THE PROFESSIONAL

EDGE

ISSUE 168

MAY/JUNE 2017

Read the Edge on the go at
www.apegs.ca/e-Edge

2017 Annual Meeting

2017 Salary Survey

Achieving a Safe and Prosperous Future through Engineering and Geoscience

Editorial provided by:

Martin Charlton Communications
#300 - 1914 Hamilton Street, Regina, Saskatchewan S4P 3N6
T: 306.584-1000, F: 306. 584-5111, E: marylynn@martincharlton.ca

Editor:

Lyle Hewitt, Managing Director, Martin Charlton Communications
E: lyle@martincharlton.ca

Design and Layout:

Jo Anne Lauder Publishing & Design, T: 306.522-8461, E :joanne.lauder@sasktel.net

Submissions to:

The Professional Edge Editorial Committee
300 - 4581 Parliament Avenue, Regina SK S4W 0G3
T: 306.525.9547 F: 306.525.0851 Toll Free: 800.500.9547
E: apegs@apegs.ca

POSTMASTER

Return undeliverable copies to: *The Professional Edge*,
APEGS, #300 - 4581 Parliament Avenue, Regina SK S4W 0G3

Submission Deadlines

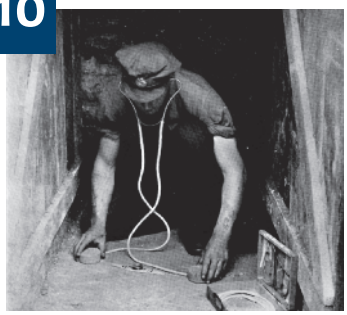
JULY-AUGUST 2017: July 1, 2017 **SEPTEMBER-OCTOBER 2017:** September 1, 2017

Subscription Rates*

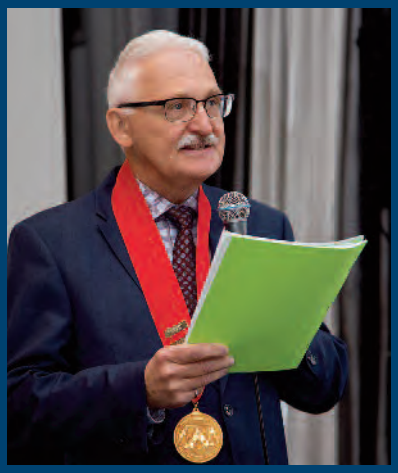
Members and Licensees - Free. Others in Saskatchewan - $12/year. Elsewhere - $20/year.

Table of Contents

ISSUE 168
MAY/JUNE 2017



President's Message



Ernie Barber, P.Ag., P.Eng., APEGS President

The 2017 APEGS Annual Meeting weekend was a resounding success, planned in exacting detail by an experienced planning committee and expertly supported by APEGS staff.

We were inspired by the IMAX *Dream Big* film and the chance to meet and talk with Ms. Menzer Pehlivan, a remarkable engineer featured in the film.

A day of professional development featured topics that celebrated 20 years of being together as professional engineers and geoscientists and looked ahead to the challenges and opportunities of our shared future.

We talked with APEGS past presidents about strategic priorities, about risks and risk mitigation strategies. A business session offered members information and an opportunity to provide input on APEGS operations and priorities.

New members and life members were recognized at a luncheon, and APEGS award winners were appropriately honoured at a closing banquet. We welcomed and learned from engineering and geoscience leaders from across Canada in both formal and informal settings.

Not surprisingly, there was lots of conversation throughout the Annual Meeting related to three themes that will receive some considerable focus over the coming year:

1 Bolstering the public's confidence in us as self-regulated professions.

APEGS exists to protect and serve the public. It is a privilege to be among the self-regulating professions in Saskatchewan and, like any other privilege, self-regulation must be actively nurtured. APEGS has very strong policies and practices to ensure that only those who meet academic, experience and ethical standards become members, and to ensure that any who are qualified to practise and who do practise engineering or geoscience are registered with APEGS. We lag behind most other provinces in Canada in being able to document the Continuing Professional Development (CPD) undertaken by individual members and licence holders, and by engineering and geoscience firms. Attendees at this year's Annual Meeting heard from many speakers about the benefits of some form of required reporting of CPD activities.

2 Sustaining our professions through attention to diversity and inclusiveness.

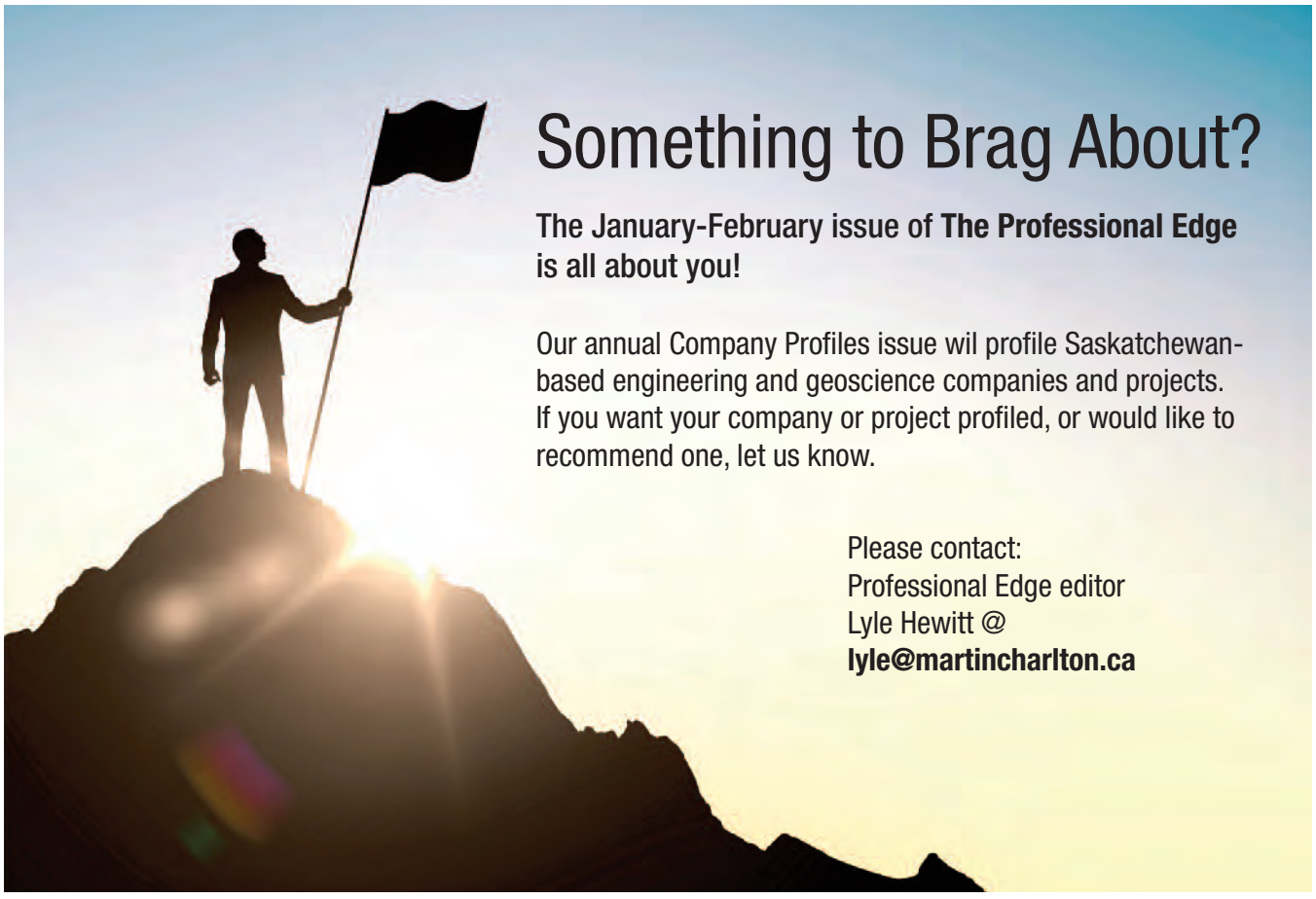
There is not a single person in our communities whose life has not already been influenced and improved by the work of engineers and geoscientists. Yet the diversity of our membership in APEGS is not reflective of the diverse demographics in those communities. Women are under-represented, especially in engineering. Indigenous people make up nearly 20 per cent of the Saskatchewan population, yet the proportion of engineers and geoscientists who identify as indigenous is much smaller. APEGS is taking strong

leadership under the 30 by 30 banner spearheaded by Engineers Canada to increase the proportion of women entering engineering to at least 30 per cent by 2030. Saskatchewan could and should likewise be a leader to identify and remove barriers for indigenous people to pursue careers in engineering and geoscience. Any steps taken to increase the diversity within our professions to more closely mirror the diversity of our clients and communities will most assuredly challenge us individually and collectively to think and act differently, to embrace the "different ways of knowing" that these others bring to the creative work we do as engineers and geoscientists.

3 Enhancing public understanding of our professions as forces for better communities and for a better world.

A recent survey conducted for Engineers Canada highlighted the public's lack of familiarity with professional engineers, and the same likely is true of geoscientists. The same study suggested that the more familiar the public are with us, the more they trust us and believe that we make the world a better place. We have a story to tell. APEGS will add a communications professional to its staff this year to focus and coordinate our internal and external communications programs, especially to help the public know what to expect of engineers and geoscientists. You can help make our professions less invisible by, for example, always identifying yourself as a professional engineer or geoscientist – in the workplace by consistently adding your professional designation after your name, and in the community by explicitly using the words "engineering" or "geoscience" when talking about your work.

I look forward with enthusiasm to serving this year as APEGS president and I sincerely thank you for giving me this opportunity. I want personally to acknowledge with gratitude all those who offered themselves as candidates in the recent election, to congratulate new and returning Councillors and to say thanks one more time to those individuals who have completed terms and given so much of their time and talents. Over 200 volunteers have committed or recommitted themselves to service on various task groups, committees, Council and executive. We have a talented staff at the APEGS head office. Ours is an extremely well- functioning organization. Please contact me, or any member of Council or the APEGS office, with any ideas that you want to share.



Lifelong Learning:
It's Not Optional

BY MARTIN CHARLTON COMMUNICATIONS

Mark Twain would have been proud of the organizers of the Continuing Professional Development plenary session. Phrases like "required reporting" and "plenary session" strike one as being unpleasant chores. But, like Tom Sawyer convincing his friends to help him paint the fence, the organizers of the plenary session succeeded in creating a fascinating and eye-opening presentation on the dangers and opportunities of the issue of reporting Continuing Professional Development (CPD).

The key issue of the session is one that will be familiar to readers of *The Professional Edge*. Although APEGS regulations require minimum annual hours of CPD, reporting those hours has so far been voluntary. This makes APEGS's CPD requirements a toothless tiger. Without confirmed information on compliance, there is no way to enforce them.

PART ONE:

Presentation from Engineers Canada

The CPD plenary session began with a presentation by Chris Roney, P.Eng., FEC, president of Engineers Canada, on why CPD is needed in the first place. Ethics and competence are taken as givens amongst engineers and geoscientists but Roney outlined three recent examples in which ethics and competence were lacking, with disastrous results.

The first was the Elliot Lake Mall roof collapse in Ontario in 2012. Roney brought home the extent of this disaster by showing live footage captured from a security camera at the exact moment of the collapse. The report that followed the inquiry noted that there had been years of overly optimistic engineering reports and make-do patches to serious structural issues. An engineering report issued just two days before the collapse declared the building structurally sound. Even during the construction phase, the mall had a history of dangerously unsafe cost-cutting and building practices. The report included the damning statement that "the engineers pandered more to their clients than to their moral obligations." As one of the outcomes of the final report, engineers in Ontario are now obligated to report an incompetence ruling to all of their clients – past, present and future.

Next, Roney reviewed Quebec's Charbonneau Commission's investigation into the sordid history of corruption and incompetence among Quebec engineers. The commission investigated a long-running and complex scheme of bribes and bid-rigging among Quebec engineers and contractors which included the involvement of corrupt politicians, civic officials and organized crime. The result is that innumerable infrastructure projects in Quebec are sub-standard. The long-term costs to Quebec society have not yet been fully assessed. As for Quebec engineers, their level of public support and trust has dropped to an all-time low.

Finally, Roney looked at the Mount Polley Dam collapse in British Columbia in 2014. Inadequate inspection and flawed geotechnical assumptions contributed to the collapse of a tailings pond dam, resulting in the release of over 15 million cubic metres of toxic waste and causing effectively permanent environmental damage.

All of these cases show that engineers and geoscientists must not only maintain the highest level of ethical integrity but must also be transparent and be prepared to prove to the public that they are constantly maintaining this integrity.

"It takes years for a profession to build a reputation but that trust can disappear in a day," Roney said.

PART TWO:

Panel Discussion Q&A

The second half of the CPD plenary session featured a Q&A session with a panel that gathered objective perspectives from outside Saskatchewan and outside the professions. These included Grant Koropatnick, P.Eng., FEC, CEO and registrar of Engineers and Geoscientists Manitoba (which has required reporting), Leigha Hubick, CPA, director of regulatory affairs, Chartered Professional Accountants (CPA) Saskatchewan (which has long had required reporting) and Chris Roney, P.Eng., FEC from Engineers Canada. Shawna Argue, P.Eng., FEC. FGC(Hon), APEGS's Director of Education and Governance, served as moderator.

Some of the questions fielded by the panel included:

Why is required reporting important?

Koropatnick noted that, in the age of the Internet, people are asking more questions, seeking more information and watching more closely than ever before. This atmosphere of heightened inquiry not only applies to the public but to the media. In one case in Manitoba, there was a construction scandal in which the competence of an engineer was involved. Because the association was able to track and prove the member's CPD, the association was able to "have his back," reach out to the media and demonstrate that the competence allegations were groundless.

Hubick stated that, for their association, required reporting was a straightforward necessity for establishing and maintaining public trust.

Roney underlined this by noting that required reporting is, ultimately vital for APEGS to preserve its status as a self-governing body. "If the public ever learned that a P.Eng. designation was essentially a licence for life, that there was no enforceable requirement for ongoing learning, they would be outraged and demand changes." He gave the examples of Quebec where the OIQ is now under provincial trusteeship and Ontario where the government imposed CPD rules on the association.

How do members react to the advent of required reporting?

Hubick said that, for her profession it was a non-event. Members understood the need for it. She also observed that the process in the CPA association, while detailed, is not onerous and, in any case, is a once-a-year chore.

Roney stated that, in Ontario, when the need for the practice was explained, resistance faded and it is now broadly accepted.

Koropatnick echoed Roney's observation about the need for explanation and education. Manitoba is in the second year of required reporting. In the first year, it had 60 per cent compliance. In the second year, it had 98 per cent.

What are the consequences of non-compliance?

In the CPA, members must pay a small late fee if they don't get their reports in on time. If the problem persists and members don't submit their annual report at all, their licence is suspended until they comply.

In Manitoba, members are sent several reminder notices and are then suspended if they do not respond.

Roney noted that the Law Society of Manitoba had faced similar issues. One lawyer challenged the Law Society's right to suspend him over CPD issues and fought the issue all the way to the Supreme Court of Canada. The Supreme Court upheld the Law Society's right to suspend members over CPD.

PART THREE:

Turning Risks into Opportunities

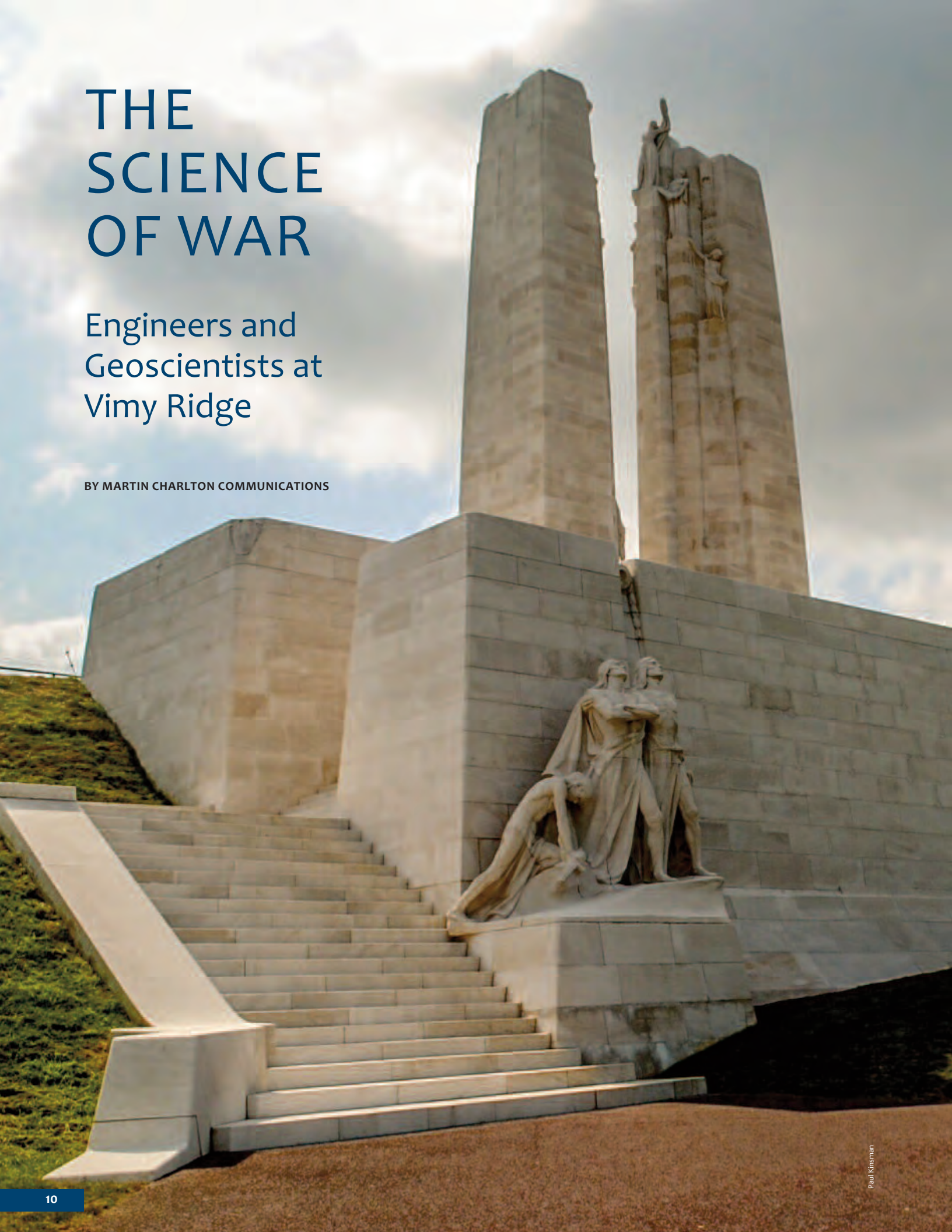
The session concluded with Koropatnick re-emphasising the benefits of transparency for building public trust and for converting potential pitfalls into opportunities to enhance the professions' reputations.

"If a member ever comes under any sort of media scrutiny, strong competence measures such as required reporting gives the association the ability not only, if appropriate, to defend the member but also creates an opportunity to educate the public about the strict standards and ethics of the association."

THE SCIENCE OF WAR

Engineers and Geoscientists at Vimy Ridge

BY MARTIN CHARLTON COMMUNICATIONS



Paul Kinsman

Many historians believe Canada came of age as a country in April 1917 when soldiers took control of that now-famous hillside and forced the German enemy to retreat.

How did they do it?

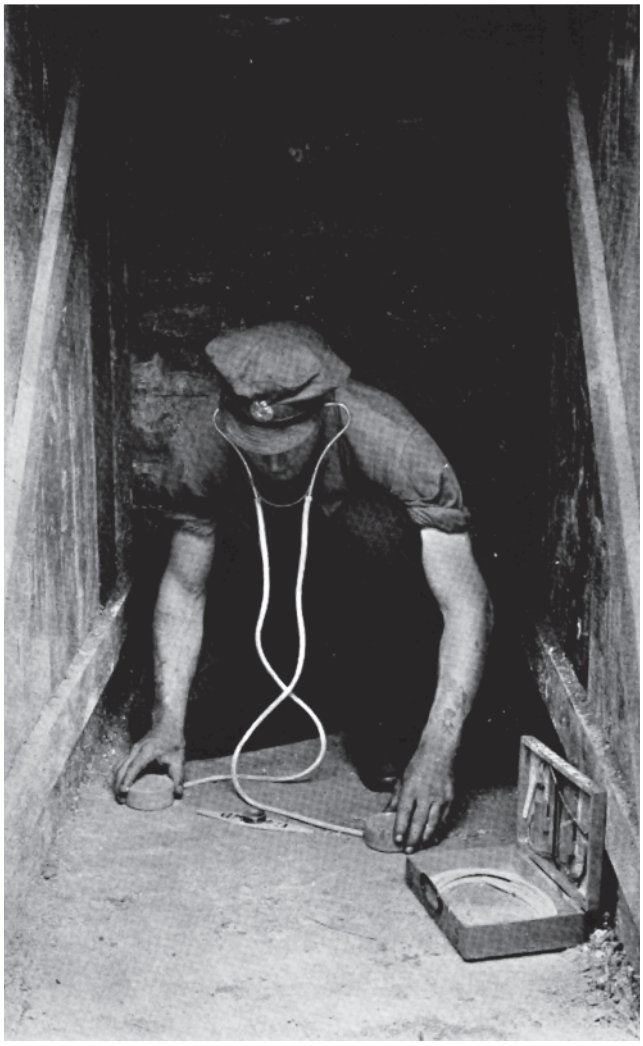
With the aid of engineers and geologists, of course.

The Canadian infantry was doubted, had their ideas scoffed at and called unorthodox by British allies and weren't expected to be successful in combat at Vimy Ridge.

Thanks to several engineering marvels and a well-orchestrated attack, a Canadian-led force won a key battle in the First World War in northern France.

Mole Men

Vimy Ridge is the highest point in northern France and is about 14 kilometres long. It was already home to dozens of ancient tunnels prior to WWI. German and Allied forces dug more tunnels for various reasons – protection, command posts, ammunition storage, listening posts and to plant explosives beneath enemy soldiers on the above battlefield.



The network of tunnels was one of the most remarkable engineering feats of World War I. Digging was integral to the role of a soldier. Hundreds of kilometres of tunnels were dug, which helped reduce the number of casualties, return the wounded through a safer route and enabled supplies to be brought up under less hazardous conditions.

Engineers ensured tunnels had piped water and were lit by electricity provided by generators. Tunnels also housed telephone lines.

Within these tunnels, soldiers would use geophones with stethoscopes to tap in to nearby enemy conversations. These listening techniques also enabled soldiers to hear where enemy tunnels were being dug.

Geophones could detect noises up to 50 metres away. Using two geophones, a listener could decipher the direction of enemy activity by moving the sensors until sound levels were equal in both ears.

By the end of 1916, the scale of tunnelling warfare expanded so much that there were not enough listeners to man every post. As a result, central listening stations were devised. Working electronically like a telephone exchange, the signals from up to 36 remote sensors (tele-geophones and seismomicrophones) could be distinguished and logged by just two men.

(By comparison, a modern seismic survey for oil could potentially use thousands of geophones).

Plotting the Route

In addition to constructing a vast tunnelling network, Canadian and British engineers repaired approximately 40 kilometres of road and added 5 kilometres of new plank road. They also reconditioned 32 kilometres of tramway used for light trains that hauled ammunition.

Above ground, engineering methods took shape in the form of surveying and mapping and stereoscopic photography. Maps of that region of France were not reliable so soldiers had to come up with alternative ways to determine the best route of attack.

How did they do this? Observation balloons carried cameras and wired phones in a basket hanging below – historical images of this practice resembled a small blimp with a hanging carrier basket.

Military aircraft also had mounted cameras, though flying a surveyor plane proved to be a dangerous mission as the average life expectancy of a pilot was two months. Famous German fighter pilot von Richthofen (aka: the Red Baron) registered 80 kills in the war, most of which were surveyor pilots.

Moosomin born engineer General Andrew McNaughton

Retro High Tech

Other popular engineering practices used by Canadian and Allied forces at Vimy included:

Sound ranging: This helped to locate enemy artillery by triangulating on the muzzle blast. The first sound rangers were Lucien Bull, Charles Galton Darwin and William Lawrence Bragg.

Bull improved a string galvanometer electrocardiograph, a Willem Einthoven invention. This was a 600-pound machine originally used in heart research and requiring five operators. Small electric currents flowed through the string and were deflected by magnets, which would cast a shadow on a moving film strip. The position of the shadow indicated the strength of the current.

Bull modified this to record cannon sounds by producing high-speed photographic analysis of ballistics.

Bragg, Darwin and Bull were not well received by British commanders.

"The idea of carrying an electrocardiograph into the line, setting it up, and depending on a photograph of the vibrations of an oscillograph to tell you of the enemy gun positions was treason, literally treason," said General Andrew McNaughton, a civil engineer and artillery specialist who hailed from Moosomin, Sask.

"We brought the sound rangers down to the Canadian Corps area. The first thing I did was get them physically looked after and then we began demanding information from them and we made darn good and certain they knew we were using it."

Canadian Corporal Tucker, while at Imperial College, studied the change of electrical resistance with temperature, so they used his idea to detect enemy cannon noise.

Hot wire microphones were deployed in a long line and plotted on a map. When an observer heard a shot, he would turn on the microphones, while a technician measured the sound through each microphone.

Flash spotting: Telescopes were used to spot a flash and measure the angles. Telephones were used to turn on a timing light, and when all the lights were lit simultaneously they had the same target.

Calibrating cannons: Guns were aimed directly over open sights or indirectly using forward spotters with code to indicate right or left for the next shot. By the time the target was located and ready to be fired upon, it was moved to a different spot.

General McNaughton's calibration of heavy guns allowed his soldiers to hit the target on the first shot, achieving surprise, using map coordinates from sound ranging and flash spotting and corrections for muzzle velocity, weather and topography.

Boulenge screens: A cannon shell passes through two wire screens, breaking electrical circuits causing two brass rods to fall. The time is calculated from the two fall times, and distance between the two screens divided by calculated time gives muzzle velocity.

What did the Germans do to counter these tactics? German Ludger Mintrop, a physicist, found a method to estimate the distance to cannons by using seismic and sonic signals. However, German generals did not believe him.

Late in 1918 Mintrop finally convinced a general to invest in 100 seismic reconnaissance groups, but this project was never realized because the war ended.

After the war, Mintrop moved to Texas and found oil with his seismic methods.

Putting It All Together

Canadian soldiers were diligent in their preparation. They perfected their attack through "dress rehearsals" before their surprise onslaught.

The troops in strict formation advanced behind a creeping barrage, a tactic first used at Vimy. Heavy artillery fired just ahead of the advancing troops, which prevented German soldiers from escaping their bunkers and trenches.

Two weeks before the Vimy assault, the Allied forces started to soften German positions with a massive artillery barrage. More than a million shells rained down during what the Germans called the "Week of Suffering." Aerial reconnaissance allowed spotters to report the position of German guns, which were then hit.

Some 30,000 Allied soldiers went over the top at Vimy Ridge, with 3,598 killed. There were 20,000 German casualties (dead or wounded), with 4,000 captured.

SELF-DRIVING CARS

Implications for Engineers

BY MARTIN CHARLTON COMMUNICATIONS

There is something about Carl Kuhnke's infectious charm that reminds one of Doc Brown from *Back to the Future*. They both have a bold vision for future technology which is at the same time exciting and a bit scary. And coincidentally, they both work with high-tech vehicles.

Kuhnke is the managing director at Saskatchewan Centre of Excellence for Transportation and Infrastructure and previously served as the executive director of the Intelligent Transportation Systems Association of Canada. In his talk, his first task was to dispel any lingering notions that autonomous cars are some sort of far-off, hypothetical technology that exists now only in prototype. As Kuhnke made clear, autonomous vehicle technology, in whole or in part, is already here, already part of our lives and will become a much bigger part of our lives much sooner than we think.

"For the 2018 model year in Canada, all cars from the 10 major manufacturers will be equipped with frontal crash braking radar and rear cameras as standard equipment. Already today you cannot hit someone from behind due to distraction. Neither can you veer out of your lane or claim your blind spot made you cut someone off."

And the current implementations are not limited to these partial measures.

"Google, Tesla, Audi, Mercedes, Denso, Delphi and others have logged tens of millions of miles with the only known at-fault accidents caused by human error. Major resource firms around the world are already using autonomous vehicles on their private lands, saving hundreds of dollars an hour in human operator costs."

Kuhnke recalled his own experience monitoring an autonomous semi-trailer going 180 km/hour down the Autobahn in Germany.

"It was a weird experience but not in the way you might expect. It was weird because it was boring. The whole ride felt so smooth and safe."

If we accept that autonomous vehicles are not hypothetical but imminent, the implications for engineers and society at large are enormous. It falls into the category that Kuhnke calls disruptive technology – one that will change everything it touches.

To Kuhnke, the biggest and most important effect of these vehicles is the reduction in harm to people and property. Studies estimate that autonomous vehicles could reduce collisions by unimpaired drivers by as much as 80 per cent.

Autonomous vehicles would also require that transportation engineers radically rethink the way they design roads. These vehicles can travel faster and more efficiently on less road space and with much less traffic congestion.

"Right now, we design roads for human error but now we can abandon that thinking. We don't have to build more and more lanes or make them wider and wider because the autonomous vehicles are operating with much smaller margins of error."

The autonomous vehicle might also make public transportation obsolete as people instead opt for on-demand cars such as Uber's experiment with autonomous cabs.

"This all makes autonomous vehicles very attractive to governments. They offer the prospect of reducing the costs of health care, public infrastructure and public transit dramatically."

Kuhnke estimates that the technology could save up to 100,000 lives a year and lead to a $30 billion a year drop in health care costs. As well, through reduced traffic congestion, up to 300 million annual tonnes of greenhouse gases would no longer be emitted.

Kuhnke also sees revenue potential for governments such as more efficient toll road systems where drivers pay for the precise distance they travel rather than flat fees for using toll roads.

With the money saved and earned, Kuhnke envisions that governments could invest in other kinds of infrastructure, such as solar-powered roads that could be embedded with guidance sensors while also keeping roads ice-free.

The implications for engineers are countless. Road design and land use policies would have to be reconfigured. Traffic systems such as traffic lights would become effectively obsolete. Autonomous vehicles would make automatic adjustments for road construction which would allow work zone safety to be enhanced.

While the autonomous vehicles offer many potential benefits, they also have troubling aspects, many of which were raised in the question and answer session.

How would autonomous vehicles fare on Canada's icy roads? Kuhnke maintains that ground-penetrating radar would allow the vehicles to adapt to any road conditions. They would even adapt for minor road repair annoyances such as poorly painted lane lines.

> "The vehicles position themselves in relation to the road and other vehicles. You don't even need painted lines as long as you've got the slope of the road right."

Many have questioned how these vehicles would make ethical choices. In the classic dilemma, if no other options were available in an emergency situation, would an autonomous car plow into a crowd of people but save the driver or drive over a cliff, saving the group of people but killing the driver? Kuhnke acknowledged that these are issues that need to be worked out on a societal level and some of them may not be perfectly resolvable.

As Kuhnke himself pointed out, autonomous vehicles are part and parcel of the concept of the internet of things – devices that communicate, share data and interact with each other. With this in mind, what are the implications of cyber-security? Could a cyber-terrorist seize control of vehicles and transit systems and cause mayhem on the roadways? Kuhnke acknowledged that this problem was unsolved at present and would require serious attention.

Yet for all of these potential potholes, trends in the automotive industry make it clear that autonomous vehicles are coming down the road fast. As guardians of public safety, engineers will be challenged to either get on board or get run over.

Landfill Gas to Energy

BY MARTIN CHARLTON COMMUNICATIONS

Eight million tonnes of trash is not appealing to the average person. But for the city of Regina views a heaping mound of garbage as a potential treasure.

That's because city officials and approximately 30 engineers from various disciplines recently introduced a reciprocating lean burn engine that burns landfill gas (methane) created by anaerobic degradation of organics in the landfill.

The system could generate more than $1 million in revenue annually for the city.

Recently the landfill-gas-to-energy model earned the City of Regina a Sustainability Award at the Regional Centre of Expertise (RCE) Saskatchewan Education for Sustainable Development recognition event, which recognizes organizations that are making our province more sustainable.

Environmentalists should also applaud the initiative.

The project is expected to convert approximately 30 000 tonnes of methane gas collected at the landfill into enough electricity to continuously power 1,000 homes. This is the equivalent of taking 8,000 vehicles off the road.

Engineers in hydrogeology, mechanical and electrical engineering, among others, played a role in developing of this system.

Here's how it works:

In 2008, the landfill began collecting gases through vertical wells. However, instead of that gas being converted into electricity, the gases were combusted with a candlestick flare.

Four years later, 27 extraction wells now act as a vacuum to suck methane from the landfill. The gas collected is mostly methane – approximately 48-56 per cent. Carbon

dioxide (42-45 per cent) and oxygen (1.5 per cent) also are collected on site.

The brain of this network is referred to as DIANE – the dialogue network. This module controls and monitors every aspect of the engine, blowers and conditioning units. Additionally it ensures gas has appropriate methane and oxygen concentrations, monitors all temperature and pressure in the engine and throttles the gas into the engine based on input from the gas analyzer.

Once the methane is removed, it'll pass into a gas conditioning unit. This is the initial knockout period where chillers flow through a heat exchanger to cool the gas to 8 Celsius.

From the gas conditioning unit, the gas then is transferred into a 20-cylinder, gas-burning engine that runs at about 1,800 rpm and weighs 14 000 kilograms. This engine then transfers the gas to a generator which in turn passes it on to a transformer for electrical output connected to SaskPower data.

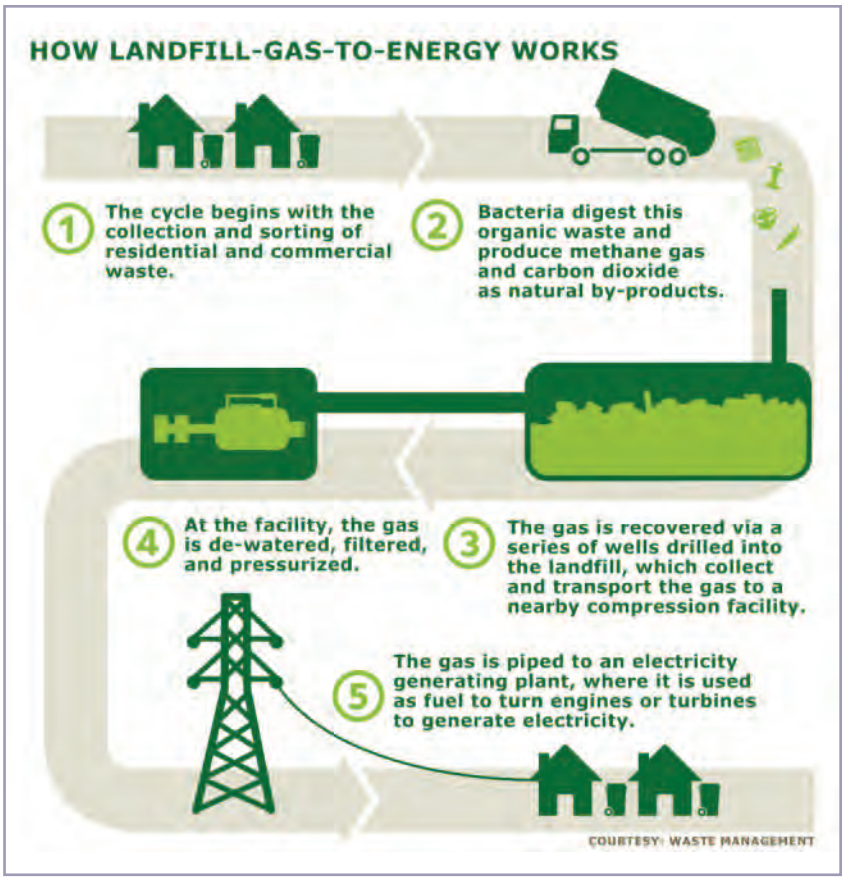
The methane burns and the engine turns a generator that produces about 1 megawatt of power.

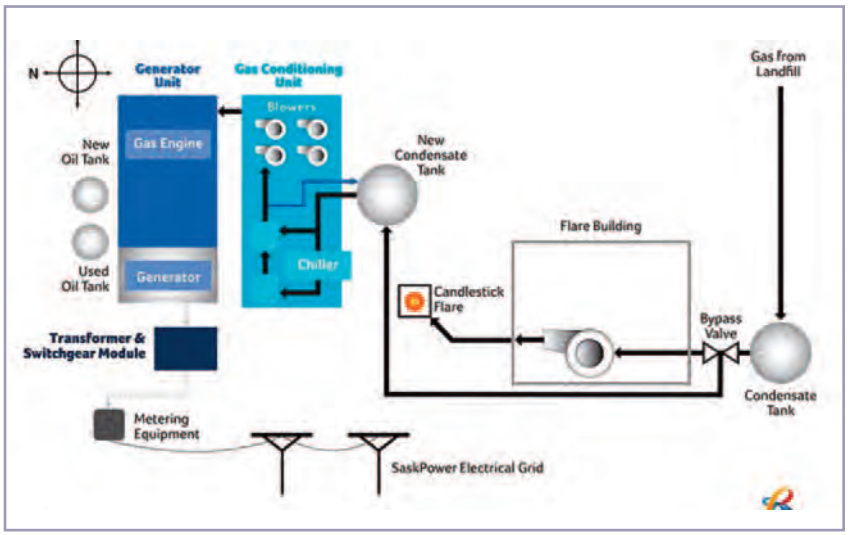
According to Greg Kuntz, P.Eng., the manager of environmental services with the City of Regina, there should be enough methane generation at the Regina landfill to power the facility for the next 50 years, though conditions at the landfill are considered very dry which results in less aggressive methane production.

The entire system is below ground to avoid freezing.

In conjunction with the project, the city and SaskPower agreed to a 20-year contract. The power company will only pay for the power the city produces, rather than a consistent flat rate.

Buying the power from the City of Regina will also help SaskPower move closer to its goal of generating 50 per cent of its electricity from renewable sources by 2030.

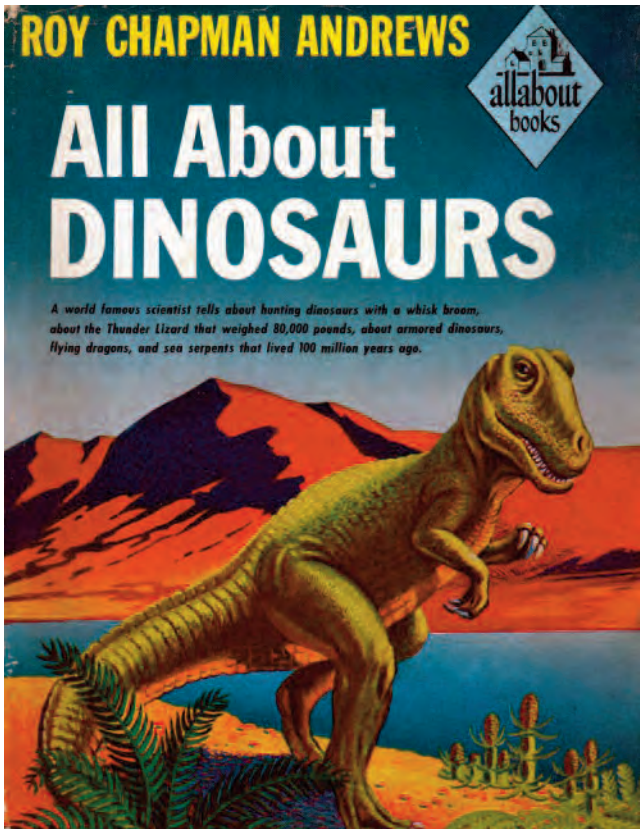




If the facility proves to be successful, an expansion could happen in the future. There is enough capacity to add a second generator, an expanded gas collection system and a bioreactor, and the potential to move to a full waste-to-energy system.

Keynote Speaker - Philip J. Currie, Department of Biological Sciences, University of Alberta

BY MARTIN CHARLTON COMMUNICATIONS



Make no bones about it – the subject of dinosaurs is one that has captivated the imaginations of children and adults ever since the terrible reptiles were first discovered nearly 200 years ago.

This was certainly the case with Philip Currie, guest speaker at the Professional Development Luncheon. Currie's interest in dinosaurs began at the age of six when toy dinosaurs were offered as prizes in boxes of Rice Krispies.

"Unfortunately my mom wouldn't let me just dump out the box to get to the prize. I had to eat all the Rice Krispies first. To this day, I can't stand to eat Rice Krispies anymore."

From the toys, Currie graduated to a popular children's book, *All About Dinosaurs* by Roy Chapman Andrews, which started him on his lifelong voyage of discovery on the topic.

After graduating from paleontology in Ontario, Currie soon headed west to Alberta, one of the great capitals of dinosaur discovery in the world.

According to Currie, American paleontologist Barnum Brown discovered the significance of the Alberta sites in the early years of the 20th century. Brown shipped cartloads of bones out of Alberta to museums in New York. In fact, Currie noted, many of the museum displays throughout North America come from Alberta sites. Some of Brown's most important discoveries lay forgotten in the stockpile of the American Natural History Museum until Currie rediscovered them.

Dinosaur bones are so common in some parts of Alberta that, according to Currie, there are fields where you can't walk without tripping over them. Since this was such a common experience, local people did not fully appreciate the significance of where they lived until the United Nations declared Alberta's Dinosaur Provincial Park – a place known as "the mother of bones" - a UNESCO World Heritage Site in 1980.

This became a great boon to the local tourism industry. Not only did the Royal Tyrell Museum of Paleontology become a multi-million dollar a year tourist attraction, but numerous smaller museums popped up around the region (including the Philip Currie Museum in Grande Prairie).

Although Currie and his teams have made innumerable important finds, one that he finds particularly important is their discovery of a near complete skeleton of Ornithomimus, a species that helped paleologists make the connection between dinosaurs and birds. Among its other features were markings suggestive of feathers. This has been supported by discoveries of feathers, presumed to be from dinosaurs, preserved in amber.

Another of Currie's favourite discoveries was the skeleton of the Saurornitholestes, a dinosaur related to the famous Velociraptor. The skeleton was displayed at the 2016 Dinosaur Expo in Tokyo where it was viewed by an estimated 1.4 million people.

Keynote Speaker - Philip J. Currie, Department of Biological Sciences, University of Alberta

Outside of Alberta, Currie has also done work in Mongolia, another of the world's major areas of dinosaur discovery. The Mongolian sites suffer from problems with theft and vandalism so the Mongolian government has reached out to the United States to help them track down poachers trying to sell bones to museums and private collectors.

Looking at the field of paleontology more broadly, Currie noted that the topic of dinosaurs is so popular that paleontologists enjoy the enthusiastic support of scientists in other fields who have helped them make important discoveries.

For example, Currie observed that there is a misconception that dinosaurs lived in tropical areas. In fact, their reptilian nature led them to be more attracted to temperate areas, away from extremes of temperature. Some dinosaurs even regularly migrated to what we would today regard as the polar regions (but before the ice caps) because they enjoyed the long hours of sunlight in the summer months.

In conclusion, Currie noted that there is a certain irony to the field of paleontology. Although a field that studies long-dead animals might seem static, paleontologists are finding new species and making new discoveries all the time. This has been reflected in the explosion of the field on the professional level.

"Fifty years ago, there were maybe six people working full-time in paleontology worldwide. Today, there are 150. Dinosaurs may be dead but the work of studying them is alive and well."

Member Profile

This month *The Professional Edge* chats with Eric Quail, P.Eng., a civil engineer working with the City of Saskatoon Roadways and Operations Division.

Tell us about your personal and professional background.

Saskatoon, born and raised. I grew up in Saskatoon, went to Aden Bowman and then went to the U of S straight out of high school.

Why did you choose to go into engineering?

I've always been drawn to construction, heavy equipment, projects and building things. I also enjoy working outdoors and being active. I did a lot of camping with Boy Scouts as well as fishing and canoe trips growing up. Working in construction, power plants and the Saskatoon Water Plant and Roadways was and is a good fit for me.

What was your biggest challenge in college?

University in general was very difficult. Nothing ever comes easy for me so I definitely had to hunker down. It was a tough haul but well worth the rewards when I was done.

One of my first summer jobs was tree planting which had a pretty big influence on me. It was one of the biggest challenges I had. With tree planting you love it or hate it - nothing in between.

What was your first job after college?

I worked with SaskPower in Regina designing power lines. I did that for five years. My first large project was the Regina to Saskatoon 220KV power line. After that I worked on many of Saskatchewan's coal, wind and gas power plants. When my daughter was born I looked for something more permanent and stable. I landed a job with the City of Saskatoon and have been here ever since in various capacities.

While in the field, I learned many of the lessons that made me the engineer I am today. It taught me about working collaboratively within a team environment to identify issues, work through the options and determine the best solution. In addition, I learned to embrace mistakes as opportunities to learn, improve and move forward.

What do you feel was your single greatest accomplishment as an engineer?

It's hard to point to one accomplishment. If I had to pick just one, I'd say the Water Treatment Plant long term plan and facility upgrade was the biggest challenge for me. I was able to apply much of what I learned from construction within an operations and maintenance plant environment.

What are your interests outside of work?

The outdoor life continues to be my preoccupation. My wife, two kids, three horses, three dogs and six cats all live on the acreage and keep us busy. In winter, we snow mobile and go tobogganing. In summer we go camping, fishing, walking, gardening and all of those acreage chores. On the volunteer side of things, I've recently become a Director of the Saskatchewan Public Works Association.

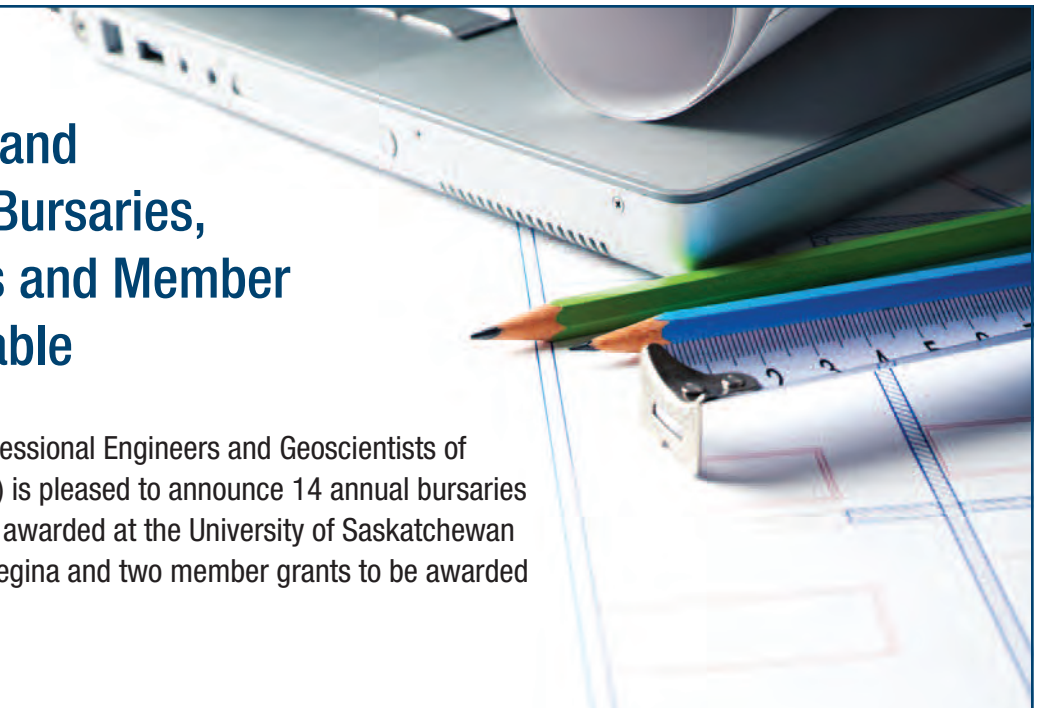
What is your favourite vacation spot?

For the most part, we stay in Saskatchewan and Alberta because of we don't want to stray too far from our animals, so camping in places like Lake Diefenbaker, Big River and Waskesiu work well. New for this year we are heading to Cypress Hills and Kenosee. We occasionally dabble our toes into Alberta where my brother lives.

Who has had the greatest influence on your life and career?

On the career side, Ken Cairns, P.Eng helped me a lot. He was the SaskPower Construction Manager for projects I worked on in Estevan, Swift Current and Saskatoon. Because of Ken and the experiences we shared I don't just see safety as a priority, I live it as a value that guides my professional and personal life. Ken's biggest words to me were to be firm but fair and that no good deed goes unpunished.

As for my life in general, I would say my wife. She helps me me keep things in perspective and keeps me balanced. Our decision to buy an acreage, for example, was one she drove but for me it was the best decision – it was the move that helped me keep my 50/50 balance for outdoor living.



Engineering and Geoscience Bursaries, Scholarships and Member Grants Available

The Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS) is pleased to announce 14 annual bursaries and scholarships to be awarded at the University of Saskatchewan and the University of Regina and two member grants to be awarded by APEGS.

Entrance Bursaries

These bursaries are aimed at encouraging and assisting high school graduates entering the study of engineering or geoscience. These bursaries are particularly aimed at Aboriginal students who are under-represented in the professions.

Two bursaries of $3,625 (one for each university) to be applied towards first-year tuition in any field of engineering for a self-identified Aborigina student.

Two bursaries of $2,750 (one for each university) to be applied towards first-year tuition in any field of geoscience for a self-identified Aboriginal student.

Two bursaries of $3,625 (one for each university) to be applied towards first-year tuition in any field of engineering for a student of any background.

Undergraduate Scholarships

These academic performance and community participation-based scholarships are aimed at recognizing leadership and volunteerism among students currently enrolled in engineering or geoscience.

Six scholarships of $1,875 (three for each university) for current students of any field of engineering.

Two scholarships of $1,875 (one for each university) for current students of any field of geoscience.

Graduate Students

These merit-based grants are aimed at encouraging existing APEGS members to further their education.

Up to six grants of $7,500 each for current APEGS members returning for post-graduate studies (either university) in fields of engineering, geosciences or an MBA program.

For more information, refer to the APEGS website: http://www.apegs.ca/Portal/Pages/Scholarships-Bursaries-Grants

Professional Development Profile

In this new section of *The Professional Edge*, we will be spotlighting members who have made a CPD report. We're trying to make a point – it's not so hard and sometimes it can even be fun!

Name:

Wes Kotyk, P.Eng.

About me:

My career has taken me a number of locations throughout Saskatchewan. I have lived in Moose Jaw, Gravelbourg, Regina, Saskatoon and Prince Albert if you count one of my work terms in university. My most recent change will see me and my family moving back to my hometown of Regina in the coming months.

Job Responsibilities:

I have recently been appointed as assistant Deputy Minister of the Environmental Protection Division for the Ministry of Environment and have been with the ministry for 25 years. The work we do in the ministry is very interesting and varied.

How I earn continuing professional development (CPD) credits:

For formal activity, I have taken various technical courses over the years related to my environmental engineering duties. As my duties and responsibilities progressed to management and executive functions, I pursued more management and leadership training, including courses in public service ethics, negotiation and personal leadership.

For informal activity, I participate in conferences organized by professional or industry groups such as APEGS, the Saskatchewan Mining Association and Saskatchewan Environmental and Industry Managers Association (SEIMA).

I also get some CPD credits through my involvement with various organizations. I was the APEGS Environment Committee Chair for a number of years. I am a member of the SEIMA board and had previous involvement with the Saskatoon Geotechnical Group executive.

I have mentored Engineers-in-Training and other professionals on occasion and also give presentations at some of the conferences I attend.

How CPD helps me:

The formal activities have typically provided direct learning development needs selected to coincide with current professional priorities of the day. But we can't underestimate the importance of informal activities and participation and presentation events. These provide great opportunities to engage with other professionals to discuss and hear other opinions and learn from others' experiences as well. It's also a bonus when these events help to strengthen your professional network and allow you to re-engage with friends and colleagues.

ANNUAL MEETING PHOTO GALLERY

TOP: Annual Meeting attendees enjoy refreshments and exhibits at the welcome event at the Saskatchewan Science Centre.

BOTTOM LEFT: Attendees enjoy "May the fourth be with you" hijinks at the welcome event.

TOP RIGHT: Future APEGS members work with Lego and other activities at the Kid's Room.

BOTTOM RIGHT: Engineers Canada President Chris Roney, P.Eng., FEC addresses attendees at the Business Meeting.

2017 APEGS Salary Survey Summary Results

The Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS) contacted 5,489 Professional Engineers, Professional Geoscientists, Engineers-in-Training, Geoscientists-in-Training and Licensees living in Saskatchewan. A total of 2,072 members completed the survey, representing a 37.7 per cent response rate. Surveys were completed in February and March 2017 and salaries reported were as at December 31, 2016. Insightrix Research Inc. compiled and tabulated all results. The detailed report, which includes analysis by gender, can be found on the APEGS website at **http://www.apegs.ca/Portal/Pages/salary-survey**

The main goals of the survey are:

- to provide information to all members regarding monetary compensation for different levels of responsibility and advanced degrees;
- to provide information to employers to assist them in establishing appropriate pay levels for recent graduates and ensuring competitive compensation packages for experienced professionals; and
- to give students, career counsellors and other interested persons information on employment, including salaries, in the engineering and geoscience professions in Saskatchewan.

Annual Salary by Final Year of Graduation (B.Sc.)

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
1976 & Prior	43	2.1%	$151,152	$118,364	$128,501	$148,873	$170,782	$190,636
1977*								
1978	10	0.5%	$187,654	$0	$125,544	$157,500	$215,000	$295,000
1979*								
1980	19	1.0%	$135,352	$60,000	$107,000	$140,000	$168,000	$197,000
1981*								
1982	23	1.2%	$145,510	$94,000	$110,000	$140,000	$165,000	$213,238
1983	15	0.8%	$160,487	$30,000	$120,000	$153,000	$203,000	$265,000
1984	14	0.7%	$162,107	$85,000	$120,000	$161,000	$195,000	$281,000
1985	18	0.9%	$150,167	$16,927	$110,000	$133,114	$186,000	$270,000
1986	27	1.4%	$138,794	$70,000	$92,500	$150,000	$180,000	$212,000
1987	24	1.2%	$132,713	$10,200	$113,786	$148,200	$162,144	$194,000
1988	22	1.1%	$140,656	$100,000	$121,000	$150,000	$167,271	$182,000
1989	22	1.1%	$134,755	$82,000	$103,380	$139,000	$157,000	$183,000
1990	24	1.2%	$147,249	$104,000	$125,000	$142,500	$176,305	$192,000
1991	18	0.9%	$146,305	$60,000	$114,000	$141,000	$175,500	$225,000
1992	17	0.9%	$187,551	$0	$110,000	$130,000	$149,000	$200,000
1993	20	1.0%	$178,423	$25,564	$94,126	$120,417	$155,750	$200,000
1994	33	1.7%	$137,872	$80,000	$96,300	$138,485	$168,700	$202,000
1995	25	1.3%	$162,432	$110,000	$128,000	$160,000	$180,000	$246,000
1996	31	1.6%	$139,525	$75,000	$100,131	$150,000	$180,000	$198,000
1997	35	1.8%	$138,524	$90,000	$105,000	$128,000	$160,000	$236,000
1998	29	1.5%	$107,317	$40,000	$90,000	$110,000	$130,000	$155,000
1999	38	1.9%	$123,339	$90,000	$100,000	$119,500	$130,000	$192,000
2000	57	2.9%	$118,603	$66,000	$97,600	$114,000	$137,000	$172,212
2001	59	3.0%	$115,180	$61,000	$100,962	$119,000	$135,000	$163,000
2002	57	2.9%	$119,639	$76,000	$106,000	$113,000	$139,000	$165,000
2003	47	2.4%	$117,277	$69,000	$100,000	$115,927	$128,700	$174,451
2004	59	3.0%	$111,281	$70,000	$89,200	$110,000	$121,000	$174,000
2005	68	3.5%	$108,836	$64,500	$91,527	$110,000	$126,500	$150,000
2006	57	2.9%	$105,174	$52,000	$89,700	$106,500	$118,800	$157,700
2007	99	5.0%	$100,196	$46,657	$87,550	$99,300	$117,000	$135,000
2008	97	4.9%	$95,734	$67,200	$84,600	$93,900	$105,060	$145,000
2009	102	5.2%	$94,770	$64,000	$85,000	$94,335	$105,000	$126,000
2010	112	5.7%	$88,678	$65,000	$78,000	$87,750	$101,200	$120,000
2011	116	5.9%	$86,246	$62,000	$73,100	$80,658	$95,650	$129,600
2012	133	6.8%	$84,392	$55,000	$71,000	$78,000	$87,750	$111,500
2013	114	5.8%	$77,466	$58,830	$67,700	$74,000	$85,000	$106,000
2014	102	5.2%	$70,167	$50,000	$60,000	$69,000	$81,500	$91,100
2015	111	5.6%	$67,972	$50,640	$60,000	$64,608	$75,000	$91,000
2016	53	2.7%	$64,917	$43,000	$58,000	$63,432	$72,000	$85,000

*Not available due to reporting rules (insufficient data)

Annual Salary by Designation

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
P.Eng.	1274	64%	$119,952	$73,000	$91,150	$109,582	$136,000	$192,000
P.Geo.	82	4%	$126,627	$78,500	$100,000	$124,500	$145,000	$185,000
P.Eng. and P.Geo	19	1%	$143,191	$30,000	$110,000	$160,000	$168,000	$210,000
Engineering License	14	1%	$121,761	$86,000	$97,500	$114,500	$140,000	$190,000
Engineer-in-Training	572	29%	$74,406	$50,000	$63,000	$71,030	$82,500	$110,000
Geoscientist-in-Training	33	2%	$76,044	$32,000	$62,000	$72,000	$88,000	$150,000
Geo Licensee*								

Annual Salary by Discipline

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Civil	421	21.1%	$99,529	$60,000	$72,000	$91,500	$110,000	$170,000
Mechanical/Industrial	456	22.8%	$104,092	$60,000	$78,000	$96,108	$123,089	$179,262
Electrical/Eng. Physics	315	15.8%	$110,295	$60,000	$77,000	$100,000	$127,000	$164,000
Chem/Ceramic/Metal	91	4.6%	$116,230	$70,450	$85,000	$105,000	$146,219	$192,000
Geo/Mining/Petro	237	11.9%	$128,305	$70,000	$90,900	$110,000	$149,000	$208,000
Agriculture Forestry	46	2.3%	$82,690	$50,000	$64,534	$75,700	$93,000	$145,000
Environmental	125	6.3%	$93,469	$54,000	$72,000	$90,000	$110,000	$154,000
Geo./Hydro.	95	4.8%	$111,406	$54,000	$82,000	$105,000	$137,000	$185,000
Software/Computer	40	2.0%	$91,667	$48,250	$72,250	$88,710	$109,250	$153,738
Biological/Biomedical*								
Industrial*								
Other	165	8.3%	$111,905	$57,000	$75,533	$100,962	$140,000	$200,000

Annual Salary by Function

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Corp. Mgmt.	136	6.8%	$153,514	$85,000	$125,000	$146,500	$171,500	$265,000
Project/Op. Mgmt.	778	39.0%	$111,460	$63,000	$85,800	$103,852	$130,000	$182,000
Project Admin.	64	3.2%	$87,243	$52,000	$63,534	$81,500	$105,000	$130,000
Design	410	20.5%	$92,572	$57,000	$70,000	$80,978	$102,000	$150,000
Research/Planning	125	6.3%	$94,328	$40,000	$70,624	$89,000	$120,000	$150,000
Inspec./Quality/Res.	69	3.5%	$78,832	$52,000	$63,000	$72,000	$91,000	$133,000
Operating/Maint.	176	8.8%	$111,344	$56,472	$81,277	$95,670	$120,000	$165,000
Teaching	40	2.0%	$155,022	$80,000	$96,000	$137,500	$166,500	$202,500
Marketing/Sales	28	1.4%	$105,422	$60,000	$77,500	$87,750	$107,500	$190,000
Reg./Enforcement	65	3.3%	$92,790	$65,000	$76,000	$91,000	$103,000	$130,000
Exploration	39	2.0%	$104,777	$32,000	$73,713	$95,677	$135,000	$185,000
Other	66	3.3%	$100,045	$49,000	$72,000	$96,840	$125,000	$165,000

*Not available due to reporting rules (insufficient data)

Annual Salary by Industry

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Consulting Service	479	24.0%	$97,691	$60,000	$71,060	$87,570	$113,200	$175,000
Oil & Gas	109	5.5%	$97,400	$55,000	$75,200	$90,000	$116,286	$155,000
Except Oil & Gas	369	18.5%	$125,920	$73,713	$94,000	$113,000	$145,000	$198,000
Procure/Const.	171	8.6%	$102,137	$62,400	$72,000	$93,000	$120,000	$185,000
Manufac. Durables	182	9.1%	$89,602	$53,857	$67,200	$82,350	$109,000	$145,000
Manufac. Non-Durables	76	3.8%	$128,908	$57,700	$85,445	$108,450	$146,860	$212,000
Service For Profit	29	1.5%	$102,446	$49,000	$70,000	$81,500	$101,112	$205,000
Service Not For Profit	148	7.4%	$99,331	$59,892	$80,000	$97,270	$111,050	$150,000
Utilities	265	13.3%	$115,930	$62,000	$86,000	$109,920	$131,635	$177,610
Educational Services	76	3.8%	$130,817	$40,000	$84,180	$125,000	$162,144	$203,000
Agriculture/Forestry	18	0.9%	$79,328	$42,000	$63,000	$74,062	$93,252	$130,000
Other	74	3.7%	$89,508	$24,000	$69,000	$85,000	$110,000	$159,360

Annual Salary by Degrees

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Bachelor's	1367	68.5%	$102,143	$58,000	$74,300	$93,000	$120,000	$174,000
...	215	10.8%	$111,268	$66,000	$85,000	$103,347	$129,361	$180,434
Master's Degree	287	14.4%	$117,747	$55,000	$80,500	$106,000	$130,000	$186,000
...	36	1.8%	$128,273	$63,024	$85,000	$109,500	$172,226	$250,000
Doctorate	91	4.6%	$130,425	$55,000	$95,000	$137,000	$162,287	$193,000

Annual Salary by Experience

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
<1 year	79	4.0%	$68,834	$42,000	$56,000	$65,000	$78,000	$110,000
1 year	36	1.8%	$68,149	$24,000	$60,000	$62,916	$75,000	$109,000
1.5 years	79	4.0%	$66,055	$48,928	$59,892	$63,432	$71,550	$89,268
2 years	101	5.1%	$71,960	$45,500	$62,790	$68,700	$80,000	$110,160
3 years	132	6.6%	$77,939	$54,100	$65,000	$73,470	$87,680	$110,900
4 years	136	6.8%	$81,433	$60,613	$70,860	$78,000	$86,750	$117,956
5 years	165	8.3%	$83,255	$60,000	$72,700	$80,000	$92,000	$120,000
6 years	130	6.5%	$97,788	$69,000	$79,600	$90,000	$102,500	$125,000
7-8 years	193	9.7%	$98,072	$70,400	$86,000	$96,000	$109,424	$139,600
9-10 years	174	8.7%	$107,469	$75,000	$93,900	$103,500	$121,165	$150,000
11-12 years	133	6.7%	$124,734	$76,400	$98,600	$115,000	$130,000	$175,000
13-14 years	84	0.2%	$117,369	$89,200	$100,481	$110,419	$128,350	$165,000
15-17 years	145	7.3%	$125,597	$85,000	$106,000	$123,000	$140,000	$170,000
18-20 years	79	4.0%	$157,796	$90,014	$110,000	$135,000	$171,000	$246,000
21-24 years	95	4.8%	$152,63	83,000	$114,000	$140,000	$175,000	$200,950
25+ years	235	11.8%	$154,842	$88,865	$125,000	$150,000	$179,262	$250,000

Annual Salary by Sector

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Public Sector	604	100.0%	$110,358	$60,000	$80,000	$103,000	$128,000	$180,000
Private Sector	1369	100.0%	$105,717	$59,085	$75,000	$95,400	$123,177	$180,000

Total Salary

	Count	Column N %	Mean	Percentile 05	Percentile 25	Median	Percentile 75	Percentile 95
Base Salary	1996	100.0%	$107,130	$58,830	$76,291	$97,000	$125,000	$180,000
Salary incl. bonus	1996	100.0%	$180,135	$60,000	$82,278	$108,300	$145,000	$231,500

*Not available due to reporting rules (insufficient data)

Salary Changes - Full-Time Positions

	median	% change	mean	% change
1987	$48,000		$49,269	
1989	$50,928	6.10%	$62,887	27.64%
1991	$54,110	6.25%	$57,578	-8.44%
1993	$54,480	0.68%	$56,703	-1.52%
1995	$56,400	3.52%	$59,142	4.30%
1997	$60,000	6.38%	$62,266	5.28%
1999	$62,500	4.17%	$65,401	5.03%
2001	$66,000	5.60%	$68,877	5.31%
2003	$68,800	4.24%	$71,210	3.39%
2005	$71,008	3.21%	$73,607	3.37%
2007	$74,000	4.21%	$77,374	5.12%
2008	$76,352	3.18%	$83,025	7.30%
2009	$80,000	4.78%	$86,908	4.68%
2010	$82,950	3.69%	$91,548	5.34%
2011	$84,224	1.54%	$91,154	-0.43%
2012	$89,472	6.23%	$96,219	5.56%
2013	$90,000	0.59%	$98,030	1.88%
2014	$94,500	5.00%	$102,475	4.53%
2015	$97,000	2.65%	$105,111	2.57%
2016	$96,000	-1.03%	$104,628	-0.46%
2017	$97,000	1.04%	$107,130	2.39%

Regression Analysis

A stepwise linear regression was used to find the best model for predicting salaries for engineers and geoscientists working in different industries. This process was used to:

- Identify key factors which predict salary as well as factors which are not related to salary
- Make the results independent of the different scales used to measure each factor
- Identify Boolean components (such as receipt of professional designation) influencing salary
- Create a linear formula with as much predictive power as possible

An overall formula was also produced which members of APEGS can easily use to estimate their salary. The formula for 2017 explains about 50 per cent (48.2%) of variance in salary. Any model explaining at least 50per cent of the variance in the dependent variable can be considered an effective model. B-values are the raw numerical coefficients of each variable. Since the scales for each variable are different, the beta values are a better measure of relative importance of factors within the model. Refer to the "Classification Rating Guide" which can be found on www.apegs.ca to determine the values for each factor.

Factor	B (Coefficient)	Beta (Relative importance)
(Constant)	57315	
Duties (A)	157	0.210
Experience (C)	308	0.281
Supervision Scope (G)	810	0.188
Receipt of professional designation	7998	0.064

Formula for expected salary (SE) without bonus:

SE = Se=157*A+308*C+810*G+57,315

Add 7,998 if you have acquired professional status within your field (P.Eng. or P.Geo.)

SAFETY MOMENT

Become a Saskatchewan Safety Leader

Every year we invite a dedicated group of leaders to become change-makers in Saskatchewan. Once each year, on the second Thursday in June, a group of Saskatchewan's top business leaders gather to learn, share and motivate one another to change the safety culture in our province.

This is the Saskatchewan Health and Safety Leadership Charter signatory group. Founded in 2010 by WorkSafe Saskatchewan and Safe Saskatchewan, a non-profit injury-prevention organization, the charter initiative asks leaders to sign the Saskatchewan Health and Safety Leadership Charter supporting seven principles for health and safety, and then uphold and promote them in their workplaces and communities.

Since 2010, 600 companies have signed the charter at the annual June event. Companies do not need a perfect safety record to sign the charter. For some, signing the charter validated the safety journey they were already on. For others, signing the charter and becoming part of the leadership community encouraged them to begin tracking their incidents and injuries. Other leaders found that signing the charter pushed them into taking an active role in communicating safety values with management and staff.

This year the event took place June 8 at Prairieland Park in Saskatoon. The morning featured guest speakers, an employer best-practices panel and networking time for those in attendance. The highlight of the event includes welcoming new signatories.

Jason Hrywkiw, general manager, R.H. Electric Ltd., and 2015 WorkSafe Safe Employer says signing the charter and meeting the other leaders taught him to take a more "coaching" approach to safety: rather than pushing safety policies on employees, he made safety a two-way dialogue.

The charter signatory group has seen great success. Their time loss injury rates have dropped 43.11 per cent since 2010.

To learn more about the Health and Safety Leadership Charter event and become a part of this community of safety leaders, contact Safe Saskatchewan at 306.352.3810 or email **info@safesask.com**.

Signators at a Saskatchewan Health and Safety Leadership Charter event.

APEGS View

2017 ANNUAL MEETING

Bylaw Amendments

Members in attendance at the 2017 Annual Meeting confirmed amendments to *The Engineering and Geoscience Professions Regulatory Bylaws, 1997* which had been previously made by Council on June 16, 2016. Pursuant to subsection 15(6) of *The Engineering and Geoscience Professions Act*, each member is hereby notified of the bylaw amendments.

The Engineering and Geoscience Professions Regulatory Bylaws were amended as follows:

Engineering and Geoscience Licensees

9 **To qualify for registration as an engineering or geoscience licensee, a person must, in addition to the requirements set out in subsection 20(2) of the Act:**

a) **in the opinion of the Council, be qualified to practise in a particular field or type of engineering or geoscience, under any terms and conditions that the Council may determine; and**

b) **complete an examination, called "Principles of Professional Practice," which conforms to the required admission standards, secure a grade acceptable to Council, and pay the required examination fee, or submit evidence satisfactory to the Council that he or she has already passed a similar examination recognized by the Council or was admitted to membership in a Canadian professional association recognized by Council prior to January 1, 1987.**

Rationale: To include the successful completion of the Principles of Professional Practice exam as a requirement for licensure as an Engineering Licensee or a Geoscience Licensee. The inclusion of this requirement was a drafting oversight in 1997.

LETTER TO THE EDITOR

Dear Editor,

In response to the article titled "A Tale of Tailings" in the March/April 2017 issue of ***The Professional Edge*** *(Issue 167), one strategy of proactive tailings management was absent from your discussion, particularly under the section "Potash Searches for Solutions." What if potash tailings were not created in the first place? The concept of no tailings is truly an "outside the box" approach to tailings management, and that is exactly what Gensource Potash Corporation is intending to achieve through the application of the selective solution mining technique.*

Gensource's Vanguard One project, which is currently nearing completion of the feasibility study stage, will employ a selective solution mining technique referred to as "selective dissolution." Selective dissolution mining of potash consists of using an almost NaCl (salt) saturated solution to selectively dissolve KCl (potash) from a potash bed (sylvinite ore) within a solution mining cavern. There are no salt tailings or brine ponds required for selective dissolution mining, as NaCl is not produced. Without a salt tailings pile, there is no need for brine retention ponds, and therefore no brine containment structures whatsoever. Also, since the mining solution is almost saturated in NaCl, process and mining water can be obtained from brackish groundwater sources. While these mining methods are new to the province, they are by no means untested as they have been in continuous use for over a decade in the United States. In fact, the "secondary mining" component of the conventional two-well solution mining method patented by Edmonds et. al. (US Patent No. 3,096,969) as currently employed in Saskatchewan, is a batch mode implementation of selective dissolution.

In my opinion, this is an innovation that is worthy of more attention because of how it revolutionizes environmental liabilities and long-term challenges currently faced when dealing with potash tailings. As such, I believe the application of selective solution mining to be THE most promising approach when it comes to potash tailings management.

Paul Neufeld, P.Eng.
Project Manager, Gensource Potash Corporation

SAVE THE DATE

2017 Fall PD Days

October 16-17
Conexus Arts Centre - Regina

The Professional Development Committee and the 30 by 30 Task Group are working on an exciting line-up of topics and speakers for the 2017 Fall PD Days to be held on October 16-17 in Regina.

The 30 by 30 Task Group will have two days of sessions filled with topics covering attraction of women into our professions and retaining them in the professions. A featured speaker will be Menzer Pehlivan, P.E., a young Turkish engineer now located in Seattle, whose career and passion for getting youth interested in STEM (science, technology and mathematics) was highlighted in the *Dream Big* IMAX film.

The Professional Development Committee two-day track will include topics on ethics, environment and workplace dynamics.

Registration will open over the summer – watch for announcements in your email, on the APEGS website and in the next edition of *The Professional Edge.*

DCS

The Design Council of Saskatchewan (DCS) is the collective voice of six provincial associations representing design professionals working in the disciplines of architecture, engineering, graphic design, interior design, landscape architecture and planning. DCS invites all APEGS members to attend SK Design Week, a biennial event organized by DCS volunteer members from the component organizations, which provides the public opportunity to learn about the different areas of design through a series of free lectures and other educational events. This year's events will be held in Saskatoon and Regina from September 23-29, 2017.

Watch for entry forms to submit your design projects for one of the prestigious Premier's Awards of Excellence in Design. SK Design Week will conclude with a gala in Saskatoon on September 29, 2017 to celebrate all entries and distribute awards for the various categories.

The Premier's Awards of Excellence in Design recognize great design work completed right here in our province. A jury of design professionals will assemble in Saskatoon to review entries based on criteria specifically appropriate to each area of design.

All entries are displayed to the public throughout Design Week and at the awards gala, where the professional designers from the member associations are presented with awards.

We hope that you will be able to join us at this fantastic week promoting Saskatchewan success stories in design.

DESIGN WEEK
SASKATOON + REGINA
SEP 23–29, 2017

Notes from APEGS Council

The APEGS Council met Thursday, April 6 and Friday, April 7, 2017 at the Delta Bessborough in Saskatoon. 18 of 19 Councillors were present. Luigi Benedicenti, P.Eng., FEC and Rick Kullman, P.Eng., FEC, FGC (Hon.), FCSSE attended as guests. Council will meet June 15 and 16, 2017 in Moose Jaw. The sessions will include orientation and strategic planning.

Council received the following presentations and information items:

- Activity updates were provided from the constituent society liaisons, the ACEC-SK Liaison, and the APEGS Directors to Engineers Canada and Geoscientists Canada.
- The APEGS representative on the Canadian Engineering Accreditation Board (CEAB), Luigi Benedicenti, P.Eng., FEC, presented an overview of the accreditation process and updates on the CEAB's activities. Highlights included the role of the CEAB, membership, criteria and measurements and the overall goals.
- An update on the 30 by 30 activities that have occurred since the last Council meeting. Proposed future activities include a commitment for northern outreach and indigenous relations, the development of a web presence and summer festivals.
- The APEGS Director of Registration provided an update on the on Online Competency Based Assessment Pilot Project.
- Council received a demonstration on the online Spaces Application. This file-sharing environment will now be used by Council and other committees.

Council passed motions as follows:

- Appointing the following to the Sponsorship Task Group: Ben Boots, P.Eng., FEC (Chair), Brett LaRoche, P.Eng., Holly Annand, P.Eng., Rob Stables, P.Eng., FEC, Kevin Hudson, P.Eng., Robert Schultz, P.Eng., FEC, Ashley Ransom, P.Eng., FEC, and Bob Berry, P.Eng. FEC.
- Appointing Zuri Epp, P.Eng. to the 30 by 30 Task Group to represent the Communications and Public Relations Committee.
- Appointing Ryan MacGillivray, P.Eng. as Chair of the Professional Practice Exam Committee for a two-year term.
- Appointing Rick Kullman, P.Eng., FEC, FGC(Hon.), FCSSE as Chair of the Licensee Admissions Committee for a two-year term.
- Life Membership was approved for the following members:
  Abraham, Ravi E., P.Eng.
  Andersson, Jan I., P.Eng.
  Carreiro, Joseph R., P.Eng.
  Chan, Raymond K., P.Eng.
  Charlton, Sidney J., P.Eng.
  Cisyk, David E., P.Eng.
  Cooper, Barry R., P.Eng.
  Fletcher, Wilbur, P.Eng.
  Forand, Lawson P., P.Geo.
  Forbes, Richard A., P.Eng., FEC, FGC (Hon.)
  Holmes, William L., Engineering Licensee
  Khanna, Sardari L., P.Eng.
  Lyons, Brian A., P.Eng.
  Manz, David H., P.Eng.
  Manz, Randal L., P.Eng.
  Mazurik, Bernard E., P.Eng.
  McCurdy, Robert L., P.Eng.
  McEwen, Brian A., P.Eng.
  Mollard, D. George M., P.Eng.
  Mollard, John D., P.Eng., P.Geo.
  Nycz, Ernest H., P.Eng.
  Orr, Rodney G., P.Geo.
  Paddock, Blaine R., P.Eng.
  Parkinson, James H., P.Eng.
  Pawliuk, Kenneth M., P.Eng.
  Rahman, Mohammed G., P.Eng.
  Robinson, James E., P.Eng.
  Savinov, Vladimir, P.Eng.
  Shepherd, George F., P.Eng.
  Smith, Clifford D., P.Eng.
  Szyszkowski, Walerian, P.Eng.

- Appointing Colin Pitman, P.Eng. as Chair of the Student Development Committee for a two-year term.
- Appointing Dianne Allen, P.Eng. as Chair of the Environment & Sustainability Committee for a two-year term.
- Appointing Margaret Ball, P.Eng., FEC as Chair of the Investigation Committee for a two-year and Maurice Tremblay, P.Eng. as a member of the Investigation Committee for a three-year term.
- That the Engineers Canada Strategic Plan Task Group's recommendations be forwarded to Engineers Canada with a recommendation that key consideration be given to support the constituent associations in their 30 by 30 efforts by conducting research.
- Appointing Dr. Janis Dale, P.Geo., FGC as the APEGS representative to the Canadian Geoscience Standards Board for a term in accordance with the Geoscientists Canada bylaws.
- Approving the draft 2016 audited financial statements.

Council noted and received the following reports:

- Registrar's reports for February 2017.
- The report on compliance activities for January through March 2017.
- The unaudited financial statements for December 2016 and January and February 2017.
- Executive Committee minutes, board minutes, and reports from the committees.
- Committee member appointments: Muhammad K. Mehmood, P.Eng., Erin Cardiff, P.Eng. and Luciana Thomasi, P.Eng. to the Experience Review Committee; Lori Matthews, P.Eng. to the Professional Practice Exam Committee; Tyson Smith, P.Eng. to the Licensee Admissions Committee; Marcia Fortier, P.Geo. to the Professional Edge Committee; Nicole Beatch, P.Eng. and Megan Gervais, P.Eng. to the Communications and Public Relations Committee; Robert (Bob) Cooper, P.Eng. and Hikmet Abdulkadir, P.Eng. to the Professional Development Committee; Lori Parks, P.Eng. and Kendi Young, P.Eng. to the Environment and Sustainability Committee; Karen Coates, P.Eng. to the K to 12 Committee.

Visit us online

The Professional Edge is now available online at **www.apegs.ca/e-Edge**

Many publications online are PDFs or flipbookstyle virtual magazines that are suited for reading on desktop computers. We have moved beyond that to a mobile-friendly multimedia version of the magazine.

The e-Edge displays properly on all tablets and phones so you can read it on the go. The e-Edge also features multimedia content that compliments the stories.

Comments or suggestions about the digital edition can be sent to **apegs@apegs.ca.**

Greenhouse Gas Emissions from Uranium Mining and Milling in Saskatchewan

BY CAMERON S. MCNAUGHTON, PH.D., P.ENG., DAVID J. PARKER, ENGINEER-IN-TRAINING, AND GORDON A. SPARKS, P.ENG.

Opinions expressed do not necessarily reflect the views or policies of APEGS.

McArthur River Uranium Mine

The topic of nuclear power brings up conflicting and sometimes confusing statements between proponents and critics. Proponents claim: "Nuclear power produces no greenhouse gas emissions." Critics claim: "Mining of uranium produces greenhouse gases that are ignored." The truth lies somewhere in between.

In 2013, Dr. Gordon Sparks (Professor Emeritus, University of Saskatchewan) and Dr. Cameron McNaughton were awarded a grant from the Sylvia Fedoruk Canadian Centre for Nuclear Innovation. Our goal was to use ISO (International Organization for Standardization) methods to perform a comprehensive life cycle assessment of greenhouse gas (GHG) emissions from the mining and milling of uranium in Saskatchewan. Graduate student David Parker (now with Saskatchewan Research Council) was enlisted to perform the analysis, and results were published in August 2016 in *Environmental Science and Technology*.

Between 2006 and 2013, AREVA Resources Canada and Cameco Corporation produced approximately 19 per cent of the global uranium supply. Our theory was that, in spite of the difficulty of mining in the north, Canadian uranium was being produced with the lowest GHG emissions intensity in the world. In testing this hypothesis, we had the benefit of 32 years of data provided by AREVA and Cameco, covering three separate mine-mill pairs that operated between 1995 and 2013.

Our study was comprehensive, considering both direct and indirect emissions of GHGs. Direct emissions include those from the combustion of propane and diesel for heating and production of electricity. Indirect emissions occur due to electricity consumption, from transportation of materials and people to the sites, and are embodied in materials.

Our results show direct emissions account for approximately 30 per cent of the total GHG emissions. Emissions embodied in electricity account for 30 to 45 per cent of the total, while other indirect emissions constitute the remainder. We even drilled down to look at activities at corporate headquarters in Saskatoon and emissions due to land use change, although emissions from those sources were found to be almost negligible.

As expected, we confirmed that GHG emissions intensity decreases as ore grade increases. While that is useful information, we still needed to examine how the emissions from mining and milling fit into the emissions of the entire nuclear energy life-cycle emissions. To perform this comparison, GHG emissions per kilogram of yellowcake were converted to GHG emissions per kilowatt hour of electricity.

Using a conversion factor for American light-water reactors, we found that mining and milling contributes 1.1 g CO_2e/kWh. The median emissions estimate for the entire nuclear life cycle is 12 g CO_2e/kWh with the range of estimates between 7 and 25 g CO_2e/kWh.

Our study shows mining and milling of Canadian uranium makes up less than 10 per cent of the GHG emissions of the entire nuclear life cycle. It also supports claims that nuclear power is comparable to renewables in terms of GHG emissions per unit of electrical energy. Solar, for example, has a higher life-cycle emissions profile with a median value of 44 g CO_2e/kWh and a range of 37 to 50 g CO_2e/kWh. Wind power is comparable to nuclear power with a median of 11 g CO_2e/kWh and a range of 9 to 18 g CO_2e/kWh.

Ore now being mined at Cigar Lake and converted into yellowcake at McClean Lake has comparable or higher grades than the uranium produced in Saskatchewan between 1995 and 2013. As a result, we predict Canadian uranium will continue to be produced at a very low emissions intensity. Whether Canadian uranium is being produced at the lowest emissions intensity will need to wait until other studies of similar depth and rigour are completed for mines and mills operating in jurisdictions outside of Canada. But the prognosis looks good.

To read the original study in more detail, check it out online at ***pubs.acs.org/doi/pdf/10.1021/acs.est.5b06072***

News Beyond Our Borders

First-of-its-kind study provides new insights into professions in BC.

Nationtalk.ca – Findings from a new study about key occupations that directly support the Asia Pacific Gateway will enhance employers' recruitment activities for engineers, geoscientists, technologists and technicians (EGTT).

The study, *Digging Deeper: Understanding the Engineer, Geoscientist, Technologist, and Technician Labour Market in the Asia Pacific Gateway*, is a federally funded initiative. It serves as a follow-up study to the Engineers, Geoscientists, Technologists and Technicians Labour Market Information study released in 2015 which provided a 10-year labour market information forecast with important supply and demand information on 31 EGTT occupations.

Digging Deeper focused on four key areas, which included understanding how occupations were dispersed across the different disciplines, how the EGTT occupations worked together in teams and how new entrants enter the workforce. The study also explored the extent to which BC. expertise is exported to support projects around the world and is valued here at home.

Key findings identified a need to improve methodologies and processes used to model labour market changes and labour market information forecasting for EGTT workers in the Canadian economy.

A need for better understanding of the workers in these occupations was identified, as well as what employers' needs and expectations are in the labour market. The research sheds light on the work environment, team structures and professional demands of EGTT occupations. In turn, this information will help employers strategize on how they can recruit and retain workers and improve business productivity and profitability.

Digging Deeper: Understanding the Engineer, Geoscientist, Technologist, and Technician Labour Market in the Asia Pacific Gateway is available online at http://apgst.ca/projects/pdfs/Digging-Deeper-Understanding-the-EGTT-in-the-APG.pdf.

Supreme Court rules on mandatory CPD

Engineers Canada - The Supreme Court of Canada has ruled that professional regulatory bodies can continue to suspend practitioners who fail to fulfill the continuing professional development (CPD) requirements they establish. It's a case that could inform the requirements and resulting policies of Canadian engineering regulators.

In a case heard before the Court in November 2016, Winnipeg lawyer Sidney Green challenged the Law Society of Manitoba's requirement that its members complete 12 hours of CPD each year. When he failed to report any CPD in 2012 or 2013, the Law Society gave him 60 days to comply before suspending his licence to practise law in July 2014.

Green challenged the Law Society's CPD rules, arguing that they have no statutory authority to make CPD requirements mandatory. He also argued that he was denied rights of natural justice and procedural fairness given that the effect of his administrative suspension was equivalent to one for misconduct and yet it took place without a hearing or a right of appeal.

In its ruling released on March 30, 2017, the Supreme Court ruled 5-4 to uphold Green's suspension, finding that the rules for CPD were in fact fair and that law societies are required to protect members of the public who seek legal services. CPD programs, the Court said, serve public interest and enhance confidence in the profession.

"The Supreme Court has recognized that CPD programs are important to ensure practitioners adhere to accepted ethical and professional standards in their practices," said Stephanie Price, P.Eng., CAE, interim CEO of Engineers Canada. "They've also recognized that CPD programs serve the public interest too, by providing a mechanism for practitioners to demonstrably enhance their professionalism and increase the public's confidence in them."

Nine of the twelve engineering regulators in Canada require their licensees to complete CPD hours each year, while the remaining three regulators strongly encourage it.

TECH CORNER

Sensor-equipped glove a medical assessment tool

Phys.org

Engineering 360 - A sensor-laden glove was designed at the University of California (San Diego) as a reliable tool for assessing muscle stiffness, or spasticity, in cerebral palsy, stroke and multiple sclerosis patients.

Spasticity is typically evaluated using a six-point rating scale called the Modified Ashworth Scale. This scale is the current hospital standard, but it is subjective and often yields ratings that vary from one doctor to another. These ratings help dictate the dose of medication patients are prescribed to manage their spasticity. Inconsistent and inaccurate ratings can either lead to dangerous overdose or ineffective treatment as a result of doses that are too low.

The new device, built on a regular sports glove that a doctor can wear while holding and moving a patient's limb back and forth, is engineered to provide objective assessments of muscle stiffness. More than 300 pressure sensors taped onto the palm measure the amount of force required to move a patient's limb. A motion sensor taped on the back measures how fast the limb is being moved. Data from the glove's sensors are transmitted to a computer and analyzed.

Aeromobil's $1.2 million flying car available for pre-order

Engineering 360 - AeroMobil is accepting pre-orders for its new model of flying car with full production expected by 2020.

AeroMobil says the flying car can travel in almost any weather condition, in either car mode or airplane mode. The dual mode means it can cut travel times when compared to traditional short haul airline flights of up to 631 miles.

The flying car features an aerodynamic exterior made of carbon composite construction, found in most sports cars and performance aircraft, making the vehicle lighter and stronger. The wings are constructed using pre-preg composites for handling and high maneuverability, while its suspension adapts to varying road conditions.

AeroMobil says while airborne the flying car has been designed for stability and predictability similar to existing small aircrafts. the cockpit surrounds the pilot and its structure is capable of absorbing and distributing crash and impact energy. The vehicle even includes a ballistic parachute to bring it back to the ground safely if deployed.

The initial production run will be limited to a maximum of 500 units and will only cost $1.2 to $1.6 million.

Lithium-ion batteries could be crafted from leftover wine bottles

Engineering 360 - Researchers at the University of California, Riverside have made a big development in renewable energy using waste glass bottles and an inexpensive chemical process to create the next generation of lithium-ion batteries. The glass is used to create nanosilicon anodes that are needed in lithium-ion batteries. These new batteries will provide more power and battery life to electric and plug-in hybrid vehicles and personal electronics.

Every year billions of glass bottles make their way to the landfills. With this knowledge, the researchers wondered if the silicon dioxide in waste beverage bottles could be used for high-purity silicon nanoparticles for lithium-ion batteries.

To create the batteries, the glass bottles were crushed and ground into a fine white powder which transforms the silicon dioxide into nanostructured silicon. The researchers then coated the silicon nanoparticles with carbon, improving their stability and energy storage capabilities.

The coin cell batteries that have the glass bottle based silicon anodes outperformed traditional batteries in lab tests. Researchers say that one glass bottle provides enough nanosilicon for hundreds of coin cell batteries.

News From The Field

U of S program shines a light on indigenous engineering

Saskatoon StarPhoenix - Sean Maw, P.Eng. wants young students to take another look at the humble canoe or kayak.

"They've been around for hundreds of years," said Maw, a University of Saskatchewan College of Engineering professor. "What does that tell you about them as designs? That they're good – and they're indigenous designs; they came from Canada's indigenous peoples."

A new U of S program aims to spread the word about indigenous ingenuity – from watercraft to weapons to traps to living quarters to snowshoes – to public schools across the country and inspire indigenous youth to consider engineering as a career.

Everyone involved in the project is excited; nobody has done this work systematically before, and it's an opportunity to document a neglected part of Canada's history, Maw said.

"We are under-represented in the college and in the profession," Indigenous Peoples Initiatives coordinator Matt Dunn, P.Eng. said.

"There's so much value to having a diverse workforce and the diverse thinking, the diverse processes that First Nations, Metis and Inuit engineers … can provide will really help enrich the engineering profession."

"I think there's lots of positive lessons to be learned there and I think if this brings pride to indigenous kids who are learning about it, I think that would be fantastic … And if it brings respect to Canada's first peoples, I think that would be a great thing, too."

Next phase for automated swine vehicle washing

Manitoba Pork Council - A team of engineers and scientists, working on behalf of Swine Innovation Porc, is preparing to move into phase three of an initiative to adapt technology to speed up and reduce the cost of washing and disinfecting swine transport trailers.

Terry Fonstad, P.Eng., a professor in the College of Engineering at the University of Saskatchewan, explains swine transportation has been identified as the primary risk for transferring disease causing pathogens.

"Prairie Swine Centre is involved in doing a trailer inventory. They went out and looked at all the trailers that are being used and then looked into both animal welfare and cleanability aspects of those trailers. The Prairie Agricultural Machinery Institute is developing with us a cleaning system based on a concept of using vacuum and pressure washers," Fonstad said.

"The Vaccine and Infectious Disease Organization is working on the side of pathogen destruction and giving us the engineering parameters that we need to destroy pathogens and verification of that. Then, on the engineering side at the university, we're looking at measuring those parameters in the trailers to verify that we're meeting the conditions that'll destroy the pathogens."

Fonstad also noted that the research included a strong component of industry input.

"We made sure that we put in an advisory team that's everywhere from producers to veterinarians to people that actually wash the trucks. We get together every six months and have them actually guide the research."

He says the next step is to automate or semi-automate the system.

ENERGY

Sask. encouraging flare gas capture

Saskatoon StarPhoenix - Plum Gas Solutions is a joint venture with the US liquefied natural gas (LNG) firm, Plum Energy LLC. Most of its business comes from supplying gas during pipeline outages, but that could change due to major changes in Saskatchewan.

In November 2015, the provincial government introduced new rules limiting wellhead gas flaring and venting. It said the

regulations echo those already in place in Alberta and are intended to reduce greenhouse gas emissions while creating economic benefits.

Earlier this year, SaskEnergy pledged to buy LNG or compressed natural gas from companies that capture it far from existing pipelines and truck it to wherever it is needed.

A SaskEnergy spokesman said the company's promise to buy the gas – which it uses during maintenance and as a backup supply in the depths of winter – should help firms like Plum Gas to introduce mobile facilities.

While the technology is comparatively new and the gas volumes comparatively small, mobile LNG recovery could eliminate the need to build expensive pipelines, reduce emissions across the industry and add jobs to the provincial economy, he said.

One of those companies could be Raging River Exploration Inc., which extracted an average of 20,447 barrels of oil equivalents from the Kindersley area last year – far less than industry giants such as Husky Energy Inc., but more than many "junior" producers.

Companies are already collaborating to develop permanent gas infrastructure near well clusters, but mobile LNG technology could have potential in more remote areas of the Viking oil play in west-central Saskatchewan, according to its chief operating officer.

While there are major challenges to overcome, including the high cost of the mobile gas conservation trailers, the combination of rising prices and tighter regulations means there is a huge incentive for producers to conserve associated gas.

Northern village switches to solar

CBC - An unreliable power grid, high costs of energy and frequent power outages have prompted the northern Saskatchewan village of Green Lake to flip the switch to solar energy.

The solar panels will be owned and operated by the village.

Currently, electricity is provided to the community by SaskPower, which maintains power lines and poles.

Locals estimate there are about two or three outages per month in the northern Saskatchewan community. Some of them are lengthy due to the landscape of the area, which includes forest and rugged terrain – a problem which is only exacerbated during the winter.

Hundreds of kilometres worth of power line and hundreds of poles – many of which are in remote areas of the province – mean in the event of a power outage it could be hours before the source of the problem is discovered, let alone repaired.

One outage lasted several hours when the temperatures were around –20 C.

Raising funds was one of the biggest challenges. The province helped with a portion of the costs. The community has received both federal support and private sector support from Ontario worth $20,000.

The federal government's Canada 150 Program provided "just under" $60,000. The province has a program in place which provides up to $20,000 on a $100,000 project.

The cost of the development has been about $137,000. The project itself has been years in the making.

The first phase will power the community centre with about 31 kilowatts of energy.

The province is administering a net metering plan.

MINING

Sask. and Man. most attractive mining destinations

Mining.com - Two provinces – Saskatchewan and Manitoba – are the world's top two most attractive mining investment destinations, displacing Western Australia from first to third place, according to the latest annual global survey of mining executives by the Fraser Institute.

According to Canada's policy think-tank's Annual Survey of Mining Companies, the other seven jurisdictions that currently attract the most investors to their resources

sector are Nevada, Finland, Quebec, Arizona, Sweden, Ireland and the Australian state of Queensland, in that order.

Within Canada, Saskatchewan remains the top-ranked province, though Quebec is showing clear signs of improvement. It now ranks third in the country and sixth globally – up from eighth spot last year – and is the only other Canadian jurisdiction in the top 10 worldwide for overall investment attractiveness.

Western Potash moving ahead

Mining.com - Western Potash, a subsidiary of Western Resources, seems to be finally moving ahead with its long-delayed Milestone project property in Saskatchewan, even though prices for the fertilizer ingredient remain weak.

The company, which recently held one of many open houses in the community of Kronau, located 28 km southeast of Regina, said that instead of shelving plans due to gloomy market conditions, it has chosen a new approach to develop the mine, which makes it feasible.

First proposed in 2009, the Milestone project will produce 146,000 tonnes of potash annually over 12 years of planned operations, which are expected to kick off in 2019.

The purpose of the pilot plant, the company says, is to test and optimize the horizontal solution mining method in Saskatchewan, as well as to investigate how the method can be applied to full-scale potash production.

Western Potash expects to finish the pilot project by the end of the year or start of 2018, with operations beginning in 2019.

Gensource acquires new investor

Mining.com - It's no secret that building a potash mine to compete with the big companies is no small feat in Saskatchewan. But success could come via some outside-the-box thinking from Gensource Potash Corp. which inked a joint venture with Essel Group ME Ltd., an Indian conglomerate.

Gensource, whose most advanced project is the Vanguard property in central Saskatchewan, has formed a new company with EGME called Vanguard Potash Corp., which is the corporate entity they plan to use to develop a small 250,000 tonnes per annum potash mine.

The agreement builds on a memorandum of understanding published by the two companies last November.

The plan is to build out the mine in phases, eventually reaching a million tonnes per year.

It would be mined using the solution method, where wells are sunk into the deposit and a heated brine solution is injected to dissolve the potash salts. The dissolved salts are then pumped to the surface where the water is evaporated, leaving potash and salts behind.

According to the *Saskatoon StarPhoenix*, Gensource's business model is to sell its potash product directly to farmers and farmer groups, thus avoiding competing with large companies like PotashCorp "which have better supply chains and the ability to soak up costs in a weak market."

Gensource plans to commission the mine in 2018, with first production by the end of that year, or the first quarter of 2019.

K+S opens first new SK potash mine in 40 years

Canadian Press - The first tonne of marketable potash is expected to be produced at the end of June from the first new mine in Saskatchewan in more than 40 years.

After five years of construction, German fertilizer company K+S AG is opening the new mine near the village of Bethune, about 70 kilometres north of Regina.

The company said it expects to achieve its desired production capacity of two million tonnes by the end of this year.

The Bethune mine, which is a solution mine, is the largest single project in the history of K+S.

K+S said the first train shipment of potash will head from the mine to its port facility in Vancouver. From there, it will be exported to customers mainly in South America and Asia.

URANIUM AND NUCLEAR

Universities exploring small nuke

CBC - Researchers from the University of Regina and the University of Saskatchewan are looking into what it would take to build a small modular nuclear reactor in Saskatchewan.

The $1.1 million multidisciplinary project is led by Esam Hussein, P.Eng., dean of engineering and applied science at the U of R. It brings together researchers from five faculties and departments at the universities.

The project is meant to provide the researchers with a better understanding of nuclear energy and to help Saskatchewan graduate students develop expertise around building a small nuclear reactor somewhere that has not previously used nuclear power. Saskatchewan will be used as the case study.

"Small modular nuclear reactors will inevitably play a role in the clean energy mix, and it is important to explore their technical licensing processes," said Hussein in a press release.

"This project will build the capacity of Saskatchewan researchers and students to address technical, engineering and regulatory questions related to introducing this new technology."

The work will be done by graduate and doctoral students working in the fields of geology, geography, engineering, transportation and law.

Small modular reactors have a physical footprint and power output that make them better suited for smaller electrical grids.

The project is meant to benefit countries considering adopting nuclear power, and aims to provide a comprehensive approach for adopting nuclear energy and siting nuclear power plants.

Sask. stuck with uranium mine cleanup cost

CBC - When cleanup began on the abandoned Gunnar uranium mine near Uranium City, the total price tag was

www.citynews.ca

estimated at under $25 million and the federal government agreed to pay for half the cost.

But a decade later, the expected cost for remediation of the remote Gunnar mine has swelled to about 10 times that and Ottawa isn't offering any more money, even as the province starts this summer to remediate millions of tonnes of tailings and waste rock left when the mine closed in 1964.

The property reverted to the Saskatchewan government In 1990. In 2006, Saskatchewan and Natural Resources Canada agreed to share the remediation costs, although the province would be responsible for building demolition.

The estimated cost was $24.6 million over 17 years.

Over the last decade, detailed environmental impact studies have been completed, public consultations have been held and regulatory hurdles of the Canadian Nuclear Safety Commission have been cleared.

Preliminary work to build roads for crews has already started and workers are to begin using waste rock to cover the tailings this summer.

The work so far hasn't been cheap. A Natural Resources Canada report from 2012 said the buildings, some of which contained asbestos, cost $20 million to tear down. Heavy equipment has to travel to the site in winter on an ice road.

In 2014, the province set up a liability for the remaining work, then expected to be $208.5 million.

The province will spend just under $25 million for the work that's being done, he said. The province is hoping Ottawa will kick in to cover more of the cleanup's cost, but the response so far hasn't been promising.

Natural Resources Canada says Saskatchewan owns the site and is responsible for funding the project.

INFRASTRUCTURE

BC researcher makes SK roads better

Research KELOWNA - A team of researchers has identified an improved method to predict the strength and durability of shale embarkments that line roads.

Called geochemical modelling, this type of analysis can lead to potential savings when it comes to road design and construction, particulary in Saskatchewan.

Craig Nichol, P.Geo., senior instructor of earth and environmental sciences at UBC's Okanagan campus, says when shale is exposed to the weather, oxidization can occur – along with other geochemical changes which can affect the strength of the material. Shales, rocks that are made of clay or mud, are used for roadbed or embankment construction across the prairies due to their abundance in this area. Nichol, who worked on the study with engineering researchers at the University of Saskatchewan and York University, says the strength and durability of these materials are central to road construction and design.

The cost of bringing in stronger building materials such as sand and gravel can be high," he says. "This led us to the concept that perhaps shale could be used more than previously believed."

The team studied the residual shear strength of shale within the Lea Park Formation, a dark shale that stretches across parts of Alberta and Saskatchewan. The researchers used geochemical characterization and geochemical modelling methods, along with physical tests, to study the strength and quality of the shale, especially when oxidized by weather.

Nichol says their research determines that combining traditional physical testing with geochemical modelling is a better method to accurately predict strength properties and can ultimately save money during road design and construction.

"Now we know these materials can be used instead of importing materials like sand and gravel from a considerable distance away. It's good to know that shale in this area is stronger than first believed."

OIL AND GAS

Sask. weathering oil downturn better than AB

JWN Energy and Estevan Mercury - The Western Canadian oil and gas industry has taken it on the chin since global oil prices collapsed in late 2014. While Saskatchewan was hit hard by the decline in investment and activity, it fared a little better than its neighbour to the west. The well count declined by around 70 per cent in Alberta from 2014 to 2017, while Saskatchewan saw a decline of 55 per cent.

There are a number of reasons for Saskatchewan faring better than Alberta.

The first is geology, according to industry analysts at Scotia Waterous. A study by the investment house released in late 2016 shows six Saskatchewan oil plays are in the top 10 in Canada and the US when ranked by profit/investment ratio. All six plays breakeven at oil prices of US$40/barrel and some breakeven at US$35.

All of these plays are relatively shallow and cheap to drill compared to some of the deep shale plays. The two top-ranking Saskatchewan oil plays on the list – the Frobisher and the Ratcliffe – are conventional Mississippian plays that don't require fracture stimulation.

A spokesperson from Scotia Waterous noted that the stable political and economic environment in Saskatchewan has also helped maintain activity.

"People aren't worried about the royalty regime changing like it has in Alberta. And in Alberta there are new carbon levies coming in. So there is some concern about how that's going to affect the Alberta economics."

The number of wells drilled in the province from January to the end of March was 856, compared to 399 wells drilled during the same period in 2016.

Calendar Of Events

Intermediate and Advanced Google Earth Techniques
June 14, 2017, Castlegar, BC
www.apeg.bc.ca/Events

Value by Design - Integrating Value Engineering and Sustainability
June 15, 2017, Vancouver, BC
www.apeg.bc.ca/Events

Introduction to Business Writing
June 21, 2017, Vancouver, BC
www.apeg.bc.ca/Events

NAFTA Requirement for Working in the United States
June 21, 2017, Calgary, AB
www.apega.ca/members/events

Food, Fuel and Fibre for a Sustainable Future
August 6-10, 2017, Winnipeg, MB
www.csbe-scgab.ca/winnipeg2017

Conference of Metallurgists 2017
Hosting World Gold and Nickel-Cobalt
August 27-30, 2017, Vancouver, BC
web.cim.org/com2017

Design Week
September 23-29, 2017, Regina and Saskatoon
designcouncil.sk.ca/

Maintenance, Engineering and Reliability
Mine Operators Conference
September 24-26, 2017, Saskatoon, SK
memo2017.cim.org

2017 Canadian Utilities & Critical Infrastructure
Information & Communications Technology Conference
September 26-28, 2017, Regina, SK
utc.org/canada/canadian-utility-telecom-conference

NAFTA Requirement for Working in the United States
September 27, 2017, Vancouver, BC
www.apeg.bc.ca/Events

Engineering Better Team Member Performance with Coaching
September 29, 2017, Vancouver, BC
www.apeg.bc.ca/Events

APEGS Fall PD Days
October 16-17, 2017, Regina, SK
www.apegs.ca

Electrical Power & Energy Conference (EPEC) 2017
October 22, 2017, Saskatoon, SK
epec2017.ieee.ca

Expert Witness Seminar
November 21, 2017, Vancouver, BC and Webinar
www.apeg.bc.ca/Events

PUBLICATION MAIL REGISTRATION NUMBER: 40034203