# CANADIAN CONSULTING engineer

Reinvigorating CHAUDIERE FALLS generating power in Ottawa

generating power in Ottawa

**MOUNT POLLEY** MINE SPILL -THE AFTERMATH

**FLOOD PROTECTION IN MANITOBA** 

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Cover: Chaudière Falls hydro-electricity station in Ottawa with superimposed new expansion works. Image: Ottawa Energy. See Story p. 14



See story p. 9

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Advanced buildings and controls; Videotron Centre, Quebec; new promotion tactics, fire protection. June/July 2016 Volume 57, No. 4

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#### **ENGINEERS & THE LAW**

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#### CONVERSATIONS

The Green DrinksPhenomenon. Jim Lord runsthe casual monthly eventin Toronto, where up to400 people might drop by.Interview with CCE.30

# Humbled by the huge responsibility of engineers

L ooking at aerial photographs of the 2014 Mount Polley Mine tailings spill, I was shocked by the size of the tailings pond. This one in the Cariboo Region of B.C. was four square kilometres. The perimeter dam wall that



breached was 40 metres high. I'm told some of these tailing pond walls reach 300 metres high.

As reported on page 20, the repercussions of the disaster are ongoing for engineers, mine owners, and the government. The Association of Professional Engineers and Geoscientists of B.C. (APEGBC), for example, has been revising its guidelines for engineers who work on dams. Plenty of that time has been spent clarifying the roles and responsibilities of the engineerof-record. In most cases that pivotal individual will be a consulting engineer. Janet Sinclair, chief operating officer of APEGBC, told me the guidelines will, for example, make it clear that if the engineer-of-record sees a safety problem but the mine owner is not listening to his or her concerns, the engineer-of-record has a duty to report the situation to the Chief Inspector of Mines.

This May, the Auditor General of B.C. issued another report. It said the Ministries of Energy and Mines and Environment were not conducting adequate mine inspections and monitoring. On page 21 of the Auditor's report, the government tersely responds: "The engineer-of-record is responsible for the overall performance of the structure as well as the interpretation of site conditions. The Regulator has to rely on the expertise and the professionalism of the engineer-of-record as the Regulator is not the designer."

Those few words hold a world of significance for consulting engineers. Yes, the Ministry of Mines and Energy should be able to rely on the expertise and knowledge of the engineer-of-record for both designing and overseeing the ongoing safety of a dam. And yes, engineers are supremely capable of designing safe structures and providing expert advice.

But we all know that life sometimes gets in the way. People and circumstances change, but the engineer's responsibility — and liability — continues. The Mount Polley investigations found that there had been many changes of personnel involved in overseeing the 25-year old dam — both within the mining company and as engineers-of-record. Over the years people move on to other projects, to other firms, they retire, they die.

There are also many hidden factors at play, not least being the pressure put on engineers by companies and owners. We heard that corporate pressure for profits contributed to other engineering disasters like the BP oil spill and the collapse of the roof at the Elliot Lake mall.

I'm humbled to realize the amount of responsibility that lies on the shoulders of engineers who design and verify these vast mining and other structures. As for ensuring absolutely that accidents don't happen, all you can do is be as thorough and careful as you can.

And on the other front, be as courageous as you can when dealing with owners. Bronwen Parsons



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Fort McMurray residents evacuate along Highway 63 on May 4.

#### RECONSTRUCTION

# Consulting engineers prepare to help in Fort McMurray

Consulting Engineers of Alberta were quick to act during the devastating forest fires in northern Alberta and the mass evacuation of 88,000 people from Fort McMurray and other towns on May 4.

A week later Ken Pilip, P.Eng., chief executive officer of CEA, was meeting with members of the Alberta Consulting Construction Emergency Response Team ("ACCERT") to provide help with reconstruction efforts.

ACCERT was set up following the last great natural disaster to hit Alberta, the great floods of June 2013 in Calgary and the southern area of the province. Four organizations — the Alberta Construction Association, Consulting Engineers of Alberta, Consulting Architects of Alberta and the Alberta Roadbuilders and Heavy Construction Association — created a legal entity and agreed to coordinate their efforts to help governments rebuild after the crisis.

ACCERT's purpose is to oversee construction projects from zero to completion. "The rationale is that the government departments of transportation and infrastructure have a lot of work on their plate already. They can't just shift and move over to the new problem, so instead they can hand off projects to ACCERT," says Pilip. ACCERT provides project management and "industry facilitation" services, but not actual engineering or architectural services.

Engineering companies and their employees gave generously for the im-

mediate relief efforts. Pilip said that during the first week, CEA member firms had donated 300,000-\$400,000 to the Red Cross.

The cost of the remediation and rebuilding in Fort McMurray is expected to be billions of dollars, with the federal government responsible for 90% of the costs.

By early June people were starting to return to the town and Suncor was preparing to restart its operations.

The fires had moved on from Fort McMurray but continued to burn, covering 580,000 hectares in Alberta and into Saskatchewan.

Oil sands operators were hit hard by the fires and had to close operations. One estimate put the cost to the oil industry at \$65 million a day.

#### AWARDS

## Three Union Station projects win in Ontario

At the 2016 Ontario Consulting Engineering Awards held on April 16, three large firms shared the top Willis Chipman Award — all for projects that are located around Union Station in the heart of Toronto's downtown. AECOM won for its Union Station and Front Street Revitalization project, which involved the Toronto Transit Commission Union subway station second platform and concourse improvements. Hatch

#### ETHICS

#### SNC-Lavalin employees pay fine to OIQ

Quebec's engineering licensing body, the OIQ, has reached an agreement with 107 engineers and former engineers of SNC-Lavalin who were being investigated for political contributions they made between 1998 and 2010 on behalf of their employer.

The company had "participated and collaborated" in the OIQ arrangements, which allow the engineers to pay OIQ an amount "in lieu of a fine." The settlements are confidential. Reportedly similar arrangements have been made between OIQ and other consulting engineering companies and their employees, and more will occur in the future.

During the Charbonneau Inquiry it emerged that employees of some consulting engineering companies had received bonuses from their employers in return for paying political contributions. Quebec does not allow corporations to pay political donations, since they could influence decisions. The donations involving the SNC-Lavalin staff occurred between 1998 and 2010.

SNC-Lavalin said it continues to work closely with its stakeholders to ensure its business is conducted ethically. The company says it is determined to set a new standard of ethics and governance in the engineering and construction sector.



Union Station Revitalization, Toronto.

won for its design of the Northwest PATH Pedestrian Tunnel, and CH2M Hill was recognized for its project management of the Union Pearson Express project, a new direct rail link from Union Station to Pearson International Airport.

## Pointe du Bois Spillway is top in Manitoba

In its annual awards on April 5, ACEC-Manitoba gave the top award to KGS Group for its design of the Pointe du Bois Spillway Replacement. KGS collaborated with Manitoba Hydro and contractor Peter Kiewit on the upgrades to the hydroelectric generating station 160 kilometres northeast of Winnipeg.

Three people won individual awards. Lin Watt of Dillon Consulting was named Rising Star, Cameron Dyck of Stantec Consulting won for "Engineering Action," and Jerry Cousin of J.R. Cousin Consultants won for "Lifetime Achievement."

# Quebec consulting engineers celebrate 2016 awards

AXOR received the Visionary Award at the Grand-Prix du Génie Conseil Québécois 2016. The engineers won for adding an innovative tertiary treatment process to allow the re-use of water at an abatoir and pork processing plant in St. Esprit. The project saves 500,000 litres of water per day, or 30% of the total water used by the plant.

Held by the Association of Consulting Engineering Firms of Quebec continued on page 8



Centre Vidéotron in Quebec City.



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#### up front

#### continued from page 7

(AFG), the awards were attended by 300 people at the Grande Bibliothèque de Montreal on May 17. The theme was "Quebec consulting engineering – a sustainable force."

Eleven awards for projects were handed out in total, from 34 nominated projects. They went to Bouthillette Parizeau, City of Montreal soccer stadium; SNC-Lavalin, Centre Vidéotron in Quebec City (buildings structural); WSP, Centre Vidéotron (project management); SNC-Lavalin, Hydro-Québec building energy management program; Englobe, environmental remediation in Nunavut; exp, J.-M.-Jeanson water treatment plant in Sherbrooke; SNC-Lavalin, Koudiat Acerdoune in Algeria; and Pluritec, rehabilitation of streets in Shawinigan.

Maurice Brisson of BBA was

Consulting Engineer Mentor of the Year. He was cited for encouraging young people to develop critical thinking and constantly offering constructive feedback.

Jimmy Chun Tai Chan of Stantec won the Emerging Consulting Engineering Professional Award.

#### SOFTWARE

# Free tool for assessing life cycle impacts of roadways

The Athena Sustainable Materials Institute, a non-profit research organization based in Canada, has released a web version of its free life cycle assessment (LCA) tool for designing roadways. Pavement LCA is a tool for transportation engineers and designers to enable them to calculate and compare the environmental impact of road materials. The tool was developed with support from the Cement Association of Canada and others.

PROFESSION



**PEO issues new limited license** Professional Engineers

Ontario issued its first Licensed Engineering Technologist (LET) designation in early May.

Lisa Miller, LRI ignation in early

The limited licence allows approved Certified Engineering Technologists (CETs) who are licensed with OACETT to perform professional engineering work within a defined scope of practice.

The first person to receive the LET designation was Lisa Miller, C.E.T, LET, of Toronto. She is a senior associate at LRI Engineering, fire protection and code consultants of Toronto.

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# PLANTS TO THE RESCUE

Urban Systems

At the Sechelt Water Resources Centre in B.C. innovative technologies save wastewater effluent from being discharged into the ocean.

> Above: a large greenhouse structure covers the sewage treatment process at the plant, which is located near a residential district.

By 2011, the District of Sechelt located on the Lower Sunshine Coast of B.C. had spent four years developing a vision for its wastewater management. Both of the district's two aging sewage treatment plants had received frequent odour and noise complaints. The Ebbtide plant was at the end of its life, while the Dusty Road facility had high energy demands. After secondary treatment all of the effluent was discharged to the ocean.

**By Sophie Kneisel** 

With a goal of demonstrating leadership in wastewater management, in 2012 the district issued requests for proposals for a new wastewater treatment and reclamation facility on one of three sites.

The proposals for the new plant were originally to be evaluated primarily on technical criteria, with capital, operating and maintenance costs making up only 20% of the score. After their initial proposal was turned down, Maple Reinders and its design-build partner Urban Systems "decided to either pass on the job, or come up with a creative idea," says Chris Town, P.Eng., Urban System's lead engineer for the project.

#### wastewater

Town says their team decided to select the Ebbtide Road plant site for their proposal, a site which is in a residential neighbourhood, next to a park. Veolia Water Solutions & Technologies Canada suggested they consider the Organica fed batch reactor (FBR) system, which uses plants to help treat wastewater. Originally developed in Budapest, the Organica system is now in use in many European and Asian facilities. With this innovative technology in their proposal, the Maple Reinders-Urban

#### VEOLIA'S ORGANICA SYSTEM

"In a bed of 30 cm-thick clay pellets, different species of plants with highly developed root systems are set in metal compartments below the water level of the aeration tanks. The root system grows across this layer and feeds on the effluents requiring treatment.

"The idea is to improve the natural phenomena used in water treatment through the interaction of living organisms that are able to digest a portion of the organic pollution. Bathed in the biological tanks, the plant roots will create an ideal environment for bacteria and other living organisms, such as protozoa, zooplanktons, worms and snails.

"Organica FBR thus recreates a self-managing ecosystem of several hundred species — plants, animals, bacteria and other organisms — able to capture their energy in the presence of air and sunlight, which maximizes the biological decomposition of contaminants."

Source: www.veolia.com



Above: the Organica fed batch reactor combines treatment and clarification in the same tanks; the plant roots increase biomass and biodiversity in the tanks.

Systems team won the Sechelt Water Resources Centre project in 2013.

The treatment capacity of the new plant, which began operation in 2015 averages 4,000 m<sup>3</sup>/day, up to a maximum of 6,000 m<sup>3</sup>/day — double that of the former Ebbtide Road plant. The Dusty Road plant now provides pre-treatment for the trucked wastewater, and its effluent is redirected to the Sechelt centre to complete the tertiary treatment process.

#### Nitrification and denitrification

Like a sequencing batch reactor (SBR), the Organica FBR combines treatment and clarification in the same tanks, i.e. the tank can be aerobic or anoxic. The difference is that plant roots are incorporated, provid-

ing habitat to increase biomass and biodiversity in the tanks. The plants allow simultaneous nitrification and denitrification to occur within the tank, a feature normally only found in continuous flow systems. This combination offers benefits in terms of energy consumption and overall operating efficiency.

"The plants contribute about 15% of the treatment capacity," Town explains. The Organica FBR is very effective at treating the soluble biochemical oxygen demand (BOD) in the system, but to achieve the stringent effluent criteria required by the municipality (5 mg/L BOD, 5 mg/L TSS, 1 mg/L turbidity), ultra-filtration membranes are used to remove suspended contaminants. With pores

Sechelt Water Resources Centre Team		
Owner:	District of Sechelt	
Design-Builder:	Maple Reinders (constructor); Urban Systems (design) (Chris Town, PEng., Don Nash, P.Eng., Jeremy Clowes, P.Eng., Sean Dodd, AscT, Shasta McCoy, Matt Smith, P.Eng.)	
Architecture & coordination:	Public Architecture	
Structural:	CWMM Engineering	
Electrical, controls, integration, commissioning:	IIES	
Mechanical:	HPF Engineering	
Technology partner:	Veolia	

approximately 1/1000 the diameter of a human hair, they are very effective at removing the remaining solids, suspended BOD and turbidity.

The greenhouse built over the tanks not only protects the plants and gives the appearance of a botanical garden, but may also reduce odours from leaving the facility. The process itself is said to generate little, if any, odour.

Rather than being discharged into the ocean, 100% of the liquid effluent can now be re-used for gravel-washing, golf course or public park irrigation. Town says approvals for use of the effluent outside the plant have not yet been obtained, but the effluent is being re-used inside the facility for polymer dilution, backwashing ultra-filtration membranes, cleaning tanks and channels, washing screens and flushing toilets. With biosolids now being composted (to Class A compost at an off-site facility, for sale and re-use), waste solids discharged to the ocean have been reduced by 90%.

Energy use has been reduced by almost half: a heat recovery system extracts heat from incoming sewage to provide most of the facility's heating needs, while a rooftop solar system provides up to 10% of its power requirements. Noise has been reduced by using reclaimed water in a heat exchanger to cool the emergency generator.

#### **Neighbourhood benefits**

A brownfield site that was a cause for complaint from residents whose homes surround the site on three sides, has been repurposed and improved by the addition of a wastewater treatment facility. "I'm 99% sure this is the first sewage treatment plant that has increased property values in the residential area around it," Town says. "I commend the mayor and council for sticking to a vision that cost a few million more (than a conventional solution). They selected the right process and fitted it to the site." The Government of Canada contributed over \$18 million to the project through various funds. The Province of B.C., the Sechelt Indian Government District, and the District of Sechelt provided the remaining funding for the \$24.9-million project. Since completion of the project, staff from Maple Reinders and Urban Systems have met with their counterparts at Organica in Budapest to secure the right to represent Organica on Canadian design-build projects.



# FLOOD protection in Manitoba

By Patrice Leclercq, P.Eng. and Colin Siepman, P.Eng., KGS Group

have caused damages in the drainage basins of the Assiniboine River and Lake Manitoba, notably the floods of 2011 and 2014.

To address large floods in the Assiniboine and Lake Manitoba drainage basins, the Province of Manitoba retained KGS Group to carry out a study of flood mitigation. The study was complex. It covered a drainage area that exceeded 246,000 square kilometres and extended into two other jurisdictions: the Province of Saskatchewan and the State of North Dakota.

In collaboration with Manitoba Infrastructure and Transportation, KGS Group conducted a comprehensive analysis of the interconnected flood system, including the Assiniboine, Souris and Qu'Appelle Rivers, Lakes Dauphin, Winnipegosis, Manitoba, and St. Martin, and the City of Winnipeg.

The preferred flood mitigation options that were identified during the study, which combined have an estimated cost of approximately \$1.1 billion, would significantly help to reduce water levels and damages in After doing an extensive study of flood prone areas of the Assiniboine River and Lake Manitoba basins KGS Group went on to analyze and conceptually design scores of solutions.

future floods. Furthermore, the recommendations of the study can serve as the foundation for major flood mitigation programs on the Assiniboine and Lake Manitoba River Basins for the next several decades.

# Identifying priority areas for new protection

Our study determined the existing flood protection levels of different locations across the study area and identified those that did not meet the applicable provincial flood protection policies. The protection level for each area had to exceed one or all of the following measures:

(1) The 1:200 year event, which was adopted after the 2011 flood and was greater than the previous 1:100 year standard.

(2) The highest flood on record, if



greater than the 1:200 year event. (3) A greater flood event that could be justified in an economic analysis that considered costs and benefits.

The Lower Assiniboine River between Portage La Prairie and the City of Winnipeg was found to be the highest priority area as it has infrastructure that would be vulnerable at flood magnitudes much less than both the largest flood on record and the 1:200 year event.

#### **Developing the options**

Various options for providing more flood protection, including standalone projects and combinations of projects, were considered to increase the level of protection in areas that did not meet the provincial standard. In total we evaluated over 70 mitigation options of both non-structural strategies and structural options. They included dikes, small and large reservoirs, diversion channels, wetland restoration, development controls, and modifications to land use.

Conceptual designs and cost estimates were prepared for each of the



options, followed by an assessment of benefits as well as environmental and social impacts. The assessment considered not only the flood fighting costs and the cost of flood damages and repairs, but also intangible damages such as stress and anxiety caused to local residents, property owners and people engaged in the flood event response.

#### Lower Assiniboine River

Various schemes with different capacities were considered for the existing 150-km provincial linear diking system on the Assiniboine River downstream, east of Portage la Prairie. When combined with upgrades to the Portage Diversion (see below) the improved dikes would provide a flood protection level of at least 1:200 years.

The cost of the most feasible option, which consisted of upgrading the existing dikes generally in their current location, was estimated at approximately \$270 million. Providing design flows of 655 m<sup>3</sup>/s, this option would mostly entail raising and flattening the dikes to achieve modern design standards and provide sufficient freeboard, as well as constructing access for long term maintenance and repairs. Downstream of the diking system, from approximately Baie St. Paul to the city of Winnipeg limits east of Headingley, a combination of individual flood proofing, neighbourhood dikes and the purchase of vulnerable properties severely affected by flooding was identified as the most feasible option, at an estimated cost of approximately 60 million.

#### **Portage Diversion**

Expanding the Portage Diversion, a man-made channel approximately 29 kilometres long which diverts water from the Assiniboine River north into Lake Manitoba, was determined to be a leading option for reducing potential flooding in the Lower As-

#### water management

Left: aerial view of the Assiniboine River in Brandon during the 2011 flood.

siniboine River region. Three concepts were considered: widening the existing channel; constructing an additional channel parallel to it, or a "retrofit."

Based on the conceptual designs the retrofit option was identified as the preferred alternative, since it was the most economical. The concept consists of upgrading the existing channel by raising the channel dikes and its seven bridges, and expanding or reconstructing its control, drop and outlet structures. The cost of the upgrades was estimated at approximately \$370 million. It would increase the capacity from 708 m<sup>3</sup>/s to 960 m<sup>3</sup>/s.

#### Lake Manitoba and Lake St. Martin

An increase in the discharge capacities of Lake Manitoba and Lake St. Martin to its northeast was investigated as a way of limiting the rise in lake levels during flood conditions. Eight outlet channel options were developed for these lakes, of which two were identified as preferred options. Combined, these outlet channels would span eastward 40 to 50 kilometres from Lake Manitoba to Lake St. Martin and then from Lake St. Martin to Lake Winnipeg. They would include control structures, drop structures, and multiple bridges.

The Province of Manitoba is currently proceeding with the preliminary design of the above two outlet channels. The capacity of the Lake Manitoba outlet channel will be 212 m<sup>3</sup>/s, and that of Lake St. Martin will be 326 m<sup>3</sup>/s. The project's estimated total cost is \$495 million. **CCE** 

Assiniboine River and	Lake Manitoba Basins Flood Mitigation Study
Client:	Manitoba Infrastructure and Transportation — Water Management and Structures Division
Prime Consultant:	KGS Group (Patrice Leclercq, P.Eng., Colin Siepman, P.Eng., Dave MacMillan, P.Eng., Rick Carson, P.Eng.)
Other key players:	Intergroup Consultants and Northwest Hydraulic Consultants

# Reinvigorating CHAUDIER FALLS

#### By Jim Law, P.Eng., Hatch

A new 29-MW hydroelectric facility is under construction on the Ottawa River in the heart of Canada's capital. It will provide 20,000 homes with clean, renewable energy and reduce greenhouse gas emissions by an estimated 115,000 metric tons per year.

The Chaudière Falls Hydro Redevelopment Project is on a unique and unforgettable location just 1.4 kilometres from Parliament Hill, which is visible from the site. Part of the project's purpose is to preserve these views and create greater public access. Energy Ottawa wanted to provide a public place for everyone's enjoyment, and to pay tribute to Canada's First Nations and the long history of the site. Accordingly, the runof-river facility is being built below grade and every effort is being made to minimize the project's footprint and preserve the existing ecosystem around the facility.

In 2013, Chaudière Hydro Limited Partnership, a wholly-owned affiliate of Energy Ottawa, retained Hatch to provide services on the fast-track project. Hatch's work has included the initial environmental services, reviewing the environmental assessment, realigning the intake channel, selecting equipment and preparing preliminary drawings. With construction under way, Hatch is now providing detailed engineering, procurement and construction management on the project which is slated for completion in 2017.

# Historical context and excavations

Energy Ottawa operated six existing hydroelectric generating stations near the Chaudière Falls and many of these facilities date back to the early 1900s. They include power-



Just over a kilometre from Parliament Hill in Ottawa, a new run-of-river hydroelectric generating station is being built underground.

houses, control dams and spillways, dewatering structures (bulkheads), and intake and discharge channels.

nergy Ottawa

Two 100-year old stone powerhouses that are within 12 metres of the new powerhouse footprint created challenges during the excavations with regard to vibration control. They were decommissioned at the start of the project excavations and some of their ancillary structures were demolished. Altogether some 65,000 cubic metres of mediumgrained limestone and shale were removed. A portion of this material was retained on site and used along Left: photo of site before construction. It has been graphically altered to show new green space on roof of the new underground hydro station.

with interlaced sheet-pile to construct a cofferdam upstream of the intake channel to allow work to proceed in dry conditions.

#### New plant - and complexities

Below ground, the project's impact on the visual, natural, and aquatic environments will be minimal-to-zero. The plant will have a new enlarged intake and discharge channel, allowing a maximum of 340 m<sup>3</sup>/s through the facility. The intake and tailrace designs were done using Flow 3D so as to simulate and minimize the impact of the facility on the upstream and downstream river reaches.

A new intake canal will convey water to the new 29 MW powerhouse structure. It will contain four turbine generator sets, sluice gates and dewatering gates, with all the supporting governors, control systems and appurtenances. At the discharge end of the powerhouse, a tailrace channel will be built to guide discharged water back into the Ottawa River downstream of the Chaudière dam.

It was known during the design that a fault-like feature existed within the approach channel and during the first phase excavations it was found to be a 1.0-1.8 metre wide dissolution zone that crosses the new intake channel at a 60 degree angle, roughly 45 metres upstream of the powerhouse. The construction work and channel excavation associated with the dissolution zone has been sequenced such that the majority of the construction has proceeded as planned. For now this open geological feature is ringfenced by a sizeable rock plug to protect the workers and project site from potential flooding. Planning is under way to permanently seal the fault when the Ottawa River is at its lowest flows in late summer 2016. A dive team is expected to assist in this remediation and capping.

Construction of the powerhouse itself began in January 2016 and by mid-May approximately 6,000 of 15,600 cubic metres of concrete has been placed. Installation of the turbine mechanical components (Kaplan turbines with permanent magnet generators in a horizontal bulb) will begin this summer.

## Fish habitat, aesthetics and public space

A downstream passage protection system for the endangered American eel has been incorporated into the design and a spawning habitat for lake sturgeon has been created in the tailrace. Upstream of the intakes, trash racks provide protection against fish or eel entrainment. The fine gauge racks are installed during the eel migration season.

Aesthetics and public amenities are high on the list of priorities. The reinvigorated site will have viewing platforms and public access along a corridor on the new hydro facility's roof. A bridge will stretch across the intake canal, welcoming pedestrians and cyclists and providing direct access to the falls. In a nod to the area's proud heritage, two of the oldest existing buildings on the site will be restored and repurposed. **CCE** 

Chaudière Falls Hydro Redevelopment Project Team		
Owner:	Chaudière Hydro Limited Partnership (part of Hydro Ottawa Group of Companies)	
Prime consultant/engineering/ environmental permits and approvals/project and construction management:	Hatch (Jim Law, P.Eng., Ben Gittings, P.Eng., Brad Lackenbauer, P.Eng., Irfan Maan, P. Eng., Paul Holmes, P. Eng., Brendan Arghittu, Bill Van Luven, Elena Nuta, P.Eng., Jesse House)	
Contractor:	EBC	

A 1990s-era membrane filtration plant in a northern Ontario town was creating too much backwash until upgrades enabled the process wastewater to be recycled.

# Sioux Lookout Water Treatment

bout 400 kilometres northwest of Lake Superior, high on the Canadian Shield, lies the municipality of Sioux Lookout, Ontario. The town is home to about 5,000 people, but it is also a tourist centre and acts as a hub for 29 First Nations Communities who live in the remote northern region.

At the heart of the town is Pelican Lake, which is the source of its drinking water. Even though the environment is relatively pristine, the lake water has heavy loads of suspended solids, as well as other contaminants.

A membrane filtration plant was built in the 1990s in the southwest of town to treat the raw water drawn from the lake. However, the plant was creating problems because the older membrane treatment process was creating such a large volume of backwash it was overloading the sewer system. Of the water entering the plant, about 18% was being rejected into the sewage system, which is more than double the rate of a typical plant of this type.

JR Cousin Consultants (JRCC), was asked to find a solution. Our company works extensively with remote and First Nations communities in northern Saskatchewan, Manitoba and Ontario.

We considered various options. They included adding plate settlers, DAF (dissolved air flotation) technology, or building a large settling chamber at the plant. However, all these would have required a new outlet pipe to carry the treated water about 150 metres to the lake. The construction would have been expensive because of the rocky terrain.

Whichever approach was chosen, the Ontario Ministry of Environment required that the water re-



Above: ultra-filtration membranes were added to the existing membrane system. Previously the plant had been overburdening the town's sewage system with rejected water.

leased back into the lake had to be treated for total suspended solids (TSS). The processed wastewater had several undesirable characteristics and contaminants: colour, turbidity, aluminum, iron, high amounts of suspended solids, dissolved organic carbon (DOC) and total organic carbon (TOC). There were also high Cryptosporidium levels.

### Reclaiming process water as potable water

The solution found was to add an ultrafiltration membrane treatment system and ultraviolet disinfection onto the existing processes. These additional systems remove the contaminants and make the process wastewater potable quality. It is then recirculated within the plant rather than rejected.

The raw water first passes through the original filtration unit. The

wastewater from the first unit is then passed through new ultrafiltration membrane units that were customdesigned by JRCC and a Saskatoon fabricator. The treated water from the second unit is blended with the treated water from the first unit, and disinfected by the UV system. In short, the majority of the process wastewater is treated to the Guidelines for Canadian Drinking Water Quality levels, and returned to the system as potable water.

The small amount of process wastewater that is not reclaimed is discharged to the sewer system and ultimately the sewage treatment plant, so a new outfall pipe was not required.

Reclaiming process wastewater as potable water is not common practice. A six week on-site pilot was first conducted, which allowed the team to optimize the system's parameters. The goal of the pilot was 70% recovery, but through the optimization process, we were able to have the system recover 75% of the wastewater while maintaining the adequate removal of suspended solids and achieving effective membrane cleaning.

#### Drastic reduction in release

There are two main benefits from reclaiming the process water. It reduces the amount of raw water required from Pelican Lake, and it drastically reduces the amount of water that was being released to the town's sewer system. Whereas the plant had been producing process wastewater at an average of 557 m<sup>3</sup>/ day, or 18.9% of the raw water, the overall process wastewater is now reduced to 139 m<sup>3</sup>/day, or only 4.7% of the raw water. The upgrades in-

creased the plant's treated water capacity by 8.52 L/s. The facility also uses less electricity to pump water in from the lake and out to the sewage system.

Because the project was achieved under budget, there were funds left to allow for the ultraviolet disinfection system to be designed to treat the plant's entire water supply.

To avoid a building expansion, the system was designed to fit within the existing building's footprint. To make space for the new UF equipment, a generator set was removed from the interior and replaced with a



Above: plant in southwest of town.

new 300 kW diesel generator located outside in an all-weather enclosure. An unused sodium hypochlorite bulk tank was also removed. **CCE** 

Sioux Lookout Water Treatment Plant Upgrades	
Client-Owner:	Municipality of Sioux Lookout
Prime consultant, engineering design:	JR Cousin Consultants (Jason Cousin, P.Eng.)
Contractor:	Danron Mechanical

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# Pangnirtung Wastewater Treatment

The addition of an MBR system to the sewage treatment plant of a hamlet in Canada's High Arctic helps to preserve the pristine environment.

By Daryl Burke, P.Eng. and Ed Bowes, exp

n 2012 the Government of Nunavut engaged **exp** to investigate options for upgrading the underperforming Pangnirtung Wastewater Treatment Facility. Its existing biomechanical treatment process was not meeting the environmental discharge limits, causing major problems for the community.

Pangnirtung is an Inuit hamlet of approximately 1,500 people on Baffin Island. It is located part way up the Pangnirtung Fjord, surrounded by steep, rocky cliffs and rugged terrain. Travel to the community must be either by air or by sea.

The plant's receiving water comes from the fjord, which connects with the Cumberland Sound. The fjord sustains a vibrant fishing industry upon which many of the hamlet's residents depend for their livelihood.

#### Existing plant severely undersized

Exp completed a thorough review of the plant process and concluded that it was severely undersized. The available design information for the previous facility did not clearly identify the rated capacity for the process, but the extremely poor effluent quality and review of the biological process volumes made it clear the system could not handle the required flow and loading conditions.

The plant needed a significant upgrade. Based on predesign work completed by exp, the design capacity for the upgraded facility was set at 290 m<sup>3</sup>/d.

#### **Extremely demanding environment**

The exp team had a formidable task. Construction in Canada's High Arctic is extremely demanding; fickle weather conditions and isolation can plague the success of a project. Winter temperatures in the remote Baffin Island community can go as low as -50°C with the wind chill. There are limited oppor-

tunities to ship in materials and equipment, and the construction season is short, sometimes constrained to three or four months for outdoor work. Communications can be intermittent, which further adds to the project challenges.

Exp ultimately recommended that the plant should be upgraded with a compact, high-performance membrane bioreactor (MBR) treatment system. The system provides effluent of high quality to protect the pristine receiving water and it reduces the overall footprint. A reduced footprint for the upgrade was critical as all the equipment needed to be housed in a heated building



Top: inside the existing treatment building are new membrane tanks and process piping; at left is the existing sludge holding tank. Above: expanded treatment building; temperatures can sink to -50°C with the wind chill.



prevent freezing.

New membrane tanks, which had to fit within the existing space to minimize the need to expand the building, were designed with side-opening doors to allow the membrane modules to be installed and removed. The low ceiling height in the existing building would have prevented the membrane modules being extracted through the top of the tanks.

The system was also provided with a passive sludge dewatering system using geomembrane filter bags loaded onto a hydraulically activated dump trailer.

The completed design repurposed all of the existing building space and included an addition to the building structure and thermosiphon system to accommodate new process equipment and tanks.

#### Complete design package

Exp provided a complete design package, including process piping and equipment, controls, mechanical, electrical services and the building HVAC. We also provided follow-up services throughout the design to assist with problem solving and troubleshooting of the existing process and building mechanical equipment, work which was not included in the original project scope. Architectural, structural, and geotechnical services were also provided.

The MBR system is capable of far exceeding the effluent discharge limits and outputting the highest quality of effluent to the local receiving water. On most days the operators are producing an effluent TSS (total suspended solids) concentration at or close to 0 mg/L and BOD (biochemical oxygen demand) concentrations less than 10 mg/L. It can remove greater than 99% of TSS and 98% of BOD.

The project cost was \$10,500,000 including equipment purchase, engineering, construction, start-up and commissioning services. Despite the challenging conditions, a solution was designed and implemented for the community that respects the triple bottom line — the environmental, the social, and the financial.

Donanistuna	Montowator	Tractmont	Ecollity	Unarodo
Pangnirtung	wastewater	ireatment	racility	Upgrade

Client/owner:	Government of Nunavut
Prime consultant:	exp, Ottawa and Fredericton (Stephen Burden, P.Eng., Stephen Bliss, M.Sc.E. , P.Eng.,Daryl Burke, P.Eng., Mark McCormick, P.Eng., Robert MacQuarrie, P.Eng.)



# MOUNT POLLEY DISASTER THE AFTERMATH

The failure of a 40-metre high tailings dam at a copper mine in the B.C. interior caused widespread environmental damage. It has also shaken up the mining industry — and its engineers.

By Bronwen Parsons

Above: aerial view of the Mount Polley Mine area a few days after the tailings pond breach on August 4, 2014.

Jamie Heath, Terrasaurus Aerial Photography

hen up to 20 million cubic metres of tainted water and slurry spilled out from the tailings pond at the Mount Polley Mine in the Cariboo Region of central B.C. on August 4, 2014, it unleashed an environmental disaster.

The dam had been designed 20 years before and was built unknowingly on a pocket of soft clay 10 metres below. The water levels in the tailings pond were high: the copper mine had been expanded since 2005 and wastewater from processing the ore, along with run-off from the site, had been accumulating in the pond. A month before, the owner, Imperial Metals' Mount Polley Mining Company, had finally received a permit to discharge more of the pond's contents and had ordered a water treatment plant for the purpose.

At about midnight on August 4, the 40-metre perimeter embankment of the pond slumped approximately five metres. At first just a slow trickle began to flow over the dam. But it was the middle of the night and no-one was around to see and try to avert disaster.

Within an hour the flow had become a torrent. NASA images of the region show that the 4-sq. km tailings pond was virtually empty of water four days later. The water and slurry had flowed down into Polley Lake, which rose

nearly 1 metre. The overflow gathered debris as it scoured open the banks of Hazeltine Creek, and then travelled southeast down the valley approximately 7 kilometres into Quesnel Lake, one of the most pristine deep water lakes in the world.

The environmental clean-up continues. Imperial Metals has spent at least \$67 million on remediation so far.

The impacts of the dam breach reach much deeper and wider than into the soils and waters that were touched. The repercussions are changing the way that B.C. mine owners and their consulting engineers operate and how the government oversees them.

In the days immediately after the spill the province ordered that all 60 metal and coal mines that had tailings ponds should have a dam safety inspection within four months, and that these would be reviewed by an independent third party. Hatch was hired to help the Ministry of Energy and Mines with the review process. Each mine had its risk classification reviewed, and any that showed a high risk of failure had to update their emergency response plans.

Since then there have been three in-depth investigations into what caused the breach. First, a three-member Independent Review Panel was asked to investigate. It reported six months later.

The Chief Inspector of Mines from the B.C. Ministry of Energy and Mining also quickly initiated a detailed investigation of the technical failure and other factors at play. Klohn Crippen Berger helped develop the report — work which took 18 months and was published in December 2015. The government responded by immediately promising to introduce new regulations and requirements.

The third investigation, by the Ministry of Environment, is still ongoing.

Then on May 3 this year, the B.C. Auditor General issued her bombshell report. "Inadequate" was one of the less harsh conclusions Carol Bellringer reached in her, *Audit of Compliance and Enforcement of the Mining Sector.* The Mount Polley Mine breach had occurred during the period of her audit, and she found that the Ministries of Energy and Mines and Environment were not conducting adequate monitoring and site inspections. She did not mince words: "To avoid such failures, business as usual cannot continue," she wrote.

At the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) in Burnaby, work has been going on to tighten their guidelines since the disaster. One of the explicit recommendations in the first two investigative reports was that APEGBC should strengthen its guidelines for dam safety and construction, in particular for the design of tailings ponds. This summer APEGBC will release two new documents: new APEGBC Professional Practice Guidelines: Site Characterization for Dam Foundations in B.C., and updated Professional Practice Guidelines for Legislated Dam Safety Reviews in B.C.

Janet Sinclair, chief operating officer at APEGBC, explains, "Our guidelines are not prescriptive. They're about how you practice, not specifically how you do A, B and C. Members are held accountable to those guidelines. If for some reason there is an incident or we had a complaint, we could use the guideline as a measurement of whether or not the member had met common expectations in that area of practice."

#### "The irony of these failures is that they actually improve practice."

One crucial point they wrestled with is defining the roles and responsibilities of the Engineer of Record. "It's about qualifying what that term means," says Sinclair. "What the expectations are of the engineer of record, including how they deal with issues when perhaps the client is not heeding their advice. So, for example, if they feel something is a public safety hazard, they have an obligation to report it to the Chief Inspector of Mines."

It's not said, but it seems those writing the guidelines feel there could be cases (not specifically at the Mount Polley mine) where mining companies are putting pressure on consulting engineers.

Harvey McLeod, P.Eng., Geo., a principal of Klohn Crippen Berger (KCB), has spent the last year and a half of his life studying the causes of the Mount Polley Mine dam failure and what can be done to avert a similar accident. He was the lead engineer for KCB's work on the Report for the Chief Inspector of Mines. McLeod is also helping to revise the guidelines for APEGBC, and new guidelines for the Canadian Dam Association and the Ministry of Energy and Mines.

"The irony of these failures is that they actually improve practice," says McLeod. "From Mount Polley to the failure last year of the San Marco dam in Brazil [which killed 15 people], these events raise the awareness of regulators, of engineering companies, and owners, about the tremendous liability that failures impose, both on society and on the mining companies. So certainly we have seen an increased vigilance, and appropriately so, of doing it right. The technology for the safe design and management of tailing dams is there. You have to apply it."

#### "It's not an issue of 'Thou shalt design it this way.' ... Dams are all so different that you just can't have one-size-fits-all."

At KCB there were up to 15 people at a time working on the Chief Inspector of Mines' investigation. They completed over 50 subsurface investigations at the site, unearthed design documents going back to 1989, and reviewed 100,000 pages of documents. They took part in interviews with scores of people, reviewed mine design regulations around the world, and helped with the final report, including the recommendations.

A press release by the Ministry of Energy and Mines' issued on December 17 summarized what they found: "[T]he dam failed because the strength and location of a layer of clay underneath the dam was not taken into account in the design or in subsequent dam raises. The [Chief Inspector of Mines] also found other factors including the slope of the perimeter embankment, inadequate water management, insufficient beaches, and a sub-excavation at the outside toe of the dam exacerbated the collapse of the dam and the ensuing environmental damage."

The statement continued: "While the breach would not have occurred had it not been for the undetected glaciolacustrine layer of soils (UGLU), the consequences of the breach were made worse by the other factors. Although operations on the mine site were not in contravention of any regulation, the Chief Inspector found that the mine failed to operate using best available practices."

Asked if he was surprised about what they found during their investigations, McLeod answers: "The technical rea-

son was not a surprise, certainly given that the glacial geology has the potential for that kind of layer."

"I think what was interesting," he adds, "was the number of contributing causes. The mining company had a number of different consultants involved; there were different mine personnel with different responsibilities. And the company had issues with getting a permit to discharge water, so they had more water in the impoundment than they otherwise would have. As outlined in our report, there was a number of contributing causes which individually would not have caused the failure, but we put them all together and, in combination with the geologic setting, they resulted in the disaster."

One of the recommendations in the Chief Inspector's report is that mine owners must have a qualified person on staff designated as responsible for the tailings. He or she would be responsible for safely managing the tailings, such as overseeing the planning, design, operation and maintenance of a tailings pond, as well as managing the levels of wastewater inside it.

As for the engineers, "It's not an issue of "Thou shalt design it this way," McLeod says. "But it is making clear who is accountable for different responsibilities and keeping records. I like to use the term that we are regulating good practice, not telling people how to design dams. Dams are all so different that you just can't have one size fits all."

**But what about the revolving door of consulting engineers?** Not only were different engineering companies involved over the years at Mount Polley, but also the individuals within the companies changed.

"Certainly since Mount Polley we've been working towards greater clarification of what we call the engineerof-record," says McLeod. "One of the outcomes [of the Mount Polley spill] is that we are incorporating into the regulations for the Ministry of Energy and Mines a better continued on page 25



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technology

# DRONES & ENGINEERING

Unmanned aerial vehicles open up new vistas for surveying and photographing construction sites. They also can save companies time and manpower.

Above: Aeryon Skyranger drone being used to inspect a quarry.

s the Edmonton Oilers' new downtown arena arose from its subterranean foundations early last year, design consultants DIALOG wanted to visually showcase the construction progress of Rogers Place. So they took to the air, not with a helicopter or airplane but with something that looked very much like a toy.

It was in fact a remote-controlled drone, weighing a few kilograms and equipped with a GPS system and cameras. After lifting straight up, it flitted above the massive construction site for a few minutes. In the process, it captured remarkably clear, detailed video footage, which was posted on the company's website and shown on local TV stations.

"A lot of exciting, large projects are being built in downtown Edmonton, and we wanted to help tell that story," says DIALOG structural engineer and principal Jeff DiBattista, P.Eng. "A drone allowed us to get video and still photography from vantage points not accessible from the ground or from traditional aerial photography."

In the public mind, drones are associated with two ends of the spectrum: armed military surveillance and hobbyists flying off-the-shelf units around, say, a park. Yet drones — or unmanned aerial vehicles (UAVs) — are finding a wide range of engineering uses. They include surveying, mapping and inspecting in industries such as construction, oil and gas development, forestry, mining and agriculture.

#### An exciting time for branching out

"It's a very exciting time. We're constantly being asked about new applications," says Stephen Costello, president of Sudbury-based Costello Utility Consultants. It recently launched affiliate company AirVU UAV Solutions. "I think UAV use will be routine in five years. I'm convinced it will change the way engineering work is done."

A licensed pilot, Costello decided to combine his aerial hobby with his consulting engineering work. So about a year ago, his firm bought its first UAV and flew some 60 commercial missions.

"We just thought, why not put the two fields together and gain a competitive edge," he says. "We are using this UAV technology to do our core engineering work better, faster and cheaper."

The firm's clients to date are primarily Ontario electric utilities with high-voltage infrastructure such as substations, power lines and distribution networks. AirVU uses its UAV, for example, to easily and safely inspect hard-toreach distribution circuits in rugged terrain. Attaching infrared sensors allows engineers to readily detect overheated electrical connections in need of repair. And surveying software can produce detailed 3D models of substations, accurate to about one centimetre per pixel.

#### Surveying in much less time

Consulting engineers McElhanney operate three UAVs, which are particularly active in surveying small oil and gas sites in northern Alberta. "It's another tool we use when it makes sense, especially from a cost-effectiveness perspective," says Dan Tresa, McElhanney's Vancouverbased branch manager of mapping services. "To get an aircraft from Edmonton or Calgary to a northern site is going to cost at least \$10,000 to start. By contrast, a drone transported from a field office in the back of a truck can typically do the job for under \$3,000."

Because of their small size and weight, UAVs can usually be loaded, deployed and operated by one person. Recently, a single surveyor with a drone mapped an entire Manitoba dam construction site, compared with the 14 people normally needed for a land-based survey.

Once it's unloaded, a UAV can be launched in minutes. "If you're inspecting a cell tower, you can be up, take your pictures and back down in 20 minutes, which might be less time than it takes to just put on fall-arrest equipment for a manual inspection," says Costello.

A hovering UAV offers unique perspectives unavailable to conventional aircraft. An attached camera with 30-times optical zoom can, for example, inspect threads on bolts, read serial numbers or detect rust. Because drones fly low and slow, often at consistent heights, they can capture many data points and produce detailed, accurate maps.

Using UAVs to inspect confined spaces or survey potentially hazardous environments like a quarry or tailings pond is generally much safer than sending in workers on foot. "There's growing interest in their use on construction sites, because you don't have to send people over obstacles or up structures to do inspections or environmental reporting," says Andrea Sangster, senior marketing manager with Aeryon Labs.

Based in Waterloo, Ontario, Aeryon has been manufacturing small unmanned aerial systems (sUAS) since 2009. Its latest version, the SkyRanger, weighs 2.4 kilograms (without payload), measures 102 centimetres in diameter and 24 centimetre in height when deployed. Prices for the machine start at about \$65,000.

#### Abiding by the rules (and the lack of them)

While any commercial UAV can be operated by one person, a second person is legally required as a spotter. Indeed, Transport Canada, which regulates the drone in-



Above: hydro tower inspection by a drone.

dustry, stipulates that all flights must remain within the line of sight of its operators. For this reason (along with limited battery life), UAVs are not good candidates for surveying long, linear features such as pipelines or sprawling sites.

In the U.S., commercial drone operators are required to be licensed pilots. No such restrictions currently exist in Canada, though Costello's company does it voluntarily, in part so that operators can make radio contact with air traffic controllers should the need arise.

Most commercial UAV use does require a Special Flight Operating Certificate (SFOC) from Transport Canada. The permits can take weeks to obtain, at least for the initial permission.

#### Flying into the future

To help construction companies prepare for the UAV future, Canadian Construction Innovation (CCI) recently published a booklet covering such issues as drone costs, sizes, uses, peripheral equipment, legal requirements and insurance coverage. "It gathers a lot of information and will hopefully help educate people as drone use increases in the industry," says CCI President Pierre Boucher.

Drone use has exploded in recent years, with Transport Canada permits for commercial flights rising from 66 in 2010 to 1,672 in 2014. That boom shows no signs of abating, as operators continually find new applications for these little flying machines.

In Japan, for example, Komatsu is developing robotic vehicles that can be guided around sites by drones. And a Swiss firm is working on drones equipped with cable dispensers that can quickly weave lightweight tensile structures in the air.

Clearly the sky is the limit.

CCE

Bill Corbett is a freelance writer based in Calgary.

#### **Mount Polley Disaster**

continued from page 22

clarification of responsibilities, both of the engineer and the owner. Because if responsibilities aren't clear, then people may assume that something is not their problem. An important component of good management is having people understand what they're responsible for."

Within consulting firms people retire or move on to other firms, so how does that affect who is responsible for the design of their clients' project?

"That's part of the discussion we're having with the profession - the transition over time of the engineer of record's responsibilities," says McLeod. He adds, "Internally [at Klohn Crippen Berger] for example, we have an engineer-of-record for a project, but we also have a person who can move into that position over time."

Doesn't it mean the person is taking on a heavy load of responsibility for someone else's design.

"You have to be careful, and that's all you can do," says McLeod. "When you take over a new dam you can't know everything. But at the same time you have a professional responsibility to assess the information as best you can. If you have concerns you have to raise them so that they can be appropriately addressed."

At APEGBC, Sinclair also hopes that companies will take a long hard look at what happened at the Mount



Above: aerial view of Mount Polley Mine a few days after the breach.

Polley mine: "I would expect that the practitioners in the area would learn what they can about what happened and determine if they need to make changes in their own practice."

She adds, "I also think that any time an event like this happens, the public questions how it could have been avoided — and that's a reasonable thing to ask." CCE

#### Reference:

Investigation Report of the Chief Inspector of Mines, BC Minister of Energy and Mines, November 30, 2015. http://mssi.nrs.gov. bc.ca/1\_CIMMountPolley/BCMEM-report-3\_04-web.pdf

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#### products

#### STRUCTURAL

Legacy Building Solutions' Solar Ship Brantford offgrid hangar, a joint venture with Canadian Energy

and Solar Ship, was awarded the "Game Changer Project of the Year" by CanSIA. Located in Brantford, Ontario, the 40,597-sq.ft. hangar is a fabric structure on a rigid steel frame which supports the weight of PV cells on the roof, as well as a 1.18



kPa roof rain-on-snow load. The structure is sized for the Solar Ship aircraft which has wingspan of 164 feet. www.legacybuildingsolutions.com

The Canada Green Building Council (CaGBC) awarded its 2016 Green Building Product of the Year Award to LiteZone Glass. The insulating glass units use multiple interior layers of film rather than glass, attaining dramatically improved insulating values of R19.6 at centre of glass, and R17 for the overall window. Lite-Zone has also produced the units with a life span of more than 60 years. www.litezone.ca

# Danger is my middle name

Five considerations when signing a contract to consult on a remote international project.

aybe you have just qualified as a P.Eng. and want to gain some "real world" experience in the uranium mines in Namibia, or your kids are finally off the payroll and you are considering consulting on a gemstone project in Myanmar. There are five key consideration you need to address before signing that agreement and setting off on your adventure abroad.

The first consideration in your consulting contract is usually compensation. Is that reference to your salary in the contract in Namibian or Canadian dollars? The promise of \$5,000 Namibian dollars per month may sound like a lot, but is only about \$438 Canadian dollars. Consider which currency bears the least risk. Since local currencies in less politically stable countries often vary widely in their conversions, you will likely want to be paid in US dollars, GB pounds or Euros.

Related to compensation is taxation. Generally, Canadians who maintain residence in Canada but work abroad for a period of time must still declare all their income earned both in Canada and abroad. You may want to consider setting up a local holding corporation, or being paid to a corporation in a different lower tax rate jurisdiction.

The third consideration is insurance. Is your client, or your employer if you are going overseas as an employee of a consulting firm, providing and paying for all your professional and life insurance?

Is it necessary in the jurisdiction to carry insurance against risks such as kidnapping? Such insurances can be expensive but are



prudent to carry in dangerous countries. You will want to negotiate with your client or employer to pay those costs Does your consulting contract provide for emergency and health insurance with access to private clinics? Will such insurance cover evacuation out of the country? Does the insurance policy carry the required endorsements applicable in the jurisdiction where you will be working?

The fourth consideration is expenses. Who will pay for all your transportation and moving expenses? If your children are travelling abroad, will your company or the owner pay for private schools? You should look to have these expenses invoiced directly to the owner, as then you may avoid problems with being reimbursed in the future. Review your benefit package carefully and ensure that all your relocation expenses are covered.

The fifth consideration is human resources. Does the owner employ qualified project managers and administrators who will make your job possible? Often consulting engineers are retained to solve specific problems. However, due to the remote location, the project owner may not employ a similar set of employees that Canadian mines would employ. Related to human resources is the lack of services. High speed internet access or remote access back to head office business systems may not be available, or only for short and intermittent periods. You will want to ensure that the owner agrees contractually to provide whatever you require to complete your duties. Otherwise your consulting contract should provide for the possibility of you terminating the contract, with losses payable by the owner.

With regard to the termination of continued on page 29

#### GRUNDFOS

# Mechanical Contractor Delivers Low Costs while Maintaining High Superiority in BC with Grundfos Pumps

For more than 35 years Pitt Meadows Plumbing & Mechanical Systems has been involved in designbuild for lower mainland British Columbia, which has expanded to the rest of the province. Pitt

Meadows projects include hundreds of institutional buildings, as well as the construction of thousands of residential high-rises. What sets Pitt Meadows apart and gives a leading edge over other mechanical contractors is their cost consciousness. Senior Project Manager, Steve Robinson said, "We believe that we need to deliver projects consistently at a lower cost. We don't believe that our costs need to rise year after year."

In order to reduce costs on project delivery Pitt Meadows uses a number of technologies in their shop, one of them being Grundfos pumps. "Were using a lot of Grundfos product," said Robinson. "We like the fact that it's quite compact, they are very energy efficient, and the other thing we really like about Grundfos pumps is their serviceability — the fact that there's one replaceable part: the whole thing." The only challenge for Pitt Meadows is to grab the costs from project start to finish to ensure that they are recoverable back to the building owner.

For one particular unique project, a mixing loop system, over 150 MAGNA3 circulator pumps consisting of just six different models were used as part of a structural steel frame that would form part of a building that hadn't yet poured its first concrete slab. The MAGNA3 was chosen specifically for the project for the following reasons:

- Unbeatable efficiency; with the lowest power consumption in the market and the fastest return on investment, MAGNA3 can achieve energy savings up to 75%.
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Article by Melissa Almonte of Grundfos. Grundfos is the world's largest manufacturer of pumps and pumping systems. Grundfos' Canadian headquarters is in Oakville, Ont. 1-800-644-9599, www.grundfos.ca



# Specifier's Literature Review



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#### **Engineers & the Law**

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the consulting contract, does it allow the consulting engineer to terminate for convenience, e.g. with 30 days' notice? Or must the term of the contract be fulfilled in its entirety? Is termination of the consulting contract connected with compensation? Often expat consulting contracts will make a significant portion of the total compensation payable only on completion of the term of the agreement. Related to termination is force majeure. Does the consulting contract have a force majeure provision which allows you to terminate the contract in the event of an event such as labour unrest? ash from a volcano? mine closure by employees?

Working abroad in a remote location can be a valuable career stepping stone or opportunity to give back to the engineering profession. Ensuring a clear, balanced and binding contract is negotiated and executed is an important step to complete before flying off to the great beyond. **CCE** 

Chad Eggerman is a partner with Miller Thomson LLP in Saskatoon. Email ceggerman@millerthomson.com

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# The Green Drinks Phenomenon

Jim Lord runs Green Drinks Toronto, a casual monthly event where up to 400 people who are interested in sustainability issues might drop by.

Once a month in cities around the world people interested in sustainability issues gather for an informal, free event called Green Drinks. It all started in the U.K. in 1989, when a few environmentalists found themselves chatting around a table in a pub. Today www.greendrinks.org posts gatherings in 73 countries, including 55 cities in Canada. CCE spoke to Jim Lord, BBA, FCIP, LEED AP, principal of Ecovert Sustainability Consultants, who organizes the Toronto events.

### How many people come to Toronto's Green Drinks?

We get between 150 and 400 people, depending on the month. The very first one in Toronto was in 2005, and in 2008 when I started running it we had 50 to 75 people. Since then we've seen a dramatic increase.

# Q. I had no idea it was this big. It's quite amazing.

When I started attending I found it to be a unique networking event. People were friendly and welcoming, and they weren't selling anything. They were just there chatting and wanting to meet other people, which was excellent compared to a lot of networking groups where there are sales people trying to sell you stuff.

# Q. Did you have a problem finding a venue for 400 people?

Grace O'Malley's holds 400 so we're good. We usually don't have 400 all at the same time; it's over a span of a couple of hours.

But if we continue to get more



Jim Lord at Green Drinks in downtown To-ronto in May.

popular we might be in trouble!

#### Q. What kind of people usually come?

It's a really diverse group. We get everyone from engineers, consultants, architects, to students, professors, government officials. Every month it changes. I would say probably at most events 30% to 40% of the people are there for the first time.

#### Q. If you see someone standing by themselves, do you try and introduce them to a group or do you just let things happen?

We put out name tags and signs, and people just show up. We encourage people to go up to others and ask "What makes you green?" The people who've been to previous events tend to be very outgoing and draw people in. There are tables on the perimeter, but the main space is just an interactive mingling spot.

It's quite often that we have visitors from out of town. And we get international visitors. I'll get an email from someone who goes to Green Drinks in Paris, for example, saying, "I'm going to be in town, is it o.k. if I come along?"

# Q. What kind of things do people talk about?

A lot of people talk about renewable energy. Certainly solar and geothermal get a lot of discussion. We have people talking about waste and waste diversion — it seems to be one of the topics that comes up a lot.

#### Q. Do you stay pretty much on topic about green issues, or does the conversation stray?

Whatever is going on. The pub has a big screen TV, so if there's a critical game and it happens to be the Blue Jays winning, or the Raptors, the talk will drift. Or politics. Donald Trump certainly came up a lot at the last event.

### Q. So you don't keep it strictly to green talk?

Oh no, people can talk about whatever they want.

#### Q. It probably gets pretty loud, does it?

It does. Certainly in September and December when we get close to the 400 mark, it's very loud. They're our really big events.





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