A DAY IN THE LIFE

Meet Imperial employees who are helping to bring the new Kearl oil sands development to production.
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THE NEXT GENERATION OF CANADA'S OIL SANDS

Imperial’s Kearl oil sands project will set a new standard of environmental performance for oil sands mining

By Bruce March, Chairman and CEO of Imperial Oil

Even now, when I arrive on the site of the Kearl oil sands project, I am impressed by the scale of technological and environmental progress that is happening there. From the stockpiles of soil for reclamation to the kilometres of pipe that lace together processing equipment, this is a cutting-edge project on a massive scale. We will soon be starting production at Kearl, marking the beginning of the next generation of oil sands mining.

From the outset, our approach was to develop Kearl in a different way, and we took the time to advance the technologies we’re applying there today.

In Kearl, we knew that simply building a new mine – the same as other oil sands mines – would not be acceptable. Kearl will include next-generation technologies, and is being built in a way to incorporate technological innovations that are yet to come.

In this issue, you will learn more about Kearl, its process and new technology through the employees who work there. (A Day in the Life at Kearl, page 6). With a workforce of more than 5,200 continually on site, Kearl has become a community of its own.

There are several key features that set this project apart from oil sands mines of the past. At Kearl, we’ll be using a proprietary bitumen extraction technology called paraffinic in situ treatment technology that will remove the bottom-of-the-barrel crude materials, fine clay particles and water from the bitumen in order to produce a product suitable for pipeline transport. As a result, Kearl will be the first oil sands mining operation that will not require an upgrader to make a saleable crude oil, allowing that 50% of our production will go directly to market.

To minimize water use and protect aquatic habitat, we’re using on-site water storage. The first to operate to do this. We’ve installed capacity to store 90 days’ worth of water to sustain production when water withdrawals may be restricted during the winter. We’re also taking a progressive approach to land reclamation. This means we’ll reclaim mined-out sections as we make progress, rather than waiting to reclaim the land at the end of mining operations. The mining direction at Kearl is circular, not radial, which will allow for earlier placement of reclamation material in place.

We’ll use a single tailings ponds until pit space is available. After that, we’ll use both proven and new technologies to separate fine tailings from water before they reach the tailings pond. As a result, we’ll have a smaller surface area for our tailings ponds compared with heritage operations. We will also return tailings for reclamation to the mined-out areas much faster compared with existing mining operations.

Another Kearl achievement I want to highlight is the way Imperial’s safety culture is having a positive impact on our communities, helping to increase awareness and improve safety across the industry. (Raising the Bar for Safety, page 22). Our safety performance continues to be one of the best in our industry and we remain focused on our goal of zero incidents. When we get safety right, everything else follows: better integration, production, expenses and the rest of our business metrics.

From its very beginnings, the story of the oil sands has been one of continuous development of new, more efficient, more environmentally effective technologies. In 2013, Imperial will start a commercial pilot of its cyclic solvent process technology at our in situ operations in Cold Lake, another step in our ongoing efforts to improve how we produce oil in Canada. The project is named (Compressed Solvent Eikon Kearl, page 20). As you can see, the project is being developed in a way to minimize the environmental impact of our operations. We’re already at work on the second phase of this project, and we’re looking forward to seeing how it goes.

Innovations in environmental technology and in operational efficiency are also enabling us to advance the environmental footprint of the oil sands sector. In fact, we’re the first oil sands company to achieve a net zero water footprint (Net Zero Water, page 24).

In November, Imperial partnered with the Faculty of Education at the University of Calgary to invest $2.5 million to support science, technology, engineering and math programs, also known as the STEM subjects, during the early school years. This initiative includes establishing a research chair in science education and the development of innovative research projects for K to 12 schools in STEM subjects.

This is only the start. By engaging a new generation of students in the pursuit of technical careers, we are investing in Canada’s future.

And finally, I would also like to highlight a connection that Kearl will have in honouring Canada’s past. In this issue you will learn more about Flight Lieutenant Eldon Kearl, the Second World War pilot for whom the project is named (Commemorating Eldon Kearl, page 20). Access road at the project site will be named in honour of Eldon Kearl and his crew members, who were killed during a bombing mission over Germany in 1944.

It is a small tribute to the sacrifices that were made by these soldiers and so many others, but one we are proud to include as we begin first production and start the next phase of development at Kearl.
A look at Imperial's new oil sands development by the employees who help make it happen

By Marcia Kaye

It's 7 a.m., and the day shift at the massive Kearl oil sands project is about to begin. This is the largest project Imperial has undertaken in its 132-year history, and indeed, everything about Kearl is big. The scale of the equipment is gargantuan. There are shifts that are 12 hours long, 10 days in a row. The fly-in, fly-out camp, called Wapusuk Creek Lodge, can house and feed 5,000. And the pride and excitement are immense as Kearl nears its targeted production start-up date in early 2013.

Kearl, 70 kilometres north of Fort McMurray and jointly owned by Imperial and ExxonMobil Canada, is one of Canada's highest-quality oil sands deposits. It has an estimated 4.6 billion barrels of recoverable bitumen resource, which will help meet North America's energy needs for the next 40 years.

It's thrilling to be involved at the very beginning of this development, say the employees who share their weekday stories in the following pages. Kearl provides numerous opportunities for teamwork, cooperation and creativity on the job, while also ensuring that safety, security and environmental protection are absolute priorities. "There are three core values that Imperial lives by at Kearl," says Jamie Allibon, a recently hired heavy equipment operator. "First, 'Nobody gets hurt.' If anyone's safety is at risk at Kearl, we shut it down. Also, 'Security is everyone's business' and 'Protect tomorrow today.'" She adds, "It's nice to know the company cares about the well-being of their employees over profit or production. That's a huge perk for me."

Here, through the lenses of five employees, is a glimpse into life at Kearl.
It's much more than a truck. It's a behemoth, weighing 623,000 kilograms, measuring nearly eight metres high and powered by a 4,000-horsepower diesel engine. At the wheel is Jamie Alliban, 29, who after six years of office work is now in her element operating the Caterpillar 797E, one of the largest mining haul trucks in the world. "I'm loving this job and my new life up here," she says.

Preparing to receive her first haul of the day, Alliban carefully backs up to the loading area, underneath the bucket, and waits to hear the shovel operator sound a horn telling her to stop. The massive shovel dumps three or four loads into her truck, which can hold about 600 tonnes. For her first three months she was just hauling dirt to create a flat stockpiling area at the site. "But now," she says, "we're into the oil sands, hauling the black gold." She then takes her load (the 797E's maximum speed is 68 kilometres per hour) less than two kilometres to a flat-stockpile, where a bulldozer pushes it into place, awaiting production. Over the next 12 hours of her shift, Alliban will make between 20 and 30 such trips.

At Karl since May, Alliban is one of a 38-member team, including only four women. It's not so much a physical job as one of precision, concentration, coordination and multitasking, she says. Safety, of course, is paramount. Sitting in the cab, which is seven metres up and accessed by about 20 stairs, Alliban checks the monitor on the windshield that projects images from the four cameras mounted on the outside of the truck, and keeps an eye on the dispatch monitor to her right at the same time that she's steering, using the pedals and operating levers on the centre console that control the transmission and hoist.

Alliban, who has a fine arts degree in new media, was a graphic designer at ICOM, an online training company that developed computer-based training for Imperial's Karl mine operations, when her interest in oil sands began to surpass her interest in leading a team of 12 developers, programmers and 3D artists. "This suits me better than an office job," says Alliban, who grew up on a grain and legume farm near Swift Current, Sask. "The people I work with at Karl are like a second family. They're great mentors, observing us constantly, always eager to help us out and passionate about doing the job well."

To maximize safety, operators wear personal protective equipment, including fire-retardant coveralls with high-visibility stripes and steel-toed boots. The newbies wear green hard hats for the first three months; she has now switched to white. Whether her team is on the all-day or the all-night shift, it begins with a safety meeting, which emphasizes weather conditions, work plans for the shift and preventative "stop and thank" tips.

Then Alliban takes her turn leading the pre-work stretches, which include arm rotations, ankle circles and lunges, for all operators, foremen, supervisors and superintendents. "It's a good body warm-up, as well as great team building," she says. When it's muddy, operators have to wear white slippers over their workboots to keep the interior flooring clean. "Picture 40-plus people with white hard hats, blue coveralls and big white slippers in a circle doing morning stretches," she says. "It look like a bunch of Smurfs dancing around!"

The health-conscious Alliban always makes sure she gets a good sleep before her shift, packs plenty of fruit and vegetable snacks and drinks lots of water in the cab, and walks or roller-blades around the two-kilometre road that runs the camp after her shift. During her dayoff, she snowboards, plays volleyball and spends time with friends around her Calgary home or with family on the farm.
Shafqat Mahmood  
INSPECTION TECHNOLOGIST

As a boy in rural Pakistan, Shafqat Mahmood never imagined he'd one day be living and working 10,000 kilometres away in a place called Alberta. "Not in a million years did I ever think I'd be studying or working abroad," says Mahmood, 25. "But I wanted to get out of Pakistan, and the key thing I got from my grandfather and my father is that hard work pays off."

Today, Mahmood is working hard as an inspection technologist at Kearl. A large part of his role is to put together and implement inspection plans to maintain all the pressure equipment, tanks and piping. He studies how erosion and corrosion may degrade equipment over time, provides recommendations to mitigate those effects and optimize production, and helps implement and maintain standards and procedures to safeguard the integrity of the equipment. "Our goal is to ensure safety of personnel working around the equipment, protect the environment and maintain production. We keep the equipment safe and make sure there's no leak, no failure, no injury and keep the plant running," he explains. The Alberta government has set standards but Imperial goes beyond those, Mahmood says. "We are under scrutiny all the time, and as the owner, we have full responsibility, so we go above the government regulations."

The eldest of six children, Mahmood grew up near the city of Gujranwala, in northeast Pakistan, on a farm that raised cattle, buffalo, wheat and rice. His father left school after Grade 10, his mother couldn't read or write. While Mahmood didn't feel he had any special skills — "I was just an ordinary person," he says — he was determined to pursue opportunities outside of his country. After high school he went to Malaysia, but the culture shock hit him hard. The biggest obstacle: the American Degree Program in Kuala Lumpur was taught in English, a language Mahmood had studied but had never spoken. "For six months I was completely lost," he recalls. "But I hung in there; I knew there was going to be light at the end of the tunnel."

To improve his English, Mahmood found a job in a restaurant that catered to Western tourists. After eight months his English was good enough for him to pass a language test that was his ticket into a university in the West. He chose to study engineering at the University of New Brunswick. Once there, he experienced an even greater culture shock. "I was nervous when I first arrived. I didn't speak much English when I first arrived." He says, "I didn't speak much English when I first arrived." He says, "I didn't speak much English when I first arrived.

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Vaughn Wintonyk
One Preparation Plant and Extraction Operator

Working in the oil sands seems a natural progression for Vaughn Wintonyk, who as a boy spent hours in the sandbox pushing around trucks, dumping out sand, screening out stones, adding water and making separate piles. In plant operations at Kearl he gets to do the same thing, only on a much grander and far more sophisticated scale. "I really fell in love with this industry," he says.

Wintonyk, 32, who has worked in the oil sands for five years, is an ore preparation plant and extraction operator trained to cover every stage of the process. As a fully trained employee, he can work at whatever post he's needed. The first step begins at the "dry end," when the haul trucks unload the ore into the dump hopper. From underneath the dump hopper, the large chunks of ore are fed by an apron feeder - "It's a huge metal conveyor belt," he explains - into the crusher, which breaks up the consolidated oil sands into smaller pieces. "These then fall onto another conveyor that carries the crushed ore up an incline at a rate of five metres per second into a massive surge bin. About 30 metres high, this retention bin can hold 12,000 tonnes. "That's a huge pile of oil sands!" says Wintonyk.

Now begins the "wet end" of the process. From the surge bin, the material travels by conveyor to the ore preparation plant, where it's mixed with warm water to form a slurry. Massive vibrating screens then catch the bigger pieces while allowing the slurry (10-centimetre pieces or smaller) to fall through the holes into the pump box. "It's kind of like the opposite of painting for gold," Wintonyk says, except the large nuggets are the rejects. The slurry that's small enough to fall through the giant vibrating screen is sent through 4.5 kilometres of pipeline to the extraction plant. There, in a separation vessel, the sand and coarser material in the slurry are separated from the bitumen froth, which rises to the top. It's this valuable froth that ultimately becomes the saleable bitumen product that is then mixed with diluent to produce "dilbit," which is refined off-site. Wintonyk grew up not far from Kearl in the small town of Athabasca, near Fort McMurray. Earning a third-class power engineering certificate, he worked in building management for a few years in Edmonton, then in Victoria, before developing an interest in the oil sands. He now lives in Nanaimo, B.C., on Vancouver Island, where he can jog, surf, cycle and indulge his love of fly-fishing.

But as much as he enjoys his time off, Wintonyk always looks forward to going back to work. "I don't know if Imperial has a formula or what, but they've hired the greatest group of people I've ever worked with," he says. "Different nationalities, age groups and cultures, but everybody's just so positive and energetic and excited about the work." He says that the intense 10-days-on, 10-days-off schedule doesn't deter camaraderie; it enhances it. "Not only do we all live together, work together and eat together, but after work we'll get together and play a game of basketball or catch," he says. He knows of 15 guys who got together last summer on a day off to play golf. As for Wintonyk and his fellow operators, he says, "we're planning to rent a houseboat together next summer and go on a fishing trip."
Ailsa Macdonald
Plant Operator

You might think that spending your days outdoors in a rugged environment, putting in 12-hour shifts for 10 days straight and sharing living quarters with many others would ideally suit a marathon runner, or perhaps a mountain climber, or maybe someone with a military background. Meet Ailsa Macdonald. She’s all three.

Macdonald, 32, is a plant operator at Kent’s froth unit. Prior to coming on site in January 2012, she had a seven-year career with the Royal Canadian Air Force as a water fuels environmental technician, then studied power engineering. After her degree, she worked in Cold Lake for Imperial for four years.

She’s an accomplished athlete, too. She won the Calgary Marathon in 2011 and Las Vegas’s Red Rock Canyon Marathon in 2009, was a top five women’s finisher in last June’s Rock ‘n Roll Marathon in Seattle and placed in the top three percent of all female finishers in the 2010 Boston Marathon. Last summer she cycled in Alberta (with her mother) from Jasper to Banff, a 100-kilometre trip over three days. She also does triathlons. “Oh, and I climbed Kilimanjaro in Africa last November,” she adds as an afterthought.

Her high levels of fitness and endurance keep Macdonald in peak condition for climbing ledges and stairs around the vast 25-metre-high vessels. The froth unit serves to separate the clean bitumen from the sand and water, with the addition of a solvent, she explains. Her job is to check gauges and dials to verify pressure and temperature settings, take froth samples for water analysis, prepare the equipment for maintenance and inspection, and troubleshoot any inconsistencies to ensure the optimal running of the unit’s operations. “I like the actual work we do, because it’s outside, it’s physical and it’s challenging,” says Macdonald, who has her certification in power engineering, second class.

One of only four women at Kent, Macdonald says, “Not only are women a minority at work but also at camp. But I think my previous experience with the military has prepared me well.” When she joined the Canadian Forces she was one of only two women in her trade. Kent is establishing a “Women in Wage” group to support, mentor and encourage women in non-traditional roles.

Life at Wapiti Creek Lodge is “way better than in the military,” Macdonald says. Instead of bunking with three or four others, as she did with the Canadian Forces, she has her own room. “One of the benefits of living at camp is we don’t have to worry about cooking or cleaning – it’s all done for us,” she says. That frees up her time to run the two-kilometre loop around the camp – in summer she’ll run it as many as 10 times after work – or to train in one of the gyms. (There’s a gym just for women.)

Macdonald, who grew up in Bridgewater, N.S., but now lives in St. Albert, outside of Edmonton, says the only disadvantage of her schedule is that her husband, who works in water treatment, works Monday to Friday, which means some months they have only one or two weekends together. “I find that the hardest part,” she says.
"Making sure we’re responsible stewards of the environment is very important to me."

Harold Funk
FIELD ENVIRONMENT AND REGULATORY ADVISOR

When you move into an area that was previously undeveloped, whether it’s a housing development, a new cottage or an industrial site, you’re likely to encounter wildlife that may be curious, hungry or just passing through. It’s the same at Kearl. “Our oil sands site is in a wildlife region,” says Harold Funk, field environment and regulatory advisor. “It’s their area to use. We consider ourselves visitors.”

To that end, Funk, who has been at Kearl for more than three years, works to implement a wildlife protection and preservation program. It keeps animals and birds safe in the undeveloped areas around Kearl and deters them from coming into the developed areas, where they risk becoming habituated to humans. The program includes observing, identifying and reporting to the Alberta government all sightings of bears, coyotes, foxes and other wildlife. “We use ‘critter cards’ to monitor animals on-site,” Funk says, “and we use noise to encourage them back into the undeveloped areas.” To deter creatures looking for food, all general waste sites are completely wildlife-proof.

But what about birds? How can you stop ducks, geese and other waterfowl from landing on a tailings pond, which contains residual bitumen that creates a potential hazard for waterfowl? Funk explains that Kearl has a state-of-the-art Bird Deterrent and Detection program. “It’s similar to what they use at NASA, with 360-degree radar extending three kilometres. It makes in real-time all the bird activity and movement over our ponds.”

It then emits random noises that mimic scream owls, howling wolves, storms and other sounds. Funk says, “It’s very successful. We were able to run this program for a year, and keep improving it, before the plant becomes operational.”

Also in use are propane-powered bird-scare cannons like those used at airports, and giant “air dancer” inflatables like those used in car lot advertising. The thickened tailings material will be deposited in mixed-cut areas of the pit.

To compensate for disturbing this habitat, Impex activists worked what’s taken away, in compliance with Fisheries and Oceans Canada. The Phase 3 Compensation Lake, using water diverted from Kearl Lake and after consolidation with local First Nations, is a 750-by-400-metre lake with an irregular shoreline, consistent with a natural environment, and with gravel beds, builder gardens and aquatic and terrestrial vegetation. Eventually it will be stocked with seven species of fish. “We’re creating an ecosystem where we’re providing twice the habitat than what was removed,” says Funk. “Because this lake is deep, we’ll be able to overwinter some of the larger sport fish species that would not survive in Kearl Lake.”

There’s also an aggressive program against noxious weeds such as scentless chamomile and perennial sorrel, which can quickly choke out all other vegetation. A single scentless chamomile plant can produce up to 3 million seeds.

Another key component of Funk’s job is to help oversee the surface water quality program. All water that leaves the Kearl site, including water from parking lots and ditches after a heavy rain, must be clean. Water goes through polishing ponds that allow sand and finer particles to settle to the bottom, and the water is discharged when it meets Alberta Environment criteria.

Funk, 46, who grew up in Winnipeg, learned to love and respect nature during his summers at a family cottage that had no electricity or indoor plumbing but often had bears. A graduate in environmental sciences and a married father of two living in Calgary, Funk enjoys outdoor activities with his family such as hiking, biking and skiing. He says, “Making sure we’re responsible stewards of the environment is very important to me.”
Imperial Oil's Kearl operation represents the next generation of oil sands mining. Compared with existing facilities, these innovations and technologies will reduce Kearl's environmental footprint. Illustration by Joel Kimmel

Ground-breaking technology

Biomas at Kearl is processed using a proprietary paraffinic trash treatment to create a product suitable for pipeline transport to market. As a result, Kearl will be the first oil sands mining operation that will not require an upgrader to make a saleable crude oil, meaning a significant reduction in energy use and greenhouse gas emissions per barrel.

Cogeneration

The operation plans to use energy-saving cogeneration to further reduce its greenhouse gas emissions. Cogeneration is an efficient method of capturing waste heat to produce steam and electricity at the same time.

Water storage

By using on-site water storage systems, Kearl will be the first oil sands mine that can completely stop drawing water from the Athabasca River during low water flow periods.

Progressive reclamation

Rather than waiting until the end of mining operations, Kearl will reclaim land as it goes. Reclamation work includes native plants, selected with input from local First Nations in light.

Tailings

By intercepting and treating tailings, the surface area of Kearl's tailings pond will be significantly smaller. Technology helps the operation return the thickened material to mined-out areas, allowing the tailings pond to be reclaimed much earlier.
COMMENORATING ELDON KEARL
Imperial honours Second World War Canadian pilot – namesake of its new oil sands development by Margo Pfeiff

The first threads connecting Flight Lieutenant Eldon Ernest Earl of 408 Squadron with the larger, single underlying in Imperial Oil’s history appeared in 1930. It was then that Canada’s post-war government renamed a northern Alberta lake in honour of a decorated serviceman who was killed in action.

Eldon Kearl was a 24-year-old Second World War Canadian air force pilot when he and his crew crashed near Berlin aboard a Lancaster bomber on June 18, 1944. Lake Eldon, located on the site of the Kearl oil sands project, which will operate for more than 40 years, recovering an estimated total of 4.6 billion barrels of oil.

And for a 32-year-old company that was part of wartime efforts and continues to commemorate Imperial employees who fought and died in wars, the connection holds a special significance.

In 2005, Imperial learned that there were still Kearl’s living in Alberta. A company representative invited Eldon’s brother, Harold Kearl, to a Fort McMurray meeting about the proposed development. “They wanted to honour the man who is the project’s namesake,” says Harold, now 90 and living in Calgary, “and they thought it fitting that those who will enjoy future benefits are reminded of the sacrifices made for our freedom.”

Gary Silgard
operations manager, Kears
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“It’s appropriate that those who will enjoy future benefits are reminded of the sacrifices made for our freedom.”

challenge of flying over Berlin on dangerous missions in his lumbering Lancaster, hardly laden with explosives. “If I have to go missing,” he often told a friend. “I hope it’s over Berlin.” January 26, 1944, marked his 24th birthday. After bombing a series of targets, the plane was hit by shots from a German fighter and the bomber plummeted into a forest southeast of the city.

Harold had joined the RCAF at age 20 and was home on leave from training when the station agent knocked on the door and delivered the telegram that proclaimed Eldon missing in action. His parents devastated, Harold vowed to find his brother.

Two weeks later he received his pilot wings and the family said goodbye to their second pilot. After he’d flown 17 missions over Berlin, Harold would have returned home, but he was still focused on his promise to find his brother and took a year-long posting with Transport Command, flying passengers and freight to and from southwest Europe. He knew he had to find a way to get to the countryside 50 kilometres outside Berlin where, his parents had learned from the Red Cross, his brother’s plane had crashed into what was now hostile Russian-occupied Germany.

On February 23, 1946, he was able to land past-convoy. Berlin. He knew it would be risky but he did it anyway. In the Soviet zone. After days of searching help, he at last met with the officer overseeing Canada’s diplomatic mission in post-war Germany. With his help, Harold secured a car and driver, a Russian translator and, most important, an impressive-looking, rubber-stamped but non-official letter explaining his quest.

Harold finally set off through the battered Brandenburg Gate, the start of a nerve-racking trip. Stopped at a check-point, he had a gun shoved in the vehicle window before being led to a Russian captain for questioning. But the letters did the trick, and within an hour Harold was in the village of Bugk with a kind German farmer named Karl König, who had seen Eldon’s plane crash in a ball of flames. He had buried the men and planted flowers on the gravesites. Harold stood silently at his brother’s grave two years after his death. He said a prayer, stepped back and saluted. “I felt I had fulfilled my family’s desire and visited my brother’s grave,” Harold says now.

At the age of 23, Harold Kearl returned to Alberta, married and worked for two oil companies before moving into real estate. He looks forward to his brother’s commemoration when the Kearl facility is complete. “I see it as a meeting of two good names,” says Harold. “I respect Imperial Oil and what they are doing, and they are respecting my brother’s name, the 408 Squadron and the veterans who served our country. They’re a good match and our family feels honoured.”

Kearl and his crew
Flight Lieutenant Eldon Ernest Earl DFC, of 408 Squadron, was killed in action in January 1944 when the Lancaster bomber he was piloting was shot down over Berlin. He is buried in the Berlin 1939-1945 War Cemetery.

His Canadian crew members were:
Flying Officer Elmer Rodolphi Proulx, Royal Canadian Air Force (RCAF), age 25. He is commemorated at the Runnymede Memorial, which is situated at Engelfield Green, near Egham, about 30 kilometres southwest of London.

Pilot Officer Joseph Paul David Pekul, RCAF, age 25. He is buried in the Berlin 1939-1945 War Cemetery.

Pilot Officer Alfred Smith, RCAF age 23. He is buried in the Berlin 1939-1945 War Cemetery.

Pilot Officer John Angus MacLean, RCAF, age 21. He is commemorated at the Runnymede Memorial.

There were also two British crew members:
Pilot Officer John Adamson, Royal Air Force (RAF), who died in the crash, and Alfie Brown, an RAF airman, who was captured and became a prisoner of war. He survived the war. Source: Canadian Forces.
RAISING THE BAR FOR SAFETY

High standards at Imperial are increasing awareness — and improving safety records — among contractors

By Russell Felton

Steve Bolen, a heavy construction and mining contractor of extensive experience, much of it in the rugged wilderness of Western Canada, "had his eyes opened," he says, following an incident that occurred during the early stages of Imperial Oil's Keill oil sands project.

Bolen is project director with K2 Mining, one of the lead contracting firms on the Keill project and one of the earliest hired. The firm has worked on site clearance and excavation since 2008. In total, K2 has moved more than 70 million cubic metres of material from the Keill site and has had as many as 1,500 craft workers and 400 skilled employees on the site at a time.

The crucial incident occurred in April 2009, when a K2 employee lost the tips of two fingers in a workplace accident. "To that point, our safety record was good for our industry, but Imperial's reaction marked a turning point for us," Bolen says. "We met with Imperial management and were told we would not be allowed to resume our operations unless we made a full, top-to-bottom commitment to safety. This included adopting Imperial's and ExxonMobil safety management programs and tools into our day-to-day operations, which we did.

"More than anything, though, the genuine passion that all Imperial's people showed for workplace safety, their commitment and determination that nobody was to get hurt working on an Imperial site, was very evident not only from safety professionals but at every level, from senior management all the way to the job site," Bolen continues. "At K2 we knew we had to raise the bar of our own safety expectations to go on working for Imperial. For example, for previous incidents we would investigate to determine who did something wrong and try to correct it. At Imperial the emphasis is on prevention right from the
start. It is management's responsibility to create the conditions and provide the supervision, awareness and training to achieve zero incidents, and managers are held accountable for meeting that expectation."

K2 Mining's safety record since April 2009 testifies to the change in approach. Since that date, a stretch of some 7.7 million person-hours of work on the K2 site, K2 has not had a single lost-time injury. For three separate periods of more than one million person-hours, no K2 employee has sustained an injury requiring medical treatment of any type (known as a "recordable"), and at the time of writing, the company has not had a recordable safety incident for 48 days, representing more than two million person hours of work.

It might seem reasonable to expect that a project as huge, complex and physically challenging as K2 would result in people getting hurt on the job. After all, 16,000 people, in aggregate, have been employed on the site, as many as 5,000 at a day. Most of the work involved demanding physical labour using heavy equipment to clear a forested wilderness subject to extraordinarily harsh weather — and then construct a mining, processing and industrial complex the size of a small city.

What level of such incidents might be considered "acceptable" for such a project?

The average for the heavy construction industry in the province of Alberta, which for 2011 was 3.11 recordable workplace safety incidents (those requiring some medical treatment) per 100 person-years of work. Or perhaps the average for operations on oil sands facilities in Alberta, which for the same year was 1.2 recordable incidents per 100 person-years of work.

At K2, the acceptable number of work-related injuries for any project or operation, regardless of size, duration, complexity or inherent risks to workers, is zero. This goal is not negotiable or flexible under any circumstances, for any reason, in any facility or aspect of the company’s operations, from construction programs on an enormous as K2 to the desk of every office employee and everything in between.

"Safety is the first and paramount consideration in everything that we do," says Dave Fennell, Imperial’s senior safety advisor, resources. "Our goal of ‘Nobody gets hurt’ is much more than just a slogan or a banner. It reflects an all-embracing philosophy and approach to safety.”

Dave Fennell

senior safety advisor, resources

"Our goal of ‘Nobody gets hurt’ is much more than just a slogan or a banner. It reflects an all-embracing philosophy and approach to safety.”

Imperial’s senior safety advisor, resources. "Our goal of ‘Nobody gets hurt’ is much more than just a slogan or a banner. It reflects an all-embracing philosophy and approach to safety to which every company manager, supervisor and employee and every manager, supervisor and employee of any contractor working for Imperial must be fully and wholeheartedly committed, in actions as well as intent."

Negotiations with any contractor aspiring to work on an Imperial site begin with the question, "Can you meet our safety expectations?" Fennell notes that other factors such as price, timing and operating capability are never even discussed until the commitment to safety is confirmed. "Every applicant contractor is told that safety expectations are different at Imperial from those of other companies," he adds. "That means more stringent in terms of safety education, training and provision of safety tools for contractor employees, and especially in the attitudes and behaviours of both contractor employees and management.”

Imperial safety programs and tools also include an "observation and intervention" program that requires every person in every job to observe his or her coworkers and intervene directly whenever an unsafe practice is seen — such as taking a ride-shoot or other job whether by a fellow contractor employee or an Imperial employee.

Imperial's acknowledged status as the safest operator in the Western Canadian oil patch is guarded for Fennell. Yet to a safety professional he is concerned by the relatively high incidence of workplace injuries in Alberta generally and among construction contractors in particular. "There's a tendency to take a 'get it done, to heck with the risks' attitude to work," he says. "A challenge for all industries and companies, as well as the government, is to engender a stronger belief in and commitment to safety as a fundamental value. Formal training in risk assessment and work practices is part of it, but what's needed is a broader change in attitude, a desire to make Alberta a safer place to work, period.”

Bob Kerr, Imperial’s Western Canada major projects safety, security, health and environment manager, believes the company's emphasis on safety during the K2 construction phase will help improve awareness and practices throughout the industry.

"Along with the six lead contracting companies, we have had some 150 subcontractors and suppliers also on site. We have held one-and-a-half day formal orientation and education sessions for more than 39,000 individuals brought in to work on the site over three years, while managers and supervisors were enrolled in an intensive two-day course called Leadership in Safety to help them become better safety champions. In addition, individuals received safety training specific to their jobs and situations such as working in confined spaces, working at height and so on. Our basic position is that nobody can touch anything or do anything that he or she has not been trained to do so.

"In total, around 85,000 workers have participated in our safety program on the project, with still more to come. I believe that has to help raise safety standards among contractors themselves and throughout the industry generally."

With its fundamental goal of "zero incidents,” the concept of Imperial's commitment to safety of personnel as well as protection of property, the company's Contractor Safety Leadership Team, which brings together managers who work with contractors as part of a concerted effort to have all contractors meet Imperial's safety standards for workers. "Since 2000, contractor safety performance in the Dorestrom products and chemicals operations has improved from 2.22 recordable incidents to 0.17 per 100 person-years to less than 0.4 in 2012,” Stump says. "We still have a long way to go, but there has been dramatic improvement."

A highly successful initiative introduced by the Contractor Safety Leadership Team is Imperial's Buddy Manager program, in which a senior manager from each contractor hired by Imperial is teamed up with a senior-level manager from the company for the exclusive purpose of discussing and managing safety-related issues, especially those engendering a "safety culture" within the contractor's workforce.

John Dillman, president and general manager of NGH Industrial Services Ltd. of Dartmouth, Nova Scotia, a general services contractor at Imperial's Dartmouth refinery, participates in the Buddy Manager program with Frank Dake, turnaround manager at the refinery.

"Frank and I meet regularly to discuss safety issues such as management techniques for risk assessment, behaviour-based tools such as observation and interventions, and any near misses on the job,” Dillman says. "We also host 'Stand up for safety' meetings with our employees, and once a month we walk through the site to observe behaviour and assess risks and discuss safety with our frontline workers. At any time we might have between 25 and 65 people on the site, so it's a significant time commitment.”

The results for both the refinery and NGH (which Dillman confirmed was named for "Nobody gets hurt") have been impressive. Dartmouth refinery as a whole has not had a lost-time injury to an employee or contractor employee since 2004, more than five years ago, while NGH Industrial Services Ltd. has not had an accident requiring medical treatment in more than three years. For this performance, NGH received Imperial’s 2011 President’s Award as the outstanding contractor from a safety viewpoint across Canada. "And we are on the road to winning again this year,” says Dillman.

As it turned out, the safety program during the three-year construction phase at Keal was 0.59 recordable incidents per 100 person-years in 2011. While this was more than five times better than the Alberta Heavy Construction Industry average of 3.11 incidents and substantially better than the records of comparable Canadian oil sands projects, for Imperial, it is not an acceptable level of performance.

Why not? Because it wasn't zero.
SEEKING A SMALLER FOOTPRINT

More than five decades in the making, game-changing technology will reduce emissions and water use for in situ oil sands recovery

By Paul Miller

A new technology that has the potential to dramatically reduce the energy and water needed to recover heavy oil from underground deposits will soon be taken out for a $100-million test drive at Imperial Oil's Cold Lake bitumen lease. A major pilot facility to test the process, called cyclic solvent process or CSP, is currently under construction, with startup expected in the fall of 2013.

"CSP is a total game-changer," says Eddie Lui, Imperial's vice-president of oil sands development and research. "By using solvents rather than steam to produce bitumen, this new process eliminates the need for large amounts of energy and water and reduces direct greenhouse gas emissions by more than 90 percent."

In fact the carbon intensity of CSP-produced bitumen will be below the average intensity of crude oil now being used in North American refineries. As a result, CSP has the potential to be a game-changer for concerns about greenhouse gas emissions from Canada's oil sands.

"It also allows us to recover bitumen from deposits that are too deep for surface mining but don't lend themselves to traditional steam methods," says Lui.

The company estimates that at its Cold Lake leases alone, there are about one billion barrels of bitumen in deposits that are not thick enough or not heavily saturated with bitumen to be produced economically using the existing steam stimulation method. CSP could bring these stranded resources within reach of a commercial production, and with a much more environmentally friendly technology.

To put in perspective, one billion barrels of bitumen are roughly equal to the total amount that has been produced at Cold Lake since commercial production began more than a quarter-century ago.

Given the significant environmental and resource development benefits associated with the solvent recovery process, you may well ask why it wasn't tried earlier. The short answer is, it was. An article published in this magazine about three decades ago described some of the early methods used to try to coax the molasses-like bitumen out of the ground at Cold Lake during the years immediately after Imperial obtained the leases in the late 1950s. In several tests, mixtures of solvents were placed down a well that had been drilled into the bitumen deposits. The solvents promptly disappeared without a trace.

"One of the keys to any large-scale heavy oil production process that uses a high-value component like solvents is that you have to recover a significant percentage of the solvent," says John Elliott, Imperial's manager of oil sands recovery research. "Without that, the economics just don't work."

But recovering the solvent is by no means the only challenge.

Tom Boone, who preceded Elliott as oil sands recovery research manager, outlined a number of additional major unknowns and impediments that lurk along the path to solvent production as a co-author on a paper on CSP that was presented at the World Heavy Oil Congress in Aberdeen, Scotland, in September 2012.

"First, of the many light hydrocarbon solvents available, you have to determine which one has the best combination of attributes," says Boone, now a senior reservoir impacted oil recovery and enhanced oil recovery consultant at Imperial. "It not only has to be effective
in recovering heavy oil, it also has to have acceptable health and environmental characteristics, as well as being available at a reasonable price and in sufficient quantities to support large-scale production.

Another known problem without a solution occurs when bitumen and solvents are mixed together. The result is not a uniform mixture but two distinct oil-based liquids. The heavier elements of the bitumen — called asphaltenes — reside in the bottom of the two layers, creating a stagnant mass of bitumen that could potentially plug up production wells.

A critical challenge is getting the solvent distributed evenly throughout the reservoir so it comes into contact with as much of the heavy oil as possible. But here again, the underlying physics of the bitumen reservoir present some serious roadblocks.

"The contrast between the mobility of the bitumen in the reservoir and the solvent you’re injecting is huge — up to 20 million times different at Cold Lake," notes Boyle.

Solvent injected into a bitumen deposit acts a bit like water flowing across land: it finds the easiest path, forms a channel and eventually creates a stream. In this solvent-aided in situ process, the solvent also takes the path of least resistance, forming pathways, or "fingers," that can take it further from the injection well. The farther the solvent travels, the less chance there is that all of the solvent, or the heavy oil it contacts, will be recovered. Fortunately, in addressing these and other challenges, Imperial has an important ace up its sleeve — the company’s upstream research laboratory, widely recognized as one of the best in the world for heavy oil research and located on the campus of the University of Calgary.

During the early 1990s — following the recommendation of a corporate innovation task force that had identified solvent recovery as one of the most promising technology paths available — this research lab was the site of a series of experiments designed to answer some of the major questions about solvent production.

"We took a core sample from Cold Lake and, under controlled conditions, injected it with the solvent," says Elliott. "We found the solvent was attacking the heavy Cold Lake bitumen. We also determined that, with careful operation, the resulting heavier liquid phase will flow and can be produced."

The tests also showed that solvent fingering, if properly managed, could turn out to be beneficial, allowing the solvent to contact large amounts of bitumen without requiring high injection pressures.

With some of the initial questions about solvent production answered in the lab and through mathematical modeling, it was time to take the show on the road — or rather up the road — to Cold Lake. In 1996 the first field trial was conducted using a single vertical well through which the solvent was injected into the heavy Cold Lake reservoir.

"We used xylene, even though it’s much too expensive for commercial production, because it’s nearly a perfect solvent for bitumen — in fact, it’s what we use to clean bitumen off the lab equipment," notes Elliott. "The results, in terms of solvent-bitumen mixing and our ability to recover the injected solvent, were encouraging."

Two years later, the company undertook a second field test in which ethane, more widely available and less costly than xylene, was injected into a horizontal well. Although the test showed that ethane had very good injection characteristics, an unexpected influx of water into the test well made it difficult to interpret production results.

The third field trial came more than a decade later, this one using the solvent propylene injected into three wells. Results of the 2009 test provided critical input to the design of the major field trial now underway at a site designated The Pilot Project.

"The development of this technology is a prime example of why you need companies like Imperial Oil," says Rick Kry, an Imperial

The Pilot Project

A multi-year, $100 million pilot project is now underway at Cold Lake to determine and advance the commercial potential of the company’s patented cyclic solvent process (CSP).

The field pilot, the fourth and by far the largest CSP pilot the company has undertaken since 1996, involved drilling three horizontal wells into an underground deposit that is not heavily saturated with bitumen to allow efficient recovery using its existing cyclic steam process. Each of the wells will be used both to inject solvent — mainly propane, although a variety of other mixtures will be tested to determine their effectiveness — into the reservoir and produce the resulting fluids, which will be processed at the nearby bitumen recovery facilities.

The injection and production cycles will continue for up to five years, followed by a two-year period to maximize propane recovery.

Given the research nature of this project, it’s not surprising that it will involve extensive measurement and testing.

Six observation wells, which have already been drilled, will take a wide variety of temperature, pressure and reservoir measurement through the use of sensitive geophones. The company hopes to actually hear the movement of solvent through the reservoir.

Advanced 3-D seismic instruments, using sonic pulses generated from and captured in the underground observation wells, will provide a more precise map of solvent movement in the reservoir than seismic observations taken from the surface.

"We’re hoping this measurement and testing will give us a very accurate picture, in both space and time, of what is going on in the reservoir," says David Courtnage, team leader for the field pilot.

Other solvent processes

LASER

After more than a decade of research and field trials, Imperial has begun large-scale bitumen production using a new technology called LASER (liquid addition to steam to enhance recovery). LASER involves injecting a small amount of gas condensate with the same material that is added to bitumen so it can be shipped by pipeline along with steam into wells that have already been treated through several cycles of steam injection. Adding solvent to the steam increases the amount of oil that can be produced per unit of injected steam, while reducing greenhouse gas emissions by more than 25 percent.

Solvent-assisted SAGD

Steam-assisted gravity drainage (SAGD) is a recovery technology developed and patented by Imperial that can be used in reservoirs at Cold Lake and Athabasca where heat-robbing features such as water at the bottom of the reservoir or gas on top can make traditional recovery methods such as cyclic steam stimulation impractical.

For the past several years, Imperial has been pilot-testing a process at Cold Lake that entails adding solvents to SAGD to determine the amount of additional bitumen that can be recovered, as well as the reductions in greenhouse gas emissions that can be achieved.

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LAND OF OPPORTUNITY
Long history to leases that make up the Kearl oil sands project

IT was in the early 1950s when Mobil Oil Canada picked up the first of the Kearl leases in northeastern Alberta, long before most people had any inkling of the juggernaut the oil sands play would one day become.

These two parcels of land, once known as 36 and 31A, are located more than 70 kilometres northeast of Fort McMurray, in an area of boreal forest and muskeg so remote geologists first travelled by canoe to explore the potential of its bitumen-laden sands.

It was a time when many North American companies, including Imperial Oil, were taking an interest in the oil sands areas across northern Alberta, where prospects were being found from the Athabasca region to the Peace River area. For Imperial, it was in the 1950s that the company bought the first of its Cold Lake leases, now home to its Cold Lake operation, which has produced more than one billion barrels of oil sands production since commercial operations began in the 1980s.

There were many oil sands areas of interest, particularly in the Athabasca deposit surrounding Fort McMurray. With many deposits too deep to be mined, it was in the erosional valley near the Athabasca River, where the bitumen was closer to the surface, that the prospects appeared the most promising for mining.

“There was a lot of work done in the 1960s and ’70s to understand the geology and distribution of the bitumen,” recalls Bob Peterson, who retired as chief executive of Imperial Oil in 2002 and was a champion of the company’s early oil sands efforts as both a founding partner in Syncrude and at Cold Lake. “Of course, everybody had a different view of where you wanted to be.”

A view that was shared, however, was that development of this massive resource would have to wait until a combination of higher oil prices and advances in recovery technology would make these projects economic. One of the biggest challenges was separating the sticky bitumen from the sands, a process that would take decades to refine and still continues to undergo improvements today.

The early drilling and evaluation work of the 1950s confirmed significant bitumen resources on the two Mobil Oil Canada leases. But it wasn’t until 1997 that the company would file the first preliminary disclosure outlining its plans for the Kearl oil sands project. Named for Kearl Lake, which lies within the lease area, the mine and upgrading project was slated to produce 130,000 barrels a day of synthetic bitumen by 2003.

Following the creation of ExxonMobil in 1999, the new company took another look at the Kearl oil sands opportunity. After deferring the project’s regulatory filing, ExxonMobil continued to evaluate the project.

What may have appeared as a setback for development would prove to be strategic as oil sands technology continued to bring both economic and environmental gains.

Throughout this time, Imperial was also establishing its holdings in the Kearl area. In 1989, Imperial bought Lease 87, acreage located directly east of the Mobil Oil Canada Kearl leases. Imperial acquired this lease jointly with Husky Energy and, together with Husky, extended the area in 2000 with the purchase of Lease 6, another parcel located directly to the north.

In 2001, Imperial and Husky concluded an agreement that gave Imperial all rights to the expected oil sands mining area on the two leases.

In that same year, Imperial and ExxonMobil entered into a memorandum of understanding to jointly develop these leases as the Kearl oil sands project. Today, Lease 87 is the location of the Kearl oil sands project initial development, which is scheduled to soon start production. Resources on the other leases will be developed over Kearl’s expected 40-year lifespan.

The current Kearl land position was finalized in 2005, when ExxonMobil concluded an agreement with neighbour Shell Canada to swap portions of adjoining leases.

Today, Kearl is one of Canada’s largest and highest-quality oil sands deposits, with 4.6 billion barrels of recoverable bitumen.

More than 50 years after the region was first tilled for its resource potential, these areas of muskeg and forest now surround a new generation of oil sands mining developments at Kearl.

Unlike the original Mobil Oil Canada project, Kearl will be the first mining project to produce a saleable bitumen product without an upgrader. Kearl will also use energy-efficient co-generation technology, progressive reclamation, tailings management and water storage to reduce the environmental footprint of oil sands development.

For a story that has taken more than half a century to tell, Kearl is a chapter in Canada’s oil sands history that marks a brighter future.

— Lin Schmidt

What may have appeared as a setback for development would prove to be strategic.