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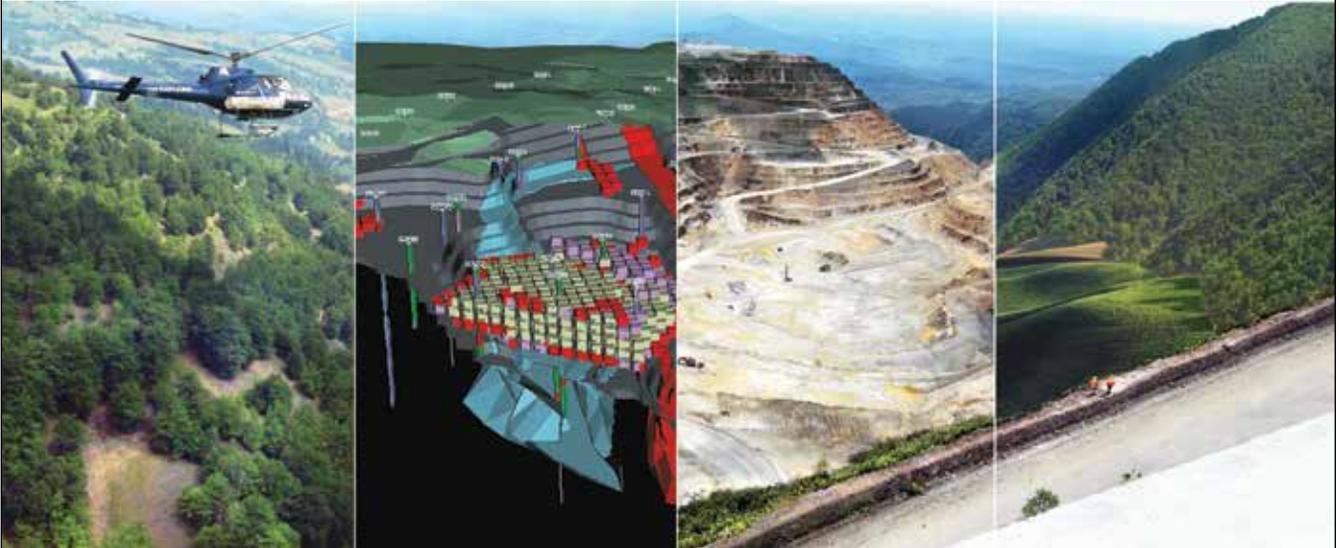
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Message from the editor **Shayna Wiwierski**

There's lots going on in the potash front.

At the beginning of 2018, Canada's two largest fertilizer companies, PotashCorp and Agrium, officially merged to become Nutrien Ltd., the world's largest nutrient company and the third-largest resource company in Canada. It was reported that post-merger, approximately 20,000 people will work for the company in 18 countries, with the enterprise valued at \$36 billion USD.

In early November 2018, Nutrien announced that it would permanently close its New Brunswick potash facility after a strategic review of the company's potash portfolio. The facility was placed in care and maintenance in early 2016 and has not produced potash since that time. As a result of this closure, Nutrien will be able to increase potash production in Saskatchewan at a significantly lower operating and capital cost rather than resuming production in New Brunswick.

Another major potash player, BHP has reported that it has also reached some significant milestones during 2018. At its Jansen Potash Project in Saskatchewan, the BHP team reached the bottom of the shafts using SBR technology. To find out more about this story, read the feature on page 26.

Also in this issue of *PotashWorks* magazine, we look at what is happening with the major potash players, as well as the suppliers that make the magic happen. We also explore safety initiatives, the importance of potash to the Canadian economy, and so much more.

I hope you enjoy this issue of *PotashWorks* magazine, and if you have any story ideas or comments about this edition, feel free to reach us through our official site, potashworks.com. ♦

Shayna Wiwierski

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Message from the Premier of Saskatchewan **Scott Moe**

On behalf of the Government of Saskatchewan, it is my pleasure to welcome readers to the 2019 edition of *PotashWorks* magazine.

In terms of economic value, Saskatchewan's combined resource sectors comprise an indispensable part of our industrial base. The mining and petroleum industries together were responsible for 21 per cent of our provincial gross domestic product in 2017.

Billions of dollars of revenue and royalties are generated in this province every year from resource industry activity and exports. Saskatchewan has the highest goods exported per capita of all Canadian provinces, and our province's total exports have grown by 50 per cent over the past decade. In 2017, these exports were worth almost \$29 billion.

Saskatchewan is rich in economic opportunities, but also in human ones, in terms of education and training, jobs, and long-term community growth. Tens of thousands of Saskatchewan people are employed by our resource industries.

The fact that we are the world's number-one producer of potash is a major reason for this. Certainly, our provincial potash mining industry has had a remarkable decade, thanks to major expansions of existing mines in addition to significant new interest and development. Investments in increased capacity have been timely; total Saskatchewan sales in 2017 increased by 12 per cent from the previous year, breaking the record established in 2014. Record potash demand, due to strong global consumption, is largely the reason, along with increased sales into China and India.

The recent merger of PotashCorp and Agrium to create Nutrien - the world's largest potash producer, headquartered in Saskatoon - is a strong sign of our continued leadership in the potash market. At the same time, among the sustained work and interest in Saskatchewan's potash potential from various companies, K+S Potash Canada is implementing plans to increase the productive capacity at its Bethune mine, Saskatch-

ewan's first new potash mine in almost 50 years; Mosaic's K3 Mine is steadily ramping up production; and BHP continues to move forward with its Jansen Lake potash project.

These companies are, in fact, among the most innovative and competitive on earth. They exemplify the tough and entrepreneurial spirit that defines the best qualities of Saskatchewan's people and businesses.

Part of our job in government is to do our best to enable these and other businesses to invest in our great province, which helps to create sustainable jobs that grow our communities. The Saskatchewan Geological Survey, which celebrates its 70th anniversary this year, embodies this commitment. Since 1948, the Survey has been responsible for gathering, studying, and sharing information on our geology, mineral and energy resources. By providing maps, reports, mineral deposit studies, and much more, it helps guide the exploration for, and development of, our key provincial resources like potash.

Work of this nature helps to reinforce our province's reputation with the global resource industry as a preferred place to do business. Even as the global economy continues to push through a resource market cycle that has brought major changes to growth and activity worldwide, one fact hasn't changed: the Province of Saskatchewan will remain a destination where resource companies can find some of the world's best prospects for development.

Scott Moe
Premier



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Message from the Minister of Energy and Resources ***The Honourable Bronwyn Eyre***

As Saskatchewan's Minister of Energy and Resources, I am delighted to have the opportunity to provide readers with a snapshot of how important potash is to our province. Potash is generally a "made-in-Saskatchewan" commodity and a vital resource that connects us to the world. Our government recognizes the importance of our "pink gold" when it comes to feeding the world, improving food security, and providing prosperity here at home.

Potash is one of the largest industries in Saskatchewan, comprising nearly 30 per cent of total global production. The total value of Saskatchewan's mineral sales for 2017 was \$6.6 billion, of which \$4.8 billion was generated by over 20-million tonnes of potash.

About 45 per cent of our potash exports are currently shipped to the United States, Asia, and Latin America, all of which have seen significant growth in their potash consumption.

Over recent years, there have also been substantial, long-term development projects and investments by Saskatchewan's potash producers. Since 2006, Nutrien and the Mosaic Company have completed expansions of their production capacity at every one of their Saskatchewan mines. The total capital cost of these efforts, as well as the current project at Mosaic Esterhazy and the new K+S Potash Canada mine at Bethune, is estimated at \$17.6 billion – a solid expression of investment confidence in this industry and in our province.

Saskatchewan is considered one of the most attractive jurisdictions in the world for mineral exploration and development. Enabling sustainable development of our mineral resources by fostering a stable and reliable business environment is a priority for our government. Our province is currently ranked second in the world out of 91 global jurisdictions, and first in Canada, by The Fraser Institute for mining investment attractiveness. *The Mining Journal* – one of the industry's most well-established international publications – recently ranked Saskatchewan number one out of 85 jurisdictions with respect to favourable investment risk.

Our mining industry is continually adapting and evolving to meet the challenges of today's global economy. As a result of the substantial capital Saskatchewan producers have committed to expansions, mines also operate at world-leading low emissions levels.

The Government of Saskatchewan continues to work hard to help ensure that our province remains a dominant player in the global potash and mining industry and to stand up for its interests. We are #proudfopotash. ♦



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Message from Canada's Minister of Natural Resources **Minister Amarjeet Sohi**

Potash and Canadian Mining: *A rock solid relationship*

When most Canadians think of the mining industry, fertilizer might not come to mind. But it should.

When it comes to potash, Canada is the undisputed global leader. With a quarter of the world's potash reserves, we produce nearly twice as much as our nearest competitor and lead the world in exports. Potash is essential to our economy, to job creation, and to food production.

By 2050 the world will need to increase food production by 70 per cent. Without fertilizer, global food production would be half of current levels, requiring farmers around the world to grow more food on less land.

While Canada has been a leader in exports, competition is fierce and growing. We cannot sit still and hope to maintain our position. For potash, uranium, nickel, cobalt ... and all the elements that we extract.

Simply put, Canada must adopt a new vision that fosters the growth of the mining industry as a whole – a vision that reflects today's realities, where issues such as climate change, Indigenous participation, sustainable development, and social acceptability are key elements.

To sharpen our competitive edge, federal, provincial, and territorial governments are finalizing the Canadian Minerals and Metals Plan. The plan is informed by nationwide conversations with industry, Indigenous peoples, civil society, and stakeholders to consider all aspects of mining – from pre-exploration to mine closure and everything in between – in order to position the sector for long-term success.

Advancing the participation of Indigenous peoples will be a priority within the plan. Our government believes that a competitive and sustainable minerals industry must ensure that Indigenous peoples participate as partners; ensuring that their rights are recognized and respected, and ensuring that they

share in the benefits of natural resource development from their lands and traditional territories.

Much work has already been done in this area. Many countries look to Canada and our mining companies for the way we build partnerships with Indigenous peoples and local communities, not to mention our efforts to protect the environment, our unparalleled access to capital markets, and our innovative spirit.

The Muskowekwan Potash Project is a shining example. The Muskowekwan First Nation is the first in Canada to hold mineral rights to its reserve land, which holds potash. The project aims to develop the resource and generate a return on investment for investors in First Potash Ventures – a joint venture between Muskowekwan Resources Ltd., Muskowekwan First Nation, and Encanto Potash Corp. It will also deliver socio-economic benefits for the Muskowekwan people and the surrounding community.

Innovation also features prominently in the Canadian Mineral and Metals Plan. Here again, we can look to the potash industry for leadership on this front. In the last 20 years, the industry has achieved significant reductions in emission levels – while production has increased. All through continuous innovation and technology development.

As a result, today more than 12,000 Canadians are employed directly by fertilizer companies in highly paid and highly skilled jobs. This includes engineers, scientists, and tradespeople working in mines, production plants, laboratories, and farm supply outlets. Our government would like to see those numbers grow even more.

By bringing together industry, government, Indigenous people, and stakeholders under a forward-looking Canadian Minerals and Metals Plan that includes potash, we hope to improve our competitive position in the world and stake our claim as a global mining leader. ♦



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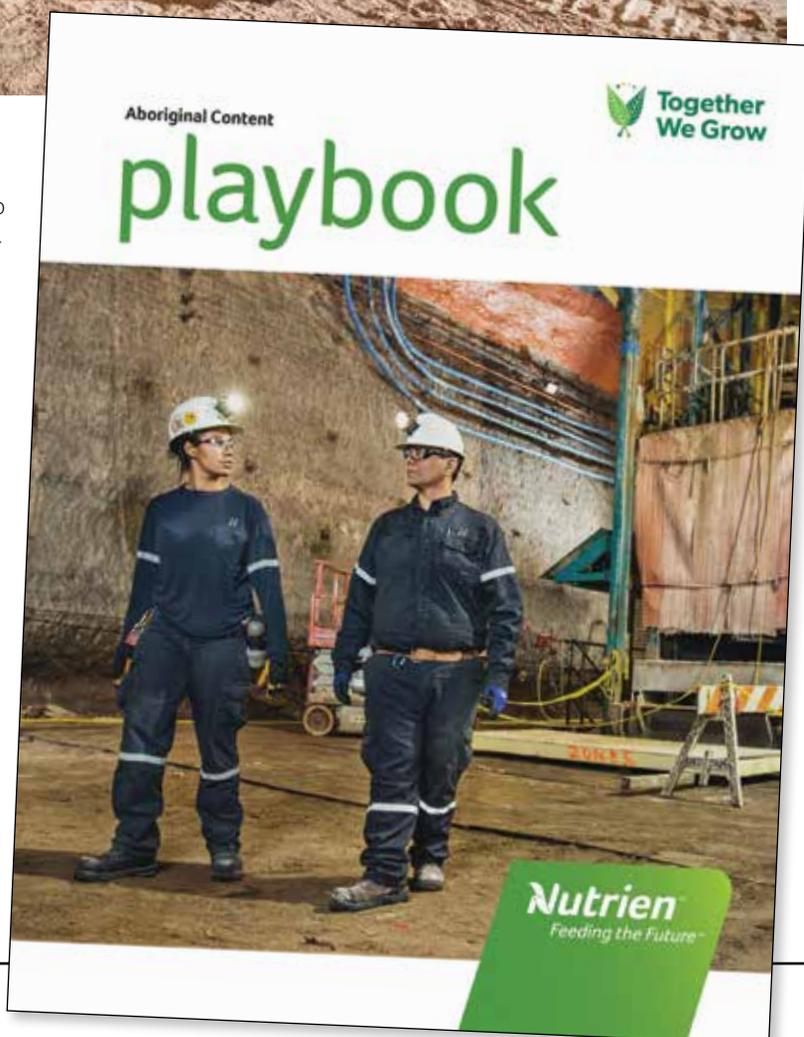
Nutrien's large-scale operations touch or attract people from several treaty territories, languages, and heritage groups.

In nature, a healthy ecosystem relies on diversity to boost productivity. Every aspect of nature contributes; every contribution is important.

As the world leader in providing crop inputs, services, and solutions, Nutrien recognizes the value of diversity – in nature, in our workplace, and in the communities where we work and live. We understand that to grow our world from the ground up, we need to draw on unique insights from all areas of our company, supply network, and community.

We also know that our focus on diversity provides us with an opportunity to lead. Our supply chain should be as diverse as the communities we serve. Our large-scale operations touch or attract people from several treaty territories, languages, and heri-

Nutrien developed an Aboriginal Content Playbook (available on Nutrien.com) that details their strategies and gives suppliers suggestions to help them in the development of their own inclusion strategies.





Planting seeds for a better tomorrow.

The seeds we plant today hold our dreams and aspirations. At Nutrien, we're committed to expanding our relationships with Indigenous people globally, including Aboriginal people in Canada, knowing that diversity and inclusion will help us feed the future – together.

Stacy Sutherland
Muskeg Lake Cree Nation
Treaty 6, Saskatchewan

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Since 2016, Nutrien has spent more than \$50 million with over two-dozen Aboriginal-majority-owned suppliers in Saskatchewan.

tage groups, which is why we have a company-wide commitment to diversity, and one of our engagement principles is inclusion.

Working with our suppliers

We believe that investing in the potential of Aboriginal people and businesses today will lead to a better workforce, more vibrant communities, and stronger suppliers tomorrow. We actively assess

Canadian suppliers to identify companies that can deliver exceptional value through their products and services, as well as drive positive impact through Aboriginal communities. We also award bonus points on RFP submissions to companies committed to local Aboriginal content.

To help suppliers follow our lead, we developed an *Aboriginal Content Playbook* (available on Nutrien.com) that details

our strategies and gives suppliers suggestions to help them in the development of their own inclusion strategies. We also host town hall sessions to explain our policies and answer questions, and maintain a database of Aboriginal suppliers and job seekers that we share across our supply chain.

Measuring progress

Nutrien is committed to allocating 30 per cent of local spending to majority-owned Aboriginal suppliers, or suppliers who share our commitment to Aboriginal development in Saskatchewan by 2020. And by making this commitment, we have achieved immediate progress.

Since 2016, we have spent more than \$50 million with over two-dozen Aboriginal-majority owned suppliers in Saskatchewan. Our outreach also resulted in suppliers investing more than \$600,000 in Aboriginal communities through their own inclusion strategies.

By sharing our knowledge with industry, we are having a broader impact. And by demonstrating the powerful impact of diversity, we're helping build a stronger company and healthier communities. ♦

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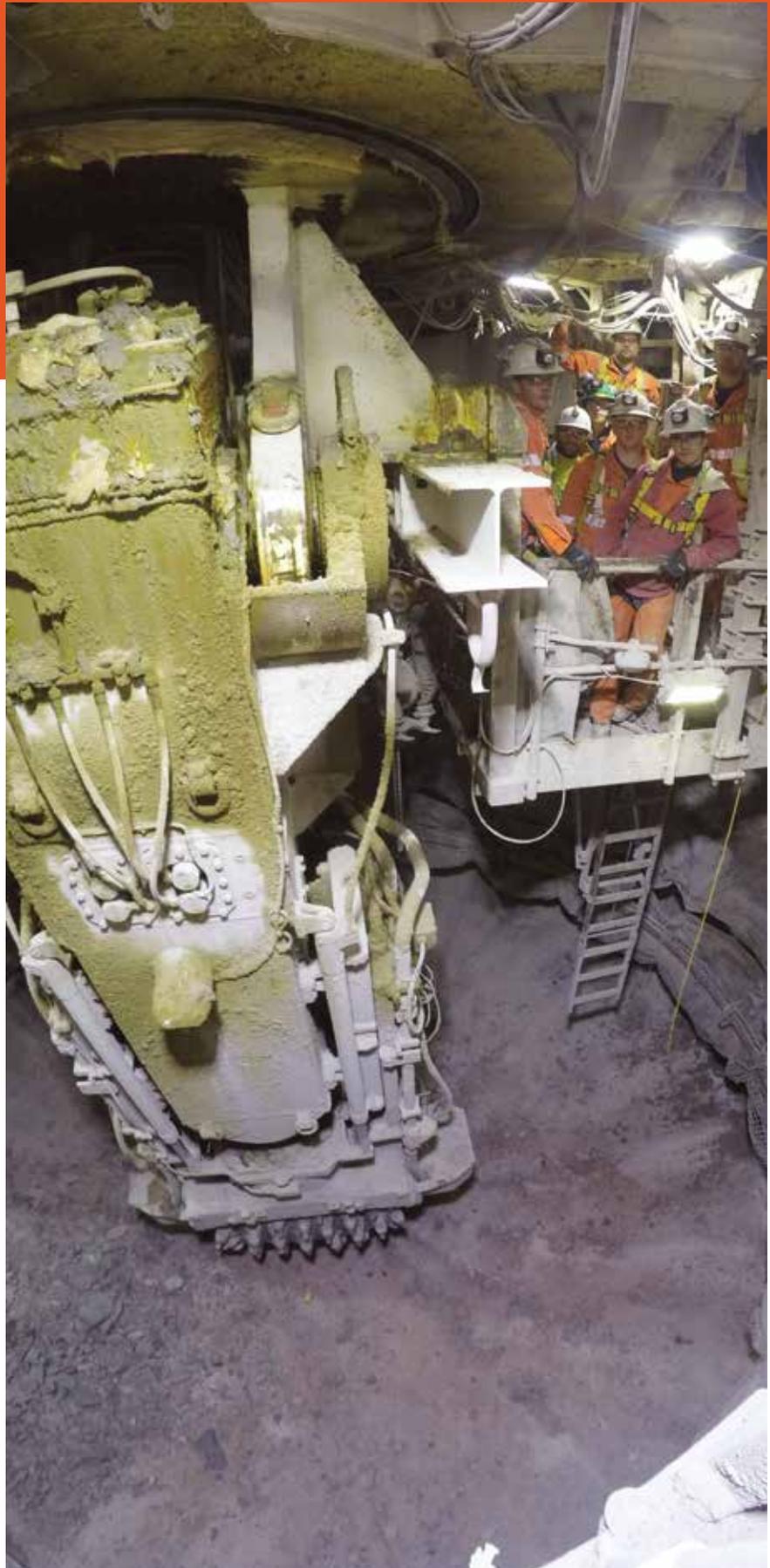
BHP's Jansen shafts reach bottom

The teams sinking the one-kilometre-deep shafts at BHP's Jansen Potash Project in south-central Saskatchewan, reached some significant milestones during 2018.

First, early in the morning of March 30, both the service and production shafts broke through into the pink of potash into the Upper Patience Lake formation. After several months of excavating a base station level, the service shaft hit its final depth of 1,005 metres on August 18, followed on August 29 by the production shaft reaching its own bottom at 975 metres.

The two 7.3-metre-diameter shafts at Jansen are the first in the potash industry to be sunk by mechanical means rather than the traditional drill and blast method. A 42-metre-tall Herrenknecht Shaft Boring Roadheader (SBR) machine was suspended in each shaft and a rotating drum excavated the shaft. The cut material was vacuumed up prior to being lifted to the surface. The mechanical excavation removed people from the workbench during operations - a remarkable step change in shaft-sinking safety. As the SBRs progressed, a concrete preliminary liner was installed.

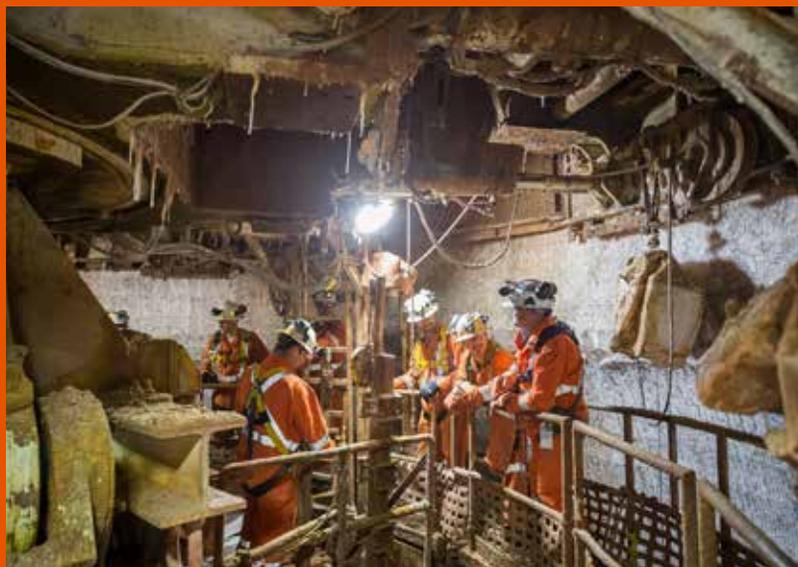
Along the way, the teams from BHP and its shaft-sinking contractor, DMC Mining, had to manage changing conditions through the various petrophysical domains from glacial till to Saskatchewan prairie evaporite. The conditions brought many challenges.



DMC Mining crew reach potash in the Upper Patience Lake member at the Jansen Project in March.

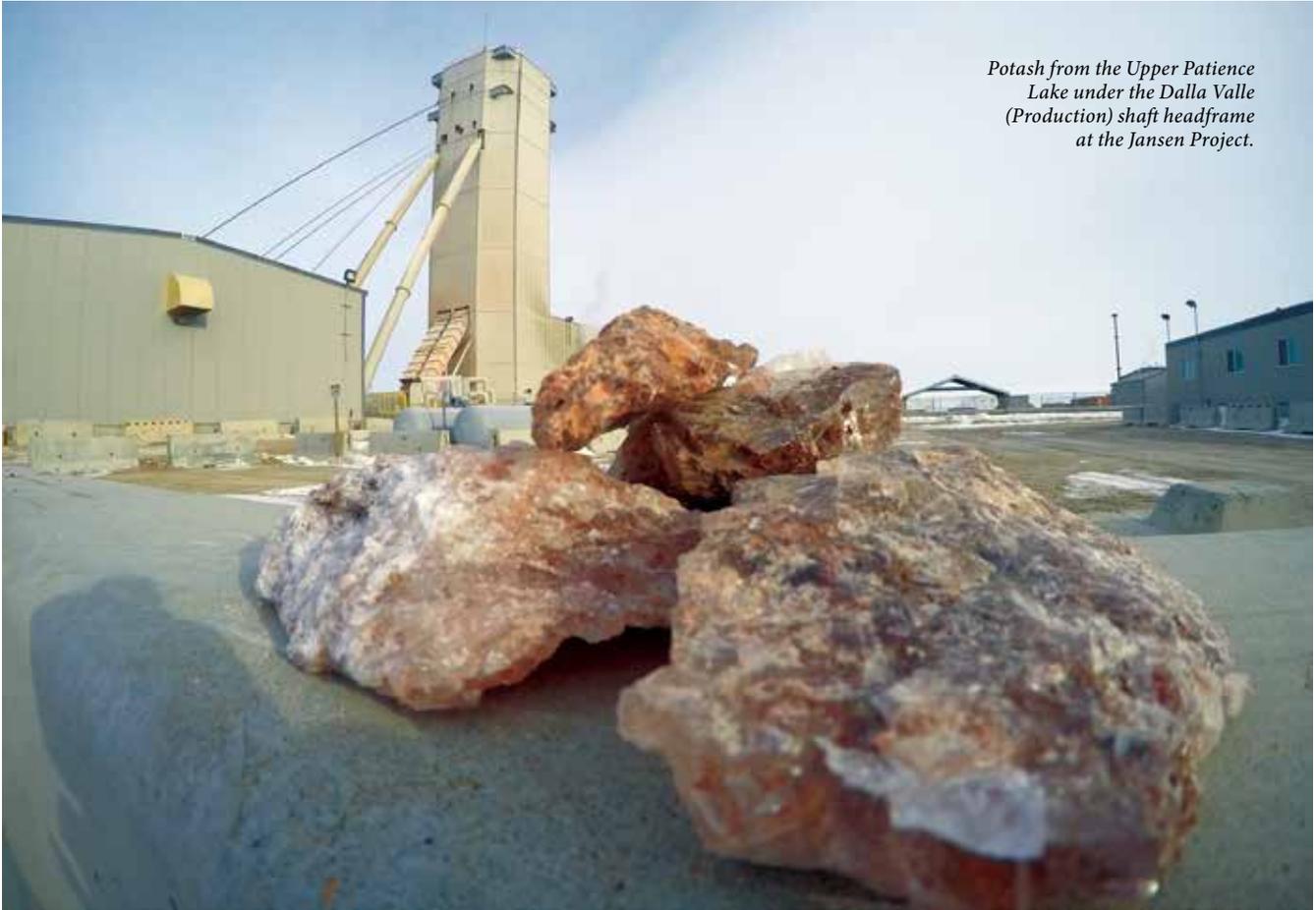
BHP

Our Jansen Potash Project in Saskatchewan, Canada, has the potential to feed a growing global population.



Congratulations to our teams on safely excavating and reaching the shaft bottoms at our Jansen site!





Potash from the Upper Patience Lake under the Dalla Valle (Production) shaft headframe at the Jansen Project.

“We were all terribly proud to reach the bottom of the shafts,” said Brock Gill, BHP’s VP projects, potash. “It has been an enormous challenge, and we have demonstrated that safely sinking mine shafts using SBR technology is possible. We have taken the first positive step for the industry in this sense.”

Since reaching the bottom, the teams have been removing weight from the SBRs to raise them up the shafts in preparation for the installation of the final waterproof liners. The SBRs will then be removed from the shafts.

New workstages for installation of the final liners are being built in modules in Estevan, Saskatchewan and will be trucked to Jansen, where they will be assembled and lowered into the shafts. The watertight composite concrete and steel final liners – comprised of about 30,000 m³ of concrete and 7,500 tonnes of steel plates – will then be in-

stalled from a depth of approximately 900 metres upwards to the surface.

Shaft sinking is technical and one of the most risky aspects of building a potash mine. The shafts are the critical infrastructure that has de-risked the development of Jansen and provides BHP access to what the company believes is the world’s best undeveloped potash resource.

Jansen is being designed to be the most efficient and lowest-cost potash mine in Saskatchewan, incorporating new technology that gives it a competitive advantage over smaller existing mines, that in many cases were developed decades ago and before new technology became available. Technology also enables BHP to design Jansen as a mine of the future, appealing to a diverse workforce.

Jansen remains subject to sanction by the BHP board and decisions on the project’s future will be value based and

taken in accordance with BHP’s strict Capital Allocation Framework. While the shafts are completed over the next couple of years, the potash team will continue to consider potential partnerships, trial technologies such as the integrated borer-conveyor system that is being put through its paces in a German salt mine, and every possible enhancement out of the design and operation plans.

“Our capital discipline has ensured that we have optimised this project, and we are always challenged to think innovatively to minimize risk and create as much value as we can,” said Giles Hellyer, BHP’s VP operations, potash. “I believe Jansen is a great Tier 1 project that sits right in the sweet spot of our core competencies of bulk mining and marketing. It is exciting that these two enormous shafts have reached the orebody that could realise the option for BHP, Saskatchewan, and shareholders.” ♦

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Canpotex and global food security: From Saskatchewan to the world

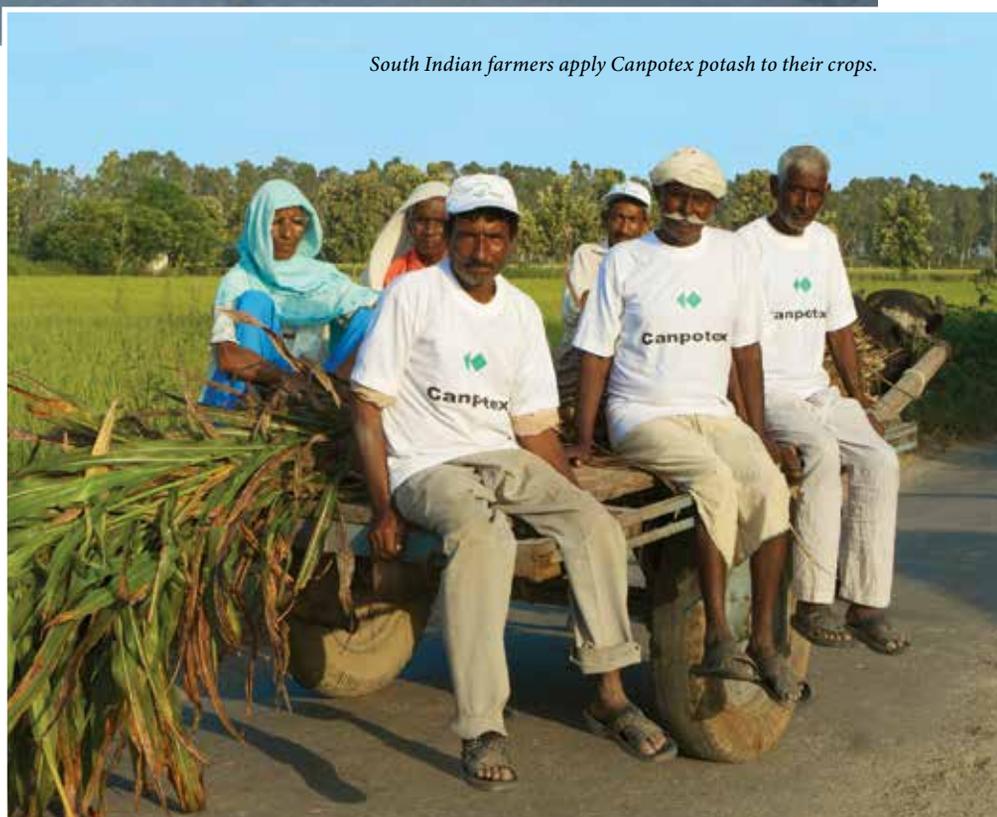
International participants of the Canpotex Fertilizer Management program (2018) at the Canpotex Railcar Maintenance Facility, Lanigan, Sask.



Canpotex is a vital link in the pursuit of global food security by reliably selling and internationally exporting high-quality Canadian potash from Saskatchewan to 120 customers in 40 overseas countries. This potash sales and logistics company aims to help farmers in its export markets grow better-quality food to feed a growing global population.

As a Canadian company, Canpotex recognizes its responsibilities as global citizens. Driven by core values, Canpotex works hard to promote an essential Canadian resource – potash – and the desire for a more food-secure world. They do this through international sales and agricultural education programming. At home, this occurs through a strong commitment to giving back to

South Indian farmers apply Canpotex potash to their crops.





Growing Food for the Future

Since 1972, Canpotex has invested over \$50 million in market development and education programs to customers in more than 25 overseas countries. We teach farmers in our export markets how to use high-quality, Canadian potash from Saskatchewan to improve crop yields and food quality. Everyday, Canpotex is helping to feed the world's growing population because we are a vital link in the pursuit of global food security.



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SASKATOON SÃO PAULO SHANGHAI SINGAPORE TOKYO

local communities and promoting local food security.

For over 40 years, Canpotex has been committed to educating farmers around the world about crop nutrition and the benefits of Saskatchewan potash. They do this through crop-specific field demonstrations; hosting seminars and symposiums for farmers; harvest days and crop tours, and partnerships with organizations like the International Plant Nutrition Institute (IPNI), providing agronomic advice and education.

This year, as part of the Canpotex Fertilizer Management Program held in Saskatoon, the company hosted 20 customers from overseas markets like Indonesia, Malaysia, Japan, Guatemala, Peru, China, and Brazil. Participants learned about the benefits of balanced fertilization, the history of Canadian potash, its uses in agriculture, and the journey from Saskatchewan mines to farms around the world.

Canpotex's local community efforts are focused on food security and service, especially when it comes to fighting child hunger.

For the second year in a row, Canpotex has pledged to match the public's donations up to \$50,000 to the Saskatoon Food Bank and Learning Centre's Milk for Children program. Employees were inspired to give even more, contributing approximately 300 hours of volunteer service, helping to provide food security to the people of Saskatoon.

Through a partnership with the Saskatoon Salvation Army, Canpotex also provides \$26,000 per year for the next three years to fund the Canpotex Weekend Investment in Nutrition (WIN) program. This initiative ensures that 26 school children receive a weekly backpack filled with nutritious, child-friendly food options.

From 10 shareholder-owned mines in the province, Canpotex collects and transports more than 12-million metric



Canpotex potash from Saskatchewan packaged for use in Malaysia.



Canpotex potash test plots in China.



Canpotex Harvest Days demonstration in China.

tonnes of processed potash to overseas markets. They do this using a fleet of over 5,000 dedicated railcars and operating nearly 250 chartered-vessel voyages each year from their terminal operations facilities. This includes two ports along North America's West Coast, and access to two ports along Canada's East Coast. If you have ever had to wait at a railway crossing because of their railcars, Canpotex thanks you for your un-

derstanding because they are proud to transport Canadian potash to help feed people around the world.

As the global population continues to grow and the availability of arable land decreases, there is a lot more work for Canpotex to do – abroad and at home – utilizing Canadian potash to promote global and local food security. It all starts here, in Saskatchewan. ♦

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NATIONAL STEEL CAR

Potash companies committed to highest safety standards

By Michael Schwartz

Training is an essential part of any company's responsibilities. In Saskatchewan, the potash sector makes higher-than-normal demands on employers to ensure that workforces are aware of potential dangers of working in the potash industry, and that employees are fully trained to deal with problems and emergencies.

One of the companies is Nutrien, the world's largest provider of crop inputs and services. Nutrien applies itself to educating its workforce to work safely, as well as efficiently.

"We track our training regularly and often go through internal and external au-

ditions to ensure there is rigour in our systems," according to a Nutrien corporate supply. "Safety training is not just training, it's a way we conduct ourselves, 'to go home safely every day.'"

Nutrien mentions that employee headcount varies from site to site, from 30 to 600, and that all employees receive mandatory training depending on job classification, department, and the nature of the work. Workers can refresh their training through the company's Learning Management System, which alerts them of such renewal of skills.

Another major potash player, the Mosaic Company also conducts a number

of training initiatives. The company employs over 15,000 people in six countries, and their potash unit is headquartered in Regina, Saskatchewan, from where Mosaic conducts many corporate functions, including training.

"Mosaic's first responsibility is to ensure every Mosaic employee returns home safely at the end of each work day," says Holland Thompson, Mosaic's director, health, safety, security – potash. "We are committed to conducting business activities in a manner that protects the health and safety of its employees, contractors, customers, and communities, and recognize that our [health and safety] performance is a constant journey towards our vision of zero incidents."



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Training against fire and gases

Thompson says that all Mosaic sites have award-winning emergency response teams and mine rescue teams that train extensively to respond to all types of emergencies, including fires. In turn, all Mosaic sites and offices conduct regular fire drills to ensure that employees and contractors are prepared to follow protocol in the event of an emergency. Site and office visitors, too, are trained on Mosaic's safety procedures, including fire drill procedures and escape plans.

Mosaic also conducts training against gases and fumes. All underground workers are trained in the use of escape respirators that protect against carbon monoxide. Workers handling hazardous materials, e.g., ammonia, receive specialized training.

Emergencies are not, of course, confined to underground locations.

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hearing protection



"All Mosaic sites conduct regular fire drills and ensure employees and contractors are prepared to follow protocol in the event of an emergency," says Thompson.

At Nutrien, employees are trained on how to inspect fire extinguishers and how to operate them. They also have e-learning courses on fires and extinguishers. In addition, there is a practical element in the field for specific employees, and their mine rescue and surface Emergency Response Teams (ERT) go through more in-depth training.

According to Nutrien, employees are also trained on how to report a fire, and trained annually on emergency procedures. They conduct two fire-drill simulations per year underground where the stench gas is set off and all personnel underground at the time take refuge.

Nutrien's training for gases and/or fumes is included in company emergency procedure and confined space training. Mine rescue/surface ERTs also undergo train-

ing, which allows them to identify gases and their specific properties.

Treating burns

Training on how to deal with burns is also covered by both companies. All Mosaic employees receive awareness training and some employees will be required to train as first responders, while Nutrien supervisors, mine rescue personnel, surface ERT members, and electricians take either emergency first aid, standard first aid, or intermediate first aid, depending on their job title. In some instances, Nutrien has certified in-house instructors or utilizes external vendors to train employees at certain frequencies (anyone else who wants to complete this training can also have access to it).

Each company is keen to stress that every one of its employees has been through mandatory training, which includes extensive safety training. All of its sites have a detailed matrix which identifies the required training for each job. ♦

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Helping potash mills and refineries lower operational costs

By Sheldon Hill and Andrew Downing,
Saskatchewan Research Council



SRC has helped potash processing facilities address a wide range of problematic equipment and assets.

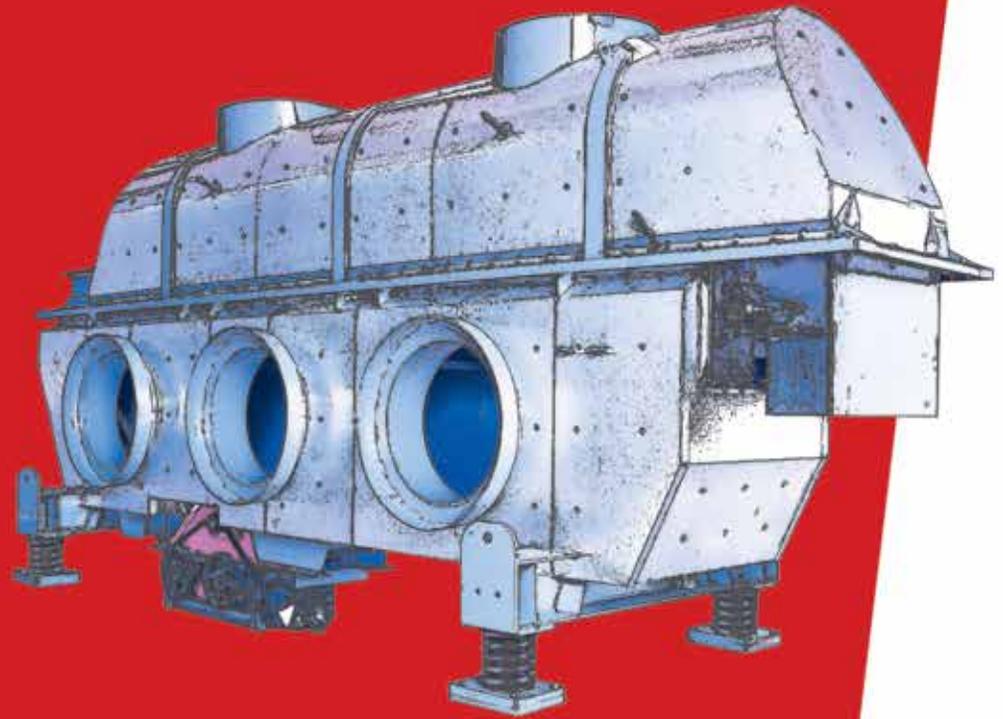
The potash industry around the world needs ways to optimize their operations given the potential fluctuation of market prices that ultimately impact a producer's success. Equipment upgrades allow potash mines and mills to reduce maintenance and operational costs. Engineered equipment upgrades can help potash producers increase capacity, improve reliability, increase employee safety, reduce maintenance costs, and develop more efficient operations in underground mines and above-ground mills and refineries.

The Saskatchewan Research Council (SRC) has been assisting the potash industry since the 1960s by providing robust

mineral processing and metallurgical testing experience and technologies from lab scale to pilot scale for pre-feasibility, feasibility, and engineering studies. SRC has also provided stack sampling services to help industry meet environmental obligations. These services are now complemented with industrial engineering services focused on equipment and circuit upgrading.

Engineered equipment upgrades are central to the development of solutions that enable mine operators to lower their operational costs. These services help improve the lifespan and reliability of components, such as screens, bucket elevators,

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SRC has helped potash processing facilities address a wide range of problematic equipment and assets, including:

- Mechanical drive upgrades to optimize component life (support frames, vibration isolators, bearings, seals, belts, sprockets, sheaves, fasteners, and welds)
- Blower and pump performance
- Vibration management
- Screening optimization
- Design of customized clarifiers, flocculent make-down and dosing systems, sieve bends, mix boxes, tanks, chutes, hoppers, stands, mezzanines, stairs, and walkways
- Assessments and upgrades for cyclones, wet scrubbers, bag houses, and electrostatic precipitators
- Failure analysis services
- Preventative maintenance training
- Practical engineering design courses

Failure analysis techniques involve quantifying the chemical composition of metals and establishing any localized variances within, such as inclusions or migrations (such as chromium loss in a metal). In addition, metallography can be conducted to evaluate the microstructure associated with surface hardening, work hardening, and welding. In SRC's experience, failure analysis increases

the reliability of engineered equipment upgrades because of the shared focus on failure prevention and life extension.

SRC's expertise enables clients to pursue continuous improvement by addressing troublesome assets through engineered refurbishment and remediation. This improves reliability and integrity without the capital costs associated with replacing equipment. SRC uses its extensive experience to tailor services to a clients' unique needs, including the provision of design, design-education, and design-build services. In addition, the provision of operational support for equipment upgrades includes installation instructions, standard operating procedures, and maintenance training.

The services from SRC's Industrial Engineering group are crucial to engineering equipment upgrades that increase safety and reliability, while SRC's Advanced Instrumentation and Tools Initiative complements these services by helping the potash industry develop advanced technologies for mining activities. Optimizing equipment and components are critical services that the potash industry needs to reduce maintenance and operational costs associated with potash mines, mills, and refineries.

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. ♦



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TRIO being used to form tunnel walls.

K+S Group, one of the world's largest potash producers and number-one producer of salt, has invested over \$4 billion in a new potash mine development northeast of Moose Jaw, Saskatchewan. Once completed, the facility will be the first potash mine constructed in the province for nearly 40 years. When operations begin, production is expected to be around 2.86 million tonnes per year.

PERI worked closely with sub-contractor FWS Industrial Ltd. to provide cost-effective formwork solutions for various elements of the project including: TRIO/MAXIMO for tunnel walls, SKYDECK for the tunnel roof slab, and customized VARIO panels for buttresses. Due to the aggressive schedule, systems that were simple, fast to work with, and easily cycled (to suit the repetitious nature of the structure) as specified by the customer.

Tunnel walls were cast in 30-metre sections, and the minimal components required per square foot of the TRIO system meant quick, systematic assembly of ganged panels was possible. The large craneable units also reduced cycle time when moving the shutters from one pour to another.

For the tunnel roof slabs, SKYDECK provided an ideal solution. The lightweight components, in conjunction with the SKYDECK Drophead, meant quick erection/striking of the material was possible, and resulted in reduced turnaround times

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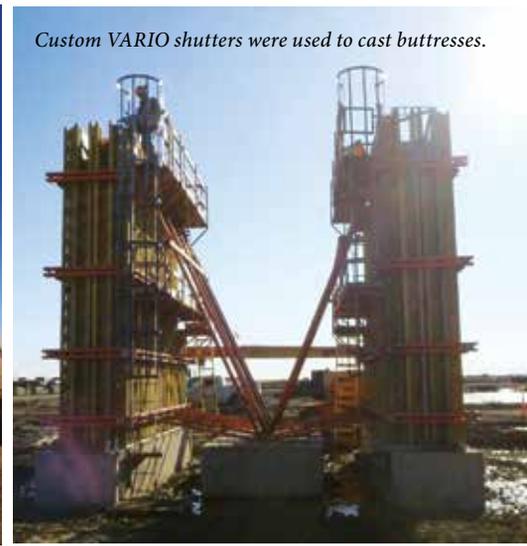
CABLE PULLEY



TRIO for tunnel walls (foreground), and VARIO in place for the buttresses (background).



The resultant finish achieved by using VARIO.



Custom VARIO shutters were used to cast buttresses.

for each slab section. This was particularly important on this project because of the site's geographical location and the effect cold winter temperatures have on concrete curing time. To keep costs to a minimum, the design proposed by PERI utilized PEP props; this was possible as the structural dimensions were relatively small, resulting in narrower bay sizes for the SKYDECK system. This, in turn, meant shoring loads were within the ca-

capacity of the PEP prop and the customer was able to benefit from the cost savings over the stronger, but more expensive MULTIPROP.

The buttress walls were formed using VARIO. This allowed a high pour pressure while minimizing the number of ties per square foot as much as possible. As the VARIO formwork system allows a selection of plywood, barrier

film was chosen to face the panels; this produced a consistent, blemish-free finish even with high utilization and re-use of the shutters. Each buttress had a battered face. To reduce erection, striking, and re-use time, the VARIO shutters were assembled into a simple rectangular shape, with a timber box-out constructed and fixed to the panel, which provided a sloping face to the poured concrete. ♦



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CanNorth takes potash companies under its wing

How an environmental consulting company is helping potash companies assess risk to bird populations

By Alyse Kambeit



CanNorth's experienced and interdisciplinary team has been actively working with potash proponents and regulators to reduce and/or eliminate risk to birds while navigating changes to best management practices (BMP).

Bird populations are declining on a global scale and the main culprit? Cats. While mining activities are among the lowest contributors to the declining bird populations, nevertheless, the potash industry has responsibilities regarding protecting birds. That's where Canada North Environmental Services (CanNorth) comes in.

As one of the largest environmental service providers in western Canada, CanNorth prides itself on its scientific integrity, ability to effectively meet clients' needs, and commitment to safety and quality. The company's technical skills, knowledge, and per-

formance are recognized by a variety of certifications, including ISO 9001:2008 (quality management), ISO 14001:2004 (environmental stewardship), and OHSAS 18001:2007 (occupational health and safety) International Standard certifications. CanNorth is also a Certificate of Recognition (COR) program certified company and is registered with ISNetworld.

CanNorth's experienced and interdisciplinary team has been actively working with potash proponents and regulators to reduce and/or eliminate risk to birds while navigating changes to best management practices (BMP). One such change pertains

to Environment and Climate Change Canada's new BMP that no longer recommends nest surveys in complex, undisturbed habitat to reduce risk to birds. This change has resulted in the new standard BMP of avoiding work during the breeding bird season. As the breeding bird season typically spans from April to August and overlaps with many potash industry activities, such as exploration, construction, and operations, it is quite challenging for the industry to adhere to this new BMP, which is where CanNorth can help.

CanNorth has been assisting a variety of potash mines develop alternative practices that allow work to proceed from April to August, while mitigating risk to birds. Feasible Avian Risk Assessment Programs that ensure due diligence during the breeding bird season are the potash industry's solution, and CanNorth is providing companies with the necessary tools and experience needed for the implementation of such programs. A few key components to these programs include:

- A *Migratory Bird Conservation Act* (MBCA) guidance document;
- An MCBA awareness presentation;
- Standard operating procedures;
- Bird surveys to establish species composition/distribution and habitat within project areas; and
- Comprehensive habitat risk-based maps and pertinent mitigation options.



CanNorth has been assisting a variety of potash mines develop alternative practices that allow work to proceed from April to August, while mitigating risk to birds.

As expected, the transition to the new BMP has spurred a variety of permitting and approval processes that potash companies have successfully navigated with CanNorth's help. To contribute to the potash company's success, CanNorth maintains active communication with federal and provincial officials to ensure the most recent information, including any changes to legislation, policies, and/or recommended approaches that aim at preventing harm to migratory birds and their habitats, is available to its clients.

Ultimately, careful design and planning of an Avian Risk Assessment Program can mitigate risk to birds from potash industry activities during the breeding bird season - under CanNorth's capable wing. ♦



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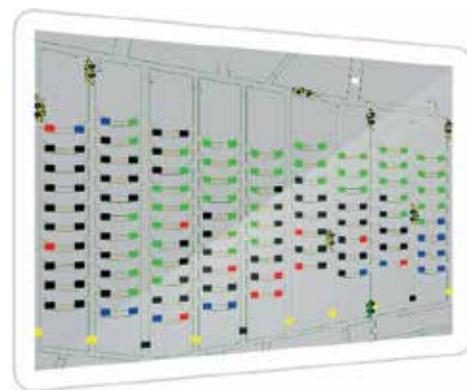
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Specializing in the mining industry

Dynamic process simulation for the potash industry



A broader range of dynamic process simulations are now included in SRK Consulting's portfolio of mining services. These simulations help companies mining potash and other minerals to predict future performance and thereby optimize productivity and avoid costly mistakes.

The expansion of SRK's services results from its recent merger with Labrecque Technologies Inc. (LTI). Although newly formed, the SRK simulation group includes specialists who have been applying mechanical and industrial engineering methods to potash and other mining for over a decade. The group employs a systems approach, with models accounting for interactions and interferences between all aspects of ore flow systems and mining equipment. By building discrete event simulation models, SRK helps clients plan expansions, evaluate design and process options, identify and overcome bottlenecks, predict performance, optimize development and

production schedules, and assess the impacts of incorporating new equipment and technology into existing systems.

Using their extensive experience in simulating mining processes for the potash industry, the SRK group's experts have created models for processes ranging from entire face-to-mill material flow down to focused characterization of individual mining system components. They have performed several trade-offs comparing the performance of drill and blast with mechanical excavation, as well as combining both processes in a single operation. Material handling studies conducted by group members have included modelling the performance of shuttle cars, flexible conveyor trains, fixed conveyors, load-haul-dump (LHD) loaders, trucks, crushers, skips, and rail haulage. Detailed models have addressed factors such as pick changes, equipment availability, tramming speeds, shift schedules, traffic interactions, layout constraints, excavation sequencing, and stockpiling.

SRK's simulation group takes an unbiased, customized approach to understanding how the specific details of each project affect its overall processes. The digital platforms that the group creates characterize critical interdependencies, identify limitations, and highlight opportunities that are key to the success of clients' operations. The quantitative data generated by the simulations supports real-world decisions on asset management and utilization, and the establishment of best practices to benefit the potash mining industry.

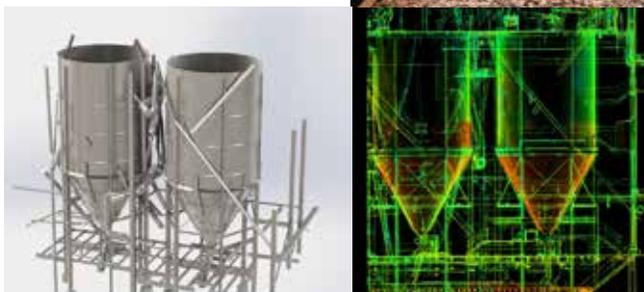
With the demand for simulation through computer modelling continuing to grow rapidly, SRK's augmentation of its simulation expertise will further its ability to identify and mitigate risks to potash projects, optimize operations to improve their efficiency, and ultimately reduce costs.

About SRK Consulting

SRK Consulting is an independent, international consulting practice that provides focused advice and solutions to clients, mainly from earth and water resource industries. For mining projects, SRK offers services from exploration through feasibility, mine planning, and production to mine closure. Please see www.na.srk.com for more information, or get in touch with Pierre Labrecque, principal consultant, SRK Consulting (Sudbury), plabrecque@srk.com. ♦



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Mining for zero injuries in Saskatchewan

In 2008, Saskatchewan had the second-worst workplace injury rate in Canada. The province's total workplace injury rate was at 10.21 per 100 workers.

In response, in May 2008, WorkSafe Saskatchewan – the partnership between the Saskatchewan Workers' Compensation Board (WCB) and the Ministry of Labour and Workplace Safety – launched the ambitious goal of Mission: Zero. Mission: Zero is a call to action and culture change for leaders, employers, and workers to achieve zero workplace injuries, zero fatalities, and zero suffering.

"It was time to put a stop to injuries happening in the workplace and end the suffering of injured workers and their families," said Phil Germain, the WCB's vice-president of prevention and employer services. "Preventing injuries does more than save lives; it also has a positive impact on the economy and business. Injuries are a significant drain on resources that add no value to workers, customers, or businesses. All workplace injuries and deaths are preventable. We need to work together to achieve Mission: Zero. It's a goal we're still striving to reach today."

Since the launch of Mission: Zero, there has been a steady decline in workplace injury claims. In 2013, Saskatchewan's total injury rate was 7.80 per 100 workers. Saskatchewan's 2017 total injury rate is at its lowest rate in 65 years at 5.25 per 100 workers, a decrease of almost 50 per cent since 2008.

In 2017, for the second year in a row, 88 per cent of Saskatchewan employers achieved Mission: Zero.

"This remarkable achievement is because of the efforts of employers, workers, safety professionals, and leaders in our communities," said Germain. "With so many people leading by example, injuries have been prevented and lives have been saved."

Total injury rates for the mining industry have also largely improved over the last five years. In 2013, the average combined injury rate for open-pit mining, underground softrock mining, and underground hardrock mining was 7.46 per 100 workers. The lowest total injury rate was 6.03 per 100 workers in the underground hardrock mining industry, and the highest total injury rate was 14.40 per 100 workers in the open-pit mining industry.

In 2017, the average combined injury rate for those same industries combined decreased to 5.94 per 100 workers. The lowest total injury rate was 4.04 per 100 workers in the underground hardrock mining industry and the highest total injury rate was 14.15 per 100 workers in the open-pit mining industry. Only the underground hardrock mining industry's total injury rate was below Saskatchewan's total injury rate of 5.25 per 100 workers in 2017. Over all three mining industries, in 2017, the top two main causes of injury were bodily reaction and exertion, and contact with objects and equipment.

Throughout all industries province-wide during the past 15 years, Saskatchewan has seen an average of 37 workplace-related deaths per year. Last year was the lowest year in the past 15 years at 27 deaths. Sadly, as of Sept. 30, 2018, the WCB has accepted 40 claims for workplace deaths. The leading causes of death for these 40 workers are motor vehicle crashes and occupational diseases, such as lung dis-



Work to live.

Chart 1: Total injury rates in the mining industry, 2010-2017

Total Injury Rate

Industry	2010	2011	2012	2013	2014	2015	2016	2017
D71 - Open-Pit Mining	9.95%	14.58%	14.64%	14.40%	7.46%	6.59%	11.88%	14.15%
D72 - Underground Softrock Mining	10.94%	9.01%	7.83%	7.25%	7.28%	6.51%	13.50%	5.44%
D73 - Underground Hardrock Mining	12.52%	11.73%	9.55%	6.03%	5.06%	3.54%	3.77%	4.04%

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Chart 2: Time Loss injury rates in the mining industry, 2010-2017

Time-Loss Injury Rate

Industry	2010	2011	2012	2013	2014	2015	2016	2017
D71 - Open-Pit Mining	0.69%	0.47%	0.75%	1.69%	2.28%	0.90%	3.25%	1.78%
D72 - Underground Softrock Mining	1.27%	1.11%	1.19%	0.77%	0.78%	0.98%	0.65%	0.73%
D73 - Underground Hardrock Mining	1.17%	1.54%	1.12%	1.16%	0.66%	0.51%	0.52%	0.64%

eases and cancer. Of the 40 deaths in 2018 so far, 43 per cent were related to occupational diseases and 57 per cent were traumatic deaths like motor vehicle crashes, falls, and electrocutions.

So far in 2018, there has been one fatality in the open-pit mining industry. From 2010 to 2017, there were no fatalities recorded in open-pit mining and underground hardrock mining. In underground softrock mining, there was one fatality recorded for every year from 2010 to 2017 with the exceptions of 2013 and 2017 where no fatalities were reported, and in 2010 when two fatalities occurred.

“There are too many workers not going home at the end of the day,” said Germain. “This is not acceptable.”

Developing research and trends suggest that building a culture of health and safety, both on and off the job, will have a positive impact on workplace injuries and fatalities. The Saskatchewan WCB is beginning to shift prevention initiatives in this direction. The WCB has taken steps to define serious injuries and is currently completing an analysis. The Saskatchewan WCB’s serious injury definition includes claims that meet specific criteria and include claim characteristics that are both life threatening (fatalities and contact with high-energy sources) and life altering (amputations and loss of mobility).

“We applaud the efforts that have reduced the province’s total injury rate by close to 50 per cent in the last 10 years. These efforts have not gone unnoticed, however, we’re now looking to place a renewed focus on understand-

ing the causal factors related to serious injuries and fatalities, and in turn, gain new prevention insights,” said Kevin Mooney, the WCB’s director of prevention. “Our preliminary analysis points to a consistent pocket of serious injuries in Saskatchewan and research points to the positive effects that the reduction of serious injuries has on a jurisdiction’s overall fatality rate and total injury rate. We’ve got a real opportunity here. Achieving Mission: Zero is the collective efforts of multiple parties working together – from individuals to organizations to leaders.”

WorkSafe is continuing to educate employers and workers to eliminate workplace deaths. WorkSafe uses a targeted approach to help industries and employers improve workplace health and safety.

In 2010, WorkSafe Saskatchewan and Safe Saskatchewan launched and promoted the Health and Safety Leadership Charter. This charter exists as a foundation for a cultural shift in the way leaders view injuries and injury prevention.

Since the charter launched on June 10, 2010, more than 650 companies have signed it, subscribing to seven principles for health and safety.

“Everyone who’s signed the charter has made a commitment to making Mission: Zero a reality in this province,” said Germain. “Together, we can make sure everyone returns home from work safely to be with their families.”

To learn more about Mission: Zero, preventing injuries away from work, and the Health and Safety Leadership

**Mission:
Zero by the years**

2008

At the WCB Annual General Meeting, WorkSafe Saskatchewan launches Mission: Zero as a call to action for workplace safety.

2009

Safe Saskatchewan adopts Mission: Zero for all walks of life – work, home, and play.

2010

The first Health and Safety Leadership Charter signing event is held, and 127 leaders sign the charter, promising to uphold seven principles of health and safety.

2012

Magna Electric Corporation is the first partner to place the Mission: Zero logo on company vehicles.

2012

35,000 pairs of safety glasses distributed within schools and communities, made possible by a number of community partners.

2018

More than 650 companies to date have signed the charter.

Charter, visit www.safesask.com.

For resources on how to prevent workplace injuries, employers and workers can reach out to their industry safety association, or by visiting the WorkSafe Saskatchewan website at www.worksafesask.ca for practical steps to prevent workplace injuries and deaths. ♦



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is a company focused on offering pump sales, pump service/repair, pump rentals, dredging and dewatering. NFIT has been in business for over 10 years and has been focused on pumps and pump-related markets and services since the start. Products and services include manufactured pump stations and dewatering stations, pump sales, pump/hose rentals, pump repairs, parts and accessories, hoses, dewatering, evaporation, filtration, screen sales and dredging.

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CMI continues to develop innovative solutions for the mining industry with our CMI-EV-1730 Battery-Powered Mancarrier

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 make sure 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.

The next generation of mining will be working to expand and maximize the use of electric equipment to minimize the emissions and operating costs associated with diesel equipment. The reduced ventilation requirements will allow mining companies to increase productivity within their operations. This shift does not come without its challenges. Mine operations have experienced reliability issues with batteries and mechanical components. The high cost of infrastructure for charging systems is prohibitive to some operations to implement these new strategies. We have used our process to develop our new CMI-EV-1730 Battery Powered Man Carrier. CMI's designs have taken all of these issues into consideration to provide the optimum solution for all mining applications.

First we started with a proven chassis. We have utilized the Club Car Carryall 1700 chassis, as it is already proven in the Saskatchewan potash mines. In this application, this chassis has well over 11,000

hours of service with minimal repair requirements. This chassis has a 1,600-lbs. rated capacity and it also comes with a certified modular ROPS with an optional 72-inch low-profile version to meet the needs of any mining industry. Next, CMI adds our battery-powered drive system into this chassis. Our system is designed with modular construction for ease of maintenance. We have six main components, the drive motor, programmable drive controller, lithium iron magnesium phosphate batteries, battery management system (BMS), control box, and the charger. Our system is designed to protect the mechanical components from failure due to the torque capacity of the electric motor system. The control system will monitor overall system current and the allowable time at high-current loading can be adjusted to meet the needs of the operation while preventing abuse. This control system also allows a number of other safety options to be added, such as inclinometers or impact monitoring, and is designed to provide maximum reliability. This reliability is backed by a five-year battery warranty. There are many models

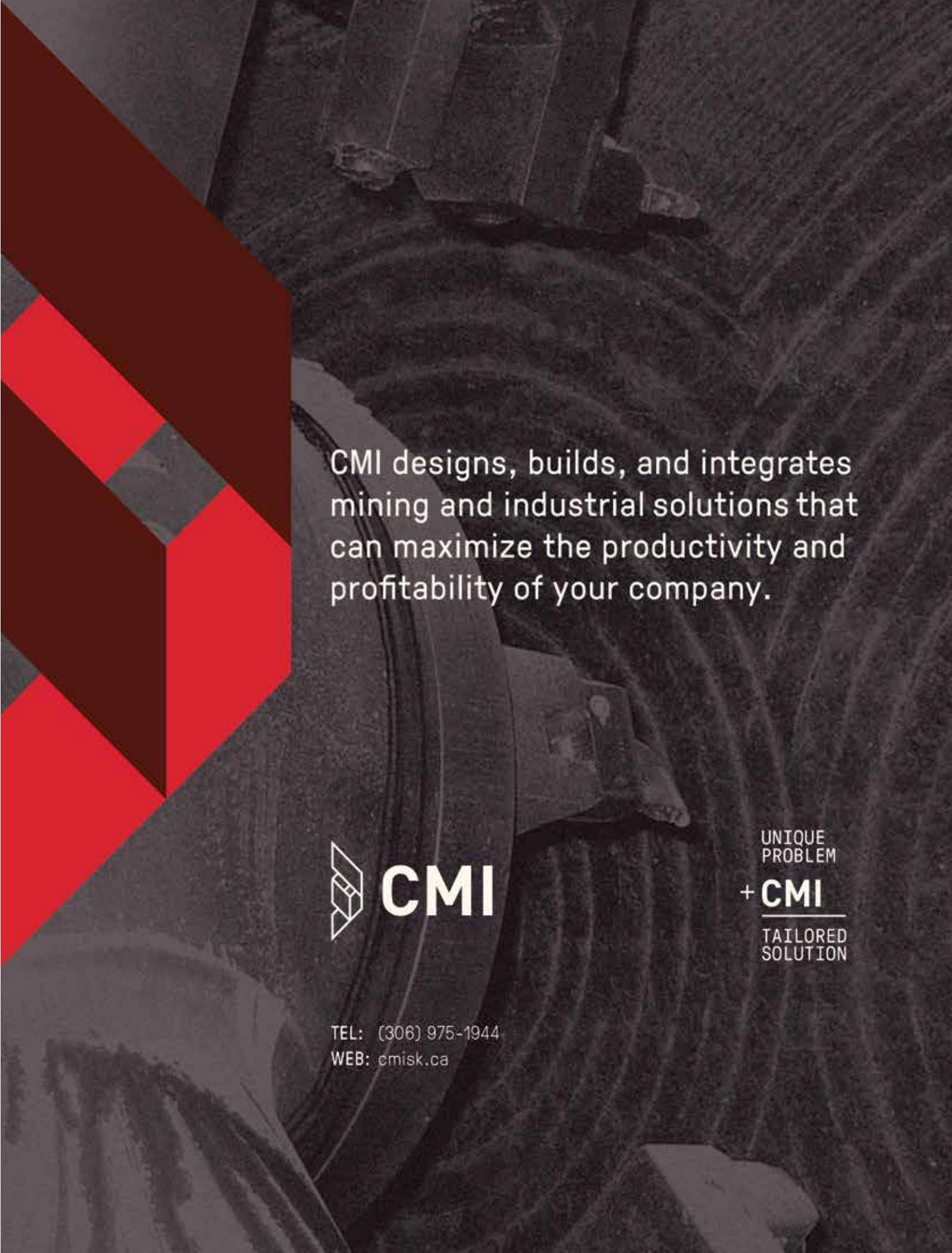
available with battery capacities up to 210 Ah with an estimated range (without regenerative braking or opportunity charging) of 60 to 75 kilometres.

Our regenerative braking system is designed to provide a third means of braking while it maximizes battery life and minimizes brake maintenance. The system is designed to bring our vehicle to a full stop on a ramp, and the degree of braking can be optimized based on our customers' unique mine conditions. To maximize opportunity charging while eliminating any costs for a major charging infrastructure, our unit is equipped with an onboard charging system. This system can plug into any 110 or 220 volt plug throughout the mine which allows for opportunity of charging during lunch and coffee breaks.

CMI has produced a battery-powered man carrier that can be tailored to the unique requirements of any customers' mine. We look forward to working with you to optimize your fleet and reduce the emissions to maximize your overall efficiency. ♦



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Keeping your secrets safe

The basics of a non-disclosure agreement



By Matthew J. Bennett,
lawyer at McKercher LLP

A non-disclosure agreement (NDA), also known as a confidentiality agreement, is a form of contract used in business relationships to protect proprietary business information not otherwise generally known to the public. This might include product ideas and designs, pricing strategies, marketing methods, accounting and financial information, business practices and processes, and lists of customers and suppliers, to name only a few. NDAs are a useful way to allow parties to have sensitive commercial discussions with some comfort that the information revealed will not be used improperly or be disclosed beyond its intended recipients. This can be vitally important for start-

up businesses seeking funding or strategic advice, or for established businesses dealing with a competitor or an unfamiliar party on the other side of the table. NDAs can be mutual, so that both parties have obligations to protect the others' information, or one-way; in both cases the recipient of the others' proprietary information has an obligation to use the information only for the intended purpose and to protect that information from being disclosed to unauthorized third parties.

The first step in preparing an NDA is to determine the purpose of the proposed business relationship, the nature of the information necessary to that purpose, and consequently the information to be protected by the agreement. The party

receiving the confidential information should only be permitted to use it for the purpose set out in the agreement, and the conclusion of that purpose typically triggers the return or destruction of the confidential information to ensure that it cannot be accidentally disclosed or improperly used after the fact. The parties should define the purpose carefully to ensure that they have sufficient flexibility to assess the merits of the proposed transaction but, at the same time, will not reveal more information than reasonably necessary or allow information to be shared indiscriminately with employees, subsidiaries, consultants, or others that need not have access to that information.

Parties should also be clear on what

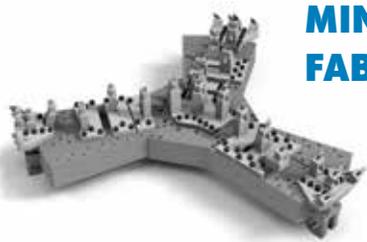


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McKercher LLP has a specialized team of lawyers and support staff dedicated to providing advice to local and international clients in the oil patch, potash industry and other natural resource sectors. Our mining and natural resource practice includes specialized mining agreements, acquisitions & dispositions, financing, regulatory issues, environmental concerns, First Nations & government relations, and litigation.

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



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information is covered by the NDA. An NDA should cover all sensitive information that a party receives as a result of the relationship, but should not cover information the receiving party may have already had before entering the NDA or otherwise may legitimately obtain from a third party during the term of the agreement, or after its expiry. In other words, you cannot use the NDA to prevent someone from using or disclosing information sensitive to you which they may have otherwise legitimately obtained. Where only certain information requires protection, parties should consider labelling or otherwise identifying the sensitive information to differentiate it from other information that does not need protection.

There may be a tendency to draft highly restrictive agreements to exercise greater control over the dissemination of business information, but there is a danger in doing so, as courts in Canada have been reluctant to enforce overly broad NDAs that place unreasonable limits upon the receiving party or the marketplace. Therefore, you should be as specific as possible in defining the

information you wish to protect and the extent to which it may be used or disclosed. Factors to consider regarding the enforceability of an NDA include:

1. the extent to which the information is known outside the business of the disclosing party;
2. the amount of money or effort expended by the disclosing party in developing the information;
3. the value of the information to the disclosing party and its competitors;
4. the extent to which the information is known by employees and others involved in the disclosing party's business;
5. the useful life of the information being protected; and
6. the ease or difficulty with which such information could be otherwise legitimately acquired or duplicated by others though their independent effort.

Ultimately, an NDA is just a piece of paper and can never be absolutely effective in preventing disclosure of confidential information. Unfortunately, once the information is out, "the tooth-

paste doesn't go back in the tube". Therefore, your NDA should have enforcement provisions which allow you to limit your damage and/or recover the value of your losses resulting from improper disclosure of your proprietary information. It should be structured so that if the proprietary information covered by your NDA has been leaked by the receiving party, then you may sue that party for monetary damages and/or injunctive relief. Monetary damages are a cash award intended to compensate you for your lost profits or the value of your lost opportunities resulting from the improper use or disclosure of your confidential information. Obtaining adequate monetary damages can be difficult, particularly because it involves speculating on future sales or profits. Alternatively, you may seek an injunction to (i) stop a party from using the information and/or (ii) prevent leaked information from spilling further into the marketplace. Injunctive relief is a court order preventing others from further disclosing the leaked information and/or from further using the leaked information. ♦

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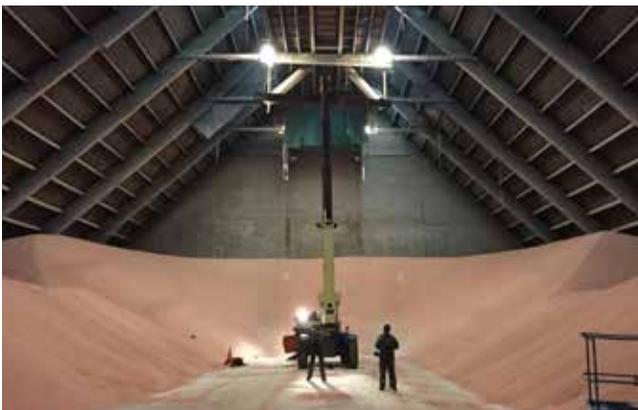
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ArrMaz helps producers optimize potash processing and product quality



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 globally.

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 depos-

it. 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. 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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Rotary versus fluid bed dryers for potash



FEECO potash rotary dryer with trommel screen.

When it comes to potash, drying is a key contributor to the quality of the end product, curing it to remove any moisture and ensuring that product integrity is maintained throughout its lifecycle.

Both rotary dryers and fluid bed dryers are widely accepted as a suitable drying solution throughout the industry, with rotary dryers offering a few key advantages - listed in this article.

Reliable, continuous operation

One of the most attractive advantages rotary dryers offer is continuity in operation. Rotary dryers are largely insensitive to changes in feedstock or process inconsistencies, allowing them to continue to produce a uniform product despite process fluctuations. For this reason, they also require much less supervision compared to fluid bed dryers.

Tolerance to variation in feedstock

While variation in feedstock is less of a concern with potash, some variation in product can still occur.

Despite any such variance – be it in moisture content, particle size distribution, or otherwise – rotary dryers are able to continue producing a uniform product. Fluid bed dryers, on the other hand, are highly sensitive to any changes in feedstock, meaning even the smallest fluctuation has the potential to cause a process upset.

Tolerance to process inconsistencies

Similarly, unexpected changes in the production process, such as lapses in energy, changes in throughput, or unplanned shutdowns, are intolerable for a fluid bed dryer, quickly resulting in process upsets, cleanouts, and downtime.

Rotary dryers, however, are highly tolerant of changes in the production process. They continue to operate reliably despite such fluctuations, and can pick up where they left off in the event of a shutdown.

Increased capacity

Rotary dryers are also often favoured in the potash industry for the high throughput they can accommodate, up to 300 TPH in a single unit depending on the drying requirement. Fluid beds on the other hand, are closer to 100 to 150 TPH in capacity.

Reduced electrical energy consumption

Fluid bed dryers are often touted for the energy savings they can offer because they are more efficient from a heat transfer point of view, but because they need to run on lower hot gas inlet temperatures, the initial energy savings is negated.

Furthermore, rotary dryers require less electrical energy than fluid bed dryers. Fluid bed dryers require a much higher volume of air to fluidize and transport the material, in addition to the air required for drying, resulting in higher electricity costs. As well, this base level of required air for fluidizing and transporting the material means that costs are not reduced as much when operating at a reduced capacity when compared to a rotary dryer.



Rotary dryer flights.

Smaller air-handling system

Similarly, the constant high volume of air required by fluid bed dryers means that they require a much more extensive and costly air handling system which can add a lot of cost to the CAPEX.

More robust

Another important reason why rotary dryers have become the potash dryer of choice is their robust construction. Rotary dryers are incredibly durable, and as such, are relied upon in the most demanding settings.

Rotary dryers are designed for a nominal life expectancy of 25 to 30 years, but it is not uncommon for a rotary dryer to last 50 years with proper maintenance! They are also very customizable and can be tailored to work with any challenge potash may present.

A premium product

Rotary dryers also produce a highly refined potash product as a result of the tumbling and rolling action they impart. This is especially true of compaction granulation circuits, where drying is used as a finishing tool in the glazing process: potash granules are wetted and dried in order to create a recrystallized surface on the granule, reducing the opportunity for attrition to occur.

Granules produced via compaction granulation have jagged, angular edges, which rub against each other, causing product to break down into fines and dust. If a rotary dryer is used in the glazing process, however, the tumbling action polishes and smoothes the granules.



Potash pellets produced in the FEECO Innovation Center.

Conclusion

The potash drying process is a crucial component in producing a premium end product. Both rotary and fluid bed dryers offer a suitable drying solution, with rotary dryers offering an enhanced approach by providing a more reliable processing option, creating a more refined product, and offering increased efficiency along the way. For more information on potash rotary dryers, visit FEECO.com. ♦

Trust the experts

IWL Steel Fabricators



IWL Steel Fabricators
Trust the Experts



IWL Steel Fabricators is proudly 100 per cent Aboriginal owned by the Clearwater River Dene Nation of La Loche, Saskatchewan.

IWL Steel Fabricators was originally established in the 1950s in Saskatoon, Saskatchewan. IWL has a proven track record and continues to provide quality, cost-effective solutions to the potash, industrial, and construction market sectors.

IWL is proudly 100 per cent Aboriginal owned by the Clearwater River Dene Nation of La Loche, Saskatchewan. Clearwater River Dene Nation is the fourth generation of ownership at IWL, and is committed to growing and expanding the company to its full potential. Through the core competencies of the Clearwater River Group of Compa-

nies, IWL is able to provide full-service customer solutions for a wide array of projects, large or small. With three fabrication facilities, IWL has a multitude of options to best facilitate project execution.

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

IWL's Quality Management System is third-party audited via the Canadian

Institute of Steel Construction, ensuring best value controls, performance, and customer focus for the unique needs of our customers. The cornerstones of the system include full material traceability, specialized process controls and execution, focused project management, all levels of product verification, and subcontractor management. IWL is registered with ISNetworld as a certified subcontractor.

IWL is signatory to Mission: Zero and supports the goal of a workplace with zero injuries. IWL puts safety first, empowering all employees to identify safe work practices, establish best practices



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IWL is signatory to Mission: Zero and supports the goal of a workplace with zero injuries.



With professional engineers on staff working in conjunction with external engineering firms, IWL provides an integrated approach to project solutions, optimized to their customers' needs.

within our facilities, and maintain a safe work environment focused on complete injury prevention.

With professional engineers on staff working in conjunction with external engineering firms, IWL provides an integrated approach to project solutions, optimized to our customers' needs. Our CAD/CAM department uses 3D mod-

elling technology to provide detailed project analysis, support for customer requirements, and fabrication drawings for both shop and field use; as well as input data for our robotic fabrication equipment.

3D modelling provides a seamless transition from the design concept to the reality of fabrication. The direct interface

of modelling software to automated fabrication ensures the additional benefit of increased productivity, integrated project management, scheduling accuracy, reduced field cost, and maximum site efficiency.

IWL has invested in technology to ensure efficiencies throughout the fabrication process. At time of drawing issue, all pieces are assigned a unique barcode to track material from the fabrication stage through to painting, loading, and shipping to site. This barcode forms the basis of all material control documentation, throughout its fabrication lifecycle.

Barcode scanning also ensures precise, up-to-date shipping documents and eliminates the possibility of delivery delays or missing components. Through cell phone technology, IWL is able to facilitate barcode scanning on site, to further assist in material receiving and site storage.

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

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- Platework – tanks, chutework, pump boxes, surge bins, hoppers, and launders
- Material handling – conveyor galleries, belt conveyors, cross conveyors, mechanical soft drop systems, and bucket elevator casings
- Splitter gates, grizzlies, material gates, and pipe spools
- Platforms, stairs, handrails, and mezzanines
- ASME welding, sandblasting, painting, galvanizing, and installation services are available through our qualified subcontractors.

IWL Steel Fabricators brings a wealth of experience to the table in all types and sizes of projects. We pride ourselves on thinking outside the box, and offering a fresh perspective to our clients to ensure a successful project. ♦



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The science of pumping water



By Jim MacRae, Project Specialist, Ketek Group

If you've ever thought about it, you might have thought pumping water is simple: Hook a pump to a couple of hoses, turn it on and away you go.

Nothing could be further from the truth. Pumping water, especially large volumes over long distances, is a science that involves calculations of atmospheric pressure, volume, flow, friction loss, and more.

The basic premise is that pumps work by creating a vacuum. Nature, which abhors a vacuum, searches for a way to fill it. If the pump is connected to a suction hose and the other end of that hose is immersed in water, the weight of the atmosphere pushing down on the surface of the water will force it into the hose and up to the

pump. The impeller in the pump will then push the water along the discharge hose.

The calculation of atmospheric pressure is crucial to choosing the right pumps. As you may remember from high school science class, the weight of the atmosphere pushes on the surface of the Earth. If the planet's surface were perfectly round, the pressure (at sea level) would be 14.7 pounds per square inch (PSI) everywhere. But it's not. So atmospheric pressure increases at low elevations (where there is more air above you) and decreases at high elevations.

Atmospheric pressure of 14.7 PSI will force a column of distilled water to rise 33.9 feet in a vacuum. Of course, water

to be pumped is never distilled – it's usually coming from a river or lake or from an underground well. So the rule of thumb is that most pumps can lift water 20 feet. But even that calculation is just a beginning, as the pumps actual efficiency will be affected by temperature, humidity, suspended solids, and the inability of the equipment to create a perfect vacuum.

Then there's friction loss and "head" to consider. Friction loss is the loss of pressure that occurs because, as the water tumbles through the pipe, it encounters resistance from other water molecules and from the sides of the pipe, which might be rough. "Head" is the height to which a pump can raise water. If you have



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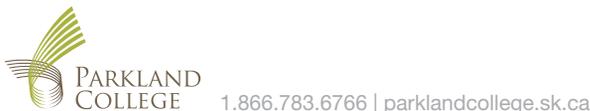
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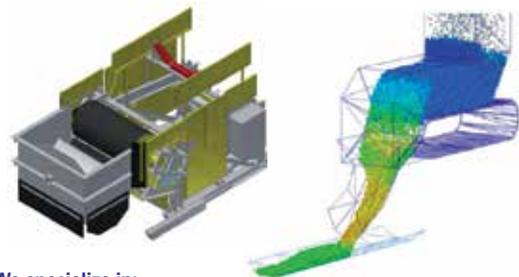
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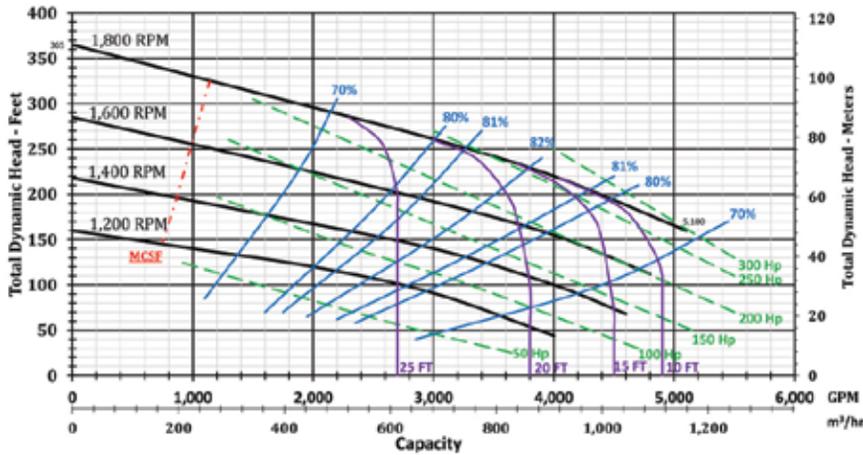


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Think of each pump as a runner in a relay race. As one pump is almost exhausted it passes the water to the next pump, which is fresh!



A typical pump curve showing the “head” a pump can generate at different RPMs and the flow it will be able to achieve. The pump’s sweet spot will be somewhere in the middle of the lines.

to pump water up 30 feet and your pump doesn’t have at least 30 feet of head, it won’t work.

Many pumps need to be primed before operation. Prime refers to the suction hose being water tight. Air bubbles in the water can implode and cause a shockwave known as cavitation, which damages the pump surface. This is a potentially dangerous problem as cavi-

tation can cause the impeller casing to explode and send metal shards flying.

Each pump will have an operational sweet spot which can be seen on a pump curve, which is a graphical representation of the pump’s performance characteristics. For complex jobs, where multiple pumps are required, it’s best to prepare a profile of the entire job. Think of each pump as a runner in a relay race.

As one pump is almost exhausted, it passes the water to the next pump, which is fresh! You don’t want the pumps to be too close together or you’re wasting energy. If they’re too far apart, the water won’t get there.

Even with all the calculations, it’s important to remember that every pump is unique and requires a knowledgeable operator. Improper operation can lead to property damage and serious personal injury. Pump operation can be particularly tricky in cold climates, where snow and ice add to the challenges. Be sure to use a company with the experience to determine which pump, or pumps, are right for the job.

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Mine Supply Company: Over half a decade serving Saskatchewan's potash industry

Mine Supply warehouse supervisor, Wes Champ remembers driving some parts out to B.C. overnight to ensure the client had them when they needed them the next day. More than once. That's the kind of service you get when dealing with this Saskatoon-born company, serving mining operations across Western Canada since 1966. With over 50 years of operation, the company has continually modified its focus to reflect the needs of clients and the ever-changing demands of an industry that is constantly in flux.

The Potash Company of America became the country's first potash producer in Canada when Patience Lake began operations in 1958. At this time, mine development kicked into high gear across Saskatchewan's Prairie Evaporite Formation. Duval Sulphur & Potash was building a potash mine at Cory (still in operation today by Nutrien) and expressed their frustration at the lack of regional mine supply companies to their lawyer, Regina-based Jim Balfour. Balfour took an idea to his longtime friend Warren Champ, and Saskatchewan's first mine supply company was born.

Until the province's potash mines came online in the late 1960s, the world's potash market centred around operations in Carlsbad, New Mexico. Champ and Balfour headed down to America's potash basin to see the industry in action and connected with Elmer Skinner, owner of The Mine Supply Company, serving the region's potash mines since 1946. That connection led to a partnership and the creation of Mine Supply Company. Champ and Balfour decided to centre operations in Saskatoon, with major potash operations centred around the city and hard rock mining to the north.



Jack Merrick and Tom Champ testing out products at site in the late 1980s.

Mine Supply Company's focus in the early days was on providing consumables to the mining contractors building the headframe and sinking the shafts. When production began to amp up around 1970, Mine Supply switched its focus to underground equipment and consumables. The Mine Supply Company of Carlsbad was the distributor for American Brattice Cloth (ABC), so naturally that relation-

ship shifted to the Canadian office and eventually led to the establishment of ABC Canada. ABC Canada remains an important Saskatchewan manufacturer and one of Mine Supply Company's most valued brands.

Mine Supply Company has always focused on developing brand relationships that best serve client needs. In the 1990s, this meant further diversi-



Warehouse supervisor, Wes Champ, at Mine Supply Company's Saskatoon warehouse.

ifying its product lines to include new focuses on ground support for clients in northern B.C. and Saskatchewan, underground lighting for mobile equipment, and specialized underground doors. Increased potash production

schedules in the 2000s meant a strong focus on Continental Conveyor systems (now Komatsu), as mines ran at their highest capacity. The company has made its mark at every site across the province.

Right from the beginning, a dedication to customer service drove Mine Supply Company employees.

"No matter what product we were selling, we always knew we were in the service business," says Champ. "When Jack Merrick joined the company in the 1960s, he quickly became a legend in the industry. He believed you did whatever was needed to make the customer happy. And that's how the company has always done it, whether that means driving overnight to B.C., Esterhazy, Grand Cache, or wherever. We help our clients get the job done."

Mine Supply Company employees remains in touch with end-users at site, working with them to develop solutions for site-specific issues, and working to align products with the clients' production goals. To find out more about this Saskatchewan company and its premium product lines, visit www.minesupplyco.com, or call the office to connect with their sales team at 306-653-1056. ♦



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With multiple systems, Imperial Pipe spincasts three-inch through 54-inch diameters.

The most commonly recognized solution for pressurized liquid conveyance is carbon steel pipe, and the most cost-effective interior protection for carbon steel pipe is cement-mortar lining. Mortar-lined carbon steel pipe is used worldwide in potable water systems, raw water systems, brine transport, and a multitude of injection, extraction, and processing applications.

Mortar linings are available in a variety of mixes: American Water Works Association's standard C205 for potable water, American Petroleum Institute's RP-10E for oilfield applications, etc., employing combinations of Portland cements, Well Cements, Ca cements, and optional pozzolanic additives.

Potash solution mining, however, relies primarily on Pre-Krete G-8 due to its historically proven superior performance in combined high heat, pressure,

fine abrasive, and corrosive environments.

Industry-leading potash solution miners in Saskatchewan and elsewhere have successfully integrated Pre-Krete G-8 mortar-lined carbon steel pipe into their systems for many years. Their material choice is based on the economic combination of suitability, durability, reliability, enhanced rigidity for buried service, ease of installation, and other factors.

Imperial Pipe's Pre-Krete-lined carbon steel pipe is an integral element of numerous mining systems, from the most venerable to the newest installations in Saskatchewan. Imperial's pipe is present throughout the harshest high-volume pathways of potash solution, cavern development, well collection, return lines, and on into the processing modules. Imperial's pipe is operating throughout North America in over 100 kilometres

of piping systems from 75mm through 915mm diameters.

Imperial Pipe has invested decades developing our products, along the way delving into and mastering the melding of cement mortar with carbon steel pipe through the spincasting process. Imperial recognizes that successful application of each mortar mix requires specific controls, treatments, curing and finishing methods, perhaps none moreso than Pre-Krete G8. In addition to the application and process controls, Imperial incorporates critical end-preparation and finishing details on every part we produce, ensuring the field installer can perform the most consistent and trouble-free assembly possible. The crowning achievement of this R&D is an SOP that reliably produces the highest quality, most dependable products of their kind available.

Imperial has custom-designed and built many of our own machines, incorporating generations of mechanical process and procedural experience into highly refined equipment and operating procedures that are a cut above industry standards, all specifically focused on the intended task and the superiority of the end product. Along the way, we also developed and patented the Joint Lock Ring™, a new technology that finally allows CJP field welding on carbon steel pipe with various internal linings, including all types of cement mortar.

Imperial's commitment to excellence en-

compasses all of our manufacturing endeavours, including our state-of-the-art HSAW pipe mill, producing carbon steel pipe from 16-inches through 54-inches (400mm to 1,400mm) diameters, and up to 5/8-inch (15.8mm) steel thickness, for waterworks, mining, structural, and other applications. The full range of which we then line, coat, fabricate, and finish into engineered systems meeting our customers' requirements.

Imperial's manufacturing scope is further complemented by our team's ceaseless dedication to first-class project management-driven customer service.

We include technical project support and industry-relevant advice from the initial inquiry and project initiation, then continue with project planning, impeccable real-time production communication, inspection coordination, product traceability, and logistics management... complete uninterrupted support from concept to jobsite delivery trench-side, equaling one sole pipeline solution.

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Fletcher Scaling Vehicles

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 seven feet (2.1 metres), up to a high-reach scaling vehicle, working in heights of up to 52 feet (15.8 metres).

With a Fletcher scaler, all scaling is performed from a stabilized carrier designed to aid in eliminating bounce and vibration of the operator's cab. The ergonomically designed cabs are designed for optimum comfort and visibility, allowing full view of the scaling.

The Fletchbus System

The latest in development for Fletcher's scaler product line is the Fletchbus system. The Fletchbus system works as a smart hub for machine operations and data collection. In other words, the system works as a port of communication between the operator and machine, by interpreting to the operator what the machine is doing, and to the machine what the operator wants it to do.

With the Fletchbus system, customers will receive more interlock features, safety features, diagnostics, flexibility, and an increase in performance.

The system is equipped with a home screen display specific to the machine. Through this screen, the operator can perform machine functions and view an active dashboard for machine statistics. The operator also has the ability to review schematics, circuits, and feedback information through the home screen display.

Within the Fletchbus system, Fletcher offers the Scalerometer feature. The Scalerometer is designed to show various sensor readings that are monitored during scaling, providing operators pressure feedback via bar graphs. Included are sensors for boom lift pressure, boom extend pressure, pick pressure, and tool roll pressure. Each sensor has a menu set for a Warning and Trip setting that are monitored to prompt the operator with a red bar graph and warning icon when overexerted. The pressure value and time is logged into the display's memory whenever the Trip pressure level is exceeded. These sensors are passive and are not required for the machine to continue to function.

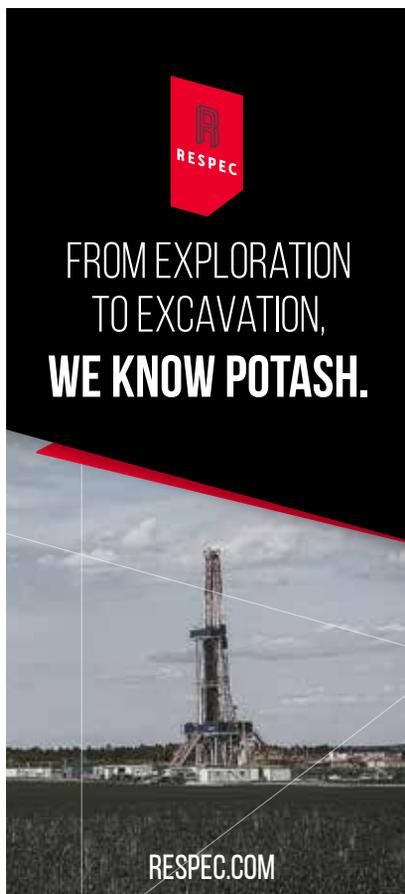
The Fletchbus system works to increase safety with the ability to incorporate a variety of interlocks into the system. This feature makes the state of functions mutually dependent. Interlocks aid in preventing the machine from harming its operator or damaging itself by preventing one element from changing state due to the state of another element. While Fletcher offers options for various interlocks and configurations, an example is the rock guard interlock. This limits the machine from scaling without the rock guard being in place to better protect the operator.

Fletcher customization

The capabilities of the Fletchbus system are determined by customer specifications. This allows Fletcher to program the system specific to each machine and accommodate any additional options. Because the system can be programmed in-house or on-site, adding and/or updating features has never been more flexible.

The flexibility of the Fletchbus pairs with Fletcher's ability to custom design equipment to mine conditions. This means customers are offered the ability to customize any model scaler, including the option for an enclosed filtered cab. Models are also available with either tire or crawler-driven carriers.

Some Fletcher models also offer the ability to remotely control functions via radio transmitter. This allows the operator to maneuver the machine from the exterior. As the handler operates with the remote, they can function the scaler with enhanced safety and vision of the area being scaled. ♦



With the Fletchbus system, customers will receive more interlock features, safety features, diagnostics, flexibility, and an increase in performance.



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Innovation delivered on time and on budget – **FWS Group**



Slipform concrete headframe built by FWS at Nutrien's Scissor's Creek mine near Rocanville, Sask.

In recent years, we have seen steady growth for overall potash demand. Forecasts indicate this trend will persist due to increasing global population, driving the need for additional food production, and thus increased demand for fertilizer. This has brought about substantial investment by industry stakeholders in both mining and processing infrastructure to expand future output capacities.

Worldwide production hit an estimated 67.9 million metric tons in 2017, 20.9 million (30 per cent) of which originated in Canada, making it the largest producer in the world. With competition on a global scale, potash companies are looking for new ways to maximize efficiency, productivity, profitability, and quality.

When it comes to storage, handling, and distribution requirements in the potash world, one company has proven it has what it takes to deliver creative and innovative solutions. That organization is FWS Group of Companies. Headquartered in Winnipeg, Man., with offices in Calgary and Vancouver, the company focuses on design-build project development and construction across multiple sectors, including mining, agribusiness, as well as oil and gas. Founded in 1953, FWS is best known for the turn-key design and construction of slipform and heavy concrete facilities such as inland grain terminals, as well as agricultural processing plants across the Canadian prairies.

As one of Canada's Best Managed Companies, FWS prides itself on providing clients with quality turn-key projects delivered safely, on time and on budget. Through growth and diversification, FWS brings its team's expertise to the mining sector, and consequently, to the potash industry. The company was recently involved in the K+S Potash Canada (KSPC) Bethune mine project and commissioned to design-build two arch rib truss storage buildings with a combined capacity of 140,000 metric tons. The FWS team also brought their know-how to Nutrien's Rocanville project where a concrete headframe was erected.

Over the past 30-plus years, FWS, an industry innovator, pioneered a project

development approach deemed “integrated design-build”. This model integrates the design, engineering, project management, and construction phases of a project to have them all executed by a single firm. This method has also proven successful in shortening project timeframes and minimizing unforeseen constructability issues, in turn eliminating the occurrence of expensive change orders which can lead to delays and budget overruns. The overall result is a simplified and much less stressful experience that fosters collaboration and teamwork between the client and FWS.

Continuing down the path of innovation, FWS employs Lean planning and construction practices, which are relatively unheard of in the construction industry. These serve to ultimately eliminate the waste of resources throughout a project, resulting in a more efficient and cost-effective delivery. Always staying ahead of the curve, state-of-the-art BIM and VDC 3D design technologies are also



100,000 mt fertilizer storage facility shown at K+S Potash Canada’s mine site near Bethune, Sask.

used to create a virtual model of a facility before any ground is even broken.

When collaborating on a project, FWS considers the whole life value of the facility to ensure clients are generating a return on capital investment as quickly as possi-

ble to solidify their competitive advantage in the marketplace. With the future of the potash industry looking bright, FWS is eager to offer its continued support to the industry, by providing innovative design expertise and projects delivered safely, on time, and on budget. ♦

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A history of service and success



Pre-Krete placement via Lance prior to spin casting.

Pocono Fabricators' Pre-Krete lining experience in solution mining of potash began in 1982. The Pre-Krete G-8 was tested and found suitable for exposure to an abrasive slurry very high in sulfates and chlorides. Performance was based on a pH ranging from five to eight, with line pressure varying from 1,250 to 1,500 psi with process temperatures of 10 C (50 F) to 140 C (284 F). Favourable data resulted in the utilization of our Pre-Krete G-8.

Service environments

Pocono Fabricators' Pre-Krete systems are designed to combat the detrimental effects of corrosion and abrasion at elevated temperatures (1000 F / 538 C). The combinations of both chemical and physical attack often lead to unanticipated failures in infrastructure and process equipment.

Experience

Pre-Krete remains a cost-effective answer to the corrosion/abrasion conditions of solution mining. In addition to protecting pipelines for potash, sands oil, sulfur, lithium, and geo-thermal applications, Pre-Krete safeguards process equipment, such as stacks and vessels, with uses in the power generation, pulp & paper, petro chemical, waste treatment, chemical process, and cement markets.

Product

Pre-Krete G-8 is a bauxite-based material. The material matrix is defined by incorporating products that provide corrosion and abrasion resistance, as well as innovations that control physical characteristics. Compressive strength, flexural strength, coefficient of thermal expansion, thermal stress index, thermal shock, k-factor, or thermal conductivity must be tendered in order to assure compatibility with substrates where Pre-Krete is employed.

In situ application

Existing subsurface pipe is lined. Excavated access points are located every 600 feet to 1,000 feet providing access to the pipeline. Utilizing high-pressure pumps, the Pre-Krete is moved through flexible hoses and pulled through the pipe while a rotary spray head centrifugally applies the Pre-Krete.

Spin casting application

In new pipe, Pre-Krete G-8 is applied via spin casting. Utilizing a lance, a ribbon of Pre-Krete is placed along the entire length of the pipe. The pipe is then spun and the Pre-Krete is centrifugally cast to the interior diameter of the pipe. This process requires special equipment and a skillset to assure that component distribution and densification of the Pre-Krete is consistent to assure maximum service life.

Installation

Excavation, placement, and backfilling of Pre-Krete-lined pipe are performed by highly skilled contractors. Standards have been developed for the transporting, handling, placement, and welding of the pipe. These details may differ and are specified on a project-by-project basis.

Future

Pocono Fabricators continues to supply Pre-Krete G-8 to potash producers for pipe ranging from three-inch to 54-inch diameter. Additional applications for Pre-Krete exist in the refinery process of potash. Pocono Fabricators is committed to this market and involved with improving existing products, as well as involved in R&D to consider new mate-

rials for this service. As the world demand for agricultural-based food sources increases, yield per acre must as well. The demand for potash will keep pace with this trend.

Pocono Fabricators is a Division of Sauereisen, a third-generation company established in 1899. Sauereisen offers a complete line of protective linings and repair materials for new and rehabilitation applications. Visit them online at www.sauereisen.com.

For more information, contact:

Robert B. Boileau
160 Gamma Drive
Pittsburgh, PA 15238
610-400-1885
rboileau@pre-krete.com ♦



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Know your mine

Accutron Instruments Inc. is a leading manufacturer of underground mine ventilation monitoring technology founded in 1993. We supply worldwide industrial markets with products and services for ventilation monitoring, process automation, and optimization of mine ventilation systems to improve process efficiency and energy conservation.

We design, manufacture, and commission a wide range of mining sensors to meet the demands of harsh industrial environmental conditions and infrastructure demand. Our products include airflow monitors, toxic gas detectors, temperature, pressure, and humidity level sensors and complete mine air quality stations (MAQS).

We aim to create the global standard in underground mine ventilation systems. We are always innovating and never compromising on quality. We develop, apply, and supply the best technologies to our customers.

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The leader in ultrasonic airflow technology, providing highly accurate measurements for velocity, direction, and volume of air movement in demanding mining environments. Use FlowTrax as part of an air quality management system for ventilation control in underground mines. FlowTrax gives you access to pri-

mary and auxiliary fan airflow, as well as drift and tunnel airflow monitoring.

Climatrax

Always know the climate in your mine with the all-in-one temperature, humidity, and pressure sensor. Climatrax provides accurate and real-time measurements of your air quality. This helps you determine efficiencies of automated processes in your ventilation control and energy management systems. The Climatrax can also be implemented into a heat stress indicator with real-time visual alarms, in order to determine safety for workers in harsh environments.



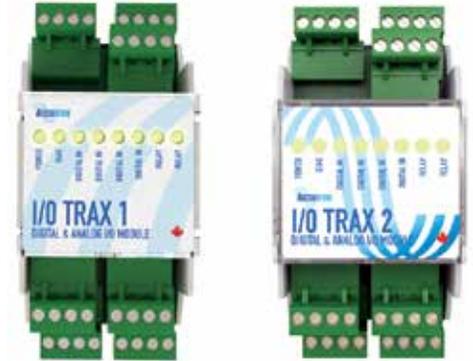
Commtrax

The Modbus TCP port can operate as both client and server (master and slave). In addition, Commtrax can use threshold rule templates to continuously monitor modbus data and generate SNMP Traps upon sensing "alarm" conditions. As a Modbus to Modbus gateway, Commtrax can map multiple RTU devices to a single Modbus TCP server map.



I/O TRAX

The I/O TRAX™ is a flexible and affordable solution designed to connect, monitor, and control field-remote devices.



The I/O TRAX system allows users to install remote field I/O devices without having to invest in any other controllers. The I/O TRAX is an affordable and practical distributed I/O system.

A.M.C.S.

The Accutron Mine Communication System (A.M.C.S.) is an all-in-one communications solution linking your analog 4-20 mA signals and Modbus RTU protocols to your communications networks.

The AMCS accepts analog and digital in and outputs Modbus TCP and digital signals that can be accessed through your network.

M.A.Q.S.

The Mine Air Quality Station (M.A.Q.S) is an affordable and complete underground mine ventilation monitoring station. Monitor your working environments, as well as integrate and communicate with remote devices to automate your ventilation process.



This flexible, low-cost instrumentation is designed to function with your existing monitoring software applications and communication infrastructure. Automate your underground mine processes, optimize ventilation, and improve health and safety, all while reducing energy consumption.

GasTrax

Always know the air quality in your mine with our dual-gas sensor design for harsh environments. GasTrax Smart provides accurate and real-time measurements of the air quality in your mine, allowing for safe operating conditions



Pinssar D.P.M.



The Pinssar Diesel Particulate Matter (D.P.M) technology, when utilised in hostile environments, is superior to any other in the world, with particle measurement to less than 800nm.

The supply of this vital information to the ventilation officer, health and safety professionals, and management, combined with the integrated Pinssar ventilation systems means real-time interfacing with

all required applications, and increased (if necessary) ventilation-on-demand, as well as superior information provision to enable the relevant processes

Laser Range Finder

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 traffic monitoring, collision avoidance control, and level monitoring. ♦





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What keeps you up at night?

By Mark Ferge

When I ask leadership teams around the globe each at world-class potash production centres, "What keeps you up at night?" I instantly hear "Fazendo o melhor produto!" or "Сделать лучший продукт!" or "iHacer el mejor producto!" or "making better product". I also hear things like "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".

The potash industry is changing and potash producers are changing with it. Farmers now demand products such as time-release fertilizers, multi-element granular blends, multiple grades of particle sizing, and specialty prod-

ucts. And they all demand high-quality products that they can get to their fields.

Providing rugged information-enabled OEM-quality compaction systems is what keeps Ludman Industries up at night.

At Ludman we focus on the following:

- Investing in new technology to continuously improve our equipment
- Reducing the total cost of ownership of our systems
- Delivering information-enabled smart plants
- Building robust equipment incorporating features that simplify the maintenance of the equipment, increasing MTBF and OEE, and eliminating unplanned downtime

Providing rugged information-enabled OEM-quality compaction systems is what keeps Ludman Industries up at night.

Our equipment makes superior granular fertilizers while having the highest yielding compactors in the world. Our new super-alloy technology allows customers with high-abrasion or high-corrosive feed materials to have significant increases in MTBF. Our patent-pending coordinated roll control system gives customers with high variation in feed materials the ability to ensure that each piece of flake is compacted to an ideal geometrical shape, which in turn reduces the fines produced during the crushing process. Ludman Industries utilizes "absolute positioning force feeders" with coordinated motion to control and reduce any roll skewing created by segregated feed materials. This motion-control system coupled together to our active hydraulic gap systems provides a system with both variable pressurization abilities, but intelligent optimization of the gap control system. Lastly, we integrate mining duty advanced automation control systems with full visualization, power distribution, digital-control PLCs, and information-enabled automatic control abilities. These upgrades are what help our customers see yield improvements from seven to 13 per cent and quality improvements of 50 per cent.

Tonight, when you are awake thinking about your compaction plant, try to imagine a world in which you make a superior product and have higher yields, while enjoying the lowest cost of ownership. Then think of your partners at Ludman Industries. Sleep well my friends. ♦

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Ens Industrial has been providing the most reliable, proven Toyota Land Cruiser trucks for underground mining use for over four decades.

"We're able to provide the same phenomenal level of products and service to an entirely new list of clients," says Kyle Robinson, sales manager for Ens Industrial. "It's just so exciting to build something new, yet proven. We cannot express how excited our team is to offer our amazing products to an entirely new client, with all new challenges and obstacles to help them overcome."

Ens Industrial has been in discussions with various clients in the oil sands for the past year. In that time, it's been determined that there is a huge opportunity for Ens Industrial to work with many of Canada's top-producing companies in the oil and gas industry. The constant struggle of upkeep in a modern fleet of service vehicles is costly and time consuming. Since time equates to money, Ens Industrial is here to help. The team at Ens is now building custom-engineered trucks to tackle the biggest challenges in

the harshest environments, saving time and money.

"We built our first truck and took it to the Oil Sands Trade Show and Conference in Fort McMurray, and it was incredibly well received. We weren't expecting that kind of impact, especially since we're entirely new to the market," says Robinson. "Our first truck should be on-site within the next couple months, and we have zero doubts that what we've built will meet or exceed their expectations. It's not like we're re-inventing the wheel, we're just providing a better version of it that we've already tested."

Operating costs in such a harsh environment wreak havoc on the vast majority of components on new electronically controlled vehicles. Combine that with unsealed components in the braking system and drivetrain, and you've got extreme risk at exponentially increasing costs.

We have taken our proven Toyota Land Cruiser HZJ79 platform and set it up to be the ultimate vehicle for use in the demanding conditions of the oil sands and similar work-site applications. The vehi-

cle pictured takes our stock chassis and cab and turns it into the ultimate work-site roaming machine. It is equipped with a suspension lift, sealed brakes, utility flat-deck, aggressive mud terrain tires, custom lighting, exterior skeleton, mechanical 4WD, A/C and a positive air shut-off, among other features, such as:

- A completely sealed braking system ensures minimal downtime, extended wear, and minimized maintenance costs.
- Improved and customizable all-terrain suspension components and air in-cab A/C systems are engineered for operator comfort.
- An entirely mechanical 4WD system makes for unbeatable reliability and longevity.
- Our trucks are built in Saskatchewan and we stock every component to ensure we offer the level of service you've come to expect from the Ens Industrial experts.

The Toyota diesel powerplant is undeniably one of the most reliable powertrains available on the market today. Simply put, our trucks are less expensive to operate, more reliable, and with a wider variety of available components for built-to-spec applications, we have exactly what you need.

Trust the Ens experience. Call Kyle Robinson today at (306) 242-4441, or visit them online at ensindustrial.ca. Visit them in person at 626 47th Street E., Saskatoon, SK, S7K 5X3. ♦

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Canadian Electrical Code revisions to impact mining industry

New requirements introduced in Section 10 of the 2018 CSA 22.1-18 Canadian Electrical Code will impact the application of impedance-grounded systems within Canada's various industries, including mining.

The importance of NGR monitoring in mining

In North America, impedance grounding is commonly achieved by inserting a neutral-grounding resistor (NGR) between the system neutral and ground at the distribution transformer or the generator. Doing so lowers the prospective ground-fault current to a predetermined value dictated by the impedance of the NGR. This is advantageous in mining as it reduces or eliminates the chance of an arc flash or hazardous ground-fault voltages on portable trailing-cable-fed equipment during a phase-to-ground fault.

The use of NGR monitoring relays is mandated by CSA M421, Use of Electricity in Mines. By providing continuous monitoring of the neutral-to-ground path, NGR monitors verify that the NGR is intact. This is important, as an open NGR renders current-sensing ground-fault protection inoperative and could result in a false belief that the system is properly functioning.

CE Code revisions and NGR monitors

In addition to current CSA M421 requirements, the 2018 CE Code requires that:

The integrity of an impedance grounded system shall be monitored, and the system shall have an audible or visual alarm that corresponds to the occurrence of:

- a) a ground fault on current-carrying conductors, including the neutral conductor where line-to-neutral loads are served;
- b) a ground fault on the conductor connecting the impedance grounding device to the source; and
- c) a loss of continuity of the impedance grounding circuit from the system source through the impedance grounding device to the grounded non-current-carrying conductive parts of the electrical system.

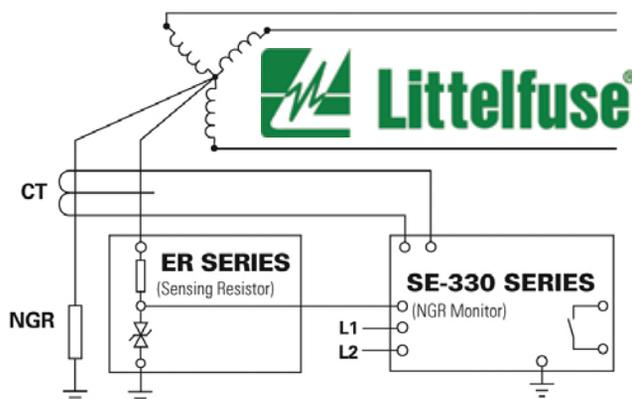


To meet the intent of the CE Code's new requirements, the NGR monitor must provide detection of a ground fault on the neutral-to-NGR conductor or on a distributed neutral where line-to-neutral loads are served. Although NGRs do not typically fail shorted, a person who is accustomed to solidly grounded systems can mistakenly wire the neutral directly to ground, which effectively bypasses or shorts out the NGR. Shorted NGRs can result in dangerously high currents during a phase-to-ground fault that can often lead to arc flash incidents.

NGR monitors in mining and industrial applications were introduced in Canada by Littelfuse Startco more than 30 years ago. Littelfuse Startco engineers have served on the CSA M421 Use of Electricity in Mines committee for decades, helping to develop the mining standards that ensure the safety of people and equipment.

Impedance-grounded systems must use continuous monitoring devices in order to meet code requirements. To help customers meet the requirements of the Canadian Standards Association's publication of the 2018 CE Code, Littelfuse developed an update to its SE-330 series' firmware that provides the additional protective functions that are fully compliant with new CE Code. Littelfuse tested the update in select mining sites throughout Canada.

The new CSA requirements do not necessarily require the procurement of new protective equipment. Facilities that were already equipped with the SE-330 NGR Monitor, for example, can upgrade their equipment in the field to the latest firmware update. The free update ensures that workers and equipment across the Canadian mining industry are not only compliant with the 2018 CE code, but safe. ♦



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Park Derochie presents HAKI

The game changer in scaffolding



Park Derochie believes that the HAKI system is the game changer in scaffolding and that it will play a major role in steering scaffolding into a new era throughout North America.

Effective April 2018, Park Derochie became the primary contracting partner and distributor in North America for the HAKI Universal product range. Combining HAKI's innovative system and Park Derochie's established scaffolding experience, customers are provided with unparalleled opportunity.

As Park Derochie strives to provide best-in-class services, they require best-in-class products. Choosing to partner with HAKI provides clients throughout North America with a system that addresses the three most important factors in determining the best scaffolding; safety, quality, and productivity.

Safety

A direct comparison between the use of traditional scaffolding material and HAKI scaffold components on a recent Park Derochie tank project demonstrates HAKI's superior safety.

Reservoir Dimension - 46.1 metres; Reservoir Height (top of berm to parapet) - 13.5 metres

HAKI Scaffold Components required: 5,814 (approximate)

Scaffold components based on traditional material:

7,206 (approximate)

Approximate hammer swings: 1,512

Approximate hammer swings on traditional material: 21,516

By using HAKI scaffolding, Park Derochie reduced exposure to dropped objects by 1,392 pieces (20 per cent) and reduced the weight/exposure to strain by 41,676 pounds (25 per cent).

Hammer swings, based on four per ledger, four per brace, two per right angle, and three per nail using the traditional system, decreased by 93 per cent, which also significantly reduced exposure to strain-related impacts and repetitive motions.

Based on historical data for similar projects, HAKI has reduced the overall scaffold erection man-hours by 35 per cent.

Additionally, with HAKI's ability to increase work behind a guardrail, almost all exposure hours related to falls from heights have been eliminated.

Quality

HAKI's focus on researching, developing, and evolving superior products is evident in their exceptionally hardwearing components, which are hot-dipped in galvanized high-tensile steel or aluminum and sent through unsurpassed quality control measures.

The HAKI Universal Scaffolding System, Park Derochie's exclusive offering, is a modular scaffolding system that can be utilised on applications from the simple to the most complex. This includes, but is not limited to, building projects, industrial applications, shipyards, offshore installations, and refineries. This scaffold system is particularly adaptable with respect to bay size and load class. It is also compatible with other HAKI systems, such as the HAKITEC weather protection system and HAKITEK TRAK rolling roof.

Productivity

Many HAKITEC and HAKI Universal components have the option of being assembled in place or on the ground in long sections, which are then lifted in place with a crane. Roofs, bridges, and platforms are assembled safely behind guardrails and rolled out in sections as they are completed.

HAKI's patented spring-locking catch system makes erection easy and safe. The spring-locking catch is primarily designed for manual locking and can be easily moved with the thumb to locked or unlocked positions, allowing for erection from a distance.

This, combined with the overall decrease in required components and reduction in man hours, results in a significant increase in productivity.

Based on over 60 years of industrial coatings, fireproofing, insulation, scaffolding, and blast cleaning experience, Park Derochie believes that the HAKI system is the game changer in scaffolding and that it will play a major role in steering scaffolding into a new era throughout North America. ♦



Park Derochie demonstrated HAKI's superior safety during the completion of this recent tank project.



A Park Derochie employee adds an addition to a HAKI scaffold build from behind a guardrail.



HAKI's patented spring-locking catch system can be easily moved to locked or unlocked positions, allowing for erection from a distance.

Trade-off studies – Indispensable tools for creating value to clients



Some of the most frequently underutilized tools during project development stages are comprehensive trade-off studies. This article showcases a process selection trade-off study that was completed by Advisian for a confidential client that is developing a conventional muriate of potash (MOP) for a potash mine and process plant project in South America.

The potash ore processing route originally selected by the client was a hot leach process, based on ore process testing conducted at a European laboratory during the earlier stages of the project. As usual, project economics and product recovery were of primary importance.

To demonstrate the economic superiority of either the incumbent hot leaching (HL) process versus the challenger mechanical separation (MS) process route, the client asked Advisian to conduct a trade-off study, comparing the two. Only the ‘wet’ part of the whole process route was analysed in detail, as the remaining process parts, ore handling, and ‘dry’ side are virtually the same for either HL or MS. The trade-off study was based on AACE Class 4 cost estimate inputs to equalize the level of accuracy.

SRC Laboratory in Saskatoon was engaged to conduct further testing, with a focus on the MS process route. The results from this testing showed the viability of the MS process route, but with a slightly lower rate of recovery than the HL process route.

The results from this testing showed the viability of the MS process route, but with a slightly lower rate of recovery than the HL process route.

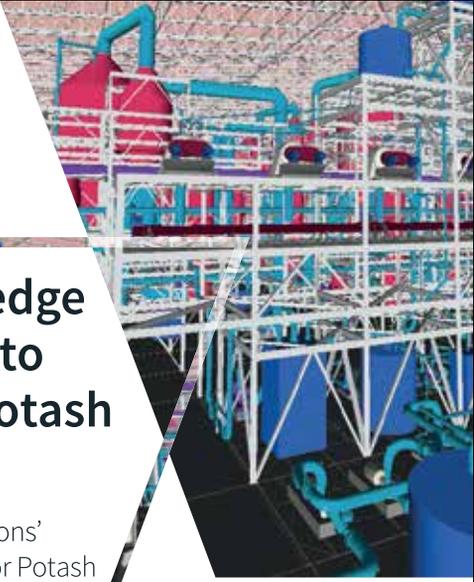
Cost Category	Hot Leaching (HL)	Mechanical Separation (MS)
Energy & Reagents Cost	100%	33.3%
Capital Expenditures	100%	28.6%

This relatively quick and inexpensive trade-off study conducted by Advisian identified opportunities for significant improvement of projects economics.

With positive laboratory results in hand, Advisian narrowed the focus to a comparison of the key factors contributing to project economics: 1) energy and reagents consumption for the operating cost, and 2) initial capital intensity per tonne of potash product. The results of the comparison per unit of MOP production were significant, as shown below.

The trade-off study revealed that there was an opportunity to reduce the production cost of MOP by US\$25/tonne and to reduce the initial capital expenditure by US\$70/ of production capacity.

This relatively quick and inexpensive trade-off study conducted by Advisian identified opportunities for significant improvement of projects economics. Advisian was proud that the study results created tangible value to the client. ♦





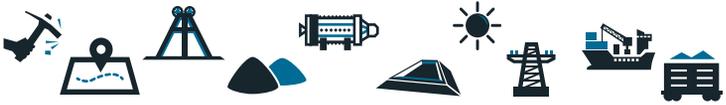
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Luff Industries belt conveyor idler and pulley solutions for the potash industry

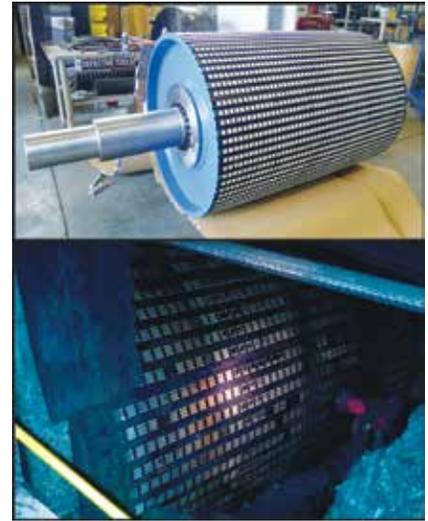
Luff Industries, from its Calgary-area factory and warehouses throughout North America, has supplied the potash industry for many years with belt conveyor idler and pulley components and accessories. Through the various relationships with OEMs, distributor representatives, and engineering firms, quality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

tamination. It combines the advantages of the Safety Anti-Lock Shields (SALS) 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 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 possi-



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.

bility 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. ♦



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.

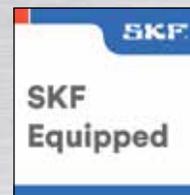


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Composite materials – Disruptors in the potash industry



3D model and actual pictures of High-Density Polyethylene (HDPE) Sclairpipe® at a potash mine site to replace traditional steel tailings pipelines.



Finite Element Analysis (FEA) model and real-life pictures of a Fibre Reinforced Plastic (FRP) lift station used for sanitary and storm water applications.

There is a lot of discussion about disruptive technologies and how they are set to change our world in the next decade. With close to 20 years in the potash industry, March Consulting has always believed in leading at the forefront when it comes to change and disruption. The status quo has never satisfied our curiosity and we have always had the courage to look at new technologies from other industries to help solve the problems we encounter in our core work. That is primarily the reason that in addition to all core-engineering specialties and project services, we have and continue to develop specialists in numerous other technical areas. These areas include material handling, asset integrity and inspections,

mine ventilation, arc flash mitigation and solutions, as well as our latest expertise in the design and analysis of structural and mechanical components made of composite materials.

Composite materials, such as fiber-reinforced plastics (FRP), have been successfully used in a number of other industries. Composites are materials that are made up of two or more phases (i.e. materials) with significantly different properties, but when these materials are combined, they produce a distinctive material that typically possesses properties that are superior to that of its constituent components (e.g. higher strength-to-weight ratio). Even though these materials have been used in the

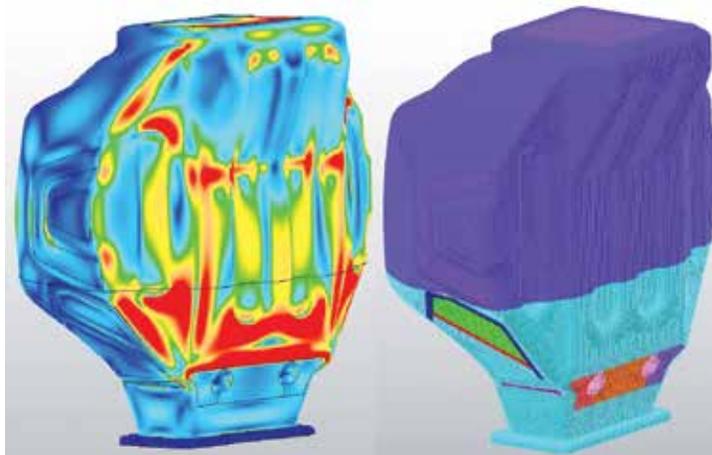
potash sector, their use has been challenging in part due to a limited understanding of their behaviour and performance in the severe and demanding potash environment. Additionally, the design and analysis of structures made of composite materials is significantly more challenging than traditional materials, such as steel and concrete. The analysis of composite materials typically requires advanced experimental and material characterization techniques followed by a detailed finite element analysis, considering the multi-directional properties of the material.

March took advantage of our experience in finite element analysis and modelling, other available technologies and

subject matter experts by collaborating with world-renowned composite material characterization labs, to design and analyze structures made of composite materials. As a result, we have been successfully designing fiberglass-reinforced tanks and lift stations for the past three years. These lift stations have been installed and used throughout Canada and the U.S. in a number of industries, including heavy industrial mining, and oil and gas sectors. Some of our other work has included research, analysis, and design to replace existing copper piping with aluminum/polymer composite pipes at a potash operation in Saskatchewan. We also performed a detailed study, which included experimental and finite element analysis for the replacement of steel containers with fiberglass-reinforced containers for the transportation of uranium in northern Saskatchewan.

In summary, the corrosive effects of potash on steel and other metals affect the structural integrity of bins, tanks, silos, pipes, and machines used in potash mining and processing, and are well known and documented. Composite materials can operate in hostile environments and are not as susceptible to these effects, giving these assets a significantly longer operating life. Composites also possess superior fatigue performance, hence requiring fewer repairs and reduced maintenance/downtime. The advanced analysis that we have been able to perform, combined with our knowledge of the behaviour of structures fabricated from composite materials, gives us confidence that these materials will be one of the upcoming disruptors in the potash industry.

March Consulting Associates Inc. is a multi-discipline engineering company providing engineering, procurement, project, and construction management services to numerous resource-based industrial and commercial enterprises. We have been serving these enterprises for 20 years and proudly call Saskatchewan home. ♦



Finite Element Analysis (FEA) model and 3D model of tanks used for seeding and fertilizer applications. The tanks can range anywhere from 40 to 150 bushels.

March Consulting Associates Inc.
Celebrating 20 Years

>> agile, flexible, adaptable



Multidiscipline Engineering

At the heart of March Consulting is our engineering team. For almost two decades, March has been dedicated to quality engineering and design.



EPCM

March is capable of executing large-scale, multi-discipline projects, from project concept to completion. Clients can be confident that their project will be delivered on-time and on-budget.



EPC

March's network of strategic partners, including First Nations construction services providers, gives clients the unique experience of one-stop shopping for their design/build needs.



Specialized Expertise

In addition to our core services, March has developed specialized expertise in a number of key areas including Mining Studies, Safety and Risk, Energy Management, Asset Integrity and Secondments of Engineering and Project Management Specialists.

For more information, please visit us at:

www.marchconsulting.com

306.651.6330

Improved air quality means more time at the face

By Shannon Katary

As mines continue to go deeper underground and embrace new digital technologies, the primary goal is to ensure the safety of the underground miners. Maestro Digital Mine manufactures Internet of Things (IoT) measurement and control instrumentation for the optimization of underground mine ventilation and underground digital networks for last mile of communication. Maestro designs and manufactures products exclusively for the underground mine automation, IT and ventilation sector that delivers energy savings and productivity improvements, while meeting the highest health and safety standards.

Underground mines have challenging environmental conditions, including toxic gases from drill & blast operations or gases given off by the surrounding strata rock. Protecting miners from acute or chronic gas-related health conditions is paramount for any responsible mining company. To ensure this, a variety of sensors transmit real-time data from the underground workings to the surface control rooms. The use of sensors allows miners to return safely to their working areas more quickly, allowing significant productivity increases. However, the sensors are sensitive and require frequent maintenance and calibration to maintain accurate measurements. The previous technology required underground calibrations at each individual location using test gases. However, several physical and environmental challenges prevented accurate and repeatable calibrations of the sensors.

Maestro tackled this vital, life-saving application by designing and developing



Vigilante AQS™: The world's first total air quality monitoring station that measures multiple gas concentrations, airflow, wet bulb and dry bulb temperature, and atmospheric pressure with a single digital IP connection.

the Vigilante AQS™, a digital gas sensor that can be calibrated on surface in a stable controlled environment. The digital sensors then can be “hot swapped” by a ventilation technician without the requirement of any sort of underground calibration. Built upon the IoT (Internet of Things), the digital sensors have a complete suite of diagnostics to help determine the health of the complete system and provide maximum system uptime.

“This innovation has allowed our Vigilante AQS™ environmental stations to be installed in some of the deepest mines on the planet,” states Michael Gribbons, vice-president of sales and marketing, Maestro Digital Mine. “Prior to this innovation, the underground miners lacked the confidence of the gas readings since there was no practical method of calibrating the sensors or understanding if the sensors were even working. The IoT digital sensors allow this to become a reality. This will result in major productivity improvements by getting the miners safely back to the face quicker.”

The Vigilante AQS™ is a third-generation underground mine air qual-

ity monitoring station designed with an improved communication platform. The modular design provides extremely flexible integration to any SCADA, PLC, DCS, PLS or HMI system. Whether it is Modbus TCP/IP, EtherNet/IP or RS485 serial based, the Vigilante AQS™ is efficient. An IP address makes this system quick, simple, and economical to match to any ethernet-based network. Simply plug the Vigilante AQS™ into a network switch, configure the settings via the built-in web pages and start measuring. The register maps can easily be paired to most current or legacy-monitoring platforms.

Maestro's Vigilante AQS™ air quality and control systems and MaestroFlex regulators are used in over 100 mines globally as part of a ventilation monitoring and control system. Working with some of the largest mining companies in the world, such as Vale, Mosaic, Nutrien, Glencore, Goldcorp, Rio Tinto, Barrick Gold, Newmont Gold, and BHP, Maestro has developed ventilation solutions that reduce downtime and enable miners to return to the face faster and safer. Visit them online at www.maestrodigitalmine.com. ♦

“ENERGY SAVINGS REPORTED IN THE RANGE OF 25% TO 60% ARE VERY ENCOURAGING AS THEY INDICATE THAT POTENTIALLY HALF OF THE ENERGY SPENT FOR VENTILATION COULD BE SAVED.”

— Vale Totten Mine

Great mines think alike.

Vigilante AQS™ Air Quality Station

The **Vigilante AQS™** accurately measures airflow and direction, wet and dry bulb temperature, gas concentration and air particulates – reducing downtime and enabling miners to return to the face sooner and safer.



maestrodigitalmine.com

Delivering project success

Flotation machines.



Nutana Machine Ltd. is an integrated manufacturer and a solution provider serving many industries, potash being the main focus.

The Nutana neighbourhood is Saskatoon's oldest and was founded in 1883. Nutana was the location of the original shop when the company was established

in 1946, thus the company's name. The current facility, on 3.25 acres in north industrial Saskatoon, has been expanded to 37,000 square feet and is stocked with state-of-the-art fabrication, machining, and engineering technologies.

Three generations of the Galbraith family's management has been successful in attracting superior, long-term talent in order to best serve their customers. Welder fabricators, machinists, mechanics, estimators, project managers, and professional engineers all work as a tight-knit team to deliver quality products on time and on budget.

Continuing education and training is a cornerstone of the company's operations along with participation in the apprenticeship system. Commitment in practicing diversity and inclusion in its hiring practices and financial support for many Indigenous events and causes will continue in the future.

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Check our website for a complete list of services
www.jrlindustrialhygiene.com / www.jrlindustrialhygiene.ca

Doing it right, being honest and excelling in service is a JRL tradition.

New Mexico thickener.

The broad experience of the company's many long-term employees and the resulting positive deliverables has enabled its customers to develop a high degree of confidence in the company's ability to deliver on mission critical complex projects on very tight schedules.

Sample projects

- Engineering and manufacturing of 1,200-tons-per-hour mobile bridge conveyors. Sixteen systems are currently operating with the longest 10-bridge system approaching a length of 500 feet.
- Flotation machines of 200-cubic-metres each. Project total was 25,000 man hours, including 3D modeling of the project to verify customer details and produce shop drawings. This API 650 project required cold temperature steel, chrome carbide overlay plate, and 100 per cent radiography.
- Potash thickener fabrication. Components shipped to New Mexico for erection.

Nutana Machine's website provides more thorough information on its capabilities as demonstrated on past projects. Visit them online at www.nutanamachine.com.

The company's interpretation of quality is governed by one rule: deliver project success for the customer. Nutana Machine has developed the practice of doing an internal critical review of customer drawings. Many times this has meant suggesting alternate details or materials for customer approval to improve the final product or reduce cost.

This dedication to producing exceptional quality and value is evident by the highly valued, long-term customer relationships that have been maintained by Nutana Machine over decades. ♦



NUTANA MACHINE

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Delivering project success for the customer



www.nutanamachine.com

306-242-3822

A passion for potash projects



Walters Group assisted with the largest mine shaft head frame of its kind at the Mosaic potash mine in Esterhazy, Sask. PHOTO COURTESY OF THE WALTERS GROUP INC.



Walters executed the supply and installation of the structural steel for the service shaft A-Frame and support buildings, along with assisting with design, fabrication, and installation of the main A-Frame, hoist houses, rope galleries and the electrical room on the BHP Jansen Potash Mine. PHOTO COURTESY OF THE WALTERS GROUP INC.

Walters Group has had the privilege of working on an incredible range of potash mine projects throughout Saskatchewan, Canada. Projects such as BHP Jansen, K+S Legacy, and the Mosaic potash mine have resulted in extensive experience in this area of steelwork for major industrial structures.

Our first project of this kind, the Mosaic potash mine located in Esterhazy, Sask., dates back to 2006. This project consisted of Walters assisting with the largest mine shaft headframe of its kind. The frame stands 304-feet above grade, is 125 feet in length, and included girder fabrications weighing 95 tons. Our involvement in connection design, detailing, fabrication, and delivery of this headframe led us to the BHP Jansen Potash Project in Jansen, Sask. in 2012. The goal was to take an existing four-million tons per year capacity and increase potash output to an ultimate capacity of eight-million tons per year. Upon completion of this thrilling project, this increased incredulous output made BHP Jansen the world's largest potash mine, including the tallest potash headframes in the world. Walters executed the supply and installation of the structural steel for the service shaft A-frame and support buildings, along with assisting with design, fabrication, and installation of the main A-frame, hoist houses, rope galleries, and the electrical room.

Coupled with the experience of the Mosaic potash mine and BHP Jansen, the Walters Group became involved in a joint venture with Alberici Western Constructors in 2014 to build and construct the K +S Legacy project located

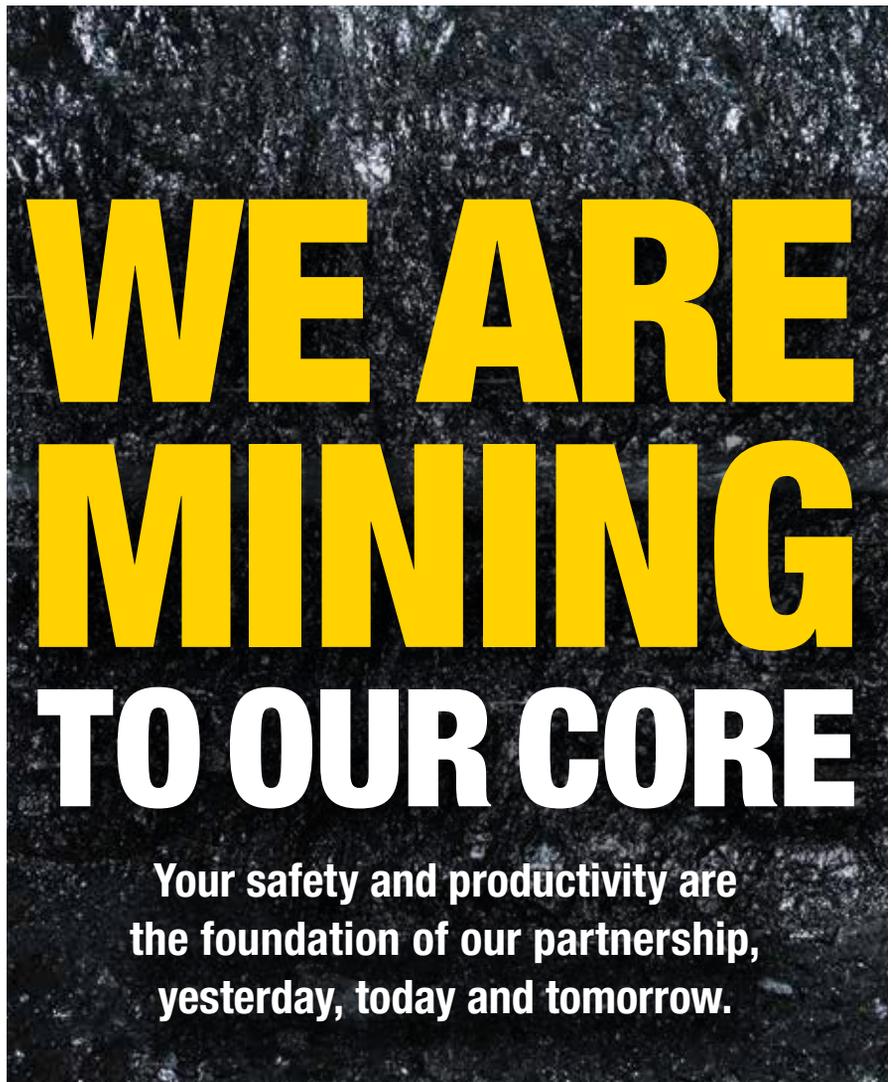


Because of their experience with both the Mosaic and BHP potash mines, Walters became involved in a JV with Alberici Western Constructors in 2014 to build and construct the K+S Legacy Project. Photo courtesy of the Walters Group Inc.

in Bethune, Sask. The Walters Alberici Joint Venture created shared responsibility and resourcing for field operations, performance, communication, client experience, and safety. Comprised of nine major industrial structures and consisting of approximately 26,000 tons of structural steel, this immense project involved setting 515 major vessels, some of which weighed upwards of 270 tons each. With up to eight cranes erecting steel on site, and with a peak staff of 430 on site representing 41 different crews and 43 office employees, construction was completed in September 2016.

K+S Potash Canada's Legacy Project had seen more than one-million direct and indirect project hours without a single lost-time injury. For Walters, this record ranks high with finishing jobs on time, keeping on budget, and staying true to a project's vision. Regardless of the size or complexity, we always bring the same passion and commitment to every project we take on. Our ability to provide vertically-integrated services in-house allows us to deliver a seamless experience and control every stage of a project. From construction engineering and design-assist, to detailing and fabrication, to finishing, delivery and construction - we are with our clients every step of the way.

For more information on our potash mining projects, along with our abilities and services, please visit www.waltersgroupinc.com. ♦



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Dynamo Electric

Power and control specialists

Established in 2002, Dynamo Electric is a Saskatchewan-owned-and-operated design-build and maintenance company, specializing in power systems and control solutions for industrial and utility clients. Within this niche market we are capable of completing broad-scope projects and services which allows us to be the complete technical solution provider for our clients.

Dynamo Electric has four business units; engineering, technical field ser-

vices, electrical construction, and steel fabrication. Dynamo Electric's staff of specialists include: electrical engineers, automation specialists, instrumentation technologists, electronics and electrical engineering technologists, mechanical engineering technologists, electrical, instrumentation, and welding trades.

With Saskatchewan mining over half the world's potash reserves, Dynamo Electric is well established in the mining sector and is partnered with numerous mining companies across Western

Canada. From projects and planned maintenance to emergency service calls, Dynamo Electric is committed to our clients and well equipped to meet long-term operational needs.

Some recent examples of diverse projects include a 5 kV switchgear refurbishment and relay protection enhancement with fiber optics light detection, commissioning and energization for surface at the Mosaic K1 facility, as well as the engineering, interconnection, and commissioning of

As a licensed consulting engineering firm, Dynamo Electric assists many customers with the various phases of the engineering process.



three 500 kW diesel power generators at the Mosaic K2 facility. From there, our technical services team is able to develop, plan, and execute preventative maintenance programs tailored for both surface and underground operations.

As a licensed consulting engineering firm, Dynamo Electric assists many customers with the various phases of the engineering process including: electrical system design, development of equipment specifications, bid/tender evaluation, procurement, and project management of capital or major maintenance projects. Our technical team also excels as an integrator of process automation and control sys-

tems with technical expertise in the areas of process control, SCADA, PLC's, information systems, and instrumentation.

Our construction services have ranged from shift support of our clients' existing electrical and instrumentation infrastructure, to the design-build of entire high-voltage substations.

The Steel Fabrication division has CWB W47.1 and W47.2 certification for steel

and aluminum. The group has extensive experience in the manufacture and assembly of substation structures for both bare conductor and aluminum bus configurations.

Combining all these functions into one organization allows us to provide cost-effective and practice-tested solutions for our clients and help them manage the needs of their electrical and control systems throughout the life cycle of the equipment. ♦



- Engineering
- Technical Services
- Construction
- Maintenance
- Steel Fabrication
- Training

Dynamo Electric sets a global standard as an integrated provider of engineering, technical and construction services in the mining, industrial and utility sectors. We strive to be the best at what we do, from providing solutions with sustainable value for our customers, to ensuring we maintain an exceptional work environment for our people.

CLIENT EXPERIENCE

We pride ourselves in taking care of our clients and creating long-term relationships.

Our integration of multiple services sets us apart because clients can get all of the services they require directly from one service provider. You can expect consistent communication, customer service and sustainable solutions, regardless of which department you need.

Saskatoon * Regina * Calgary * Winnipeg
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Email info@dynamoelectric.ca
www.dynamoelectric.ca



**BETTER BY
DESIGN**

Kristian: Carry a heavy load

When it comes to overhead cranes, safety is critical. Just like any other mechanical device, everyday wear and tear can be detrimental to the reliability of a crane's operation and safety.

It is vital that an overhead crane system be properly maintained throughout its working life. Annual inspections, lubrication of machinery, adjustments to both electrical and mechanical components, along with operational tests are all fundamental steps that need to be taken by a trained overhead crane inspector. However, one of the most critical maintenance tasks for any responsible overhead crane owner is the execution of a proper load test.

What is a load test and why is it so important?

A load test is a literal testing of limits. It's done by pushing a crane beyond its rated capacity under controlled conditions to expose any flaws or breaking points, so that any repairs can be done.

When a new overhead crane is installed, or if any physical changes have occurred to the crane system itself, a series of weight assessment protocol is mandatory for the safety of all workers and employees. Occupational Health and Safety requires a Load Test Certificate before the crane can be put into regular use.

How it works

When a crane is first designed, an engineer will decide what rate of deflection (bend) both the bridge and runways are safely able to bear dependent on the size, length, and design of the crane.

Once installed, a technician will then load the crane to 125 per cent of its rated safe-working load capacity (ex. if rated for five tons, a load of 6.25 tons will be applied). This is usually accomplished with the



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addition of rated steel test weights, or in some cases, such as sizable port gantry's, water weights are the convention.

While under the additional burden of weight, the bridge and runways will then be measured, using the proper equipment, to see if the amount of deflection in the steel falls within the safe parameters laid out by the original engineered design.

The crane will also be tested to see that all functions are working correctly. A complete check of hoisting, lowering, trolley travel, bridge travel, limit switches, as well as locking and safety devices will be completed under the extra stress.

This also allows the technician to determine and verify any load limit switches to proper and safe settings.

Why it's so important

When steel is under pressure it can expose many hidden problems, such as damaged weld seams or frame segments. Many underlying concerns that could lead to issues, including catastrophic failures down the road, will be

brought to light during a load test, which can be rebuilt or repaired before the equipment is put into use.

Who to trust

The Canadian Standards Association (CSA) requires that inspections and load testing be performed by a crane inspector having a minimum of 10,000 hours of experience, or by a team having combined equivalent qualifications, under the supervision of a crane inspector or professional engineer (CSA Standard B167-2008 (R2015)).

Kristian Electric Ltd., an industry leader in overhead crane servicing, not only provides reliable, seasoned crane technicians, but also supplies their customers with detailed inspection reports, load test certificates, and a full summary of maintenance recommendations. With over 50 years experience in the material handling and welding industry, and locations servicing all of Saskatchewan and Alberta, Kristian Electric will take the hassle out of overhead crane maintenance. ♦



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West River expands product line to become turnkey conveyor solution

West River Conveyors & Machinery Company expands product line to include reliable conveyor belt and structure



Rigid rail structure frames complete and ready for assembly.



Wire rope rigid rail structure fully complete and ready for shipment.

Large volumes of tonnage, like those produced by potash operations through improved mining techniques, have created a need for heavier conveyors and conveyor structures able to handle demanding loads. Conveyor systems that include belt and structure are the lifeline of any operations' productivity. Reliable conveyor equipment is the centerpiece of any efficient mining operation. West River Conveyors has built a business on providing quality conveyor solutions to meet any specific requirements of its customers. Having been a part of the Canadian potash market for years, West River understands the demands placed on conveyor equipment that must transport potash to the surface. Reliability and quality are both key to providing conveyor drives, tail sections, take-up units, starters, winches, belt storage units, and more to an ever-evolving potash industry.

In addition to its quality conveyor equipment, West River recently constructed a new 15,000-square-foot manufacturing facility to engineer and build a full range of underground conveyor structures to meet the most demanding applications for underground mining. West River's line of Rigid Rail Structure is designed for quick and easy installation and is available in belt widths from 36 inches up to 72 inches. The structure is made with heavy-duty structural steel and built to suit any custom needs.

The right idler is the key component to a quality piece of structure. West River has partnered with PPI (Precision Pulley & Idler) to equip their structure with world-class idlers that set the standard for the industry. All PPI idlers are de-



signed and manufactured for a long, trouble- and maintenance-free life with no greasing and high-quality sealed ball bearings. PPI idlers are suited for the most demanding applications and conform to CEMA standards that meet or exceed load ratings. Combining PPI's innovative and reliable idler design with West River's experience in the mining conveyor market, West River offers a solution that can handle the most rugged underground potash and other mining environments.

West River's structure is powder coated for a more durable finish. This type of coating is a free-flowing, dry powder that does not require a solvent to keep the binder and fill parts in a liquid suspension form. It is used to create a hard finish that is tougher than conventional paint without running or sagging. Powder coatings are resistant to cracking, peeling, and chipping, and are abrasion, corrosion, and chemical resistant, characteristics that bode well in harsh mining conditions.

West River structure is available in CEMA B through CEMA E+ arrangements and can be either single beam or box frame design. In addition to rigid rail structure, West River also offers wire rope and catenary structure.

In order to provide customers a turnkey solution, conveyor belt is the final piece to any reliable conveyor system. West River has paired with Depreux underground belts, a brand with more than 100 years of experience in designing safety belts that comply with various world safety standards. While complying with these standards, Depreux has optimized the mechanical parameters for different conveying applications to ensure the belt longevity that your oper-



PPI idlers ready to be assembled to our structure.

ation needs. As an exclusive distributor of both underground and surface mining conveyor belt, West River is able to include belt pricing in their conveyor package quotes, resulting in competitively-priced options for its customers.

Depreux offers a multi-ply or solid woven belt option that is fire resistant and meets ISO standards for rubber abrasion resistance. Another popular option is the Firemaster PVG belt, a type of belt that has a single-ply textile carcass impregnated with PVC and rubber covers. This solid woven belt offers good impact resistance, mechanical retention characteristics, a long life-expectancy and is most often used as an alternative to lesser-quality PVC belt products. This type of belt is best for severe operating conditions, such as high-speed systems,

presence of large material, risk of impact damage, longitudinal tearing, or edge wear.

West River's mantra has always been to satisfy their customers' conveyor needs in every way possible, and to them, that meant adding a line of conveyor structure and belt to complement the rest of their products. Pete Savage, VP international sales for West River, said "a turnkey solution is what customers are looking for, so that is what we are providing, a one-stop shop for all of their conveyor needs."

West River continues to be a leader in custom-engineered conveyor equipment and is a proud and trusted supplier of the U.S. and Canadian potash industries. ♦

TopVu's eTag[®] system

Hardened RFID solutions for mining efficiency



TopVu 
going above & below

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.

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 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



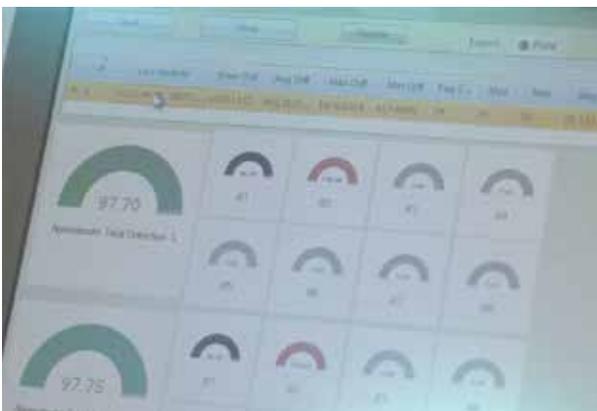
underground without having a tag placed on the board. An interlock is also available to prevent a blast in this situation.

The eTag® Board can be used to complement existing tracking systems. Since TopVu's D-RDR readers are capable of detecting other manufactures' 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 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 ore tracking, RFID personnel and asset 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. ♦



TopVu ^{WM}
going above & below



eTag® Board

Electronic RFID Tag-in board.
Improve Production and
H&S activities.



READERS

Passive RFID & Wifi
Track personnel,
vehicles, and assets.



SOFTWARE

Realtime and historical data.
Integrate to 3rd party software



WAREHOUSE & eTool

RFID-based inventory
management - Reconcile your
warehouse in minutes

www.topvu.ca

Lean times

What is your business made of?

By Sarah Jensen



NRT owner/operator, Lloyd Larocque, receives an award for 27 years of safe driving. Investing in your best people always pays off.



NRT enthusiastically supports employees' families as well. Kira Nelson Photography, by the wife of NRT's operations manager, provides outstanding promotional photography for the company.

Many Saskatchewan businesses have found themselves in a crunch lately. Whether they are already feeling the pinch of a tightening belt, or are conserving resources for an uncertain future, there is no denying that the economic landscape is thinning. This province has seen more than its fair share of cutbacks, layoffs, and projects put on hold while the natural resources sector waits to see which way the winds of change are blowing.

And, well, it blows.

It can be nerve wracking, especially for the little guys who rely on strong natural resource performance for their livelihood. Just ask Northern Resource Trucking (NRT), which has built its business model on service to the uranium mining industry. This is Canada! We have some of the richest sources of water, lumber, oil, gas, metals, and minerals in the world. When the world isn't buying, though, it's tough to transform that natural wealth into cold, hard cash.

But it's not all doom and gloom. The fact is, we still have the goods and – even if they aren't buying right now – the world still needs them. In the meantime, many Saskatchewan businesses are stuck playing the waiting game. Moaning and complaining is fun, but it doesn't accom-

plish much. So, what are we to do while we bide our time?

Here are three things struggling businesses can do to make themselves more competitive:

1. Trim the fat – Downsizing and layoffs are an unfortunate reality during an economic slump. Whether the changes become permanent or not will depend upon the business, but this can be an excellent opportunity to identify key players, streamline operations, and define company objectives. If you strip away the excess, what do the bones of your business look like? What do you need to support these essential functions? "At NRT, we've right-sized our fleet, and purchased more versatile equipment," says Dave McIlmoyl, president of NRT.

2. Take out the trash – This can be a tough one, and is particularly important for small businesses that have grown rapidly. Often, newly successful companies accumulate hangers-on of both the employee and customer variety. Whether it's an underperforming employee who has been able to coast while profits were high and time was scarce, or a customer who continues to expect the discounts and freebies offered during the company's

start-up years, sometimes it's best to say goodbye. When funds are low, it is essential to invest in the people – employees and customers – that you want to keep around. Make every dollar count!

3. Think outside the box – Are you maximizing your company's reach? Maybe your product or service could be used outside of the market niche you've carved out for your business. Businesses in the natural resource sector are often highly specific, so a blow to the industry can hit hard. But often the team and skillset that make a company successful can be easily adapted to other markets. "NRT has recognized that the downturn in the uranium mining industry is an opportunity for us to diversify our customer base using the expertise of our people, our knowledge of industry, and our equipment to expand our operations from northwestern Ontario to northern B.C.," McIlmoyl says.

It is easy to become bogged down by the negativity and uncertainty of the current economic climate, but these lean times can present opportunities as well. Let the excess waste away; hack at it yourself, even. You might be surprised to discover what your business is made of underneath it all. ♦



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RobWel Constructors was established in the 1990s in Meadow Lake, Saskatchewan. RobWel has a proven track record in construction, installation, maintenance, manufacturing, and fabrication on construction sites throughout Saskatchewan and Alberta. The company's customer base includes oil and gas, mining, forestry, industrial, and agriculture sectors.

RobWel is proudly 100 per cent Aboriginal owned by the Clearwater River Dene Nation of La Loche, Saskatchewan. Clearwater River Dene Nation is committed to growing and expanding the company to meet its full potential. Through the core competencies of the Clearwater River Group of Companies, RobWel is able to

provide full-service, cost-effective customer solutions for a wide array of projects, large or small. RobWel has three fabrication facilities in Saskatchewan, as well as two offices in Alberta.

RobWel is a full-service mechanical fabricator and contractor. With an average of 200 employees, RobWel deploys multiple crews to sites throughout Saskatchewan and Alberta, as well as managing shop personnel in their fabrication facilities. Core competencies include project management, operations management, general contracting, and subcontracting.

RobWel has an exemplary safety record and is COR certified in Saskatchewan and Alberta, as well as being ISNetworld and ComplyWorks registered as a subcontractor. RobWel is signatory to Mission: Zero and manages operations to be a workplace with zero injuries. RobWel puts safety first and believes that all injuries can be prevented, unsafe work practices are unacceptable, and employees deserve an HSE environment that they and their families can be proud of.

RobWel is certified to ASME B31.1 & B31.3 for pressure welding and Canadian Welding Bureau W47.1 Division 2 and W47.2 Division 3. Certified weld procedures for basic carbon steel, duplex stainless steel and Inconel/Hastelloy materials facilitate fabrication of various types of work.

RobWel specializes in:

- Pressure piping fabrication and installation
- Structural steel fabrication and erection
- Pressure vessel fabrication and installation
- Skidded/modular equipment fabrication
- API tank fabrication and erection
- Steel building erection
- Mechanical installations
- Specialized rigging
- Heavy lifts, equipment setting, module setting
- Cold cutting
- Field machining/facing
- Hydraulic torquing and tensioning



RobWel's shop is fully tooled with automated processing to deliver process pipe and spooling of the highest complexity and quality under safe and efficient working conditions.

- Pressure testing and flange isolation testing.

RobWel's primary fabrication facility is located in Meadow Lake, Sask. The 14,000-square-foot facility was built in 2009 to meet the growing demands of the market sectors we service. With 15-tonne overhead crane capacity and flow-through 30-foot doors, we are able to undertake projects of any size. Work that previously would have been completed on site is produced in a controlled environment to maximize efficiency and cost effectiveness. The facility sits on five acres of laydown and module production yard space. Equipped with a state-of-the-art ventilation system, the health and safety of our workers is protected while delivering top-quality products.

RobWel's shop is fully tooled with automated processing to deliver process pipe and spooling of the highest complexity and quality under safe and efficient working conditions. We also have an integrated blast and paint operation, enabling projects to move from fabrication to blast and paint with no delays.

Field construction crews are fully equipped with a modern fleet of construction equipment including picker trucks, telehandlers, AWP's, skid steers, site trailers, and much more. RobWel also offers a specialty pipe tool rental program for testing, torquing, and cold cutting.

No matter the size of project, RobWel ensures that crews have the necessary equipment to undertake and complete work safely, efficiently, and on schedule. ♦



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Mining new discoveries with Weir Minerals



The world is ever-changing; from technology to education, health to politics, manufacturing to mining, change is pervasive and demands adaptation.

With declining ore grade and low commodity prices, the mining industry has had to adapt to stay competitive. As merger and acquisitions opportunities and greenfield projects diminish, there is a strong focus on modifying and optimizing existing mine sites and processes to achieve greater operational efficiency.

Mining companies are under intense pressure to increase production through the optimization of their current plant and its resources. In order to achieve this, it is important they preserve and extend their assets, a tactic which Weir Minerals is very familiar with.

“At Weir Minerals we recognize the demand within the industry and we have expanded our service offering as a result. We don’t just design and manufacture products; we provide tangible solutions for operators across the globe,” states John McNulty, director of technology for Weir Minerals.

When it comes to supplying solutions to mining operators, Weir Minerals ensure they visit mine sites daily to assess operator’s processes, discover their pain points and work with the customer to overcome their productivity-related problems, providing the solutions they need, when they need them.

This could be anything from modifying a cyclone cluster to developing a transportable self-priming pump to increase availability of a plant.

Mining companies are under intense pressure to increase production through the optimization of their current plant and its resources.

We don’t just design and manufacture products; we provide tangible solutions for operators across the globe

Expert engineering solutions

“It is our job to ensure operators maintain optimum performance of their plant, from comminution through to tailings disposals. We want to gain an understanding of their throughput issues and use our leading engineering expertise to deliver a comprehensive solution.”

Weir Minerals supply tangible solutions to enable operators to utilize existing infrastructure and equipment to maximize production whilst minimizing total ownership cost.

“It’s not about reinventing the wheel, it’s about re-thinking how we use current assets and working together to modify the process, increasing mine throughput and improving access to high-quality mineral resources.”

Laser scanning technology

Through their plant optimization strategy, Weir Minerals use laser scanning technology to examine the entire plant, gaining a full understanding of all of the equipment, applications, and processes present.

Many older plants no longer have access to their original drawings, or find that their original drawings are out-of-date due to modifications since the plant’s establishment. If original drawings are not available, or out-of-date, laser scanning is a useful alternative to create detailed drawings alongside 3D models.

This technology enables engineers to visualize where and how the equipment fits into the entire operation; identify what works and what doesn’t, and detect bottlenecks.

Weir Minerals’ engineers can then refine the data collected to determine the best approach to modify and enhance the operators’ entire process.

“Laser scanning allows for us to modify our products to fit our customers’ application accordingly and enable them to run exactly how they need them to,” states McNulty.

Eliminating bottlenecks

It’s important to take a holistic approach to optimization; modifying each process with the entire operation in mind, and avoiding bottlenecks which slow down the overall process.

“A bottleneck represents a restriction in the process which must be dealt with to improve the production process. The key is to understand where the bottlenecks are in the process and evaluate the root cause before they negatively impact the throughput of the entire operation.”

Bottlenecks are inevitable in mining, therefore, it is important to unlock these barriers and plan the production flow accordingly.

Aside from removing bottlenecks, mine operators may be looking to expand capacity, lower operating costs or increase productivity. Whatever the challenge, Weir Minerals are adept to provide innovative, multi-product solutions for their customers.

“It’s our job to truly understand our customers’ challenges and use our engineering expertise to optimize the process, taking their business to the next level,” says McNulty. “We constantly look for innovative solutions to industry problems, and utilize our engineering skills, experience, entrepreneurship, and innovation to address these problems.”

If you would like to learn more about Weir Minerals’ solutions and services contact canada.minerals@mail.weir, or your local Saskatoon location by calling David Kell, area manager at +1 306 955 1797, extension 3315. ♦

Supplying the industry

Commercial Sand Blasting and Painting



Celebrating 50 years of operations, Commercial Sand Blasting and Painting has provided corrosion protection services throughout Canada since 1968.

Commercial has custom-built shop facilities along with the largest fleet of mobile equipment in Saskatchewan, all designed to achieve the highest possible performance standards. We provide year-round services to the mining, oil and gas, chemical, pulp and paper, and industrial companies throughout Western Canada.

Our services include:

- Industrial media blasting of all types
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- Installation of environmental containment systems
- Tank linings
- Fiberglass inspection and maintenance
- Abrasion-resistant linings, including ceramic tile and beaded systems, rubber, urethane, and epoxy-based systems
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- Floor coatings
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- Industrial inspection services
- Cathodic protection systems: Inspection, maintenance, and design

Commercial has supplied coated structural steel to every industry within Saskatchewan, from single to multi-coat systems, as well as fireproofing. Commercial is certified for the application of fire-proofing materials from several material suppliers.

Our firm works with steel fabricators within the province, Canada, and the United States, as well as European suppliers to abrasive blast, coat, and line special service equipment. With on-site cranes and specialty lifting equipment for the handling of items up to 300 tons at our shop facilities in Saskatoon, projects of all sizes can be handled easily.

The petrochemical industry in Saskatchewan, Manitoba, and Alberta require high-end coating and lining products to protect both their storage tanks and process equipment. Our firm both coats and lines oil storage tanks and oil and gas pipeline systems.

Commercial has provided industry with tiling and wear-resistant lining services since the early 1970's. From butted tile, to hex-matt systems, to engineered tile placement, to high-end beaded epoxy mortars, our firm has applied systems to every configuration of equipment and pipe spool system in the province.

Many operating facilities use fiberglass piping, tanks, and process units for the delivery of liquid cargos throughout their plants. From the installation of new equipment to the maintenance of existing assets, our fiberglass technicians will help plan and execute your project.

With our large shops and 40 acres of fenced land, forklifts, and cranes, no project is too large to handle.

Our experienced staff is available for a complete list of inspection services for: structural steel, tanks and vessels, carbon and stainless steels, and structural fiberglass. We will assess the integrity of your coating and lining systems using both visual and destructive testing as required. Our NACE- and SSPC-trained staff, engineers, and technologists will provide inspections on industry-standard practices. Commercial is the only SSPC QP1 and QP3 quality certified contractor in the province of Saskatchewan.

You will find the Commercial Sand Blasting and Paintings headquarters and production facilities located just north of Saskatoon in the Corman Industrial Park.

Please visit the Commercial Sand Blasting and Painting website at www.csbp.ca. ♦



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Carlson Commercial & Industrial Services Ltd.

Carlson Commercial & Industrial Services Ltd. is proud to provide our potash customers with decades of knowledge in the abrasive blasting, specialty coatings, fibreglass manufacturing, and FRP service needs.

Carlson has been serving the mining industry, and specifically the potash mining industry to help reduce or remove corrosion-related issues in many of their buildings and processes. Carlson has serviced, supplied, assembled, and manufactured tanks, scrubbers, walkways, and structural members to increase their lifecycle with our abrasive blasting and specialty coatings. We can also replace the aged product with our corrosion-resistant fibreglass vessels, grating and structural shapes which does not rust, rot, or corrode like traditional materials.

Carlson also provides NACE CIP Level III certified inspections on coatings, and non-destructive inspections for FRP products to determine cost-effective solutions that will help reduce or eliminate mission-critical downtime within the facilities we serve.

Carlson prides itself on being a strategic alliance partner with many other companies that service the potash industry, which allows

Carlson and our partners to work from each others' strengths and provide the quality in service and workmanship that our potash customers have come to rely on.

Carlson is always striving to be first in quality, first in service, and the first choice to support our clients' needs. Our team is committed to the highest standards of customer satisfaction and as a leader in the composite, abrasive blasting, specialty coatings, drywall, painting, and raised-access flooring industries. We continue to build upon an 80-year-long tradition of integrity, excellence, and profitable growth. We maintain our competitive advantage by developing innovative solutions to unique problems.

Some of our clients include PCS/Potash Corp. of Saskatchewan and Agrium Vanscoy who has recently formed Nutrien, as well as the Mosaic Company.

Through the years, Carlson has grown to be a global leader in the composites industry from automotive components and finishes, aerospace, and agriculture to chemical storage vessels, duct work, grating, walkways, and other FRP items for extremely harsh and corrosive environments.

Contact Carlson for your next project! ♦



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