- Ensuring a good business and regulatory environment for investment;
- Removing unnecessary barriers to development here in our province; and
- Working collaboratively with our industry stakeholders and provincial agencies to facilitate new projects.

Saskatchewan's potash industry had sales and production of 11 million tonnes K_2O in 2016, the second-highest in our history, and demand for Saskatchewan potash is expected to reach an all-time high in 2017. Rising global population and the increasing wealth of developing nations will continue to be factors driving this growth well into the foreseeable future.

Our province, its innovative and competitive potash producers, and the many communities who benefit from this industry are well-positioned to meet this future, and we look forward to continuing to be a jurisdiction of choice for the industry. ♦

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Message from the mayor of Esterhazy

Roy Spence



It is amazing the difference a few years make. Back in the boom times, a few years ago we were in the midst of expansions at both of Mosaic's potash mines (K1 and K2). On any given day, we might have had 800 contract workers in the area. This put tremendous stress on our infrastructure, caused house prices to become inflated, and caused rents to go through the roof. Today, the daily number of contractors in the area runs about 200 to 250, so many of the stresses experienced a few years ago have subsided. However, what we now find is that many of the older homes that were being used as rental accommodations are vacant and have been put on the market. As well, rental units are far more available than they used to be and this has resulted in rental rates declining. Both of these developments are positive for anyone looking to relocate to Esterhazy and call it home. Being an industrial community with many high-paying jobs, Esterhazy has tended to be an expensive place to live. I believe this is now reversing itself to some degree, but we won't go back to the pricing that existed 10 years ago.

At the present time, there are four subdivisions either in the development stage or that are completed and are being filled with new residences. One of these developments is immediately south of town and offers acreages for those seeking the rural feel, but with all the amenities of living in town. There are many options available for those seeking to relocate to Esterhazy whether you are looking to build a home, buy an existing one, or seek out rental accommodations. The services available to citizens has expanded over the last few years and it can be said that you will find more retail outlets and community services in Esterhazy than you would normally find in a community of our size. We pride ourselves in the fact that we normally have five physicians practicing out of our clinic and hospital. We also boast a full-time dental clinic and veterinary clinic. As well, health services, such as a chiropractor and optometrist, are available on a regularly scheduled basis.

Town council has been working on upgrading our infrastructure, including the recent completion of an additional water reservoir which will serve the stored water capacity needs of our citizens for decades to come. On the recreational front, we have just opened a splash park for the kids, and a short while ago we installed a new skateboard park. Our local golf course that is located in the regional park bordering the town has undergone significant renovations and represents a most enjoyable and challenging venue for golfers of all ages.

Esterhazy is not only a beautiful, crime-free community, but also a prime location for anyone looking for a place to retire. It has been said that Esterhazy is one of Saskatchewan's best kept secrets! ♦

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Mergers and enhanced productivity boost potash output

An overview of what's happening with the potash industry worldwide

By Michael Schwartz

Any review of developments in the potash sector this year must be dominated by the merger of PotashCorp and Agrium. Since PotashCorp is tight-lipped and not at liberty to discuss some of the finer details of the merger due to the ongoing regulatory approval process, a certain amount of comment is available in the public domain.

On September 14, 2017, PotashCorp was able to announce that the Canadian Competition Bureau (CCB) had granted unconditional regulatory approval for the merger by issuing a no-action letter three days previously. CCB's conclusion is that the merger is unlikely to result in substantial lessening or prevention of competition regarding potash fertilizer, phosphate fertilizers, and nitric acid. Furthermore, CCB concluded that global potash prices are correlated with Canadian prices and also that customers can obtain potash from several suppliers.

Three other major potash-producing countries, Brazil, Russia, and India, have also given their approval to the merger, while at the time of writing, the USA is still reviewing the plans. China is also expected to accept the transaction.

This leaves the industry with a new company called Nutrien, the largest global provider of crop inputs and services. PotashCorp is confident that Nutrien will play a critical role in feeding future generations by assisting farmers to increase food production sustainably.

In simple terms, this largest crop nutrient company in the world will become the third-largest natural resource company in Canada; integration is claimed to result in a key global retail distribution system. In addition, Nutrien is promoting the annual efficiencies from the new company at US\$500 million from its new headquarters in Saskatoon.



Mosaic recently announced plans to acquire Vale Fertilizantes in Brazil.
PHOTO COURTESY OF THE MOSAIC COMPANY.



The Mosaic Company's potash operations comprise of four sites in Canada.
PHOTO COURTESY OF THE MOSAIC COMPANY.



Mosaic's new Esterhazy K3 mine is on target for completion in 2024. The entire complex is expected to be the largest underground potash mine in the world. PHOTO COURTESY OF THE MOSAIC COMPANY.



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The Mosaic Company

Other companies not facing the challenge of merger were more forthcoming. The Mosaic Company employs nearly 9,000 people in six countries, participating in all aspects of crop nutrition development. Its potash operations comprise of four sites in Canada, from where the product is processed into crop nutrients and then shipped via rail, barge, and ocean-going vessels. Total production in 2016 was 7.6 Mt, or 13 per cent of estimated global capacity and 42 per cent of North American capacity.

Mosaic operates three potash mines in Canada, two of which are shaft mines, and the other being a solution mine (the fourth site is their Regina office); there is also a shaft mine in the USA. For the future, Mosaic is confident that the new Esterhazy K3 mine in Saskatchewan is on target for completion in 2024. The total Esterhazy complex is expected to be the largest underground potash mine in the world. K3 will be roughly one-kilometre deep; as with traditional underground mines, mining machines will break down the ore deposits and send them to surface using massive skips and hoists.

Sarah Fedorchuk, senior director, public affairs - potash, says that they have seen tremendous accomplishments in 2017, despite challenging fertilizer markets.

“Here in Saskatchewan, we hit potash at our new K3 mine in February, marking five years of shaft sinking. K3 is progressing very well and planned completion is for 2024,” says Fedorchuk, adding that Mosaic also announced their plans to acquire Vale Fertilizantes, securing them a place in one of the fastest-growing agricultural regions in the world, Brazil.

“We have a long-term view for our company and continue to make decisions that reflect our strategy and mission - to help the world grow the food it needs,” says Fedorchuk. “For the potash industry, we’re expecting demand to be



The new potash handling and storage facility in Vancouver port. Front: The 263-metre-long shed for the storage of a total of 160,000 tonnes of potash products. PHOTO COURTESY OF K+S.

strong—but prices to only modestly improve. We have new players coming into the market and a number of mergers and acquisitions to be completed. There’s lots of change to come.”

K+S

K+S KALI GmbH, which is based in Kassel, Germany, extracts crude salts containing potassium, magnesium, and sulphur from its six German mines. These products go towards several fertilizer specialties and preliminary products for various technical, industrial, and pharmaceutical applications. K+S KALI GmbH employs 8,000 people and belongs to the overall K+S Group. This latter is the fifth-largest potash producer in the world, and the largest in Western Europe.

While K+S KALI GmbH is German-based, it has been very active in Canada. The company has been building a new potash plant at Bethune in southern Saskatchewan. Commissioning of this plant’s facilities commenced in August 2016, with the first potash having recently been extracted. A future annual production capacity of 2.86 Mt is envisioned.

Potash produced at Bethune will be transported in freight trains up to three-kilometres long. The potash will then be unloaded, stored, and loaded onto ships

for shipment to customers, primarily in South America and Asia.

Reinforcing K+S KALI’s commitment to North America, it has partnered with Pacific Coast Terminals in opening a new potash storage and handling plant at Port Moody in Vancouver. The facility includes an unloading station for freight cars and 1,260 metres of conveyor belts, as well as a 263-metre-long shed for the storage of a total of 160,000 t of potash products. Freight trains carrying 18,000 t can be unloaded, and ships with a capacity of 70,000 t can be loaded at the facility’s quay.

Looking at global potash demand, Michael Wudonig, a spokesman for K+S Group, says that there will be a slight increase compared with the previous year (2016 saw around 66 Mt, including approximately four Mt of potassium sulphate and low-grade potash).

“The contracts signed by the major potash suppliers with Chinese and Indian customers halfway through the year should stimulate global demand in the second half of the year, particularly in Southeast Asia,” says Wudonig. “The recovery in the prices of a number of agricultural products should also give the agriculture industry incentives to increase yield per hectare by making greater use of plant nutrients in the medium and long term.”

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K+S has produced the first tonnes of marketable potash in its new Bethune potash mine in Canada. PHOTO COURTESY OF K+S.

Wudonig was also able to confirm the sheer variety of mining methods at K+S KALI. “We do conventional mining, solution mining, operate an opencast salt mine, and also operate some sea-salt production sites. That simply depends on the deposit and the local circumstances.”

Regarding mining machinery, he commented that their capital expenditure in 2017 should be significantly lower than the prior-year level (2016: US\$1.34 billion) on account of diminishing expenditures for their Bethune plant in Canada.

“Capital expenditure in our potash and magnesium products business unit is likely to remain significantly below the previous year’s level (2016: US\$1.17 billion).”

Key markets

Wudonig also identified the key markets for K+S Group at present, being Western Europe, Brazil, China, India, Indonesia, and South Africa. For Sarah Fedorchuk at Mosaic, the equivalents are all the major agricultural markets in the world like China, Brazil, and India. They have customers in approximately 40 countries around the world and also

has a strong premium product market in North America.

Both companies listed emerging markets. For K+S KALI, they are China, India, Africa, and Arabian countries, while Mosaic commented that, “For some of our premium products, areas like Australia, Uruguay, and Argentina are being explored.”

Sustainability

Meeting commitments to the environment figure strongly.

“We continue to diligently work to meet our 2020 sustainability targets. We are making good progress on reducing our water, energy, and greenhouse gas emissions, our goal being to reduce them by 10 per cent per product ton by the 2020 mark,” says Mosaic’s Fedorchuk. “We’ve also set goals around waste reduction.”

She goes on to say that Mosaic will also continue to support the communities where they operate – last year they invested \$9 million in Saskatchewan.

“This month we have two projects underway that are aimed at improving food security here at home. In Moose Jaw, we

had another successful harvest of fresh produce at the Mosaic Community Food Farm, which will benefit local agencies that provide hunger relief and support. In Regina, we launched an educational outreach program with the Regina Food Bank’s Urban Agriculture Project. The project encourages youth and educators to increase their understanding of where our food comes from by growing their own fresh food.”

Conclusion

While the mega-merger described at the beginning of this article is tending to overshadow other operations, it is very clear that those other companies are implementing their own ambitious strategies. As K+S – a European company – proves, a global strategy brings results in terms of the potash produced – and consumers ultimately fed – and the profits generated.

Major investment by potash companies is leading to new mines being commissioned and a drive for productivity from machinery purchases and flexibility of mining methods. As Sarah Fedorchuk commented, “there’s lots of change to come”. ♦



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A different mine for a diverse workforce

BHP's Jansen Potash Project is creating exciting roles for diverse backgrounds



The integrated operations centre for the Jansen project will be located in Saskatoon, which means the people who staff it won't have to travel.

Over the past few years, BHP has been progressing the Jansen Potash Project approximately 140 kilometres east of Saskatoon. Jansen is planned to be the first conventional greenfield potash mine in Saskatchewan for some decades, and this presents the rare competitive advantage of incorporating new technology to build the safest and most efficient potash mine there is.

The BHP technology purpose is clear: to enable productivity through innovation and technology. This is done by relentlessly pursuing the basics, delivering projects that drive business value and creating future options. It is an approach that covers the company's entire value chain, from resource exploration and optimisation, to production, processing, transport, and marketing. The Jansen Project embodies this.

Jansen has the opportunity to take advantage of technology in every aspect of its design.

"BHP's vision is to design Jansen to ensure that is a friendly and welcoming operation to everyone," said Giles Hellyer, vice-president of operations for potash. "A reflection of who we are and how we want to feel; it will be visibly different from any other mine. Technology will enable us to place our integrated operations centre in Saskatoon, so the people who staff it do not have to travel. We are building Jansen for the future workforce, and this means being more connected throughout every aspect of their job. Innovation effectively enables us to 'design out' implicit gender requirements, including for operational roles. For example, robotics and automation can cut the requirement for heavy lifting in a maintenance workshop (heavy tools can be suspended from the ceiling). People of different physiques would now be able to per-



BHP's Jansen Potash Project, located approximately 140 kilometres east of Saskatoon, will enable productivity through innovation and technology.

form roles that may have been implicitly restricted in the past."

The team at BHP is applying innovative thinking to the design, construction, and future operation. For example, BHP is bringing new ideas to construction, starting in the design office. All of Jansen's design reviews are done using integrated 3D models and virtual reality driven by what is essentially gaming software. The "pink" rooms traditionally used for drawing review do not exist and mark-ups are done collaboratively in a "team of teams" approach - working digitally at BHP is about new ways of working. This allows for efficiencies and enhanced engagement across many dimensions.

"This is the first step to reducing future construction costs and adding significant value," said Hellyer. "We have identified common pain points in the construction process, and we are piloting the use of leading-edge technology to monitor construction progress and building in software that allows us to manage schedule optimization."

Jansen operations are planned to be supported from the Integrated Operations Centre (IOC) in Saskatoon, which will enable the mine to be safer, more productive, and host a more diverse workforce. Multi-disciplinary teams will work

together from the IOC, and will be connected to the operation both surface and underground, in real time. Here's how it could work:

"Hammad" identifies a machine health issue in the process plant and validates his findings using other software. He also pulls historical data to analyse the time of failure and evaluates if a break-in plan is needed. From his remote position at the IOC he is able to generate a notification for corrective action and identify site personnel to support, all while referencing the *Original Equipment Manufacturer Troubleshooting* guide. The next day, the maintenance planner creates a job plan with Job Hazard Analysis (JHA), identifies the strategy to be planned and engages the planning team to secure necessary materials and resources. After maintenance execution completes the job plan, Hammad provides feedback and arranges a condition assessment. By re-designing how we work, BHP is able to create exciting roles for diverse backgrounds.

Designing for the future is exciting and BHP is designing the Jansen Project in three mindsets - manufacturing, digital, and diversity - which are complementary and which together will deliver sustainable value. The Jansen Project is well positioned to improve its operations for safety and performance. ♦

The Mosaic Company ready for the next 50

The new K3 project hit potash in Esterhazy earlier this year, marking a significant milestone for the company and province



Mosaic's senior VP of potash, Bruce Bodine, joins executive VP & CFO Rich Mack and CEO & president Joc O'Rourke underground on February 16, 2017 to witness K3 hit potash.

Mosaic president and CEO, Joc O'Rourke says the company's 'win and grow' strategy is on display 3,350 feet below the surface in Esterhazy at its new K3 mine.

On February 16, 2017, Mosaic's new production shafts hit potash. The major milestone comes after nearly five years of intensive shaft sinking through the various geological formations in east central Saskatchewan to reach one of the richest and largest-known potash deposits in the world.

Hitting the potash ore zone is an impressive accomplishment. It's been nearly 50 years since the last new production shaft has been sunk in Saskatchewan. Mosaic currently operates the K1 and K2 mines in Esterhazy. Mosaic's K1 mine (formerly IMC) hit potash on June

8, 1962, and K2 was completed in 1967. In 1985, the K2 mine experienced brine inflow, that's when salt water leaks into a mine, causing increased cost and risk.

In response to long-term market fundamentals and to decrease risk, in 2009 the company announced its intentions to build a new mine in Esterhazy. In 2011, shaft sinking began, and by 2015, Mosaic's board of directors greenlit an accelerated timeline for the project.

The first phase of construction focused on building the north headframe. Towering 384 feet above the prairie landscape, the building is the tallest between Winnipeg and Calgary.

The headframe houses two massive hoists - the Koepe and Blair, with skips that will bring potash to the surface from a kilometre underground. The Koepe

hoist will move 60-ton skips capable of lifting 10 million short tons of potash per year. The Blair hoist will carry a cage for people and equipment.

K3's full design production capacity is for 6.3 million tonnes of product, or 19 million ore tonnes per year. Mosaic's Esterhazy operations currently produce about 17 million ore tonnes per year. Upon completion of K3, Mosaic's Esterhazy operation is expected to be the largest, most competitive underground potash mine in the world.

Keeping a multi-billion-dollar project of this magnitude on target isn't easy. O'Rourke says it's talented people that have got the company to this major milestone. "I'm very proud of the team here in Esterhazy - successfully managing a project of this scale takes incred-

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Hitting potash in Esterhazy during the first shaft sinking in 1962.

ible leadership. Where other companies have historically struggled, we've succeeded. We have some of the best people in the industry working on K3."

Leading the skilled team of employees and contract partners is Mosaic's vice-president of capital & engineering - potash, Gerry Couture. Having just surpassed 25 years with the company, Couture knows how important the project is to Mosaic's future and the Esterhazy community.

"I feel privileged to be part of K3, knowing that the infrastructure we're building today will be here well into the future. We have generations of employees who are part of our Esterhazy operations and that tradition is going to continue for so many, including my family."

Lawrence Berthelet, director of capital expansion for K3 is another example of a generational Mosaic employee. His father, Remi, worked for Utah Construction in 1958 and Mosaic's predecessor IMC in 1960 during the first shaft sinking. He was IMC's 26th employee.

"The K3 project brought me back home

to Esterhazy. I have two sisters, a brother-in-law, and cousins that all work for Mosaic at K1 and K2. For us, potash is a family affair."

While the process for sinking the new shafts might not be all that different from Remi's time - the level of safety is much higher. Mosaic is coming off its fourth consecutive year of record safety performance. It's easy to see why families continue to work for Mosaic. Employees have great trust that their loved ones will be provided with the best safety procedures, equipment, and training.

An injury-free workplace is a top priority across all of Mosaic's operations. From the start, safety has driven the K3 project's planning, set-up, and execution. This is demonstrated through the Safe Start program and the Incident and Injury Free programs. These efforts have led to a world-class safety performance.

Hitting potash marks a literal 'turning point' for the project. Couture, Berthelet, and their teams have moved from vertical shaft sinking to horizontal mine development. Much of the required in-

frastructure will be added to the shafts, including lowering equipment to be re-assembled for development and future production.

"K3 is the foundation of Mosaic's future for potash production. Not only will it be a world-class operation, it drastically reduces our cost and risk, making us even more competitive as a global crop nutrient supplier," says O'Rourke. "K3 demonstrates our commitment to the long-term sustainability of our operations and the vision we have for our potash operations in Saskatchewan."

Work on the project will continue into 2024, but the impact of the project will last for decades. "We have a long and proud legacy in Esterhazy. For more than 50 years, we've managed to overcome incredible challenges and find great success a kilometre underground. We're ready for the next 50 years and beyond," O'Rourke adds.

To learn more about Mosaic's K3 project, visit mosaicco.com/K3. ♦

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Demand for potash is growing and when the market balances, the Jansen Project is best placed to meet demand.

Jansen Stage 1 comprises of an underground mining operation, a fully equipped Service Shaft, a partially developed Production Shaft, a processing facility and essential non-process infrastructure. Jansen Stage 1 is planned to produce four million tonnes of potash per year.



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Potash developer stands above the rest



From L to R: Canadian high commissioner to India, Mr. Nadir Patel, Muskowekwan Chief Reginald Bellerose (Saskatchewan), and Encanto CEO and president, Mr. Stavros Daskos standing in front of Canada House in New Delhi, India.



Encanto president & CEO Stavros Daskos and Muskowekwan Chief Reginald Bellerose walking the project land.



L-R: Muskowekwan Chief Reginald Bellerose, Encanto CEO and president Stavros Daskos, and Federation of Sovereign Indigenous Nations (FSIN) Chief Bobby Cameron.

Set amidst just a handful of junior potash developers, one company making huge strides recently to stand above the rest is Encanto Potash, trading on the TSX-V under the symbol EPO.

Encanto and its Muskowekwan First Nations (MFN) partner in Saskatchewan have developed a substantial proven and probable KCl reserves of 161.97 million metric tonnes

(MMT), allowing the company to declare a substantial 47-year mine life (based on 3.4 MMT per year) and still open to expansion on the large 61,000-acre property.

Encanto has announced a landmark offtake agreement with a Government of India's largest international trading company and one of the largest buyers of potash in the world, MMTC. It would be the largest offtake (two-million tons minimum annually) ever signed by a junior potash developer, and the largest ever signed by India as well. Understanding the domestic agricultural landscape in India, Encanto worked to establish a second offtake agreement (five-million tons annually) with a noteworthy Indian farmer's cooperative, National Federation of Farmers' Procurement, Processing and Retailing Cooperatives of India (NACOF). Each agreement has a full 20-year term.

MMTC has also agreed to a globally unique clause to allow for the possibility of buying potash through Encanto in the near term from a current producer, an extreme rarity for a potash junior which would allow for substantial near-term revenues. They have also negotiated the rights to market the company's eventual production worldwide. Encanto subsequently announced that they have secured interest from a current producer to supply those contracts.

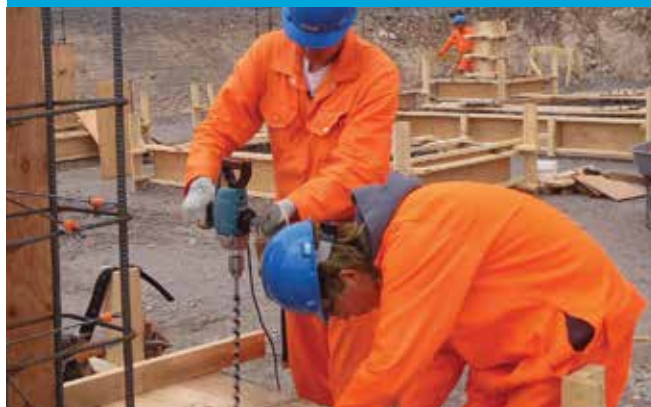
Encanto has made continual and steady progress considering the number of industry firsts required to mine on First Nations land. Having passed a number of required voting processes in order to proceed, the leadership and members of the Muskowekwan First Nation are active and supportive partners in this major project.

The company has already received their water rights license from the Saskatchewan Water Security Agency, signed a Tripartite Agreement with the Saskatchewan Provincial



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Encanto continues to enjoy unprecedented support from all levels of First Nation, provincial, federal and India governments.

Government and the Canadian Federal Government in February 2017, and also obtained both their sub-surface mineral lease and completed the First Nations Commercial Industrial Development Act requirement in March 2017. The latter act allows for existing provincial mining laws to apply to the federal land on which the proposed mine site sits; an important step and a first for a major mine in Canada. Encanto continues to enjoy unprecedented support from all levels of First Nation, provincial, federal and India governments.

Armed with a successful pre-feasibility study and new preliminary economic assessment (June 2017) on a larger 3.4 mmtpy mine capacity, Encanto is currently conducting a final feasibility study on the project. A 3.4-million-tonne capacity would present a project NPV of over C\$1 billion based on current depressed market prices.

Encanto recently (Sept 20, 2017) announced that they had secured a \$100M funding facility from a well-respected and globally connected New York-based investment group to be used primarily to commence the engineering and design

phase of the mine, and for the aforementioned procurement and supply of third-party potash to buyers in India. This is a company changer and just another way that Encanto has separated itself from other junior hopefuls. Leading-edge selective solution mining technologies are also being evaluated with a goal of being a globally lowest-cost producer.

It's actually quite difficult to catalogue the entire list of near-term goals at the company and 2018 promises to be a very busy and eventful year. Encanto director of corporate development, Gary Deathe confirmed to *PotashWorks* magazine that there hadn't been a junior potash developer that progressed all the way to production in Canada over the last 50 years. Many had either been bought out or changed control recently. But Encanto feels it now has all the right milestones being crossed off the project development list and has succeeded in attracting important long-term strategic partners with the same vision: to build a new, modern, and profitable solution potash mine in the most favourable place for potash mining in the world - Saskatchewan, Canada. ♦

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SRC processes for recovery of potassium and lithium from brines

By Jack Zhang, Saskatchewan Research Council

The Saskatchewan Research Council (SRC) provides comprehensive and robust mineral processing and metallurgical testing experience and technologies from lab scale to pilot scale for pre-feasibility, feasibility, and engineering studies. These are critical services needed by the potash industry around the world. Recently, there has been an emphasis on the recovery of potassium from salt lake brines.

Brines require specialized processing to recover the different minerals they contain. To help clients maximize the value of their deposits, SRC uses its extensive experience to continuously improve and develop processes and analyses for extracting minerals from brines. These sources occur in various locations worldwide, particularly in Australia and South America, including Argentina, Chile, and Peru.

Many brines contain a variety of mineral types that require specialized processing to recover the different mineral products, such as muriate of potash (MOP), sulphate of potash (SOP), and sulphate of potash magnesia (SOPM), as well as lithium.

SOP is an excellent source of nutrition for plants. SOP improves quality and crop yields, and makes plants more resilient to drought, frost, insects, and disease. SOP also improves a plant's ability to absorb essential nutrients, such as phosphorous and iron.

MOP, the most common form of potash, is effective in the cultivation of crops such as wheat, oats, and barley. SOP is effective in the cultivation of fruits, vegetables, tobacco, and tree nuts. SOPM is a type of SOP applied to soils with magnesium deficiencies or on crops that heavily consume magnesium.

The table below illustrates examples of the location of related products from salt lake and formation brines.

SRC's expertise has enabled clients to maximize the value of formation brines by recovering lithium. SRC recently tested a process for clients to produce lithium from formation brines. This requires specialized processing to recover lithium and potassium by-products. To help clients maximize the value of their brines, SRC uses its extensive experience to continuously im-

prove and develop processes and analyses for these brines. These deposits occur in various locations worldwide, particularly in Alberta and Saskatchewan, and other locations where formation brines are plentiful and easily accessible.

Technologies from SRC's Advanced Microanalysis Centre™ and Geoanalytical Laboratories are critical to analyzing these deposits and processing recovered minerals into products. Evaluation of Minerals by SCANNing electron microscopy (QEMSCAN®) can provide critical mineralogy information such as mineral identification and distribution. X-ray diffraction is used to identify specific minerals, particularly clay minerals, which affect mineral recovery. Inductively coupled plasma mass spectrometry (ICP-OMS) provides the precise chemical analyses of deposits. The information gained from this analysis is essential for designing mineral processing in the most effective way, to maximize recovery and minimize tailings and waste water.

SRC is one of Canada's leading providers of applied research, development and demonstration, and technology commercialization.

To learn more about how SRC supports the mining industry, visit www.src.sk.ca, or email info@src.sk.ca. ♦

South America	Salt lakes	MOP, SOP, SOPM, Mg by-products
Australia	Salt lakes	SOP, MOP
Alberta, Saskatchewan	Formation brines	Lithium, potassium



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Developing the Millstream Potash Deposit in Canada

A high-grade deposit with the potential to be one of the world's lowest-cost-producing potash mines

Atlantic Potash Millstream Corporation (APMC) is developing the 100-per-cent-owned Millstream Potash Deposit, located in southern New Brunswick, Canada, a resource-rich area with a positive business climate. It is a high-grade project with strong economics in a favourable mine location.

APMC has completed three independent appraisals which concluded that Millstream will be high grade with the potential to be one of the world's lowest-cost-producing potash mines with a total cash OPEX of less than \$80 per tonne versus its competitors, which are in excess of \$120 per tonne.

The Millstream project has a significant measured resource of 52.2m tonnes of KCl, grading at 32.5 per cent. This will provide a proforma annual EBITDA of US\$488 million with an IRR of 31.42 per cent.

Located in a proven geologic region, the project has an excellent site location for transport to key target markets being located just 70 kilometres by rail to the port of Saint John which has year-round access. This provides a \$45 per tonne freight advantage on in-

land freight to any other [North American] project, with freight costs at just \$5 per tonne.

With strong local community support for the project, New Brunswick has low/no political risk.

Development to date

In the 1980's Millstream was owned by BP, which completed eight 2D seismic surveys and drilled 12 holes with core samples, enabling them to build significant geological interpretation of the project. The natural resources world then changed and BP realigned its business focus back to pure oil and gas.

Since acquiring the project in 2013, APMC has shot 3D seismic with interpretation of 3D Vulcan. Modelling and drilling indicates the deposit extends further than originally estimated.

Three independent appraisals include a NI 43-101 Resource Estimation Report, and economic appraisal completed by Ercosplan in 2016 and by Mineral Resources Worldwide in 2017, which confirms the strong fundamentals of the project, underpinning the low-cost nature of it, with the potential to be one of the world's lowest-cost-producing potash mines.



Atlantic Potash Millstream Corporation is currently developing a potash project in southern New Brunswick.

Atlantic Potash Millstream Corporation is an exploration and development company, developing the 100% owned Millstream Potash Deposit in Canada.

The Millstream Potash Deposit is in a resource rich area with a positive business climate. It is a high grade project with strong economics in a favourable mine location.

Potash is one of the main ingredients needed for an effective fertilizer used in crops around the world.



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Millstream Potash Deposit – The Opportunity

- ✓ High grade, advanced stage NI 43-101 compliant resource deposit
- ✓ 2017 independent appraisal study outlines strong economics
- ✓ Proforma annual EBITDA of US\$488m with an IRR of 31.42%
- ✓ Favourable site location for transport to key target markets
- ✓ Well established infrastructure exporting potash for over 30 years
- ✓ Low / no political risk: strong provincial and civic level political support
- ✓ Project success does not rely on high potash prices – project is economically viable at modest potash prices in periods of oversupply
- ✓ Exceptionally low costs to FOB make the project immune to predatory pricing

What is Potash?

- Potash is one of the main ingredients needed for an effective fertilizer which is used to facilitate plant growth in crops with a deficiency of natural minerals
- Potash improves plant strength, water retention and helps to combat harmful plant disease
- There is no natural substitute for potash thus necessitating a continuous and large supply to global crops

To find out more, please get in touch: Keith Attoe, CEO | keith.attoe@apmcpotash.com

This information is to be read in conjunction with the [Disclaimer](#) found at www.apmcpotash.com



The Millstream project has a significant measured resource of 52.2m tonnes of KCl, grading at 32.5 per cent.

Wilson was former auditor general of New Brunswick, Philip Reeves the former COO of the Saskatchewan Mining Association, and Keith Crosby was the senior geologist for BP on the project in the 1980's. Chairman Guocai Liu, is a key player in the Chinese fertilizer industry and CEO of Migao Corporation, which has global expansion interests.

What next?

There are three clear development phases, the first of which will be to complete the next drilling program in order to update the NI 43-101, which is needed to complete a bankable feasibility study. Following this will be the project finance and offtake agreements before the project heads into production.


People are key

The board and key management have broad experience across the potash industry, local government, and business with CEO Keith Attoe bringing a proven track record in the areas of project management who worked with Deloitte for many years. The board also boasts Barrie Bain, a former director of Potash Group and Fertecon, and the current coordinator with the UN and International Fertilizer Association. In addition, Daryl

Millstream Potash Deposit highlights


- High-grade, advanced-stage NI 43-101 compliant resource deposit.
- 2017 appraisal study outlines strong economics.
- EBITDA - proforma EBITA US\$488 million per annum with an IRR of 31.42 per cent.
- Favourable site location for transport to key target markets.
- Strong partnership potential with sister company - Migao Corporation.
- Well-established infrastructure exporting potash for over 30 years.
- Low/no political risk: strong provincial and civic level political support.
- Project success does not rely on high potash prices - project is economically viable at modest potash prices in periods of oversupply.
- Exceptionally low costs to fob make the project immune to predatory pricing.

For more information, visit www.apmcpotash.com. ♦



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The proof is in the potash

How Canada moves its mountains of potash

Laurie Quilichini, general manager for industrial rail services, Alberta and B.C. region, at Cando Rail Services, remembers the first day Cando took over the rail operations at the Potash Corporation of Saskatchewan (PotashCorp)'s mine in Allan, Saskatchewan.

"We stayed extra hours and moved loaded cars out of the way that were blocking the loadout," says Quilichini. "The mine had workers two miles underground that couldn't work because railcars hadn't been previously pulled to make room for loading. The very first day we were there we prevented a shutdown of the mine and it hasn't shut down since."

Cando provides rail services at six of the 10 potash mines in Saskatchewan — PotashCorp's Allan and Rocanville mines (engineering services), Agrium's Vanscoy mine, and all three of the Mosaic Company mines in the province. Keeping rail cars on track and on time is just one of the

ways Cando helps move Canada's potash to market.

Ryan Yathon is a supervisor for Cando at Mosaic's mine in Esterhazy, Saskatchewan. Mosaic is the world's largest supplier of potash and phosphate products, and recently selected Cando to be its rail service provider at all of its mine sites in Saskatchewan.

The large rail companies are excellent service providers, but their focus is on operating major terminals and handling long-haul traffic. Cando focuses on optimizing local operations and offering senior rail expertise that connects customer sites with the Class 1 railways. Together it's a great partnership that enhances the velocity of moving freight to market.

"The Class 1 railroads sometimes struggle with — what we would call — 'first mile service' to the mines," says Yathon.

"To smooth things out for Mosaic, we have staff available at Esterhazy 24/7 to ensure that when the empties arrive they get back to the mine in an efficient manner."

Cando offers a variety of services to industrial customers, including industrial switching, transloading, logistics, railcar repair, cleaning and servicing, railcar storage and engineering, and track services, including track construction, maintenance, and inspection. Cando has a close working relationship with both of Canada's Class 1 railways, Canadian National (CN) and Canadian Pacific (CP), and operates at more than 25 sites across Canada.

In fact, the Class 1 railways trust Cando so much that the company has running rights agreements on CN and CP yards and mainline tracks at various locations across the country, including on CP mainline track from the Esterhazy K1 and K2 mines to Bredenbury, allowing rail operations teams



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Cando Rail Service provides rail services at six of the 10 potash mines in Saskatchewan — PotashCorp's Allan and Rocanville mines (engineering services), Agrium's Vanscoy mine, and all three of the Mosaic Company mines in the province.

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to run trains from the mines out to CP's serving yard on behalf of Mosaic.

These running rights allow Cando to operate on CN or CP's track, improving the pace of car movement in and out of work sites, and allowing rail operations to run more efficiently. These agreements reflect the credibility that Cando has built with the Class 1 railways.

Yathon says a big part of Cando's value is "picking up in the places where people might miss things." Potash companies like Mosaic know their industry extremely well and operate first-class mines, but having rail experts from Cando running their yard helps things run more efficiently.

"There can be computer glitches every once in a while, so car numbers might be wrong. They'll sometimes be missing cars, or a car might get double loaded so they are short on another train," says Yathon. "There's not as many interruptions in service with us here."

Yathon and Quilichini have both worked for Class 1 railways in the past, so they know what it's like to be on the other side of the handoff.

"Every time the wheels stop in the railroad industry, you're losing efficiency," says Yathon.

Cando crews often have decades of rail experience. Hiring specialists to run the switching operations at customer sites is a more efficient way of doing things.

Hook and haul is what the Class 1s do after Cando switches the cars into the correct order and on the correct tracks according to where they are going, building full trains or smaller sets of cars depending on the customer's production demands. The crews also perform safety checks, test the brakes, and make sure trains are ready for CN or CP to come along and haul them away.

"It takes hours to perform these tasks. What we do is a big benefit to the Class 1s," adds Quilichini.

Yathon says CN used to have two daily road assignments that would come to Esterhazy. On rail, it was a long ride and a lot of work. Since Cando came to Esterhazy and simplified the process, Yathon says the conductors are not spending as much time outside or away from home.

The end result is that the new arrangement works better for the Class 1 providers and better for the customer.

"Now that we're here, we pull all of the traffic out to the serving yards for CN and CP. They just come and hook and haul," says Yathon. "For the conductors - the proof is in the pudding."

Yathon explains that Cando has increased efficiency in the customer yards, which helps the Class 1's run larger trains in a smaller window of time and with less crews.

"We've developed a process with CN to be able to run a 205-car train to go to the east coast," says Yathon. "The only thing they have to do is build the train there. There's no longer any switching involved for them."

Over the years, Cando has carved out a strong niche in the potash industry in Canada. In fact, Quilichini says Cando handles about 70 per cent of the potash produced in Canada.

"We've certainly shown that we're the premium supplier of services in the potash industry," says Quilichini. "There's no other third-party provider that does the amount of switching that we do." ♦



Hook and haul is what the Class 1s do after Cando switches the cars into the correct order and on the correct tracks according to where they are going, building full trains or smaller sets of cars depending on the customers' production demands.

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Heading into common underground issues facing the industry today



The signature marking created in a potash ore bed by a four-rotor underground mining machine.
PHOTO COURTESY OF THE MOSAIC COMPANY.


When working in mines, it's vital to have an effective safety management system.

Shelly McFadden, director of prevention with the Saskatchewan Workers' Compensation Board (WCB), said there have been notable safety improvements since mining began in Saskatchewan.

"It's so important for any employer to have an effective safety management system so that they're identifying the hazards in their work environment and then put measures into place to address those hazards," she said.





As with any industry, there are challenges surrounding safety in mining. For James Ferstl, the Mosaic Company's senior manager of health, safety, and security, two main industry challenges include hazard recognition and risk tolerance.

"We focus daily on educating people on how to identify hazards, assess the risk associated with those hazards and





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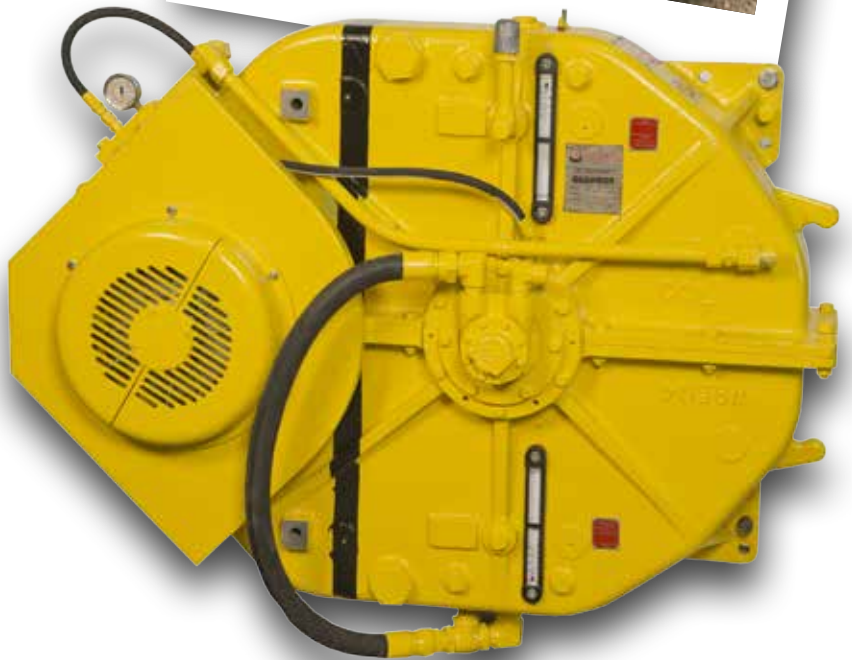
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Mosaic's Esterhazy K1 emergency response team, winners in the Overall Underground category of the Saskatchewan Mining Association's Emergency Response/Mine Rescue Skills Competition in June 2017. PHOTO COURTESY OF THE MOSAIC COMPANY.

implementing the appropriate controls to mitigate the risk," he said. "Risk tolerance is cultural and it relies on employees being able to recognize risk, understand the consequences of the risk, and then make a conscious decision not to tolerate any risk that might make their job unsafe."

Mosaic operates three potash sites in Saskatchewan: Belle Plaine is their only surface solution mine; Esterhazy and Colon-

say are standard underground sites.

He added that the company has taken continuous steps to improve safety. Employees regularly receive training on a number of safety and operational areas.

Site leaders spend more time in the field talking with employees about obstacles that might make their work unsafe. Mosaic has implemented a Field Level Hazard Assessment

Total Injury Rate

Industry	2010	2011	2012	2013	2014	2015	2016
D71 - Open Pit Mining	9.95%	14.58%	14.64%	14.40%	7.46%	6.59%	11.88%
D72 - Underground Softrock Mining	10.94%	9.01%	7.83%	7.25%	7.28%	6.51%	13.50%
D73 - Underground Hardrock Mining	12.52%	11.73%	9.55%	6.03%	5.06%	3.54%	3.77%

Chart 1: Total injury rates in the mining industry, 2010-2016

Time-Loss Injury Rate

Industry	2010	2011	2012	2013	2014	2015	2016
D71 - Open Pit Mining	0.69%	0.47%	0.75%	1.69%	2.28%	0.90%	3.25%
D72 - Underground Softrock Mining	1.27%	1.11%	1.19%	0.77%	0.78%	0.98%	0.65%
D73 - Underground Hardrock Mining	1.17%	1.54%	1.12%	1.16%	0.66%	0.51%	0.52%

Chart 2: Time-loss injury rates in the mining industry, 2010-2016

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Employees from Mosaic's Belle Plaine operations went one-year recordable incident-free in 2016, leading to a John T. Ryan award and WCB Safe Employer nomination. PHOTO COURTESY OF THE MOSAIC COMPANY.



to help crews and supervisors identify hazards, measure risk and applying controls before work begins.

Ferstl said Mosaic had a record safety performance for the fourth consecutive year in 2016 with a recordable injury frequency rate of 0.66. Esterhazy and Belle Plaine sites each won the John T. Ryan Safety Award in 2016 and 2017 respectively. The Belle Plaine site was also a finalist for the WorkSafe Saskatchewan Safe Employer Award in 2017.

WCB data shows that in 2016, the total injury rates in the mining industry are between 3.77 per cent and 13.5 per cent. This is an overall decrease from 2010 where total injury rates ranged between 9.95 per cent and 12.52 per cent.

There have also been no fatalities recorded in open pit mining and underground hardrock mining from 2010 to 2016. In underground softrock mining, there has been one fatality recorded for every year from 2010 to 2016, with the exception of 2013 where no fatalities were reported, and in 2010 when two fatalities occurred. More work needs to be done.

Ferstl said at Mosaic, they are concentrating on leading indicators rather than lagging indicators such as injuries.

"Lagging indicators point to incidents or injuries that have already occurred," he said. "We can certainly learn from these; however, the learning has come at some cost. Leading indicators assist us in identifying areas of improvement before they become an incident. Near-miss reporting and identifying potentially serious incidents help us correct issues before they turn into an incident."

For McFadden, building and sustaining a strong safety culture in any industry requires ongoing attention.

"WorkSafe Saskatchewan provides a resource to help build a solid health and safety system to foster a positive safety culture," said McFadden. "The foundational pillars include hazard assessment, safety practices and procedures, training, inspections and investigations."

For more information, visit the WorkSafe Saskatchewan website at www.worksafesask.ca. ♦

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Points Athabasca is building capacity

Points Athabasca was established in 1999 to help empower First Nations communities and foster regional prosperity in the Athabasca region of Northern Saskatchewan.

Since then, the full-service contractor for civil, industrial, and mining construction and maintenance services has compiled an impressive portfolio of successful projects in the province totaling more than \$700 million.

Athabasca Basin Development, an investment company owned by seven, largely Dene First Nations communities in Saskatchewan's Lake Athabasca area, owns 75 per cent of Points Athabasca.

President and CEO John Scarfe says two core principals at Points Athabasca - building capacity, and building beyond

the project — speak to the company's commitment to engage people in Indigenous communities. By training, mentoring, and employing local people, Points Athabasca continues to make a lasting impact on those communities where it works. The company's northern owners also reap financial benefits in the form of increased share value and dividends.

As an example, Scarfe points to Cigar Lake Mine, a Cameco operation in the Athabasca Basin that is one of the largest high-grade uranium mines in the world.

Since 2003, as part of a contract to provide ongoing site services and maintenance at the mine, Points Athabasca has been responsible for sourcing and supplying people to fill ongoing temporary

and permanent positions there — everything from labourers and skilled tradespeople to administrative personnel and management.

Local community participation was essential for this contract, and as a result, more than 90 per cent of these employees have been Indigenous.

In 2012, Points Athabasca was also awarded a contract to complete the overall surface development of the Cigar Lake Mine by constructing and commissioning ore load-out facilities, warehousing buildings and a maintenance shop, buried and surface utilities installations or upgrades, and site services support. More than 50 per cent of the workers for these projects were from local First Nations communities.

BUILDING CAPACITY



Since 1999, we have built a successful, long-lasting partnership between our company and the Athabasca communities. “Building Capacity” was the idea that started our company and remains a key theme that drives how we do business.

We're proud of our track record of success in using resources from local businesses, community investment, and providing job opportunities, training and mentoring people from Indigenous communities.

**POINTS
ATHABASCA**

pointsathabasca.ca



Highway 11 crack sealing project.

According to Scarfe, 150 people who worked on the Points Athabasca projects at Cigar Lake ended up getting permanent jobs with Cameco.

“We look at this as a really positive thing,” says Scarfe, pointing out that part of Points Athabasca’s mandate is to be a resource for companies seeking to hire long-term Indigenous employees.

Addressing the special needs of the mining industry takes a highly specialized team with proven experience. After almost 20 years of servicing Saskatchewan’s mining sector, Points Athabasca offers extensive experience



Staff receive safety training at Wollaston Lake, 2013.

and expertise in the following areas:

- Underground infrastructure projects
- Mine maintenance projects
- Mine salvage
- Shotcrete and grouting services
- Surface tailings facility management
- Berm and road construction
- Stockpile management

Points Athabasca also provides a broad range of services for industrial construction and maintenance, including:

- Structural steel installations
- Piping
- Concrete installations
- Scaffolding
- Fencing
- Sand-blasting
- Solar power installations

Road and highway construction is another speciality for Points Athabasca, which has helped build and maintain hundreds of kilometres of paved,

gravel, and winter ice roads in Saskatchewan.

Points Athabasca is also looking to diversify its market base and expand beyond Saskatchewan into Alberta and Manitoba. The goal is to forge many new partnerships with clients to design, build, operate, and maintain projects across Western Canada.

“We’re going to try to find opportunities that make sense for us,” Scarfe says.

Given Points Athabasca’s successful track record, it’s easy to see why many of these new opportunities could lie with

the growing number of companies, government agencies, and other organizations that are looking for ways to support Canada’s Indigenous communities. ♦

**POINTS
ATHABASCA**



Site resurfacing in 2016.

New report examines the HR challenges and changes unique to Canada's exploration sector

By Lindsay Coffin, Senior Research Associate, MiHR



Thor Lake Exploration Camp in the Northwest Territories. PHOTO COURTESY OF THE MINING INDUSTRY HUMAN RESOURCES COUNCIL (MIHR).

Mineral exploration is the first stage of the mining process and requires collaboration between multiple stakeholders to be successful. The mineral exploration industry consists of a myriad of different organizations that come together to discover potential areas for economic mineral resource development. The industry is both highly volatile and poorly understood, prompting the Mining Industry Human Resources Council (MiHR) to partner with the Prospectors and Developers Association of Canada (PDAC) in early 2017 to investigate the particular experiences and perspectives of the wide variety of people working

in Canada's mineral exploration sector. This research offers a new look at many topics in exploration from a broad and national lens, including topics such as women in exploration, work integrated learning, and career awareness. These insights will support industry stakeholders in creating strategies to increase the sector's ability to engage new pools of talent in mineral exploration work.

By developing and deploying a robust research tool - a survey of individuals and organizations working in exploration - MiHR and PDAC were able to fill a gap in labour market information, allowing for a more refined and accurate reflection of the labour market realities

and challenges facing mineral exploration in Canada.

Responses from the 397 completed surveys represented six categories of people connected with the exploration industry; employers, contractors, workers, educators, students, and affiliates. The key observations derived from information provided by respondents help foster a better understanding of the exploration industry. Some issues contributing to the unpredictability cannot be mitigated; the exploration industry will always be cyclical as it is closely tied to commodity prices and stock market volatility. However, this survey identified key areas for improvement.

Key observations

Key observations include a need for increased collaboration between industry and educational institutions and better career awareness and attraction efforts - students reported the most negative career outlook. Results also illustrated an absence of a mid-career workforce.

One of the positive aspects highlighted in these findings is the mineral exploration industry's much higher proportion of women and immigrants compared to the mining industry. In an increasingly competitive market for talent, diversity in the workforce is becoming a promi-

nent solution to address skill shortages. Diversifying the labour force requires an increase in participation, recruitment, and retention of underrepresented groups. These results indicate the exploration industry is making progress in diversifying its labour force.

Looking more closely at the results, although the rate of female representation is lower than the total Canadian workforce, it appears to be much higher in mineral exploration than other Canadian resource sectors (Figure 1). Thirty per cent of survey respondents were female, represented across all categories of re-

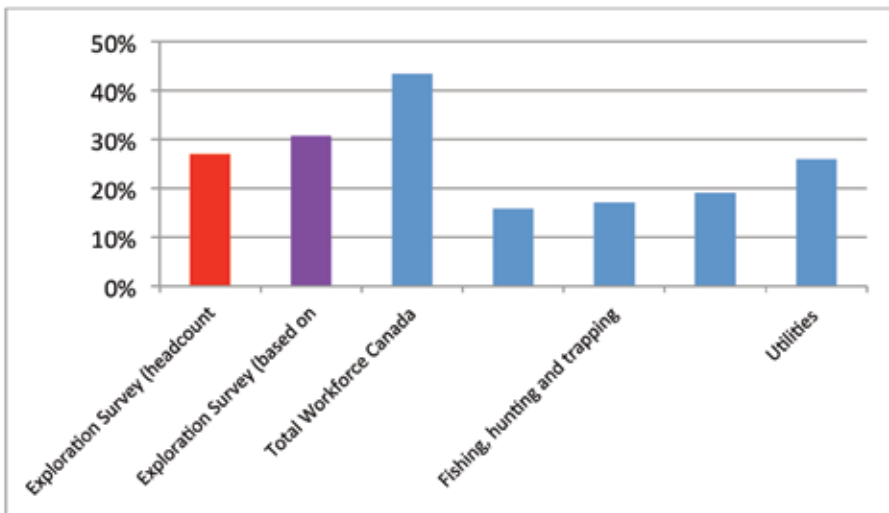
spondents (Figure 2). This is supported by employer responses indicating that female representation is much higher in mineral exploration than in mining, and female representation rate of 27 per cent reported in employer-reported headcounts.

Eighty-seven per cent of female respondents indicated they have a bachelor's degree, and 40 per cent indicated they have a graduate-level degree (master's or PhD) meeting the high educational and technical demands of the exploration sector. The increased representation of women with higher education levels is also reflected in the enrolment numbers for earth science programs in Canada where women make up 52 per cent of bachelor, 53 per cent of master, and 39 per cent of PhD programs (CCCESD, 2016). Furthermore, there is an increase in the number of women registering to become professional geoscientists (P.Geo). Currently only 20 per cent of P.Geos registered in Canada are women, but they make up 37 per cent of registered Geoscientists in Training (G.I.T.) (Geoscientists Canada, 2017).

All mining stakeholders - employers, government, educators, associations, etc. - have a vested interest in optimizing the supply of labour, for today and tomorrow. A number of key observations were made using data collected from this survey that help increase our knowledge of the labour market realities and challenges facing mineral exploration in Canada. This pilot study on the exploration industry provides valuable information about the least-understood labour market in the mining industry. This survey was the first step in a larger strategy that incorporates learning from all stakeholders in our sector - not just mining extraction - enabling us to better understand and address labour market issues related to the entire mining cycle.

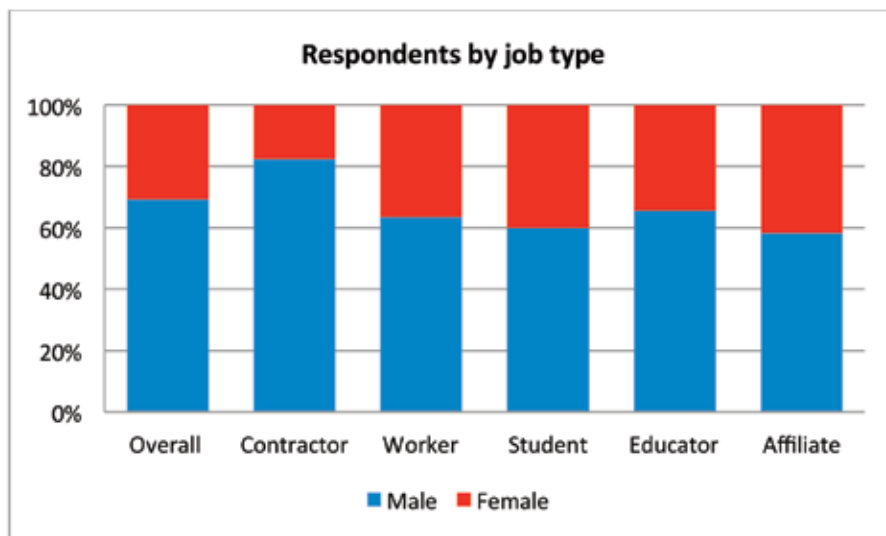
Visit MiHR's website to read the full report, www.mih.ca. ♦

Figure 1: Rate of female representation in the workforce for different industries compared to the survey response rate and headcount data provided by employers.



SOURCE: CANADIAN MINERAL EXPLORATION: HR OUTLOOK, 2017.

Figure 2: Number of male and female respondents by job category.



SOURCE: CANADIAN MINERAL EXPLORATION: HR OUTLOOK, 2017; STATISTICS CANADA, 2016.

Law in flux: Drugs, alcohol, and the duty to accommodate in the workplace



By Kit McGuinness, Lawyer McKercher LLP

Much like in other Canadian provinces, Saskatchewan human rights legislation protects persons with addictions from discrimination. This is based on the idea that addictions are a disability, and therefore falls under the same protections as other forms of disability. However, two recent decisions – one from Saskatchewan’s highest court, and one from Canada’s highest court – show how differently courts deal with policies implemented to limit drug and alcohol use in safety-sensitive positions.

In *Mosaic Potash Esterhazy Limited Partnership v. Unifor Local 892*, 2015 SKQB 391, the Saskatchewan Court of Appeal considered a grievance by a unionized employee. The employee had been terminated for repeatedly failing drug and alcohol tests mandated as part of his employer’s policy. Before the final test failure, the employee had agreed to a “last chance” agreement. At the labour grievance arbitration, the union argued that the employee was fired on the basis of an addiction disability, and should have been protected by *The Saskatchewan Human Rights Code*, which prohibits discrimination based on disability. The arbitrator agreed with this, and also found the following:

- The arbitrator was not bound by the terms of the “last chance” agreement as the agreement did not form part of the collective agreement;
- However, the arbitrator held that even if the “last chance” agreement did form part of the collective agreement, it was unenforceable because

it attempted to limit the employee’s right to accommodation under the *Code*; and

- The employer failed to discharge its duty to accommodate the employee who was suffering from disability.

The employer attempted to overturn the arbitrator’s decision at the Saskatchewan Court of Queen’s Bench by judicial review. Both the Court of Queen’s Bench and the Court of Appeal held that the arbitrator’s decision was a reasonable one based on the facts of the case and upheld the decision.

While this decision surely sent chills down the spine of more than one employer, the Supreme Court of Canada may have signalled in the recent case *Stewart v. Elk Valley Coal Corp*, 2017 SCC 30 that workplace policies prohibiting drug and alcohol use are still enforceable in many situations. In this case, the employer had a policy which required self-reporting of drug and alcohol use for workers in safety-sensitive positions. If the employee self-reported, they would be offered medical treatment under the policy. In the above case, an employee tested positive for drug use as part of post-incident testing, such use which he had failed to disclose. He was subsequently terminated by his employer.

The employee filed a claim with the Alberta Human Rights Tribunal, where he claimed that he had been in denial about his addiction and should be reinstated to his former position as the employer failed to accommodate his

addiction. The Tribunal found that he hadn’t lost his job due to discrimination, but rather because he had breached the policy by failing to self-report his drug use. This decision was upheld by both the Alberta Court of Queen’s Bench and the Alberta Court of Appeal.

The Supreme Court of Canada re-stated the law on discrimination claims, focusing the bulk of its analysis on whether or not the protected characteristic was a factor in the termination. The Court held that neither the employee’s addiction, nor his state of denial regarding the addiction, were factors in the termination. Rather, the Court held that the employee had breached a reasonable policy with which he should have been able to comply with, and it did not matter whether or not he was a casual user or if he suffered from an addiction. The majority of the Supreme Court of Canada held that the Tribunal’s decision was a reasonable one, and therefore should not be disturbed.

The *Elk Valley* decision demonstrates that perhaps the pendulum has started to swing back towards limiting the duty to accommodate. However, the divergence in the *Elk Valley* and *Mosaic* decisions also demonstrates the wide range of decisions which can come from policies which are created to deal with essentially the same issue. It underscores the need to contact a labour and employment lawyer to assist with formulating, drafting, and enforcing policies dealing with limiting drugs and alcohol in the workplace. ♦



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potash handling and storage facility located in Port Moody, British Columbia.

KSPC just opened its Bethune facility in May 2017, its first new mine in Saskatchewan in nearly 50 years. A five-year project, it was a partnership with design and project management partner AMEC Foster Wheeler. The total investment, approximately \$4.1 billion, was the single largest project in the history of K+S. The

Bethune mine produces potash crude salt, which will be further processed into three potassium chloride products, and will have a two-million-metric-ton annual capacity once fully operational.

KSPC's goal was to develop one of the most innovative and efficient plants in the world, and to do so they needed to reduce their footprint in the loadout section. The loadout area is where finished product is reclaimed from storage and screened to remove agglomerated, and/or broken and fine particles prior to railcar or truck loading.

Initial designs called for eight loadout screeners to meet KSPC's target loading capacity. KSPC and AMEC Foster Wheeler questioned whether the target loadout capacity could be done with half the number of screeners. Such a reduction would significantly lower cost – not only through the number of screeners required – but also by eliminating added material handling equipment, chute work, and by reducing the overall height of the loadout building. This was a daring approach not yet seen in potash plants, and it would require the largest loadout screeners ever produced.



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Rotex Global was one of two screening companies evaluated as a potential screening partner for the Bethune plant. At that time, the largest minerals separator Rotex had provided for potash loadout was for a 500-metric ton/hour rate. Meeting KSPC's requirement for a 650-metric ton/hour feed rate would require a larger version of the minerals separator, one that currently did not exist in the Rotex product line. Both KSPC and AMEC Foster Wheeler were willing to give Rotex the opportunity to develop a larger screener, with the ultimate goal of meeting the increased capacity and plant footprint requirements.

KSPC's trust and commitment to innovation led to a successful partnership for the Bethune project. Rotex delivered four new minerals separator models – a model MM5430-2 for the fertilizer products, and a model MM5430-1-S for the industrial grade product. Two models were provided for each loadout circuit, with each minerals separator handling 650-metric ton/hour per unit. The total screening area was 40-metres-squared (430-square-feet) per separation, a 40 per cent increase in area over previous models.

KSPC has experienced great success with the innovative Bethune plant design, as they are currently progressing through the startup phases and continue to stay on schedule for full production before the end of 2017. Bethune has a smaller footprint than originally considered, with higher plant capacity and less equipment. The reduction in screening equipment boosts the efficiency of the plant by reducing maintenance and energy consumption costs, while maintaining the same screening efficiency as the previous design.

With innovation at the forefront, expect to see continuous improvements and upgrades to help KSPC achieve their vision of "creating a legacy". ♦



KSPC Fertilizer Product Loadout Area - Two Rotex mineral separator model MM5430-2 units.



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With roots going back to 1956, Park Derochie (PD) continues to lead the way as one of the top industrial-coating contractors in North America, specializing in all types of industrial coatings, fireproofing, firestopping, blast cleaning, scaffolding, as well as mechanical and sprayfoam insulation.

Park Derochie opened their Saskatchewan operation in 2010 and its rapid growth can (in part) be attributed to providing value for clients with specialized protective coatings. They also offer tile lining, fibreglassing and lead abatement services, and have completed over \$20 million in lead abatement projects. PD staff are trained in SSPC (C-3), Deleading of Industrial Structures, as well as numerous other levels of safety training.

The company is proud to play a key role in energy conservation and since expanding its services in 2005, have left their mark on the insulation industry; applying spray foam insulation and installing mechanical insulation in a wide variety of markets.

Qualified and safety-driven staff have the ability to engineer, erect, and maintain proper containment for lead and/or asbestos abatement to ensure protection of employees, the general public, and the environment.

Attracting quality, long-term individuals is key to the success of any company. Park Derochie recognizes that job satisfaction is vital to employee retention and has built a strong safety culture, which is a major component of day-to-day operations. They are proud



Park Derochie crew performing touch-up painting on the exterior walls of the ECC building at K+S Legacy Project. Very little scaffolding was used, which allowed for an accelerated schedule and low-cost impact to complete this job. Park Derochie has completed touch-up painting on over 62,500 structural connections to date on the K+S Legacy Project. Crew size peaked at 60 employees for that contract.

to be leaders in the industry, and see discounted WCB premiums each year.

Striving to provide well-managed, turn-key, and hassle-free services to clients, the process starts at the top, within their own organization in conjunction with the client. Using an innovative, detailed approach while pre-planning projects (from HSE to QA/QC and job execution) has played a major role in the overall success of the company.

Park Derochie Saskatchewan experience

While working on the K+S Legacy Project, with multiple contracts and scopes of work, touch-up painting was completed to over 125,000 connections. With 63 different contracts between 31 different contractors, Park Derochie was able to exceed 400,000 man hours without a LTI (loss time incident). This is not only cost effective for clients, but sets a standard for other contractors on that project, as well as within the industry. Along with an exemplary safety record on this

site, PD also maintained an Aboriginal workforce of over 30 per cent.

Shut Down Success – Park Derochie has completed numerous shut down contracts at various mine sites throughout Saskatchewan, such as PotashCorp Saskatchewan, Mosaic, Yara, Agrium, and K+S. The success of these contracts, due to efficiency within the group, is evidenced by increased scope of work on the majority of projects.

The unique ability to provide a diverse package of coordinated services, with a single project manager, results in superior project coordination and translates to time and cost savings for your projects; this is also an ideal fit for all types of maintenance contracts. Park Derochie also offers a (proprietary) web-based system that gives clients access to up-to-date project cost information from anywhere in the world. This system provides detailed LEMs, summarized project costs, and cost breakdowns, and assists with expedient review and approve of LEMs on time and material contracts.



Park Derochie blasted, coated, and insulated the KCL three crystallizer for the K+S Legacy Project. This began with erecting the scaffolding and hoarding within the welding shop to ensure containment. Painters blasted and applied three coats to the exterior of the crystallizer, and the scaffolding and hoarding was removed and redesigned for the Insulators. Insulators applied mechanical insulation and cladding to the exterior. This project came with a challenging schedule, including having crews working 24/7 for 17 days straight!

This allows clients to monitor costs incurred daily to compare against budgets and avoid cost overruns, leaving them free to manage the project instead of managing the contractor.

The Park Derochie difference is apparent...striving to provide best-in-class services is their mission. For over 60 years, the company has proven to be an unparalleled sub-contractor when it comes to corporate social responsibility, innovation, and expertise.

One call....one contractor! ♦



A proud partner to the Saskatchewan potash industry

By W. Douglas, CODC Co-Chairperson

For over 20 years, CODC Construction Opportunities Development Council Inc. (CODC) has been proud to support Saskatchewan's potash industry. Formed in 1994, the CODC is a joint-venture, not-for-profit organization between Saskatchewan's unionized construction and maintenance contractors and their partner building trades unions, whose mission is to promote unionized construction and maintenance in the province of Saskatchewan. It is easy to forget that, within a job site, the parties have more



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SASKATCHEWAN'S BUILDING TRADES UNIONS AND UNIONIZED CONTRACTORS

in common than in conflict. Through the CODC, we are better able to focus on our similarities, such as safety, and solve problems more effectively through collaboration.

While the contractor and union support to the potash industry long precedes the formation of the CODC - dating back to the construction of Saskatchewan's first potash mine - for the last two decades, contractors and unions have worked collaboratively to better the construction industry for our clients, our workers, our employers, and the people of Saskatchewan.

Through the CODC, the unionized construction industry delivers safety training (Safety Construction Orientation Training - SCOT - and OH&S Rights & Responsibilities), leadership

training (Better SuperVision), policy development (Alcohol & Drug Policy and Procedures, and Harassment Prevention in the Workplace), industry forums, career development opportunities, and research and development programs to address future industry requirements.

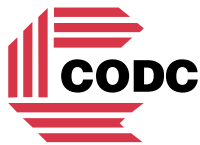
The CODC is proud to sponsor Build Together in Saskatchewan, an initiative to connect with and encourage the participation of under-represented groups in our industry. Build Together offers a four-pillar strategy for engaging Indigenous peoples, women, new immigrants, and youth into the unionized construction industry. Through these engagement initiatives, the CODC and our stakeholders continue to build and maintain a highly skilled,

well-trained, responsive workforce for our clients, both now and for the future.

The CODC also acts as a liaison between the owners, unions, and contractors. We are able to proactively identify problems and work with all parties to find a solution that works for all. The CODC finds this approach increases harmony on the job site and helps us support owners in the pursuit of creating the safest and most productive job sites.

Through all these initiatives, we are building a stronger construction industry and better value for our clients.

The CODC looks forward to continued partnerships with the potash industry into the future. ♦



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For more information about the CODC, please visit our website at www.codc.ca, or give our offices a call at 306-347-7299.



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Thanks for your continued support!

EuroChem Group AG has selected Veolia Water Technologies' proven HPD® crystallization technology for its VolgaKaliy mine expansion project in Russia's Volgograd region.



Veolia's HPD® PIC™ Crystallizer Technology chosen by EuroChem to produce 2.0 MTPY Potassium Chloride

EuroChem Group AG, a leading global fertilizer company headquartered in Zug, Switzerland, has selected Veolia Water Technologies' proven HPD® crystallization technology for its VolgaKaliy mine expansion project in Russia's Volgograd region. The mine is scheduled to begin commercial operations in 2018, and the expansion – of which Veolia's crystallization project is a key part – is scheduled to start up in 2021.

The HPD PIC™ Crystallizer System will be used for the production of two-million tonnes per year of high-purity (98.5 per cent) potassium chloride fertilizer from a brine produced from conventionally mined sylvinitic ore. The major process equipment provided by Veolia will include multiple HPD PIC™ Crystallizers, recirculation and transfer pumps, vapour condensers, and centrifuges. A combination of direct and indirect vapour condensers were used to optimize the water balance of the plant. The Veolia system has been designed for EuroChem such that process heat will be optimally reused to maximize the temperature of the spent brine sent back to the ore-leaching process.

A primary reason for Veolia's selection by EuroChem was its commitment to provide process development and process optimization services to the project at a very early stage. Through this early participation with EuroChem, Veolia was able to systematically evaluate multiple design variations, resulting in a custom-engineered system specifically suited to meet EuroChem's production, equipment layout, and operational needs, all while optimizing the cost effectiveness of the system.

"With their proven experience and talented team, EuroChem is pleased to be working with such a strong partner as Veolia," says Clark Bailey, head of mining at EuroChem. "The expansion phase of our VolgaKaliy project will increase the plant's capacity to its original proposed nameplate of 4.6 million tonnes per year of potassium in grades once all the expansions are complete. The product is suitable for both agricultural and industrial applications to better diversify our portfolio and markets. Our first phase continues to be on track to begin production in mid-2018."

Klaus Andersen, CEO of Veolia Water Technologies Inc. says that Veolia designs and implements solutions aimed at improving access to resources while at the same time protecting and renewing those same resources. "With the experience from more than 1,200 successful installations for industrial evaporation and crystallization and over 50 references in the fertilizer market, we were able to offer a custom-built system that offers the flexibility to meet a wide range of production requirements. We are proud to partner with EuroChem on this prestigious project."

About EuroChem

EuroChem is a leading global fertilizer company producing primarily nitrogen and phosphate fertilizers, as well as certain organic synthesis products and iron ore. The group is vertically integrated with activities spanning mining and hydrocarbons extraction to fertilizer production, logistics, and distribution. EuroChem is currently developing two sizeable potash deposits in Russia with its VolgaKaliy and Usolskiy potash greenfield projects. Headquartered in Zug, Switzerland, the group operates production facilities in Belgium, China, Kazakhstan, Lithuania, and Russia and employs more than 25,000 people globally.

Veolia group is the global leader in optimized resource management. With over 163,000 employees worldwide, the group designs and provides water, waste, and energy management solutions that contribute to the sustainable development of communities and industries. Through its three complementary business activities, Veolia helps to develop access to resources, preserve available resources, and to replenish them.

In 2016, the Veolia group supplied 100 million people with drinking water and 61 million people with wastewater service, produced 54 million megawatt hours of energy, and converted 30 million metric tons of waste into new materials and energy. Veolia Environnement (listed on Paris Euronext: VIE) recorded consolidated revenue of €24.39 billion in 2016. ♦

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Construction underway
at the K+S Bethune
Mine in Saskatchewan,
which officially opened
in May 2017.



Boilermakers help contractors become more competitive in the shutdown and maintenance industry

Contractors and Local 555 of the Boilermakers union in Saskatchewan, Manitoba, and northwestern Ontario have reached a groundbreaking bargaining agreement in the maintenance industry, and that's nothing but good news for both sides.

For contractors, it means that work such as plant shutdowns, maintenance, and restarts will now be done under an agreement specific to the maintenance industry and the specific conditions that exist in it. It

The Boilermaker Code

I am a Boilermaker.

I am a skilled craftsperson and a team member.

I work for my family, my crew,
my union and my employer.

I am part of a Brotherhood with a legacy
of more than 130 years.

I honour my mentors, who came before me.

I honour their struggle to give me a union opportunity.

I respect their knowledge, leadership and integrity.

I show up on time and ready to work.

I provide quality work for quality pay.

I honour our negotiated contract and let my stewards
and union representatives do their jobs.

I am responsible and accountable for my actions.

I do things right the first time.

I am an excellent problem solver.

I am a guest at job sites and
conduct myself accordingly.

I am constantly learning and sharing my knowledge.

I always work safely and demand the same
from those around me.

I am a guardian of my trade and the union way of life.

I am a boilermaker.

We encourage our members to “live the code” every day on the job.

will make them more competitive and help them win more contracts.

For boilermakers, it means the possibility of more regular work, as the contractors we work with become more competitive.

Joe Maloney, Canadian vice-president of the International Brotherhood of Boilermakers, says the agreement will strengthen an already solid relationship with the Boilermaker Contractors Association (BCA).

“This only improves the co-operative working relationship we have with the BCA and its members,” he says. “It’s a co-operative partnership that benefits both our members and the contractors we work for.”

Members of the boilermakers union already provide a great deal of value added for contractors. For example, the union’s job-ready dispatch system ensures that the boilermakers sent to a worksite are fully trained and qualified in skills that are required in a shutdown. Those qualifications include fall

arrest, working at heights and in confined spaces, respirator fit testing, and audiometric testing.

Boilermakers, as well as members of other unionized trades, have the best training in the industry thanks to a cross-country network of state-of-the-art training facilities, funded by employer contributions and administered jointly with the union.

That kind of training pays off on the job in greater efficiency, safer operations, and work that gets done on time and on budget. When our contractors succeed, we succeed.

The co-operative relationship with our contractors is one aspect of our work ethos, which is summarized in our Boilermaker Code (see sidebar). The code is a 16-point summary of our work ethic and the pride we take in our work. We encourage our members to “live the code” every day on the job.

We in the union look forward to continuing our long and productive working relationship with our contractors. And we’ll keep reminding the industry that union boilermakers bring added value to the table. Don’t shut down without us! ♦



Boilermakers and Boilermaker Contractors:

Working together in the spirit of partnership to make Canada’s potash industry efficient, safe and productive





IEI storage bays.



IEI Barge, East Dubuque, IL.

Long-lasting solution for potash storage and distribution

Potash is notoriously difficult to store. It clumps when wet. It is highly corrosive. And, like most bulk material, it requires a wide-open space to store cost effectively.

By combining architectural fabric with a rigid steel frame, Legacy Building Solutions has created fertilizer storage buildings that last longer in highly corrosive environments. The custom structures are also designed to increase operational efficiency while maintaining a low per-bushel storage price.

Non-corrosive storage buildings

PVC fabric cladding, such as the exclusive Legacy fabric ExxoTec™, is anti-corrosive. Unlike steel, fabric is immune to pitting and galvanic reactions. The fabric will remain free of corrosion, oxidation, and rust, even after years of exposure to corrosive elements.

Every Legacy building is constructed with a rigid steel frame. The steel frame uses solid web members, which are less susceptible to corrosion than the open web trusses commonly used in fabric structures. Hot dip galvanized steel adds yet another layer of protection against

corrosion. It has a zinc coating applied in post-production to extend the lifespan of the steel frame.

For the ultimate in corrosion protection, adding a fabric liner to the inside of the steel frame keeps the corrosive potash out of contact with the steel – preventing corrosion before it can even start. Lined buildings contain a separate ventilation system for the main storage area, as well as the building cavity to prevent condensation and moisture build-up that can cause corrosion and other building damage. Properly ventilating a building is a key factor in fighting corrosion.

Airtight building envelope

Studies have shown that fabric structures provide a more airtight building envelope than steel structures. Flexible ExxoTec™ fabric seals tightly around all openings, and the membrane is installed without thousands of screw holes – a natural source of leaks.

A tightly constructed building will prevent water from entering the building, which can cause potash to clump. Fabric also has non-conductive properties, which maintains a more consistent building interior temperature.

Clearspan storage space

When fabric is applied to a rigid steel frame, the buildings have greater design flexibility and wider clearspan capabilities. Legacy buildings are available 400 feet wide, without the need for interior columns. The building length, width, and height are customized to meet specifications.

Proven rigid frame engineering means building features including overhead doors, precast storage bays, and conveyors can be designed and engineered for any building application. Many potash storage buildings use precast concrete walls for the greatest storage capacity.

Another common feature for bulk storage is a lean-to. Adding a lean-to gives additional space for heavy equipment and trucks without compromising the available storage space.

By combining fabric with the design flexibility and strength of a rigid steel frame, Legacy Building Solutions constructs potash storage buildings that are designed to last longer and work better than steel or other alternate building types. ♦

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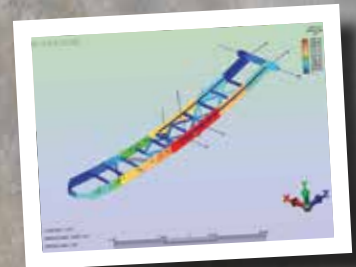
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Achieving growth goals



2017 marks Howatt Consulting's 10th year in business. The company was fortunate to move into a new building in April 2016 as their increase in staff caused them to outgrow the small space they previously occupied within a local strip mall.

Howatt Consulting Ltd. (HCL) is an engineering and project management firm locally owned and based in Saskatoon, Saskatchewan; 2017 marks their 10th year in business. In 2007, HCL started out with two employees and a project at PotashCorp Allan to manage their loadout expansion. Over the next two years, Dwayne Howatt, the company's owner and principle engineer, and Jeff Myhre, a mechanical engineer, helped lead the loadout expansion, which included upgrades to the loadout facilities in order to double the red and white product-loading rates. For the next four years, HCL continued to focus on project management at potash mine sites in Saskatchewan.

In 2013, HCL hired three more employees, two mechanical designers and one mechanical engineer. This staff were brought on to complete engineering and design projects for Continental Mine and Industrial Supply (CMI). The partnership with CMI served as a benefit for both HCL and CMI as they share a client base and could build on

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each other's success. In 2015, the company saw an opportunity to expand as a small engineering and project management firm within the potash industry by increasing the number of employees, adding more disciplines, and expanding its service offering. In February 2015, HCL hired a new general manager, Rory Duncan, who then continued to expand the company. HCL went from five employees to 28 in just two years. The company was fortunate to move into a new building in April 2016 as their increase in staff caused them to outgrow the small space they previously occupied within a local strip mall.

HCL was achieving their goals. They transitioned from a small firm with only mechanical capabilities, to a mid-sized firm that could also handle civil/structural, electrical/instrumentation, process, and geological projects during a time when other engineering companies were scaling back.

HCL's strengths include equipment design, detailing, material handling design, and discrete element modelling (DEM). DEM is simulation technology that is used to approximate the motion and mechanical interactions within a system. The simulation provides a detailed description of the velocities, positions, and forces acting in the system throughout the entire analysis. DEM can be applied to any system containing bulk materials, allowing HCL to service clients on transfer points, screw conveyors, drag conveyors, loading points, product mixing, skip loading and unloading systems, trippers, rotary plows, grizzlies, and the list goes on. As many industrial sites look to minimize dust and wear, HCL's material handling and DEM experience has proven to be very popular.

HCL is able to competitively deliver on small- and medium-size projects while supporting capital planning and maintenance groups throughout the industry. They have completed projects at all of the potash mine sites in

Saskatchewan and continues to receive repeat work from the major players in the industrial market. This success is a result of a strong team who work together to achieve project commitments and exceed expectations. Over the years, a new mission statement organically formed:

"Our mission is to support our client's capital project requirements, continuous improvement, and maintenance initiatives. We support our clients by provid-

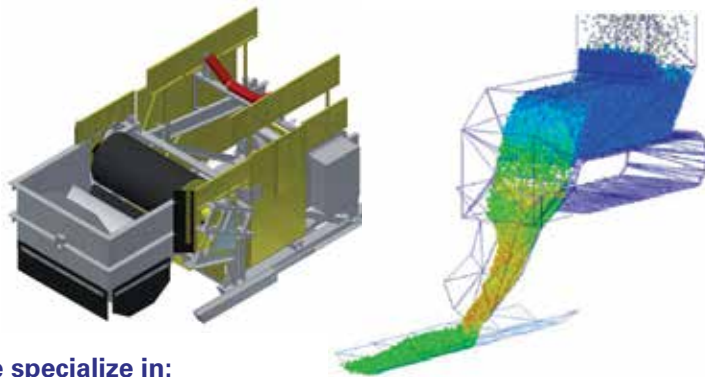
ing high-quality and practical services that offer a fit-for-purpose solution. We partner with our clients to ensure innovative, cost-effective solutions are developed to meet the operational and maintenance requirements of their facilities."

HCL continues to see success, even as the market downturn remains. In the future, Howatt Consulting hopes to continue expanding the range of services offered and markets they operate in. ♦



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Rental power equipment energizes mine operations, productivity

By Ken Pozniak

Current mining operations require access to considerable energy resources. For operations close to populated areas, this is no problem; the local power grid is capable of providing the power needed. Remote operators, on the other hand, have their own dedicated power generation facilities. These mining operations often have just enough power for their existing needs, with little or no additional capacity to support expansion or the addition of new mining processes or infrastructure.

Rental power provides a viable solution for every stage of a mine lifecycle until the grid or on-site power generation facilities are expanded in an existing or new mining region. In many situations, rental power helps an operator advance expansion plans and avoid unnecessary capital expenditures. Further, rental power is flexible, scalable, and customized to meet specific customer needs, such as equipment winterization packaging for harsh weather demands like those of northern Canada.

Mining operations in the remotest Canadian regions are realizing increased cost savings and operational efficiencies that rental power provides. For one company, the development of a new mine was hindered by a local lack of utility-scale power. The remote location of the mine, atop steep mountain terrain in the Smoky River Coalfield of Alberta, made access to power for production operations unattainable in the timeframe required for the operator to meet customer commitments.

In addition, the project site had a small footprint from which to set up base operations, and working conditions included wind chills of -49°C / -56°F ahrenheit. To realize its production plans, the mine operator not only required an alternative power source to support production local operations, but also a supplier experienced in working in challenging environments, regardless of barriers posed by terrain or extreme weather conditions.

Power provider Aggreko worked with the mine operator to quickly deliver a full-scale power plant that fit the small footprint requirement and could run the entire project operation. Aggreko mobilized cold-weather generators with a total generation capacity of six MW from its service centre in Leduc, Alberta, and transported them up the Smoky River Mountain, along with a 40-ton crane to lift and install the set up.

Rental power was used to run all operations, including electric mining equipment, drills, conveyors, offices and shops. The mine was able to go into production within six weeks, allowing the company to meet previously made customer commitments.

Throughout the project, technicians were deployed 12 hours a day for four months while systems were monitored around the clock to troubleshoot any issues and ensure performance of the power source. By assuming responsibility for the power plant, Aggreko allowed the operator to focus on other activities related to bringing the mine into production. These technicians also worked with the mining operator to transition the mine to utility grid power once the transmission lines were energized for remaining production efforts.

Upon completion of the project, Aggreko worked for 17 days in freezing temperatures and ice to safely dismantle the crane and power generators in preparation to return all of the rental equipment to Leduc.

This example is one of many that showcase how rental power solutions resolve operational issues, thereby minimizing downtime and maximizing results across the various phases of mine development until a permanent solution is commissioned. ♦

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There's an app for that

The SCSA launches the SCSA Guide to OHS Legislation app



Preparing for official launch at the Graham Construction worksite for the RM of Sherwood Potable Water Treatment Plant.



Ryan Smotra, regional safety manager – commercial prairies at Graham Construction and president of the SCSA board (left) introduces Collin Pullar, president of the SCSA.

When it comes to on-site safety and the safety of employees and co-workers, “I didn’t know” is just not valid. That is why the Saskatchewan Construction Safety Association (SCSA) created the Saskatchewan Construction Safety Association Guide to OHS Legislation app.

“The OHS Regulations and Saskatchewan Employment Act are more than 500 pages in length. While workers, supervisors, and other managers are required to adhere to the regulations and act, it is often impractical for people to carry such a massive document in their back pocket. We felt that there was a need for a quick reference tool that focused on some of the most common issues in construction safety with direct reference to the regulations and act. From the onset, we determined that the tool had to contain brief, plain language summaries and links to additional resources and training that employers and workers could benefit from. It had to be accessible anywhere and to anyone,” says Collin Pullar, president of the SCSA.

The OHS app was developed in partnership with the Canadian Centre for Occupational Health and Safety (CCOHS) and contains both a web-based version and a mobile application. This guide will help Saskatchewan employers and employees understand and comply with the legislative obligations within their workplaces. Each of the 20 topics includes an easy-to-read summary and related resources such as hazard alerts and safety talks.

Since the official launch last week, feedback on the app has been very positive, much of it echoing Anders Wheeler, district HSE manager, PCL Regina district, “It doesn’t take long to realize the value in what you the [SCSA] have been able to put together. It is easy to see that it will be a very effective tool for our project teams to reference and find the information they need efficiently. The simple, streamlined interface makes it extremely easy to pick-up and use from the first time you open the app.”

To download the app from either the Apple or Google Play app stores, simply search “SCSA” using each store’s search tool.

To preview the web-based version, visit ohsguide.scsaonline.ca.

In the 2016-2017 fiscal year, there were 38 prosecutions initiated, resulting in 25 occupational health and safety (OHS) convictions in Saskatchewan. Total penalties for the year were just under \$1 million. Education and knowledge are key to injury prevention. The Guide to OHS Legislation app delivers that to employers, supervisors and workers.

Saskatchewan Construction Safety Association – with over 9,000 homebuilding, commercial, and industrial construction member companies in Saskatchewan, the SCSA’s mission is to provide quality safety training and advice to construction employers and employees that will lead to reduced human and financial losses associated with injuries in the construction industry. ♦

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CanNorth collaborates in conservation project for a greenfield mine in southern Saskatchewan

Canada North Environmental Services Limited Partnership (CanNorth) has been providing environmental services to K+S Potash Canada GP (KSPC) at the Bethune mine (formerly the Legacy Potash Project) since 2012. The scope of services provided by CanNorth has included environmental monitoring, wildlife inventories and assessments, development of site-specific mitigation measures and guidance for wildlife and species at risk, and technical advice regarding environmental legislation, management, and best practices. Mitigation strategies have been developed and implemented by CanNorth, under the guidance of federal and provincial regulators, to avoid nesting breeding birds and other sensitive wildlife species encountered in the project area during the breeding and/or nesting periods. CanNorth has helped KSPC to ensure that work at the Bethune mine is conducted in compliance with applicable environmental permits, regulations, conditions, and commitments to regulatory agencies and stakeholders.

One of the highlights of CanNorth's involvement with KSPC has been collaborating on a project-specific compensation plan to offset impacts to wetland and grassland habitats resulting from construction of the mine. For the compensation plan, KSPC voluntarily opted to use a formula-based approach developed by

the Saskatchewan Ministry of Environment (MOE) and the Nature Conservancy of Canada (NCC) to estimate functional loss and offset requirements using a system of "debits and credits". CanNorth's contribution to this multi-component endeavour was to characterize the functional loss of habitat, or "debits". KSPC's commitment to this conservation initiative is the most significant investment in a grassland habitat offset in Saskatchewan's history. This cooperative project is just one example of CanNorth's ongoing work with KSPC.

Incorporated in 1997, CanNorth provides high-quality environmental and heritage services to a diversity of clients for a wide range of project types. CanNorth is 100 per cent owned by Kitsaki Management Limited Partnership, the business arm of the Lac La Ronge Indian Band. Notably, CanNorth is the only First Nation-owned consulting company in North America to obtain ISO 9001 (quality management), ISO 14001 (environmental stewardship), and OHSAS 18001 (occupational health and safety) international standard certifications. CanNorth is also a Certificate of Recognition (COR) program-certified company and is registered with ISNetwork. The company believes they are the only First Nation-owned company in the world with these credentials.



CanNorth has completed nearly 3,000 projects and has truly become an example of Canadian environmental stewardship. With the company's rich, 20-plus year history in mining and other sectors, there are many reasons why potash companies are turning to CanNorth for their high-quality, professionally-

delivered, and cost-effective services. CanNorth has a strong background in acting as a liaison and skillfully managing communications between multiple parties, as well as a commitment to a collaborative and positive relationship with regulators and proponents. ♦



CanNorth

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Specializing in the mining industry



CMI partners with their sister company Howatt Consulting Ltd. to provide the right solutions by providing the equipment that is tailored to meet their customers' needs.



Due to their methodologies and aftermarket service, CMI has some of the largest mobile equipment fleets in service with well over 100 pieces of underground mobile equipment put into service within the last five to 10 years.

CMI & HCL expand to meet the needs of the Saskatchewan potash industry

At Continental Mine & Industrial Supply Ltd. (CMI) we collaborate to define and provide innovative solutions. What this really means is that CMI has a unique process to leverage on over 100 years of experience in all aspects of the mining industry, from underground production and maintenance to surface processing to major projects and expansions.


Using the wisdom we have gained throughout the years allows us to ensure all of the right questions are asked at the start of a project to ensure that the right problem, scope, or needs are defined. Once this has been done correctly, it is then quite easy to provide the right solution by providing the equipment that is tailored to meet our customers' requirements. CMI delivers this by partnering with our sister company Howatt Consulting Ltd. (HCL), which is a full-service engineering firm specializing in equipment design, small project execution, and project close-out in our customers' maintenance systems. This allows us to tailor our OEM products to meet our customers' specific project requirements. CMI also partners with other likeminded OEM's such as Arva Industries, Dux Machinery, Timberland Equipment, and Magnum Slurry, where we utilize our processes to collaborate between the customers and the design engineers. All of these OEM's also specialize in tailoring their product to meet the specific needs of each customer. The combination of CMI's OEM and distributed equipment allow us to deliver solutions from the mining face to product storage.

This has allowed CMI to have a significant quantity of our OEM conveyor systems and equipment throughout the min-

ing industry in Saskatchewan. Due to our methodologies and aftermarket service, we also have some of the largest mobile equipment fleets in service with well over 100 pieces of underground mobile equipment put into service within the last five to 10 years.

CMI has recently set up CMI Tech Services Ltd. to increase the customer support and service for all of the equipment that CMI has supplied over the past 27 years. We can provide overhaul service in our shop or at our customers' mine sites. CMI Tech Services will also be completing battery power conversions for CMI who has recently rolled out our CMI-1700EV Series Carryall to market. This meets our customers' requirements by providing transportation of up to four employees with zero emissions throughout the mine. The power and performance of this unit is exceeding all of our expectations.

The present downturn in the mining industry has put more focus on ensuring that the overall best value is being obtained at all times. Value is defined as the lowest life cycle cost, which includes a balance of capital cost, maintenance cost, reliability/availability, and overall service. CMI's processes and philosophies are a perfect fit to achieve this requirement for our customers. Our innovation is helping reduce operating costs by expanding automation in the mining process, reducing clean-up costs by developing dust collection and handling systems, and improving overall safety by providing the right equipment, including battery-powered options for the job. We look forward to working with you to help meet your unique requirements. ♦



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Kristian Electric knows time is money



Over the past three years, Kristian Electric has been a go-to for some major players in the mining game for their equipment repairs, inspection and servicing.



In July of 2017 Kristian Electric was commissioned to load test three new overhead bridge cranes at the Mosaic K2 plant which would be used for maintenance purposes at the new overland conveyor transfer house, part of the K3 expansion project.

Saskatchewan boasts almost half of the world's potash reserves, with a total production value of \$61 billion in 2015. If you do the math, that equals over \$167 million each and every day. So needless to say, time is money in the potash mining world. Even the loss of one day of production can be detrimental to the bottom line. So keeping all equipment operating at its peak potential should be of the utmost priority.

No stranger to industrial equipment and repair, Kristian Electric has established themselves as a reliable and knowledgeable service company across Alberta since 1964. With their expansion into Saskatoon in May of 2014, their reputation has since trickled into the mining industry of Saskatchewan. Over the past three years they have been a go-to for some major players in the mining game for their equipment repairs, inspection, and servicing. Including hoist recertification for K+S, welder and plasma repairs for both Agrium and PotashCorp, and most recently, load testing new overhead cranes at the Mosaic K2 plant near Esterhazy.

Though some repairs can be performed offsite, others must be completed on location. Even if the repair is minor, or the inspection routine, you don't just stroll into the largest potash mining complexes in the world, there are many ducks that need to be in a row before that happens. By ducks, we mean safety requirements, engineer consultations, orientations, qualifying inspections, and possible vehicle modifications, just to name a few.

In July of 2017, Kristian Electric was commissioned to load test three new overhead bridge cranes at the Mosaic K2 plant which would be used for maintenance purposes at the new overland conveyor transfer house, part of the K3 expansion project. With a preliminary evaluation of the load test site complete, the team at Kristian Electric went to work to achieve all expectations set forth by the general contractors, engineers, and Mosaic itself. With a full company team effort, including project coordinators, safety officers, and technicians, Kristian Electric was able to complete the load tests within four days, well ahead of schedule. And in an industry where time is money, "ahead of schedule" is music to the ears.

Though their introduction to the mining side of Saskatchewan is still fresh, Kristian Electric has made quite the impression. Proving adept and competent at not only quality of service, but also time management, which is a necessity in the industry. However, their abilities are not limited to service and inspection, but also include an extensive background in the production of custom overhead crane systems that can range up to 100-ton capacity, as well as a vast inventory of industrial products, such as chain and wire rope hoists, welding equipment and machines, induction heating systems, and more.

With such a far-reaching arsenal of products and services, Kristian Electric is a name that is bound to become even more prominent in the Saskatchewan mining industry in the years to come. ♦



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The TopVu[®] eTag board is designed for surface and underground use. Existing tag-in / tag-out board can be retrofitted or replaced with the TopVu[®] eTag System providing real time, historical, and remote visualization of the board over your network.

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TopVu has designed an electronic RFID-based tag-in/tag-out board (Patent 9,668,105) that offers both the traditional method of tagging in by putting a personal tag on the board, and also has the added benefit of electronically tracking the location of that tag on the TopVu eTag[®]Board. These boards were designed so they could be installed without having any changes in behaviour of the employees.

Each worker is assigned a tag, and that tag is associated to an employee profile in a database, which allows quick access to their employee number, supervisor info, job classification, emergency contact info, and training certifications, to name a few. Visitors and contractors can easily be added to the TopVu eTag[®] System so that their information can be accessed if required. These can be entered with specific time limits; if the tag is placed on the board passed the allotted date, then an alert would go out and be acted upon.

The TopVu eTag[®] System can be interfaced with existing systems, thus making its adoption much easier. If a tag is left on the board at the end of the shift, an interlock could prevent

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central blasting from happening. By interfacing to the card access system, egress can be denied by not allowing access through turnstiles or door if the employee attempts to leave the property, but his/her tag is still on the board.

When the eTag® System is interfaced with a tracking system, third party or TopVu's D-RDR (dual technology reader), the eTag® Watchdog can provide an alert if a worker is detected underground without having a tag placed on the board. An interlock is also available to prevent a blast in this situation.

The eTag®Board can be used to complement existing tracking systems. Since TopVu's D-RDR readers are capable of detecting other manufacture's WiFi tags, it can be coupled with TopVu's eTag® system and provide a third-party verification that a worker placing a tag on the board is carrying a functional WiFi tag.

The TopVu InSight software is a powerful tool that can view and email digital reports based on custom business rules, allow for remote viewing of the TopVu eTag®Board status, provide historical records of personnel's underground activity, supply a quick report of who is tagged-in where in case of emergency, and access the location of all mine rescue personnel in seconds.

TopVu's portfolio includes location services for: RFID tracking system, RFID warehousing, RFID eTool dispenser, and customized RFID solutions.



For more info, please contact us at sales@topvu.ca, www.topvu.ca, or call us toll-free at (855) 682-3200. ♦

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Increasing production by solving conveyor line problems

In today's industrial and mining world, things are often changing, and conveyor systems in a mining operation are no different. Conveyors are the life line of any operation's productivity. Reliable conveyors from forward-thinking and problem-solving companies are crucial to any operation. West River Conveyors has the ability to think forward using the latest technologies and design, and also help their customers solve their most pressing issues that slow productivity.

Recently, West River worked with a large potash company in Canada to help solve a critical issue plaguing their conveyor system. The mine has several boring machines that produce for eight hours in a 24-hour period. Each boring panel contains a belt storage unit assisting with large-capacity storage so the boring machine can remain in one panel longer. In their situation prior to West River's solution, their existing belt storage unit was experiencing downtime for an average of 12 hours per week. The approximate time to complete one panel with a boring machine is 50 weeks. With around 12 hours of downtime on their belt storage unit each week, they were losing nearly 200 hours of production time over the 50-week period that it takes to mine a panel. The company had also calculated that they produce 1,000 tons of potash per hour; so over

200 hours, they were losing 200,000 tons of raw ore, a hugely discouraging number. Labour costs involved in repairing the crippled belt storage units were also factored into their estimates for downtime. With an average of two employees required to repair the belt storage units, the labour costs were also mounting.

The company has four large-capacity boring machines with four belt storage units, all enduring the same problems. In essence, they're losing 800,000 tons of raw ore over the course of 50 weeks. The company quickly realized that this problem needed to be addressed and West River was able to help them design a solution.

After close work with design engineers from both the customer and West River Conveyors, a solution was proposed. The solution became a custom-designed, double-decker, heavy-duty storage unit that was installed to hold approximately 435 feet of live belt. The unit, designed for 48-inch belt, consisted of a back-mount frame to be bolted to the roof of the mine. The large unit was completely assembled and tested in West River's assembly shop before being disassembled into a three-piece design for transport and mine installation. The customer purchased two units to begin their journey towards increased production.

One unit has been installed for over a year and has been working perfectly with zero downtime. The idea is to eventually install these heavy-duty storage units in conjunction with all of their additional panels and boring machines. The cost savings and increased production over time if all are replaced, will be astronomical. Productivity over time should far outweigh the cost of the equipment and replacement time.

West River Conveyors remains a leader in providing quality conveyor solutions to meet any custom needs of its customers. The example above is only one of many problems solved by working directly with the customer to understand their most pressing issues with their conveyor systems. West River technicians visit customers often to evaluate and understand their conveyor systems in order to get a better handle on their needs. In a world where getting the help and advice you need often comes in the form of six automated messages before you receive a real person, West River continues to achieve customer satisfaction by providing a direct line and after-hours phone numbers to those in charge of designing and building your products.

"It is all about solutions and customer service. We've built our business on servicing the customer. If you call, we answer, and if it is after-hours, you will always know how to get us," says Joe Street, co-founder of West River Conveyors.

Providing quality solutions to problems that can slow productivity and being the leader in customer service is how West River Conveyors has always conducted its business. ♦

West River Conveyors remains a leader in providing quality conveyor solutions to meet any custom needs of its customers.

Hoist me up!

New technologies boost mining plant operations and performance

As mines in Saskatchewan become larger, production challenges are rising as well. Companies that can effectively address issues today will be well positioned for continued success in the global marketplace of tomorrow.

“To sustain mine production in large mines, it will be necessary for the mines to increase underground power distribution voltages through the next decade,” says Rich Saccany, senior mining consultant at Stantec. “Further automation of underground operations will also be required to increase and sustain production levels cost-effectively.”

For example, at one of Saskatchewan’s world-class potash operations, Stantec recently designed and constructed a new hoisting plant for an operating mine featuring a fully automated friction hoist. Also unique on this project was the complete re-design and construction of a super-high-speed skip (HSS) loading system with a high-speed loading conveyor.

“Prior to detailed design, we completed a scoping study of the entire mine-hoisting system, from underground to surface, and converted the findings into a full EPCM contract providing detailed engineering and design on a wholly modularized system,” says Steve Rusk,

Prior to detailed design, we completed a scoping study of the entire mine-hoisting system, from underground to surface.

vice-president of Stantec’s EPCM mining business practice. “This significantly reduced construction time and cost, and increased mine hoisting capacity substantially, exceeding the client’s expectations. We accomplished this project on time and on budget, including de-bugging and de-bottlenecking, while successfully maintaining the operations on site.”

To help clients achieve their production and expansion goals, Stantec brings substantial experience and fresh perspectives in the areas of high-speed mine production hoisting, high-speed skip loading, and high-voltage surface and underground power distribution.

Stantec offers a broad line of interdisciplinary services uniquely tailored to the potash industry, including capital project business advisory services; environmental studies; design services at the pre-feasibility/ feasibility study and detailed design phases; EPCM/EPC commissioning and handover for major capital projects; life-of-mine support through operations and maintenance sustaining capital projects; and ongoing environmental and closure services.

Stantec’s success and ability to execute brown- and green-field projects is proven in the innovative execution of key mining services, including:

- engineering, design, modularization, and construction quality assurance for new and replacement shaft bottom tower steel installations;
- FEED/FEL basic and detailed engineering for high-voltage, underground power distribution;
- construction sequencing related to maintaining on-going production environments;
- shaft material movement, and water control;

- detailed engineering and design of work decks for production shaft lining repair;
- secondment of engineers in support of capital projects for, among other things, mine production planning, mine ventilation, mine pumping, and mill operations;
- site-specific shaft design risk exposure/mitigation; and
- shaft contractor selection and management.

Whether you require building design, on- and off-site transportation, water, tailings management, environmental services, business services, project management, or construction management, our integrated team at Stantec can provide competitive value solutions for projects of any size. ♦

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Westpro 300-foot flotation cell. The original design is on the right and the new W19 retrofit design is on the left.

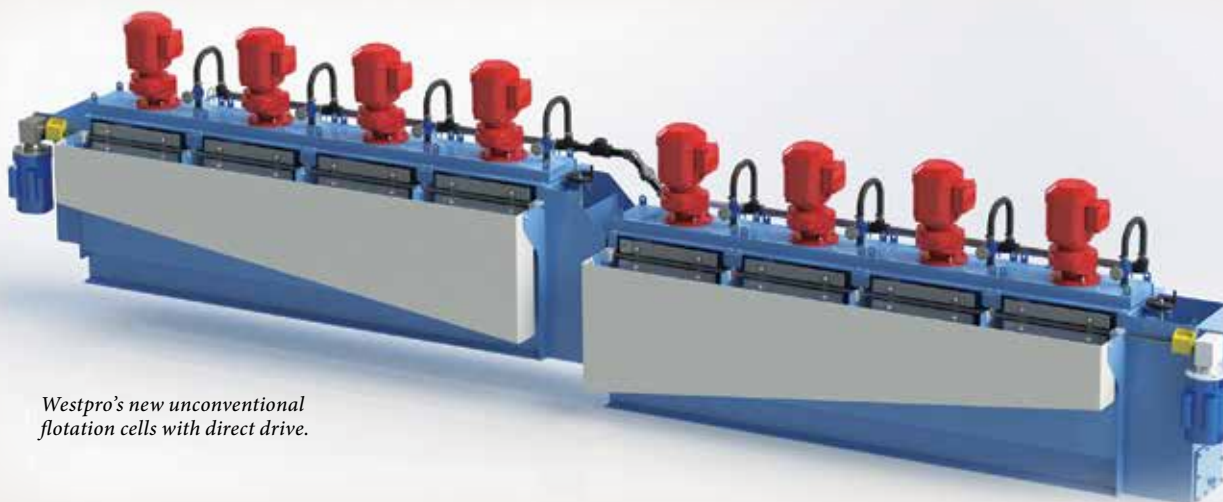
What was old is new again

Unless your process is based on evaporation and crystallization, you are probably utilizing flotation as a means of separating sylvite from the less-desirable elements. The mechanically agitated externally aerated conventional flotation cells have proven

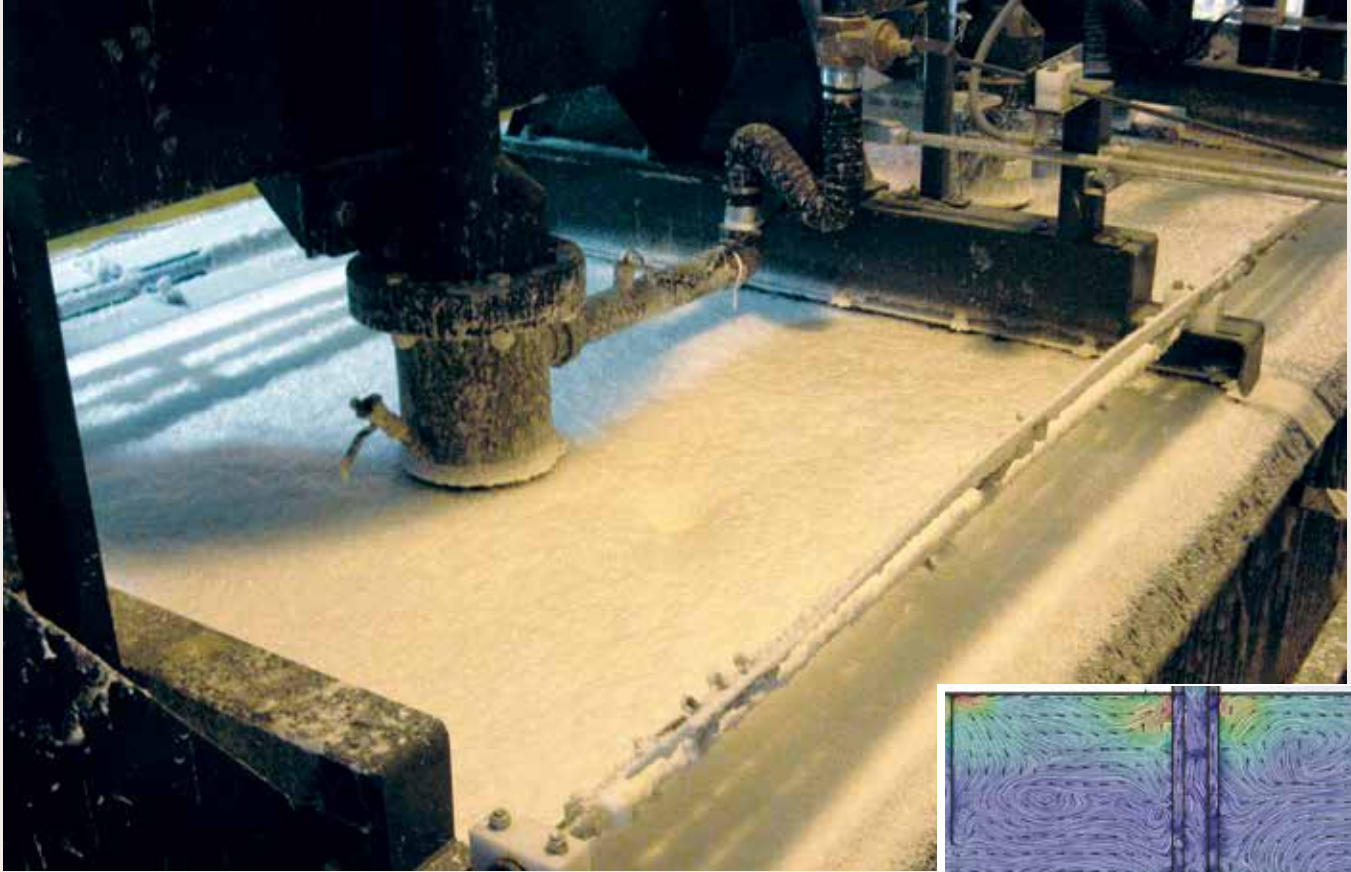
very successful in this application. This includes the 300-cubic-foot units more commonly used today, as well as its older 100-cubic-foot sibling. Modified from the more typical sulphide ore configuration to suit the unique needs of the potash industry, large numbers of these

cells are still in service, employed around the world wherever the North American mining equipment supply industry holds sway.

Time passes and as the sulphide mining industry moves into lower-grade deposits, the equipment suppliers have



Westpro's new unconventional flotation cells with direct drive.



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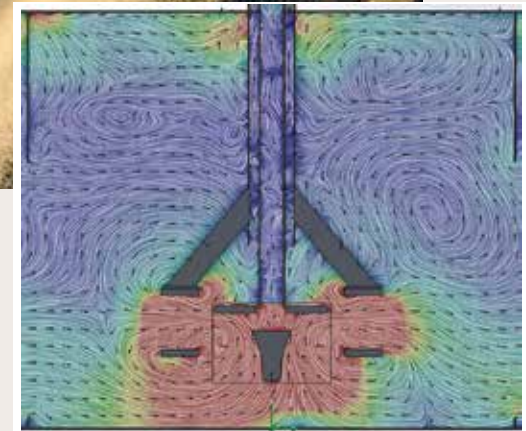
been developing both larger flotation equipment to achieve economy of scale through reduced capital and power costs, and the ability to float what would once have been considered ultra-fine particles. While the latter doesn't apply to potash, the former has led to significant research and development in the design of rotors and stators. Among other things, extensive use of computational fluid dynamics (CFD) has resulted in significant performance improvements above earlier designs.

Westpro has now applied this technology to the older cell designs and developed the W19 flotation cell mechanism. This equipment is offered as new construction incorporating direct drive and it is also available as a bolt-up retrofit kit for existing v-belt drive. The net result is the use of the more efficient new impeller design without the potential risks of issues encountered with large-tank cell designs. Both capital costs and equipment downtime are minimized.

The advantages of the W19 retrofit mechanisms include:

- Improved solids suspension.
- Turbulent conditions in contact zone.
- Excellent air dispersion.
- Reduced power consumption compared to original mechanism due to reduced diameter and improved efficiency.
- Rotor provides improved floor sweep action allowing improved coarse particle flotation.
- Can start-up under full load.
- Power draw is reduced by 20 to 25 per cent.
- Rotor exit shear velocity is increased.
- Tank sidewall velocities are increased, significantly reducing potential for sanding at the bottom of the tank sidewalls.
- Recirculation from bottom of rotor is significantly improved in the W19, decreasing required particle cleaning time inside the cell.
- A quiescent zone is established in the W19 rotor cell configuration above the rotor allowing for better undisturbed bubble-to-particle interaction.

Utilizing the skills of our talented and experienced team of multi-disciplinary engineers, all of Westpro's equipment is tai-



W19 - Rotor - Stator.

lored to deliver optimum performance in each application. From pilot plant operations to mining mega-projects, Westpro has the capabilities to design and manufacture process equipment for any project scale. Additionally, the company's comprehensive range of mineral processing equipment allows it to integrate different product lines into the design of modular process plants.

Westpro's process equipment and systems are proven in the mining, aggregate, and wastewater industry, with installations in over 20 countries around the globe. The commitment to excellence has established it as an industry leader with the latest technologies, best prices, quickest delivery, and unmatched service. Contact Westpro, your process technology partner today to discuss the new W19 flotation cell mechanism. ♦

Mining automation and communication made easy



The new BSC-AMP line amplifier has been designed to be flexible. When the needs of customers change, the unit can be upgraded to include onboard analogue and digital telemetry or built-in tag readers, which is achieved by purchasing and installing an upgrade kit.

Becker Mining Systems is a leading global supplier of unique solutions for the mining industry. Our solutions, which include energy distribution, automation, communication, transportation, and roof support, have evolved from our clients' needs and years of international experience. At Becker Varis, a part of the Becker Mining Systems group of companies, we specialize in the communications sector and hold to the high performance, quality and safety standards of Becker Mining Systems.

Stopes, drifts, shafts; smartcom® can establish communication wherever customers require it. Since 1996, Becker Varis has been a leader in the mining communications sector with the smartcom Leaky Feeder System, a system which gained Becker Varis' international reputation. The company continues to be at the forefront of mining communication technology with smartcom® ethernet, smartblast® blasting over leaky feeder, smartsense® gas monitoring and Becker Tagging and Tracking.

Smartcom ethernet has continued to complement the smartcom system as all leaky feeder systems can be converted to smartcom ethernet. Like household cable Internet, smartcom ethernet utilizes industry-standard cable modem technology to provide wired and wireless ethernet applications throughout the mine. Operational efficiencies are improved greatly

as the simple and robust infrastructure of the cable modems allow for easy maintenance, and expansions can be handled in-house. Existing smartcom installations can implement ethernet and can continue to benefit from smartcom's diagnostics and 500-metre amplifier spacing.

The numerous applications of the smartcom ethernet include computer networking, wired and wireless intranet/Internet, IP cameras, traffic control, wireless data capture for inventory applications, teleoperation, and VoIP in underground hotspots. Smartsense® environmental gas monitoring and Becker Tagging and Tracking are two specialized systems that work in conjunction with smartcom ethernet to increase safety and productivity in the mine.

The Becker Tagging & Tracking System enables tracking of all personnel vehicles and assets throughout the mine. Active tags transmit their unique codes to tag readers, which in turn updates a centralized database. The data can then be used for a myriad of solutions, including location tracking, decline traffic information, fuel management, etc. The system distinguishes between various tags, such as vehicles, personnel, assets, or control tags. The Becker Tag supports a variety of display options from the hardened underground LCD display and light module to large-screen electronic tag boards.



The smartSense fixed monitor SSFM-100 is an all-in-one gas monitoring station allowing up to four integrated gas sensors into a compact package, with true flexibility and reliability for environmental monitoring. Its unique 360° Alarm® function is capable of monitoring any combination of gases, and the wide range of external inputs allow for customer expansion.

Becker Varis is continuously improving their products to make sure that they offer the highest quality systems on the market. Upgrade paths are always available and backwards compatibility is crucial in all designs. The new Becker smartcom Leaky Feeder system is no exception. The new BSC-AMP line amplifier has been designed to be flexible. When the needs of customers change, the unit can be upgraded to include onboard analogue and digital telemetry or built-in tag readers, which is achieved by purchasing and installing an upgrade kit. The installation can be completed on site and does not require the unit to be returned. The upgrade kit allows for continued fast and reliable system expansion when the need arises. The data is represented on the Remote Diagnostics Server User Interface installed on the surface or through Becker Varis' custom SCADA package.

Becker Varis has earned an international reputation due to their dedication to quality and the success of the design and performance of their products. The successful smartcom leaky feeder system, in combination with smartcom ethernet, offers a wide variety of applications and uses. With one system, Becker Varis can provide an entire mine communication system solution for its customers. To this day, they continue to excel at exceeding customer requirements while dominating the industry in capacity, maintainability, and overall quality.

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Fletcher Model N3224-AD, engineered for scaling in potash operations

The 3224-AD scaler is a diesel-powered, four-wheel-drive articulated scaling vehicle. The hydrostatic drive, capable of up to 12 mph (19.3 kmph), and the narrow articulating chassis allow the machine to move easily to different locations in the mine.



Scaling vehicles (scalers) are used to remove loose material from the mine roof and ribs. The removal of loose rock increases mine safety for personnel by decreasing the chance of rock falls and roof falls.

With a continuing vision on safety, Fletcher engineered an entire fleet of scalers, available for a wide range of applications. Fletcher's scaling line ranges from vehicles built for limited spaces, operating in a working height of 2.1 metres, up to a high-reach scaling vehicle, working in heights of up to 15.2 metres.

The Fletcher scaler product line includes the model 3224-AD. This model has found popularity among potash operations throughout North America. The 3224-AD is a diesel-powered, four-wheel-drive articulated scaling

vehicle. The hydrostatic drive, capable of up to 12 mph (19.3 kmph), and the narrow-articulating chassis allow the machine to move easily to different locations in the mine.

The 3224-AD is engineered with a turntable-mounted swinging, lifting, and extending high-strength boom. The vehicle is capable of a maximum working height of seven metres and a nine-metre-wide boom swing, which allows large areas to be scaled from one setup position. The design allows for a scaling coverage from three metres to seven metres, and a rib scaling coverage of one metre to seven metres.

The most versatile feature of the 3224-AD scaler is the interchangeable head. The boom can be fitted with a drum cutter, hammer, or pick depending on the material being scaled. In addition,

the head rotates 270 degrees and the tool can be tilted to allow for the most efficient scaling angle.

All scaling is performed from a stabilized carrier using telescoping stab jacks, which aid in eliminating bounce and vibration of the operator's cab. The ergonomically designed cab is centre mounted with tilt for optimum comfort and visibility, allowing full view of the scaling area.

Fletcher machine designs are predominately dictated by mine conditions and individual customer desires. This allows for the model 3224-AD, along with the rest of the Fletcher scaler product line to be customized. Options, such as an enclosed filtered cab are available on all Fletcher scalers. Models are also available with either tire or crawler-driven carriers. ♦

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Maintenance procedures for maximizing efficiency in potash production

Downtime equates to lost profit and costs that can quickly add up. Maintenance is a critical component in maximizing process efficiency and up-time (and extending the life of your equipment) when working with potash.

Most commonly performed potash maintenance services

In addition to the routine maintenance recommended by the OEM, there are a few procedures that are frequently performed in a potash production setting in order to help maximize process efficiency:

Seal repair & replacements

Seals are used on both rotary dryers and coolers to minimize air from entering or exiting the unit, as well as to minimize any fugitive dust from escaping. Seal repair and replacement is a frequent service required by potash producers, particularly when it comes to rotary dryers.

A worn-out seal can quickly cause a drop in efficiency in rotary dryers as a result of air entering the dryer and reducing the required process temperature. This has the potential to increase drying time, as well as the amount of energy required to dry



Leaf seal, post-replacement.

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potash. Additionally, this often translates to a more dusty processing environment, as well as process inconsistencies.

Unexplained process inefficiencies, signs of material back spill or leakage, visible seal wear or auditory cues, as well as other signs, can indicate that a seal is in need of repair or replacement.

The need to replace or repair seals can be more frequent in a potash operation, due to the abrasive and corrosive nature of potash. Fortunately, seal replacements are a simple operation. In cases of minor wear, the seal may only require repair. Fabric-type seals, which offer more corrosion resistance, are also an option.



Ball and tube knocker assemblies awaiting shipment.

Knocking systems

Potash is prone to clumping and causing buildup during the drying process. This not only reduces efficiency, but can promote increased wear on equipment if not managed. For this reason, the addition of a knocking system is also a common service requested by potash producers.

Knocking systems serve to dislodge any potential buildup occurring within the drum. Various knocking system designs are available, with ball and tube knockers being the most commonly selected type. Knockers are easily retrofitted onto an existing dryer and begin reducing buildup immediately.

Routine inspections


One of the easiest and least costly ways to ensure potash equipment life is extended and ultimately process efficiency is maintained, is through regular inspections by operators and maintenance personnel.

Routinely examining equipment for potential build up, wear, or other signs of trouble such as visual or auditory abnormalities will help to catch issues in their infancy, allowing them to be addressed immediately, before they have a chance to cause a major upset. It is also recommended to have a technician from the OEM (or other qualified aftermarket specialist) examine the equipment on an annual basis.

Conclusion


Maximizing efficiency is a key focus in any potash processing operation. In addition to following OEM guidelines for routine maintenance and care, the procedures above can be an added tool in maximizing process efficiency.

The FEECO aftermarket engineering team is highly experienced in potash production and can provide all of the services listed here, as well as process and equipment audits, laser alignments, tire and trunnion wheel grinding, spare parts, and even training. For more information, see our ad in this issue. ♦



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Disability management

Are employers doing what they can to curb absenteeism?

By Eda Shere

In 2016, Canadians lost an average of 9.5 days of work due to illness or disability and family or personal leave.¹ This may not sound significant. However, if you consider this is an average, it means every employee was off work for almost 10 days. That's in addition to their vacation. What would you do if your entire workforce was off work for 9.5 days? This impacts Canadians by over \$16 billion annually, and roughly 2.4 per cent of gross annual payroll.²

When you dig deeper into this statistic, over 80 per cent of days missed are due to illness or disability.³ This isn't just concerning news for employers, it is for employees as well. Employees on disability can feel isolated, feel a loss of self-respect, and a loss of identity. What's worse is that employees are 50 per cent less likely to ever return to work after being off for just 12 weeks.⁴ The question remains, what can employers do to help curb absenteeism?

Wellness programs

We've all heard about the importance of wellness programs and the impact of them has been well-documented. However, often employers are at a loss for

where to start. Knowing your employees' risk factors will help you get the most out of your wellness program. The aggregate data from an evidence-based health risk assessment (HRA) or on-site biometric screening clinics will help identify target areas.

The Sun Life-Ivey Canadian Wellness Return on Investment Study determined that "wellness programs save about 1.5 to 1.7 days in absenteeism per worker over 12 months, or an estimated \$251 per employee per year in savings".⁵ That means that if all Canadian workplaces invested in wellness programs, we could reduce the national average of days lost to eight. However, eight days is still a significant number, and there are more things employers can do to lower this digit.

Health and safety

Most Canadians forget there is an entire organization that is dedicated to eliminating work-related illness and injuries. The Canadian Centre for Occupational Health and Safety (CCOHS) is a national resource for the advancement of workplace health and safety.⁶ The Occupational Health and Safety Act (OHSA) was created to protect workers from hazards on the job and

to reduce injuries and time off work.⁷ Adhering to the act will ensure you are not only meeting your legislative duty, it will also keep your employees safe and reduce absenteeism.

While larger organizations will often employ a health, safety, and environment team, smaller organizations may not. It is important to remember that a third party can help support smaller organizations, acting as their safety specialist. Risk assessments, policy development, and program initiatives to implement said policies are all available to smaller organizations. Taking the right precautions can reduce employer accidents, injury rate, and time away from work.

This can include learning about an employee's ability to function on the job before they start. Pre-employment medical exams are more common in certain industries than others. A pre-employment exam will look at the physical demands of a job and evaluate if the prospective employee has the ability to meet those demands without risk to themselves or others. Ensuring employees can safely do the work is paramount to reducing future disability claims and days lost.

1. <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor60a-eng.htm>

2. The Conference Board of Canada [http://www.sunlife.ca/static/canada/Sponsor/About per cent20Group per cent20Benefits/Focus per cent20Update/2013/Special per cent20Edition per cent20- per cent20Sept. per cent2023 per cent20- per cent20Sun per cent20Life per cent20co-sponsors per cent20major per cent20new per cent20Conference per cent20Board per cent20of/MissinginAction_SUN per cent20LIFE_EN.pdf](http://www.sunlife.ca/static/canada/Sponsor/About%20per%20Group%20Benefits/Focus%20Update/2013/Special%20Edition-%20per%20Sept.%202013%20per%20Sun%20Life%20co-sponsors%20major%20new%20Conference%20Board%20of%20Missing%20in%20Action_SUN%20LIFE_EN.pdf)

3. <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor60a-eng.htm>

4. <https://www.acoem.org/PreventingNeedlessWorkDisability.aspx>

5. http://www.sunlife.ca/Canada/sponsor/Group+benefits/Group+benefits+products+&+services/Health+and+wellness/Wellness+ROI+Study?vgnLocale=en_CA

6. <https://www.ccohs.ca/>

7. <https://www.labour.gov.on.ca/english/hs/faqs/ohsa.php>

8. <https://www.acoem.org/PreventingNeedlessWorkDisability.aspx>

9. <https://www.acoem.org/PreventingNeedlessWorkDisability.aspx>

Disability programs

Some illness and injuries are preventable, however, we all could be sick at some point and sometimes there is no way around time away from work. When this arises, ensuring you have the right program in place to support your employees and get them back to work quickly and safely will make all the difference.

A journal published by the American College of Occupational and Environmental Medicine, which includes Canadian studies, focused on employees who, due to a medical condition, should have only been off work for a few days, but ended up being away from work for prolonged periods of time, or even permanently.

The journal cited four key elements employers, insurers, and claim administrators can use to improve their disability program and reduce days lost.⁸

It found that most days lost due to an employee on disability is not because

the time off is medically required. It's due to non-medical reasons, such as ineffective communication between the employee and the employer, poor return-to-work process, a lack of modified duty offerings, and delays in accessing treatment or referrals. Approaching disability claims with the mentality that work can be accommodated, and being aware of non-medical causes can often result in faster return-to-work results.

When an employee is off on disability, the questions asked of their treating physician are often focused around determining eligibility for benefits as opposed to function and return to work. Studies have shown that returning to some type of work can improve recovery.⁹ Studies also show that activity can also aide recovery, while inactivity can slow down the recovery process. Encouraging physicians to use treatment guidelines that are evidence-based will ensure that inactivity is only recommended when medically necessary. Again, having an occupational health

physician available for you to consult and communicate with treating physicians can have an impact on days lost.

Comprehensive approach

There are many ways to curb absenteeism. A comprehensive approach that focuses on having a solid disability program, determining if your employees need accommodations before they start work, a risk assessment to prevent injuries, and a preventative and robust wellness program will all have an impact on days lost. Ensuring your organization is taking this approach can be a daunting task; however, you do not need to tackle this on your own. There are Canadian occupational health providers who help employers keep their employees safe and at work as that is their goal. These providers can implement the comprehensive approach needed to reduce absenteeism and keep employees happy, safe, and healthy.

Eda Shere is the director of business development at Wellpoint Health. ♦

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Ludman Industries' compaction system lowers total cost of ownership for potash producers


When Ludman Industries' executives ask leadership teams around the globe at world-class potash production centres, "What keeps you up at night?", they instantly hear "Fazendo o melhor produto!", "Сделать лучший продукт!", "¡Hacer el mejor producto!", or "Making better product". They also hear phrases such as "lowering the total cost of ownership and driving down maintenance costs", or "maximizing uptime and reducing unplanned downtime", or "finding good staff to backfill my aging experienced workforce".

Ludman's solution to these high-level problems requires a full-scale value approach. It urges production managers and plant supervisors to choose Ludman Industries' comprehensive experience of over 100 years to implement their compaction plants.

Ludman Industries focuses on helping producers meet their production goals through:

- Investing in new technology to continuously improve its equipment
- Reducing the total cost of ownership of its systems
- Delivering "information-enabled" smart plants, in the form of complete process solutions for compaction circuits
- Building rugged heavy-duty compactors and crushers, which simplify the maintenance of the equipment, increase overall equipment effectiveness, and thus, minimize the mean time between failures (MTBF), and unplanned downtime

The potash industry is evolving and potash producers are dynamically investing to support market changes. Farmers demand optimum products, such as time-release fertilizers, multi-element granular blends, various grades of particle sizing, and specialty products. All farmers voice demand for higher-quality products that result in less fines and improve yields, while reducing operating costs per acre.



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Ludman Industries' information-enabled compaction circuits produce the highest-quality granular product in the industry. Its new super alloy technology, coordinated motion force feeders, active hydraulic gap systems, and advanced automation control systems help customers produce yield beyond their expectations.

In addition to providing first-class OEM compaction and crushing equipment, Ludman Industries implements complete process solutions for compaction circuits, using application experts. The staff consists of an electrical engineering team with decades of experience in advanced mine automation, in addition to metallurgical and mechanical engineers, who drive production excellence and reduce production costs. The company also performs strategic acquisitions that complement its compactor and crusher product lines. Ludman Industries uses its compaction expertise to help potash suppliers achieve their production goals and minimize downtime.

Ludman Industries' systems include all drying, glazing, conveyance, bucket elevators, bins, hoppers, overflow silos,

compaction equipment, flake breakers, crushing and sizing equipment, screening systems, loadout and weigh scale systems, dust collection systems, power distribution and switch gear systems, plant advanced DCS control systems, lighting, historian systems, and more.

Ludman Industries preserves highly technical knowledge and expertise that production managers seek to build and execute their compaction plants. Ludman has been selected to the most recent greenfield fertilizer projects. Production goals have exceeded many expectations. For a typical producer, every one per cent of gained efficiency results in 40,000 tons of additional production.

Ludman Industries' broad portfolio of complete systems currently operates worldwide with customers in Europe, North America (including Canada), South America, Asia, Australia, and Africa.

Tonight, when you lie awake thinking about your compaction plant, imagine the day when you produce superior product and achieve higher yield, while reaping the lowest total cost of ownership. Then, think of your partners at Ludman Industries. Sleep well, my friends. ♦



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DSI Underground manages risk at greater depths

As mining operations extend into greater depths, mine-induced tremors have a greater risk of increasing in both the severity and frequency. When the integrity of an excavation site is modified by scaling, bolt-

ing, or drilling, the chance of air blasts or rock bursts become a regular concern for mining companies. Non-entry protocols, which limit access to the excavation following development blasts, have become a common practice to mitigate such risks.

Identifying seismicity through large-scale monitoring programs, along with ground support strategies, such as dynamic support and face bolting, have also been key implementations.

Face bolting has quickly become a standard across Canada, used to help protect operators when loading explosives to further advance tunneling. Such initiatives have reduced the possible danger to operators, however, there is still an ongoing issue of having an operator located close to the mining face while bolting his round.

DSI Underground, who has positioned themselves as “the solutions provider” for Canada’s mining industry, has partnered with several deep mine operations with the goal of adding another layer of safety by minimizing personnel exposure to the mining face. Gavin Fairburn, managing director of DSI Underground Canada, explains, “DSI Underground’s objective is to provide mining companies with a new strategy in minimizing risk to personnel, equipment, and infrastructure during the bolting process.”

Fairburn goes on to say that they have accomplished this objective by providing an innovative resin delivery system, Fasloc® XP Pumpable Resin System. “This system automates the resin delivery function, allowing operators to be positioned at least 30 feet away from the mining face,” says Fairburn.

By adapting bolters with DSI’s Fasloc® XP Pumpable Resin System, DSI Underground has not only provided safer working conditions, the product is also credited with increased productivity. Current procedures require the bolter to bolt around with inflatable bolts, and then return for a second pass to install resin and rebar bolts.



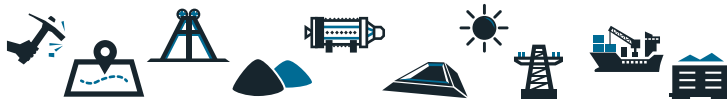
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By adapting bolters with DSI's Fasloc® XP Pumpable Resin System, DSI Underground has not only provided safer working conditions, the product is also credited with increased productivity.



The Fasloc® XP Pumpable Resin System automates the resin delivery function, allowing operators to be positioned at least 30 feet away from the mining face.

"Fasloc® XP allows true single-pass bolting," says Fairburn. "This greatly reduces bolter cycle times, only tying up equipment for one shift rather than

a two or three shift process, while also increasing mining advance rates."

The system consists of a two-component, pumpable polyester resin and a

specialized pump that delivers resin to the bolt hole. The specialized pump can be attached to a bolter machine or it can be utilized as a stand-alone unit. It is de-

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signed to be a completely automated injection process and provides 100 per cent consistency of material and set-up times without fear of operator errors.

“Mining at greater depths has created an environment of mining-induced seismicity, snowballing the number of seismic events,” says Fairburn. “DSI Underground has always been focused on providing products to the mining industry with safety as the number-one priority. By working closely with mine operators to tailor a system that meets their health and safety requirements, we are confident the Fasloc® XP Pumpable Resin System will soon become standard ground control for deep mines.” ♦

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Solutions with a vision

By Justin Hunt



Saskatoon-based Ens Industrial has designed their electric vehicle drive system to be retrofitted to nearly any Land Cruiser underground application.



Ens Industrial is only a handful of companies worldwide driving the research, development, and introduction of this electric vehicle technology to the underground mining industry through personnel carriers, and service and support vehicles.

“I think it’s the solution for the future. And I think we’re almost there,” says Josh Ens, president of Ens Industrial. “Within the next two to five years, that’s going to become a big part of the way we do business.”

Ens was talking about how rapidly battery technology has developed in the last few years. Today, automotive and commercial vehicle applications are effectively using battery power and electric drives to reduce the need for internal combustion engines and fossil fuels. Ens Industrial, based out of Saskatoon, Saskatchewan, is one of only a handful of companies worldwide driving the research, development, and introduction of this electric vehicle technology to the underground mining industry through personnel carriers, and service and support vehicles. The electric vehicle is particularly attractive to the underground mining industry due to the potential reduction in ventilation and heat, and the obvious occupational health aspects related to diesel exhaust in an underground environment. The elimination of diesel fuel dependency means the elimination of fuel costs.

“Our approach was to take our underground mine-proven Toyota Land Cruiser cab and chassis, equip it with state-of-the-art dual-lithium-ion batteries providing 68 KW of capacity, Remy 90S electric motors, and a battery management system developed for Ens Industrial by EV Drive Systems,” says Ens, adding that in keeping with their original concept, they have designed their electric vehicle drive system to be retrofitted to nearly any Land Cruiser underground application. “We did this for a number of reasons, interchangeability and multi-application use is central to our plan. The batteries replace the engine and the drive motor is coupled to the original power train. It sounds simple, but rest assured it’s not an easy proposition. We’ve adopted the Toyota philosophy of ‘Kaizen’ to ensure we’re continuously improving our processes and our products.”

After two years of product development and prototyping, Ens Industrial’s first production trucks are already in use underground at Mosaic’s potash mine in Colonsay. These electric vehicles are equipped with two on-board battery chargers, one 120V charger with a 12-hour charge time plugged into a 120V outlet, and a 600V charger with a one-hour charge time designed to be plugged into mine power. The vehicle offers self-diagnostics, a view of operational characteristics such as speed control and state of battery charge through a dash-mounted HMI (Human Machine Interface), a seven-inch touch screen, a regenerative braking system, and a driving range of 108 kilometres under normal load.

Reaching this point represents a significant milestone in achieving Josh Ens’ vision for product development at Ens Industrial, but it is not the end post.

“We have significant interest from the underground hard rock mining sector for our electric vehicles; this poses a number of challenges with regards to a variety of factors. Temperature differences, and grades of operating surfaces are the most significant hurdles. We have a few select clients whom are willing to work with us in the early introduction of the electric Toyota Land Cruisers into this environment, so we are very optimistic of being successful here.”

Ens also announced Ens Industrial has entered into an distribution agreement with Marcotte Mining Machinery Service Inc., a Canadian manufacturer of medium-to-large underground mining equipment, which includes shotcrete gear, anfo chargers, scalers, crane trucks, scissor lifts and scalers, to name a few. This is another important milestone towards realizing Josh Ens’ vision of positioning Ens Industrial as a full product line, full-service provider of underground service and support utility vehicles to the underground mining industry. This new partnership further enables them to serve their customers to a greater capacity, offering a wider variety of products and services. ♦



The evolution of Accutron Instruments

Accutron Instruments, leading the underground mining community with ventilation monitoring technologies since 1993, continues to advance and develop technologies for all industries.

Accutron Instruments produced its first time of flight technology in 1993, which provided a unique and reliable source of airflow monitoring with no maintenance or calibration required. It also provided a stable measurement through extreme conditions. This was the beginning of the renowned product, the Flowtrax.

In 1999, Accutron introduced the ILR (Industrial Laser Range) finder. The laser range finder is designed and built with the technology to provide enhanced functionality and accuracy in harsh and demanding environments. These measurements can be used for ore passing levels and long-range positioning.

As part of Accutron's continual advancements, in 2005 the design of the Flowtrax was final, which included bi-directional

sensing. The Flowtrax instrument was enhanced to recently include industrial communications and protocols, adding a patent-pending electronic J-Filter for sonic signaling and profiling in extreme turbulent applications. The turbulent applications consist of exhaust fan flow and noisy environments. MAQS (mine air quality station) or AMS is also part of Accutron's technologies, which consists of a complete station incorporating an airflow system monitoring temperature, relative humidity, and pressure readings. The MAQS also allows for dust, gas, and diesel monitoring to be incorporated.

In 2006, Accutron developed a strategic partner with an Australian group. Together, this partnership led to the achievement of providing IECEx certification, which approved Flowtrax for the coal mine industry, incorporating a blast-resistance stainless-steel enclosure.

To expand its opportunities, Accutron developed two new communication instruments called the I/Otrax and Com-



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mtrax in 2011. These instruments work independently of the Flowtrax or Climatrax, or integrated with them. The Com-mtrax provides ethernet TCP, Modbus RTU, and a datalogger for instant communication. In addition, the I/Otrax provides an analog and digital relay, outputs, and inputs.

Accutron became a factory-authorized Trolex dealer in 2012. This relationship flourished by allowing Accutron to incorporate gas-detection systems for an all-in-one environmental monitoring station.

In 2012, Accutron advanced its technologies by creating the Climatrax, an integrated multi-variable climate transmitter for both mining and industrial applications. Combined, the Accutron products provide a complete solution for monitoring all environments in mining or industrial applications.

Accutron did not stop there. In 2014 they invented the Flowtrax LR (long range) specifically for tunnels and the potash industry. This product allows for airflow monitoring over an extreme distance while maintaining precise measurements.

Accutron's most recent accomplishment is the exceptional piece of equipment called the Gastrax. This instrument provides dual gas monitoring with an easy-to-read OLED display.

The Gastrax integrates a long-life solid state sensor with a minimum of three years life expectancy. Accutron's Gastrax communicates through two 4-20 mA outputs, with a three-wire system and modbus RTU, and also provides temperature and relative humidity measurements.

In the future, Accutron looks to be the leader in all ventilation-related industries by creating new and innovative products for ventilation-dependent industries. At Accutron, we are committed to the continuous development of top-quality instrumentation for process automation solutions. We are driven by the work we do, creating global impact in the mining industry that leads to market advantages for our customers, and a strong successful future for our company.

As a company, Accutron continues to grow and progress in all ventilation-related industries by competing in the international market with the new online website. The online website is regularly updated and is perfect for quick tips and information on anything you need to know about Accutron. Also, you are now able to shop directly from the Accutron store with the online shop option; all of the amazing products just a click away. ♦

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Saskatoon, Saskatchewan subsidiary, North Rim, acquired in 2016. Our team is the only potash-focused geology consulting firm in Canada, and together, we have an unparalleled history of expertise in the Canadian marketplace. RESPEC's potash capabilities extend our applica-

tion of salt-mechanics principles to industrial projects and hydrocarbon and hazardous waste storage.

From exploration to reclamation, RESPEC provides the full spectrum of technical services required in a wide variety of salt and potash projects worldwide. Having worked in 18 countries, RESPEC offers geologic assessments, laboratory testing, mine planning and rock-mechanics design analyses, subsidence monitoring, instrumentation and field services, resource estimation, permitting support, financial evaluation, and due diligence reviews.

RESPEC's technical services in the geoscience consulting market include specialized capabilities in drilling management, mineral resource mapping, mining integrity studies, and feasibility studies. Using 43-101 report compilations enables RESPEC to provide turn-key services to the mining marketplace.

Founded in 1969, RESPEC is a global leader in geoscience, engineering, and data and information technology. With 21 locations in North America and strategic alliances worldwide, award-winning RESPEC has a 48-year reputation of technical excellence in meeting client goals.

RESPEC specializes in developing innovative solutions for the mining and energy industry worldwide. Our 100-per cent employee-owned company has been advising clients for almost five decades, with the majority of work performed for returning clients. RESPEC excels at quick turnaround and emergency response projects. Across the entire life cycle of your project, we drive project schedules from design to delivery. If there is seemingly no solution, we create one.



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RESPEC's interdisciplinary team has created hundreds of technology solutions and products, and performed thousands of projects—a testament to our experience and expertise. As an integrated technology solutions provider, we match the right team of experts and specialists to each unique client need in mining, energy, water, environment, data, and technology. We value respect for the culture, the environment, and communities in which we work.

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RESPEC's corporate headquarters is located in Rapid City, S.D. Our president and CEO, Todd J. Kenner, has over 30 years of experience in the engineering and consulting industry. We are very proud of our Canadian management team comprised of Karri Howlett, Lola Piche, Debbie Shewfelt, and Tabetha Stirrett.

Please visit our website at www.respec.com. ♦

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Providing services to the potash industry

Experience you can count on.

AECOM, has set up shop in the middle of potash country, building an 85,000-square-foot facility on 22 acres on Highway 1 East near White City, Saskatchewan, Canada, to attract the attention of new and existing potash clientele. The small-town roots of this company remain the same, with loyalty, hard work and safety at the top of our priority list. We are now owned by AECOM, which is a premier, fully integrated professional and technical services firm

positioned to design, build, finance and operate infrastructure assets around the world for public- and private-sector clients.

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Norwest Corporation (Norwest) is a leading international energy, mining, and environmental consultant that has been providing services to the resource industry for over 37 years. Norwest's geoscience, mine and geotechnical engineering, hydrogeological and surface water management, and tailings management expertise supports our clients during all stages of exploration, planning, operations, and closure. With the recent formation of Heavy Norwest, the ability to supply design-build services through the combined engineering expertise of Norwest and the construction capabilities of Heavy North now exists. Heavy Norwest brings the proven HSE performance, experience, and work execution capabilities of both founding companies to our clients to assist them in maximizing the value of their assets by conducting work in a safe and efficient manner.

Norwest has been assisting the potash industry in Saskatchewan since 2007. Norwest's Saskatoon office is supported by their operations in Calgary, Vancouver, Salt Lake City, and Denver. In addition to their potash experience, they continue to leverage off of the knowledge gained from working in various commodities in North America and around the globe to identify innovative and effective solutions for the industry.

Over the years, Norwest has safely completed a wide range of projects for their potash clients, including numerous exploration programs with planning, permitting, procurement, construction, drilling, coring, completion, and core lab data acquisition and management responsibilities. They were the prime contractor for a freeze well drilling pro-



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gram, completed under very strict tolerances, to allow shaft sinking operations at a new mine development in central Saskatchewan. They have also provided maintenance planning support, as well as operational reviews to mines.

Norwest has supplied water-related services for several potash clients. Planning and evaluation work has included the numerical modeling required to predict flow from selected aquifers into mine workings using multiple probabilistic realizations of potential conduit locations, permeabilities, and flow rates. Field services work included the construction of cluster-well sites to test the surficial aquifer and evaluate its potential for both water supply and mine inflow issues. Geological deliverables were the identification of low-permeability surficial sediments to act as the bottom seal of a future tailings management area. Hydrologic testing included baseline water data, pumping tests, slug tests, and purge/recovery tests.

Heavy Norwest's civil construction work includes recently completing the final reclamation of potash exploration well pads used during the previous winter's program, as well as the construction of a toe drain and decommissioning of the existing French drain for a tailings management area at an existing operation.

As they continue to expand their presence in the potash industry, providing HSE excellence with the goal of zero harm, the value-added and efficiency focus of their personnel in all aspects of what they do, the support from experienced personnel, and the use of industry-leading systems is their commitment to clients. ♦

For more information on Norwest and Heavy Norwest, please call one of their offices or visit their websites for a full listing of our capabilities at www.norwestcorp.com and www.heavynorwest.com.



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Industry standards for rock drill lubricants have been revolutionized

Put yourself in the boots of a miner: You're several feet or metres underground operating a drill in a confined space. As the compressed air and rock drill is exhausted, the use of conventional RDO's creates a fog or mist within your workspace. Reduced visibility and the impact on ventilation, amongst other factors, create clear health and safety concerns.

A great product is born from the recognition of fundamental problems, the ability to look deeper into those problems, and find a successful way to solve them. Rock drill lubricants used for pneumatically driven tools are traditionally conventional RDOs. The lubricant is expelled into the workspace, having a direct impact on health and safety, as well as causing downtime for equipment maintenance (air motors). Pneuma-Tool was created to address these insufficiencies.

In early 2010, after years spent in research and development, the patented product was brought to market. Major industry leaders supported and valued this product that addressed all

factors: health and safety, industry standards, environmental regulations, performance, and provided a significant return on investment. Evidence shows that although this is a premium product, the small cost up-front will save you significantly with longer tool life and safer work conditions.

- Eliminates oil fog;
- Reduces ventilation requirements;
- Significantly improves tool service intervals;
- Reduces tool freeze up;
- High-tool performance;
- Prolonged tool life;
- Less lubricant consumption;
- Biodegradable;
- Safer environment.

How easy is it to switch to Pneuma-Tool?

It is simply a straight drop-in replacement with no requirements for special equipment or training, and there are a variety of viscosities available to handle all conditions. In addition



Working with some of the largest manufacturers and distributors of raw materials in the lubrication and chemical industries, KeeMace products provide premium quality by leveraging the most up-to-date research and development.



to the formulation, the product is manufactured in-house, which allows Pneuma-Tool to be adaptable to the needs of mining contractors for various temperatures, industries, and applications. For more information, visit the website www.pneuma-tool.com.

How to be more competitive with the right lubricant

Tool and equipment performance is essential to overall productivity in any operation, representing cost savings to mining contractors alike. In a highly competitive industry, it is fascinating how often something as simple as lubricant can be overlooked in its ability to increase tool performance and decrease time spent servicing equipment. There are significant opportunities for efficiency by introducing a superior quality lubricant.

More often than not, the individuals in charge of purchasing the products being used and the individuals using them, seeing the direct impact of use, are not in the same location. Sometimes the lines of communication between these two groups can be blurry; opening these lines of communication is crucial to business. Operating profits can be improved by balancing the costs associated with equipment maintenance and failure, taking into account the costs for materials, labour, and loss of production resulting from poor-quality lubricants. Introducing innovative and well-manufactured lubricants can help to extend the life of equipment and avoid unnecessary downtime, boosting operating profits.

In 1999, KeeMace Technology Inc. began to introduce innovative lubricants for mining and concrete application, challenging the productivity offered by lubricants in the industry. Product lines were introduced to markets, including wet shotcrete process, slickline operations, concrete pumping, concrete form release agents, and dust suppression. During product development, KeeMace has consistently focused on four main areas: price, performance, environmental impact, and impact on health and safety. Working with some of the largest manufacturers and distributors of raw materials in the lubrication and chemical industries, KeeMace products provide premium quality by leveraging the most up-to-date research and development. Prices remain comparable to alternative lubricants through volume purchases, offering a win-win opportunity to mining contractors who have supported and continue to support the products offered. KeeMace offers a number of products for various applications, including site-specific products tailored to the needs of an individual mining contractor.

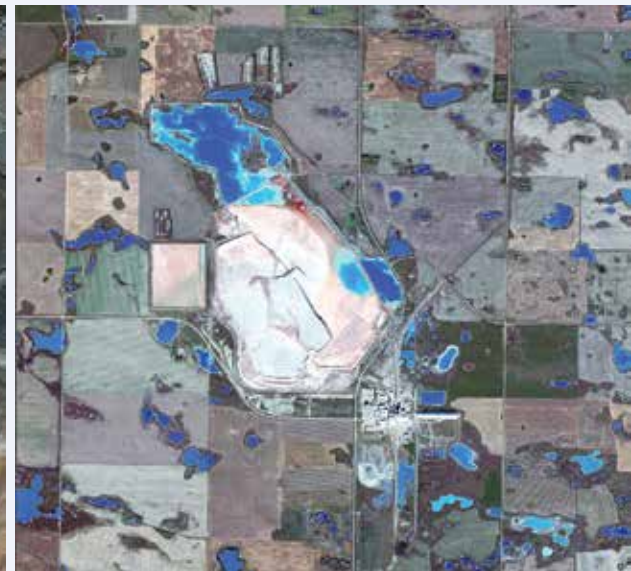
Selecting the right lubricant available at KeeMace will create new opportunities to increase productivity and uptime. High tool and equipment performance will provide overall cost savings in the form of less downtime for servicing. Equally as important, one should also assess the environmental and health and safety impact of any products being used.

For more information, please visit our website at www.keemace.com. ♦

The advantages of satellite imagery for long-term environmental monitoring



30-centimetre resolution provides detailed overviews of the entire project footprint.



Monitoring water depth across a project footprint and surrounding area.

Monitoring environmental health and tracking change over time is something that is important to every operation in the resource development sector, but is especially so for mining operations. Mines have large footprints, often utilize potentially harmful chemicals and processes, and the operations can have lifetimes spanning decades.

The challenges they face monitoring environmental health can be numerous. Mines that began operations decades ago often lack full information about the environmental conditions that existed before the mine. In addition, the ground testing required for monitoring can be very time consuming and expensive. Getting quality information about past and current environmental health in an efficient and cost-effective manner can be difficult.

In order to address these challenges, Western Heritage has developed the Environmental Footprint Monitoring Platform, or EFMP. This platform uses 30-centimetre high-resolution satellite imagery to extract important information about environmental health and delivers it to environmental managers through an easy-to-access online platform. The platform identifies landcover types and monitors change and fragmentation of the landcover. It measures vegetation health based on vegetation greenness and productivity, or the change in biomass. It also measures aquatic health and change based on surface water depth, salinity and turbidity. These indices are well suited to the needs of potash producers.

Using 30-centimetre high-resolution satellite imagery to monitor environmental health has a few key advantages. One of these is the ability to look back using archival imagery to assess environmental conditions prior to or early on in the project's life cycle. Imagery is available from the early 1970s on, and this can be used to more accurately assess baselines for reclamation, and investigate the source of past and current environmental conditions. Another advantage is the ability to monitor the entire project footprint at once. This allows managers to identify areas of potential concern and schedule ground testing or further analysis. This creates efficiencies in applying resources, making sure that time and money is used as effectively as possible.

Because the EFMP uses satellite imagery, WH Geomatics has had to be creative in ways to identify indices. An example is measuring salinity. Salinity does not naturally alter the reflectance of water, and therefore there is no way to directly detect saline water. Knowing the importance of this information to our customers, we had to find contextual clues to detect saline bodies of water. Salinity does alter the vegetation communities near the water, and based on this we have been able to map salinity in their project areas.

As technology changes, the way we look at the world is also changing. Environmental monitoring using satellite imagery has the potential to save time and money, and ensure the best possible information is available to decision makers. ♦

The Future of Environmental Monitoring



Western
Heritage

The Environmental Footprint Monitoring Platform uses very-high-resolution satellite imagery to identify areas of interest and focus ground testing where it is needed most. Archival imagery allows the user to look back at the history of environmental health in their project area. Results are delivered through an online portal, accessible at anytime. For more information, visit: www.footprintmonitoring.com

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ArrMaz helps producers optimize potash processing and product quality



Careful examination of a potash sample in the ArrMaz lab reveals surface recrystallization that can lead to dust and/or caking, depending on a variety of factors.



ArrMaz uses precise analytical methods to develop and recommend new products that help make customers' products better.

ArrMaz is a global leader in the production of specialty chemicals for the mining, fertilizer, industrial ammonium nitrate, and asphalt industries. Since 1967, ArrMaz has manufactured chemical process aids and additives formulated to optimize process performance, enhance product quality, and improve profitability for our customers. With headquarters in Mulberry, Florida and multiple locations across North and South America, Europe, Asia, Africa, and the Middle East, ArrMaz serves customers in more than 70 countries across the globe.

Efficient potash production requires a complex sequence of interconnected processing operations with each stage of the process affecting the next. For example, inefficiencies in flotation can adversely impact potash fertilizer quality. In order to optimize the entire potash value chain, it is critical to work with a supplier that can look at the big picture.

ArrMaz works with potash producers to optimize the potash process from mine to market. The company custom-formulates process chemicals, including flotation reagents, float oils, frothers, pH modifiers, defoamers, and flocculants to maximize grade and recovery, and realize the full potential of the potash deposit. In addition to process chemical offerings, their technical experts can provide process consultation and flowsheet design/improvement to optimize process performance and product quality.

One of the challenges of potash fertilizer production and use is that the product tends to cake and undergo crystal breakage during handling, which results in undesirable dust. Caking can cause severe safety issues in large bulk warehouses because the caked product may "cliff" and upper portions of a pile may collapse unexpectedly when product is being removed by loaders

from the bottom of the pile. It can also create unwanted delays when discharging from bulk vessel holds. Downstream from production, caking problems can also negatively impact bulk blending systems and can cause clogging of application equipment in the field.

Almost all potash fertilizer is conditioned with anti-caking and anti-dust coatings (sometimes in combination) during production just prior to storage, and frequently are treated again at various stages of transfer. Historically, potash coatings were simple combinations of amines to interrupt the caking process and petroleum oils to control dust. However, evolving factors such as agronomic considerations, regulatory requirements such as REACH in Europe, industrial hygiene standards and sustainability initiatives have led to a need for more sophistication and adaptability in the technologies used in potash coatings.

ArrMaz addresses these challenges by customizing its state-of-the-art anti-caking and dust-control coating technologies to potash producers' operating conditions, as well as the downstream requirements of their customers, distribution networks, and final end-users. The company provides potash fertilizer coating and application system consultations for any point in the supply chain where additional treatment may be needed, and when a particular potash fertilizer is intended to be used in liquid fertilizer systems, ArrMaz can also supply water-soluble coatings which will not interfere with the production of solutions or suspensions, or their eventual use in drip irrigation and other liquid applications in the field.

For further information on how ArrMaz can optimize your potash process from mine to market, visit www.arrmaz.com, or email info@arrmaz.com. ♦



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Luff Industries belt conveyor idler and pulley solutions for the potash industry

Luff Industries, from its Calgary-area factory and warehouses throughout North America, has supplied the potash industry for many years with belt conveyor idler and pulley components and accessories. Through the various relationships with OEMs, distributor representatives and engineering firms, quality products have been delivered to many operations for

their bulk material handling requirements. As with any industry, the potash industry has specific requirements for these types of operations, given the type of material being conveyed. In many cases, Luff Industries' standard product offerings are well suited for these applications and provide cost-effective solutions, as well as cost savings through reduced maintenance demands.

Two such standard product offerings from Luff Industries are the HMS High Moisture Seals for conveyor idler rollers, and ceramic lagging options for the conveyor pulleys.

The HMS High Moisture Seals address two major causes of conveyor idler roller failure - jammed rollers and bearing contamination. It combines the advantages of the SAL Safety Anti-Lock Shields with the protection of a grease barrier. The SALS were developed approximately 20 years ago at Luff Industries in response to the common problem of rollers jamming. Whenever there is spillage that can build up between the end of the rotating roller and the fixed frame that it sits in, there is a possibility for the roller to jam. When this happens, the belt will continue to slide over the jammed roller and in many cases, a hole is worn into the roller shell, and in turn can cut the belt and/or tear out belt splices. This end protective disc remains stationary with the roller shaft and therefore eliminates the problem of rollers seizing due to material spillage. The protective grease barrier provides a tortuous path to protect against fine particulate contaminants, such as potash, from entering the end of the roller. As well, during wash-down cleanup, the convex shape of the disc acts as a deflector against direct water pressure on the end of the roller. The rollers can come factory-installed with the HMS High Moisture Seals, or they can be easily installed in the field. As in the case with the roller in the photo, water from wash-down seen here was prevented from entering the roller ends, thus greatly extending the life of the operation's rollers. The



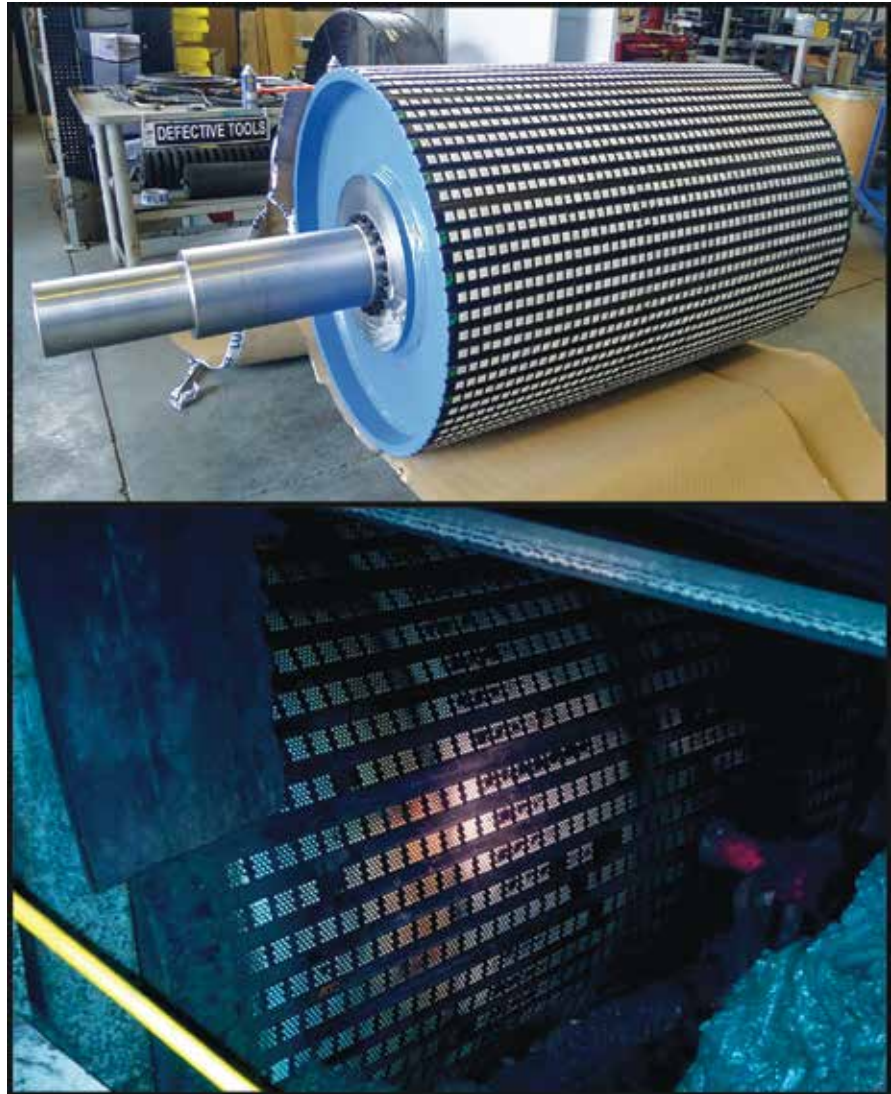
The HMS High Moisture Seals address two major causes of conveyor idler roller failure - jammed rollers and bearing contamination. The water from wash-down seen here was prevented from entering the roller ends, thus greatly extending the life of the operation's rollers.

The two major benefits of using ceramic lagging are traction and the abrasion-resistance characteristic of the ceramic tiles. The 42-inch diameter by 63-inch face-width drive pulley shown here was recently manufactured for a Saskatchewan potash operation and is an engineered class pulley.

potash customer in Florida has since standardized with all rollers coming with the HMS.

For conveyor drive pulleys, ceramic lagging is often selected. The two major benefits of using ceramic lagging are traction and the abrasion-resistance characteristic of the ceramic tiles. The raised dimples on the ceramic tiles momentarily engage in the cover of the belt, thus providing a mechanical interlock for traction. Standard rubber pulley lagging relies only on surface friction while the design of the ceramic drive pulley offers a much higher coefficient of friction. Therefore, the possibility of belt slippage is almost completely eliminated for wet belt, freezing and dirty belt conditions. The Richwood ceramic lagging that is often used on Luff Industries' pulleys is a high-quality lagging. The individual tiles are embedded in the rubber of the lagging, with a shock-absorbing layer of rubber underneath and the tiles used are of an excellent quality to promote durability against wear and impact. Richwood has several types of ceramic lagging available for drive pulley applications. The 42-inch diameter by 63-inch face width drive pulley shown here was recently manufactured for a Saskatchewan potash operation and is an engineered class pulley. The pulley design and the ceramic lagging selected corresponds to the calculations specific to the belt conveyor that it will be installed on.

Many applications have special requirements and the potash industry is no different. It is important to install conveyor components that decrease maintenance and downtime costs and increase the overall performance of your conveyor systems. ♦





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Ground fault protection with VFDs in mines

Using sensitive relay to detect ground faults in VFDs on resistance-grounded systems



By Dean Katsiris, B.E., B.Sc., product manager, Littelfuse

Ground faults (or earth faults) are a special concern in mines where high-powered portable electrical equipment operates in a harsh environment. Trailing cables are exposed to moisture and often dragged over rough surfaces that may cause damage. Portable electric equipment is also transported throughout the mine, causing vibration and mechanical stress. Many of these failures result in a ground fault.

The frame of portable equipment is typically bonded to ground in the upstream substation through a ground conductor in the trailing cable. A ground fault in portable equipment will cause current to flow through the ground conductor and cause a ground-fault voltage on the frame. Undetected ground faults pose a shock hazard to workers and can cause equipment damage and downtime.

A failure of the ground conductor in the trailing cable is of another concern. During a ground fault, full ground-fault voltage will be present on the portable equipment frame, but due to an open-ground connection, may result in very little current flow. Thus, the voltage persists until a lower impedance path to ground is found, possibly through someone in contact with the portable equipment and ground. For this reason, ground-check relays are a vital part of portable equipment safety.

To reduce or eliminate many ground-fault problems, including most arc-flash incidents, mines have long used high-resistance-grounded (HRG) systems,

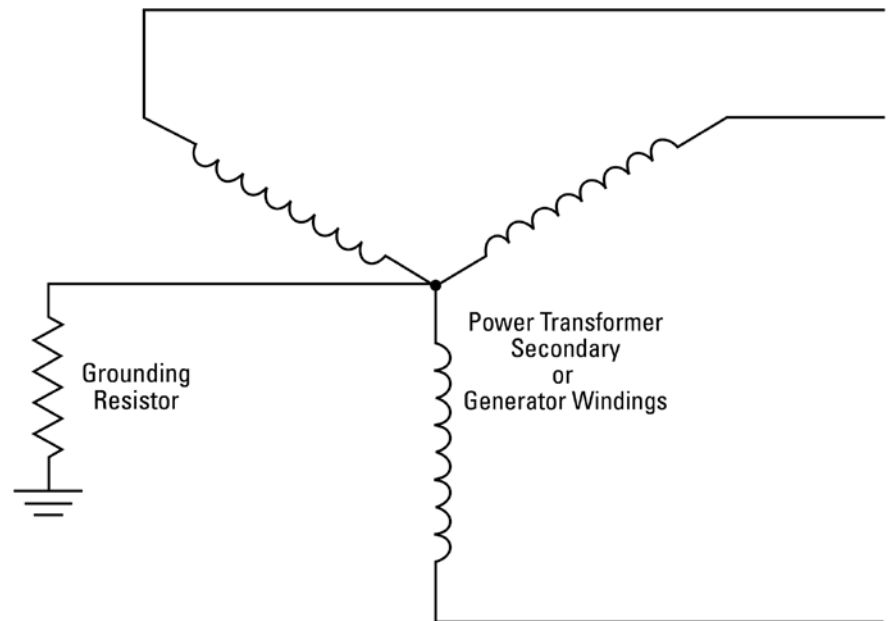


Figure 1 - In a high-resistance-grounded system, the neutral point of the transformer (or the artificial neutral of a zigzag transformer) is connected to ground through a neutral-grounding resistor.

where the neutral point of the transformer is connected to ground through a neutral-grounding resistor (NGR), Figure 1. The NGR will limit ground-fault current to a small value, reducing the fault damage, the ground-fault voltage at the equipment frame, and eliminating the possibility of an arc flash during a phase-to-ground fault.

Even though HRG systems offer improved safety benefits, they can make it difficult to detect low-level ground faults. This is further compounded by using variable-frequency drives (VFDs) to control motors in various mining machinery.

VFDs have flourished in mining operations because they allow finer control over motor speed, resulting in reduced energy consumption and a positive im-

pact to operating costs. Unfortunately, the built-in ground fault protection in many VFDs will only trip if the current to ground reaches a fixed amount such as 33 per cent of full-load current. However, the ground-fault current in an HRG system is commonly limited to just a few amps, so the drive can never trip on a ground fault. Many mine managers are unaware that the VFD ground-fault protection is not sufficient at these levels, and are unknowingly putting workers and equipment at risk.

The solution is to install a ground fault-relay that is sensitive enough to detect these low-level faults. A conventional ground-fault relay detects ground-fault current at power line frequency (50/60 Hz). Some VFD applications operate from



Figure 2 - The Littelfuse EL731 is a sensitive AC/DC earth-leakage relay designed to detect ground faults down to zero Hz in resistance-grounded environments. The relay provides two adjustable setpoints in the range of 30 to 5,000 mA, one for warning and one to trigger a shutdown, plus three programmable output relays. The optional AC700-CUA adaptor allows communications.

above 120 Hz down to zero Hz (DC). Most AC ground-fault relays don't work below 20 Hz or DC.

Ground-fault relays based on advanced technology provide the solution to the challenge of reliably detecting ground faults on VFDs at mixed frequencies without causing nuisance tripping. Littelfuse has recently introduced a ground-fault relay (Figure 2), that measures ground currents down to zero Hz. It is most often used with one CT (for output frequencies between zero and 90 Hz), and can be installed in place of an existing ground-fault relay without replacing the CT. Where higher motor frequencies are used or there is a need to measure harmonics and the carrier frequency, a second CT can be added to extend coverage to six kHz.

Safety is a good investment. The U.S. Occupational Safety and Health Administration (OSHA) estimates the average electric shock injury costs an employer over \$180,000. Mines that add low-level ground fault protection when using VFDs in HRG systems can improve safety and reduce the electric shock danger to workers.

Dean Katsiris is product manager for protection relays at Littelfuse and holds bachelor's degrees in Electrical Engineering and Computer Science from the University of Saskatchewan. Over the past decade, he has worked in a variety of roles at Littelfuse, including research & development and sales. Katsiris is a member of the IEEE. ♦



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PEBCO has over 40 years of experience in designing and manufacturing standard and customized equipment for the bulk materials handling industry.

The company started operations in 1977 in Paducah, Kentucky, USA, which is still home to its corporate headquarters and manufacturing facility. PEBCO employees are proud to keep all manufacturing and design local. The manufacturing facility spans 40,000 square feet and is complete with blasting and paint booths.

PEBCO's equipment range includes gates, valves, dustless loading equipment, high-volume loading chutes, cascade chutes, telescopic chutes, and diverters for applications such as coal, aggregates, ash, grains, cement, fertilizers, and food. This is to name just a few.

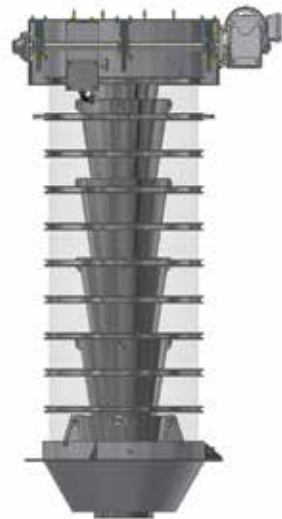
PEBCO has become an established leader in the coal, cement, and potash industries, while at the same time expanding their expertise in other materials such as ferrous and non-ferrous ores, minerals, chemicals, and forest products.

Over the years PEBCO has assembled a team of specialists with a wide array of experience in various types of bulk material control. PEBCO's engineering team treats each application individually and custom tailor's products to exact customer specifications. Seeking solutions to unique material handling problems, PEBCO's experience, versatility, and innovation have led to the development of several patented products, features and options for equipment used in the dry bulk solids handling industry. As a result of this, PEBCO has patented products that demonstrate the innovation of the company in the field of moving, storing, and weighing bulk solids. PEBCO patents include: ROLLING BLADE Gate®, Mass Flow Feeder control technology, Uni-Load Chute® and the PEBCO Cascade Chute®.

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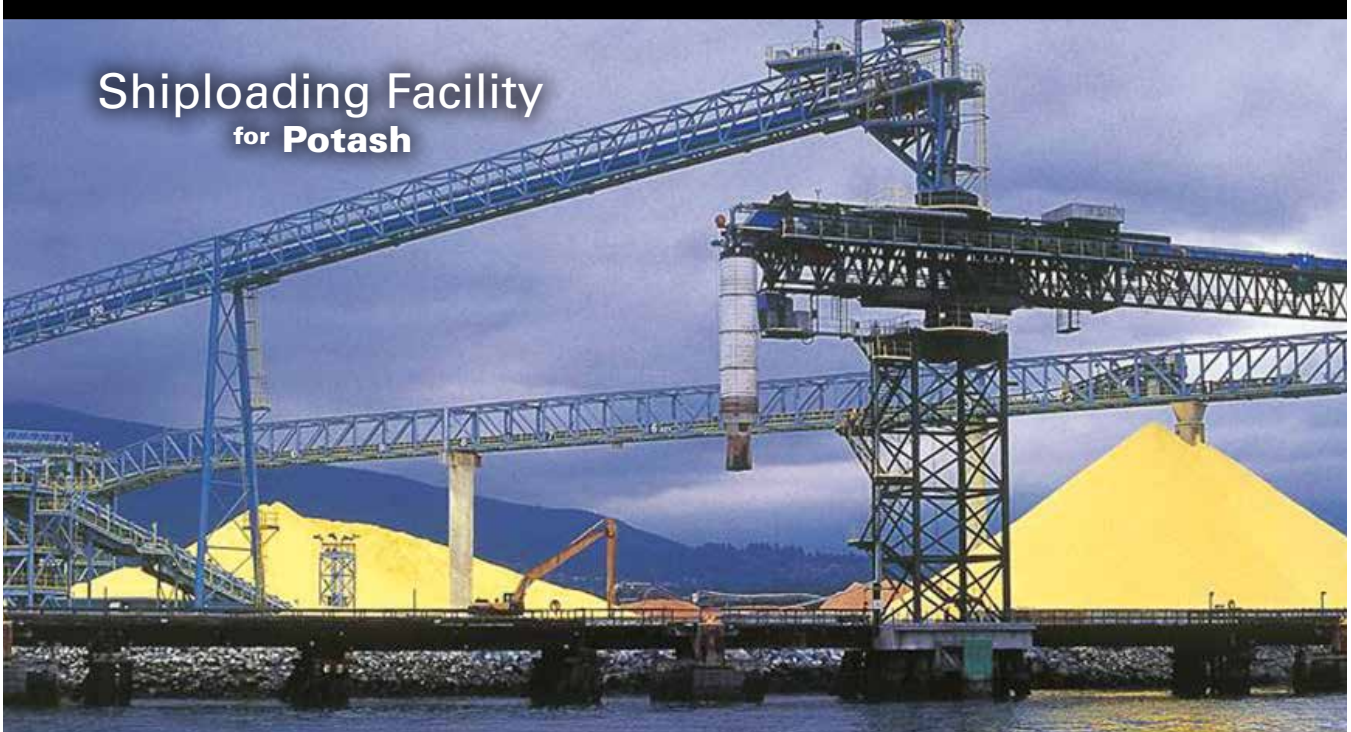
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Stronger together

How giving helps businesses grow

By Sarah Jensen



Northern Resource Trucking takes part in the Stuff The Bus program, collecting food through November and December of each year for the Saskatoon Food Bank.



A BBQ that NRT held for the people who were stranded in Saskatoon during the forest fires around La Ronge.



A puppy that the NRT receptionist took care until it was ready to be adopted out. Several staff members at NRT volunteer their time with the Saskatoon Dog Rescue, and the company is also a dog-friendly office space.

Looking to give your business a boost? Try giving back to your community. Most businesses do some charitable giving, particularly around the holiday season. There are lots of opportunities with food bank drives, adopt-a-family, and other festive fundraisers. It feels good to get involved and to give back to your community. But did you know that charitable giving can help your business grow?

Whether you run a small home business or a multi-million-dollar industry, it pays to pay attention to where your company “lives”. A successful business gets to know its community and makes a targeted effort to contribute. Identify challenges faced by your community and focus your charitable attentions on improving these areas. Strong communities support strong businesses. Here are three ways that charitable giving can boost your business...

Growing together

Northern Resource Trucking (NRT) is a company that is deeply bound to the people of northern Saskatchewan. They are our customers, our co-workers, and our employees—past, present, and future. So we prioritize giving back to these communities year round. The strength of northern communities has a direct impact on the strength of our company.

For example, NRT donates \$5,000 a year to the Blue Cross Recess Guardians program in La Ronge, Saskatchewan. This program seeks to empower youth to reach their full potential and become leaders in their schools and communities, and they do this by teaching through unstructured play. It's a great program, and we don't need any further incentive than that to support it. But, supporting youth programs is a great way to boost your business, too. Confident competent young people become confident competent adults, and someday soon you will be hiring from and working with this labour pool. Supporting youth is an investment in your business' future.

Respect and reputation

Charitable giving is also a great way to bolster your company's reputation. If you show awareness and respect to the communities you work in, you will increase the awareness and respect community members have for you. NRT is a very visible part of northern Saskatchewan. Our trucks are everywhere on northern roads and communities. So we want to have a positive impact wherever we go. Reputation is important. When your business helps people, those people will often support your business. If your company has a great reputation and your community respects you, you will draw higher-quality job applicants, too. Building goodwill in your community means you will have a network of support to draw on in the future.

Doing good feels good

It's what's on the inside that counts, right? This is true of businesses, too. Inside every great business are great employees. The daily grind of work can be tough. Employees who feel like they work for a respected, thoughtful company have much higher morale and motivation. Get your employees involved in the charities your company supports. NRT employees often spend their work hours volunteering for our charities—collecting and delivering food bank donations, shopping for and wrapping gifts for adopt-a-family programs, even keeping foster animals in the office. This helps build a strong team environment, and makes people feel like they are a part of something bigger than themselves.

Savvy companies don't give to charities in order to receive direct financial gain. But there are plenty of ways that charity benefits the giver, too. Investing in your community is an investment in your company's future. Don't wait for the holiday season to get out there and give back. ♦



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On track to repair

Frontline Railcar Repair Ltd.

Frontline Railcar Repair Ltd. is located just north of Saskatoon, Saskatchewan in the small community of Hague. Their railcar repair shop is serviced by CTRW interchanging with CN at the Chappell yard within Saskatoon.

Established 12 years ago, Frontline employs a steady workforce of 14 people, including three office staff and 11 full-time repairmen. A few of their customers include PotashCorp, Agrium, Cargill, The Andersons, GATX, Wells Fargo, and more.

Frontline offers all types of repairs limited by the Association of American Railroads (AAR), one of the governing bodies of the rail industry. Their repairs are currently limited to AAR Rule 1. Repair capabilities range from wheel and axle replacements, bottom outlet gate change outs, hatch cover renewals, or repairs to the car bodies and minor paint touch ups. With a combined

170 years of railcar repair and support knowledge, Frontline's approach has been simple: to offer timely service that cares about the customers' needs. The best way for them to deliver on this is by understanding their customers' business. What causes them pain? Without giving away their trade secrets, the Frontline team embraces a high level of transparency to each and every individual customer.

Frontline's capabilities go far beyond setting up maintenance programs with their customers. Having said that, their foundation is built on a high level of understanding hopper car designs and the various bottom outlet gates utilized within their customers' fleets. They take pride in their fundamental approach and their customers depend on their skill set.

Frontline offers mobile repairs across Canada and into the USA, specifically the state of Indiana. Some of their

other services include auditing new car builds, which had them heading the auditing process for 3,000 new cars at the National Steel Car facility, pre- and post-lease inspections. They also consulted at a variety of levels, and did accident investigations to determine root causes of slow speed derailments.

Frontline maintains a steady flow of cars through their shop, averaging 30 cars per week. They utilize a leased billing system with capabilities allowing several different formats, including standard AAR, Dat 500, and a private custom format of their own based on NITL. They also maintain a comprehensive line of inventory that reduces out-of-service days to their customers, allowing for quicker turnaround times.

To contact Frontline, call them at 306-651-1900, or email vbhfrontline@sasktel.net. ♦

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At Procon, we are committed to being the partner, contractor and employer of choice through the development of our people, building strong partnerships, and delivering innovative solutions for our clients.

Kitsaki Limited Partnership and Procon Group have combined forces to deliver a broad range of mine construction services to the potash industry. With a long history of working together and delivering services to the mining industry in Saskatchewan, Kitsaki Procon Potash JV provides value to our clients through a unique and sustainable business model with an emphasis on supporting local indigenous communities.

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Maintaining of the emergency response team

Vital for safety

Although almost every mine site, large construction project, or industrial site has an emergency response team (ERT), maintenance of the required training skills to remain current is always a concern.

The following recommendations to maintain skills come from our observations over the last 40 years of ERT training across western Canada.

Get team member involvement - They need ownership of the team, it's vital for moral and involvement. Team members need to be involved in training requirements, setting team training goals, and purchasing equipment.

Set priorities - What skills need to be maintained? How much time is required? How often is retraining required? Is training required with new equipment?

Set goals for training dates - Use skill check sheets, and document skills tested and acquired.

Set training dates and times - Set training dates at least six months in advance to allow managers to make shift arrangements and members to make arrangements.

Train for real - Always train as a real incident, treat manikins as real people, "You do as you train".

Stick to the schedule - Members must attend and to make it all work requires a commitment from the employer, management, and the workers.

The reward of this planning is having a skilled proficient rescue team. ♦



Team members need to be involved in training requirements, setting team training goals, and purchasing equipment.



Always train as a real incident, treat manikins as real people.



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Trans-Care Rescue Ltd. has been providing professional training, equipment and standby rescue services to the potash industry in Western Canada since 1981.

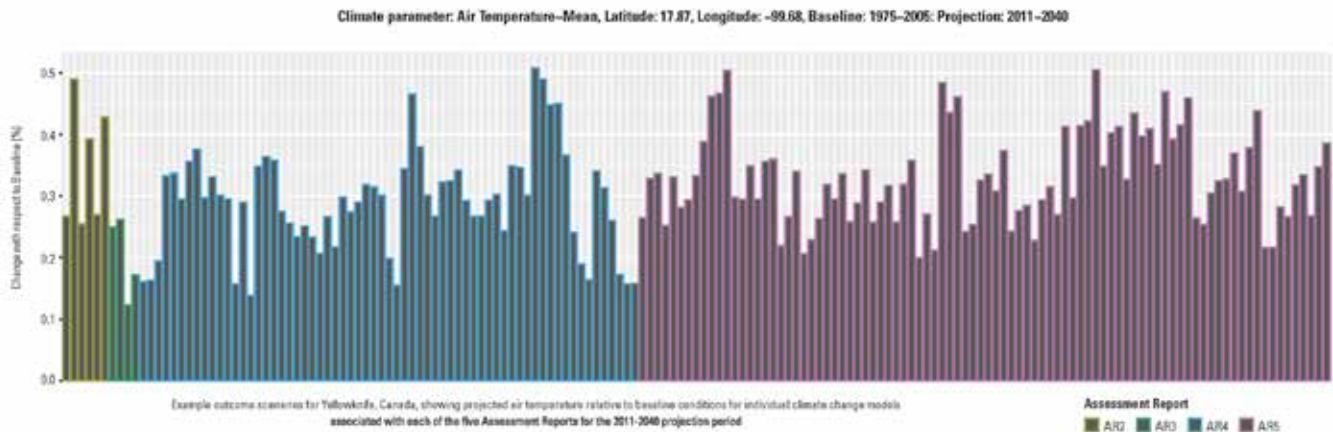


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Integrating climate change into engineering design



By Victor Muñoz



Integrating climate change into engineering design.

During the last several decades, global climate change (GCC) has emerged as a key driver of environmental processes. However, hydrologic analyses assume local climate is constant and can be directly understood from historical records. To meet the challenge of incorporating GCC into predictions of meteorological events and trends, this article presents a combination of methods that uses publicly available historical records to determine meteorological engineering design values under climate change conditions.

Environment and Climate Change Canada (EECC) is a database for GCC data. They provide access to information from Intergovernmental Panel on Climate Change (IPCC) assessment reports (ARs) one to five, which contain a wide range of variables (e.g., precipitation, temperature, and wind speed). A purpose-built script was developed using R statistical computing language.

The script compiles all available GCC models from EC that included scenarios from AR1 to AR3 (i.e., A2, B1, A1B, GA, GG) to representative concentration pathways or RCPs (i.e., RCP 2.6, RCP 4.5, and RCP 8.5) from AR4 and AR5. These were selected to show the respective rate of change in multiple climate variables for a given longitude, latitude, and time (up to year 2100).

The available GCC models are weighted equally during statistical evaluation of the cumulative results. Results are then compared to trends in historical data associated with the selected climate change parameters obtained from ERA-interim reanalysis, which is produced by the European Centre for Medium-Range Weather Forecast and encompasses more than 30 years and the entire planet.

The engineering design value is chosen as the maximum value between the median obtained from the cumulative probability curve that describes the GCC models and related scenarios, and the mean of the historical regression trends obtained with a statistical significance higher than 95 per cent (p -value <0.05).

This procedure marries the most conservative result between the GCC and the historical values at the defined geographical place. This overall procedure combines analysis of GCC models and historical data to define appropriate design values.

Victor Muñoz is a senior consultant at SRK Consulting. He can be reached at 778-785-8478, or vmunoz@srk.com. ♦

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