APPENDIX A
Mainline System Capacity

The current average annual capacity on the Mainline System is approximately 2.85 million bpd out of Western Canada. A series of pipelines run between Edmonton, Alberta and Superior, Wisconsin and four pipelines extend the system beyond Superior, providing access to markets in Minnesota, Illinois, Indiana, Ohio, Michigan and Ontario. Enbridge also has market access pipelines connected to the Mainline that serve markets in Eastern Canada, Cushing, Patoka and the U.S. Gulf Coast (USGC).

Despite the increasing challenges in permitting major infrastructure projects, between 2013 and 2017 Enbridge successfully placed into service more than 1.1 million bpd of additional capacity upstream of Superior and more than 1.65 million bpd of additional capacity downstream of Superior. These projects have enabled production growth from the WCSB and Bakken regions to move to prime markets and have provided Enbridge with the flexibility to optimize the operations of the Mainline System to become even more safe and reliable.

Recent Expansions

Focusing on system optimization and operating efficiency has contributed to record ex-Gretna deliveries of 2.785 million bpd in November 2018.
The LOMA Program has expanded access to markets for growing volumes of North Dakota and Western Canadian light oil production. It has further expanded capacity on the U.S. Mainline System, enhanced Canadian Mainline terminal capability, upsized the Eastern Access Program and provided additional access to U.S. Midwestern refineries. LOMA has provided additional capacity for light oil to move on the Enbridge system to attractive refining markets in Ontario, Quebec and the U.S. Midwest. Enbridge successfully completed expansions of Line 61 and Line 6B in 2016. We expect the remaining LOMA Program Mainline projects to be placed into service in conjunction with the Line 3 Replacement Program:

- Southern Access Expansion to 1.2 million bpd; and
- Associated tankage and terminalling upgrades.

**Mainline Tankage and Terminalling**

In 2017 and 2018, Enbridge continued making upgrades to a number of terminals across the network, with the goal of maximizing throughput and increasing the level of service provided to our customers.

This year, Enbridge will continue to support customer-initiated projects, as well as explore further opportunities to optimize the terminalling assets.

**Line 3 Replacement Program**

After receiving shipper support in 2014 to replace Line 3 from Hardisty to Superior, Enbridge continues to develop the approximately $8.2 billion program to maintain and enhance our Canadian and U.S. Mainline Systems. This is the largest project in Enbridge’s history and will involve replacing all remaining segments of Line 3 between Hardisty and Superior with 1,677 kilometres (1,042 miles) of new pipe, using the latest available high strength steel and coating technology. The Line 3 Replacement Program (L3RP) will also substantially reduce long-term adverse impacts to landowners and the environment caused by conducting numerous preventative maintenance digs to maintain the line. The L3RP will support the safety and operational reliability of the overall system, enhance flexibility and allow Enbridge to restore 370,000 bpd of capacity and optimize throughput on the Mainline System’s overall Western Canada export capacity. When completed, the L3RP will provide landowners and shippers with a new pipeline that restores the historical operating capabilities of Line 3 to move approximately 760,000 bpd in mixed-product service.

In November 2016, Enbridge received approval from the Canadian Federal Government for the L3RP. We have strong support for the project from the communities along the route. Enbridge has undertaken the largest engagement program in our history, including engaging with 150 Indigenous communities from as far away as 300 kilometres from the right of way.

In 2018, Enbridge completed over 700 kilometres of pipeline construction in Canada and combined with the 400 kilometres completed in 2017 is now over 80 percent constructed, with the remainder of construction to be completed by July 1, 2019. All throughout the construction period in Canada, Enbridge has delivered on our commitments and maintained relationships with all of our stakeholders including landowners, Indigenous communities, the National Energy Board and all levels of
In 2018, Enbridge achieved a major milestone for the L3RP by receiving approval from the Minnesota Public Utilities Commission for the Certificate of Need for the project and approval of Enbridge’s preferred route with minor modifications and certain conditions. Enbridge remains actively involved in the ongoing permitting processes and all remaining requirements are progressing well. Enbridge expects a targeted completion date for construction of the L3RP in the second half of 2020.

**Upstream of Superior System Enhancements**

Beyond Enbridge’s secured slate of projects, the Mainline System is well positioned to offer scalable, low cost and highly executable expansion projects to meet the transportation needs of industry, particularly in this time of uncertainty and wide price differentials for Canadian crude. Given the multi-pipeline configuration of the Mainline System, several low-cost system optimization and expansion options are available such as reduced Bakken deliveries into Cromer, early line-fill on the L3RP and minimizing delivery windows across our system. Enbridge is also exploring system optimization via new crude slates and drag reducing agent injections, as well as work on Line 4 to bring it back to its nameplate capacity. These system enhancements could potentially provide incremental capacity of up to 100,000 bpd ex-WCSB in 2019. Further Mainline optimizations could add an additional 350,000 bpd.

**Downstream of Superior System Enhancements**

To fully utilize the potential of the entire suite of secured and future Mainline expansions, additional capacity from Superior to Flanagan will be required. Enbridge is currently exploring multiple options that could bring on the required capacity, ranging from building new infrastructure to utilizing existing pipeline infrastructure in that corridor.

Enbridge plans to further develop both upstream and downstream options and to engage with shippers in commercial discussions at a suitable time.

**System Optimization**

**Enbridge continues to review its system configuration to maximize value to customers.**

With the significant increase in Western Canadian takeaway demand, Enbridge has placed a key focus on increasing pipeline capacity. With this focus, significant progress has been made to optimize system performance and capacity out of Western Canada, increasing capacity by 450,000 bpd since 2015. This optimization process examines a number of factors including:

- Overall system capacity;
- Power and integrity costs;
- Expected throughput/capacity by commodity/crude slate;
- Current pressure restrictions;
• System reliability;
• Linefill requirements; and
• Facility interconnection capability.

Improvements made on these factors have increased the system operating efficiency and overall throughput offered to industry. The Enbridge Mainline offers a one of a kind system related to shipper optionality and flexibility across North America, which allows quick response to supply/demand disruptions via its multiple pipelines, terminal facilities and access to several markets. Enbridge will continue to optimize the above factors to maximize throughput offered to the market.

Mainline Tolls

Maintaining toll certainty and competitiveness for our customers is a significant focus for Enbridge.

Currently the Canadian portion of the Mainline System is tolled as per the Competitive Tolling Settlement (CTS), a 10-year tolling agreement with shippers that expires July 1, 2021. The CTS provides for a U.S. dollar denominated International Joint Tariff (IJT) for crude oil shipments originating in Canada on the Enbridge Pipelines Inc. (EPI) System and delivered in the U.S. off the Lakehead System. Local rates for service on the U.S. portion of the Mainline System are not affected by the CTS and continue to be established by Lakehead’s existing tolling agreements. Replacing the expired CTS will be a new tolling arrangement that will have a U.S. dollar denominated IJT while providing priority access in Canada. Contracts offered will be up to 20 years containing flexible commercial terms for all our shippers while providing long-term toll certainty and predictability. The new commercial framework will provide a minimum of 10 percent spot capacity. The next steps are to finalize the commercial framework, hold the Open Season, and submit the regulatory application with an effective date of July 1, 2021.
APPENDIX B
Pipeline construction is officially underway on the Trans Mountain Expansion Project (TMEP).

An event marking the start of construction was held in Acheson, Alberta, Canada and was attended by Trans Mountain President and CEO Ian Anderson, Canada Minister of Natural Resources Seamus O’Regan and Alberta Minister of Energy Sonya Savage, along with other local government representatives.

The project is an expansion of the existing 1,150 km crude oil pipeline that runs between Strathona County, Alberta and Burnaby, British Columbia, increasing its capacity from 300,000 to 890,000 bbl/d.

A range of regulatory and environmental issues delayed the project for more than a year, but Canadian Prime Minister Justin Trudeau gave the expansion the go-ahead in June this year.
Construction on the project as a whole recommenced in August with works at the Westbridge Marine Terminal, Burnaby Terminal and pump stations in Alberta, including site preparation activities and facility upgrades.

Mr Anderson called the start of pipeline construction a “pivotal moment for Trans Mountain”.

“We are proud of the project we have designed and the innovative measures we are implementing that demonstrate the kind of rigour and detail that will go into every stage of this project to mitigate risks, respect the rights of those directly affected and operate safely,” he said.

Minister O’Regan said it was an important milestone in the pipeline’s construction.

“This project is supporting workers and will keep our energy sector strong – in the short, medium, and long term,” he said.

“This is a good day for our sector. It’s a good day for Alberta. It’s a good day for Canada.”

The event kicked off pipeline construction in Greater Edmonton where SA Energy Group, a partnership between Robert B Somerville Co and Aecon Utilities, is the general pipeline contractor.

The company has begun pipe transport, stringing and other preparation work for a 50 km stretch that will run from Trans Mountain’s Edmonton Terminal in Sherwood Park to Acheson.

The TMEP will cost approximately CA$7.4 billion (US$5.7 billion) and it’s been estimated that it will generate around 15,000 jobs per year during construction.

For more information visit the Trans Mountain website.

If you have company news that you would like featured in Pipelines International contact Managing Editor Chloe Jenkins at cjenkins@gs-
First shipment of semi-solid bitumen on its way to China

A modified shipping container with 130 barrels worth of solid bitumen is loaded onto a container ship in Prince Rupert. Image: Melius Energy

A test shipment of bitumen oil from Alberta is on its way to China, but it didn’t get to a B.C. port by pipeline – it was moved by train through Prince Rupert in a semi-solid form commonly known as neatbit.

Melius Energy in Calgary is not the first company to propose moving bitumen through B.C. in a semi-solid form by train, but it appears to be the first to actually land a potential customer in China and start shipping semi-solid bitumen by train.

It has sent its first container, containing 130 barrels of bitumen, to China in a test shipment, and is currently building a new demonstration plant in Edmonton that turns diluted bitumen into a solid called TrueCrude.
“Prince Rupert is expanding and they’re looking for lot of containers to move through there,” said Yuri Butler, Melius’ manager of logistics and supply.

“That’s one of the reasons we’re excited about working with Prince Rupert is they’re looking for a lot of containers. We’re looking to export a lot of containers. Right now there’s a lot of containers coming into Prince Rupert, but there’s not necessarily a lot leaving.”

Moving bitumen in semi-solid form addresses environmental concerns associated with moving diluted bitumen by rail, pipeline and oil tanker.

The concern is that an oil spill on either land or at sea could have serious environmental impacts. Shipping it in a solid, non-flammable form addresses those concerns. Should a container of TrueCrude ever crack open and end up in the ocean, it would float in one large block that could easily be recovered, the company says.

Bitumen is a thick, tarry form of oil that has to be diluted with lighter oils – condensate – in order to transport it in liquid form. Melius developed a process, called BitCrude, whereby the diluent is taken back out of the diluted bitumen. The diluent can be recycled back to dilbit producers.

The pure bitumen is heated so it can be poured into modified shipping containers, where it then solidifies when it cools. It is then shipped by train and put onto container ships. When it reaches its destination, the bitumen is heated to allow to flow into a refinery.

Melius is currently building a demonstration diluent recovery plant in Edmonton. Butler said the plants could be built and sold as turn-key operations to oil producers in Alberta.

Melius says transporting bitumen by train and container ship is cost competitive with pipeline and oil tanker transport. For one thing, there are no capital costs associated with the transportation, since the railway lines already exist.

“We’re moving on existing rail lines, it’s a safe product and we can efficiently move volume at scale,” Butler said.

There are also economies of scale associated with moving products by container ship, as opposed to oil tanker, since there are so many containers ships plying the ocean.

“When you ship in a container, your costs to ship that container are very competitive because there’s so much volume of containers moving,” Butler said.

He said there is a huge demand in China for bitumen, largely because China’s Belt and Road project will require so much asphalt.

Because of its high asphaltene content, bitumen is a highly desired feedstock for making asphalt. Roughly half of a barrel of bitumen can be turned into asphalt, with the rest being turned into other petroleum products.

“The demand from Asia right now for heavy crude oil is growing and it’s almost insatiable, especially with what’s happening with Venezuela, and Iran and Saudi Arabia,” Butler said.
sell our premium product at a premium price.”

— Business in Vancouver
APPENDIX D
### Movements of Crude Oil and Selected Products by Rail

**Product:** Crude Oil  
**Period-Unit:** Monthly-Thousand Barrels

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* = No Data Reported; -- = Not Applicable; NA = Not Available; W = Withheld to avoid disclosure of individual company data.

Notes: Rail movements of crude oil are estimates based on EIA analysis of data from the Surface Transportation Board and other information. See Definitions, Sources, and Notes link above for more information on this table.

Release Date: 12/31/2019
Next Release Date: 1/31/2020
Climate Science Deniers Took Over BBC Radio 4 For a Morning During the Holidays

Some of the UK's leading climate science deniers took to the airwaves over the Christmas break, after former Telegraph editor Charles Moore was given the chance...

Will Rail Be Key to Exporting Canada's Tar Sands Oil to the World?

Justin Mikulka (/user/justin-mikulka) | October 2, 2019
While Canadians turned out en masse for large climate protests last week, the country's oil and gas industry continued its plans to ramp up and export its massive and polluting reserves of tar sands oil, also known as bitumen, to the rest of the world.

Several recent developments in the rail arena are setting up the tar sands industry to realize those plans in a major way.
The momentum is on our side and we are not going anywhere.
#FridaysForFuture

Increasingly, pipeline capacity constraints, both in the U.S. and Canada, are forcing oil producers to turn to rail in order to export tar sands oil.

The volume of Canadian oil moved by rail in July, the latest month available, increased to 313,283 barrels per day, which is one of the highest months on record.

**Canadian crude oil exports by rail**

Source: National Energy Board
“Our operating plan considers the potential to move a million to a million-and-a-half barrels of bitumen per day, among other shipments,” Treadwell explained to the Journal of Commerce (https://canada.constructconnect.com/jpc/news/infrastructure/2019/07/engineering-spotlight-a2a-rail-aims-carve-railway-corridor-alberta-alaska) in July. “The long and the short of it is that ports in Alaska's Cook Inlet have already been exporting oil in one form or another since the early 1960s. Ports in the area export to refineries as far away as Taiwan.”

Considering the current record for Canadian crude-by-rail is just over 350,000 barrels per day, this railway would completely change the scale of the industry, more than doubling it.

Both the Canadian and Alaskan governments have traditionally been very friendly to oil projects, which bodes well for A2A's prospects. Alaska Governor Mike Dunleavy, who has downplayed climate change's effects on the state, while axing its climate response team (https://www.alaskapublic.org/2019/02/23/alaska-gop-gov-dunleavy-disbands-state-climate-response-team/) recently spoke to a group (https://www.anchoragepress.com/columnists/dunleavy-says-alberta-tar-sands-wyoming-coal-justify-mile/article_5267c264-dfa4-11e9-ab38-27175d5a7b50.html) of Republican activists about his support for the A2A project. In his remarks, he used one of the oil industry's favorite talking points (https://www.desmogblog.com/2017/06/21/fossil-fuel-ceos-tillerson-say-want-lift-people-out-poverty-usaid) — that producing oil is all about helping poor people around the globe access energy — in order to attack the philosophy of “those on the left”:

“…those on the left, [their philosophy is] that we don't want to use this energy anymore. It's too dirty. It hurts birds. Flowers wither. The list goes on and on and on. So at a time where technology has unleashed our ability to produce cheap energy for some of the poorest people on the planet, these people that purport to be the advocates for the poorest people are going to make it more expensive.”

The company behind the Alaska to Alberta Railway effort has claimed to already have invested $60 million into this project. However, as a recent Anchorage Press column notes (https://www.anchoragepress.com/columnists/dunleavy-says-alberta-tar-sands-wyoming-coal-justify-mile/article_5267c264-dfa4-11e9-ab38-27175d5a7b50.html), the project’s current price tag is estimated between $13 billion and $15 billion and while it is being marketed in vague terms, its heavy focus on shipping Alberta tar sands and Wyoming coal will likely draw considerable future resistance on climate and environmental grounds.

First Export of Solid Bitumen By Rail

A recurring environmental concern about shipping oil by rail is the potential for derailment to lead to oil spills, which are notoriously difficult to clean up. DeSmog has previously reported (http://www.desmogblog.com/2018/02/18/tar-sands-oil-technology-pellets-game-changer-export-bitumen) on efforts by the rail industry to transform bitumen, a dense hydrocarbon with the consistency of peanut butter, into solid pellets that could be transported in open rail cars the same way as coal.

Currently, bitumen is either diluted with other fossil fuels or lightly processed so that the viscous hydrocarbon flows more easily through pipelines or into rail cars.

However, last week the first shipment (https://www.bloomberg.com/news/articles/2019-09-25/oil-sands-crude-sails-from-british-columbia-despite-federal-ban) of solid bitumen, which was produced using another solidification process.
container. I've been following Bitcrude for awhile and am pleased to see exports off the NW coast of B.C!

globenewswire.com/news-release/2...

**Melius Energy Ships Bitumen to International Markets**
Successful shipment proves the viability of the BitCrude™ transportation solution that exceeds Canadian regulatory requirements.
globenewswire.com

849 2:05 PM - Sep 25, 2019
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**Tar Sands Rail Protests Continue**

One major appeal of the A2A rail project, which Alaska Governor Mike Dunleavy (https://www.anchoragepress.com/columnists/dunleavy-says-alberta-tar-sands-wyoming-coal-justify--mile/article_5267c264-dfa4-11e9-9d7b-2b50.html) highlighted, is that unlike in many port cities in the Lower 48, Alaskan communities would be less likely to protest the project. As DeSmog has documented (https://www.desmogblog.com/2018/01/29/washington-inslee-rejects-oil-rail-vancouver-energy-tosoro-savage), local communities have successfully blocked many major oil-by-rail expansion efforts in port cities across America — from Baltimore, Maryland, to Vancouver, Washington — which has impeded Canadian efforts to export tar sands oil.

Last week, protesters in Portland, Oregon, held a 60-hour-long event opposing upgrades to an oil terminal (https://www.oregonlive.com/news/g66l-2019/09/4e3679ab6a2651/demonstrators-finish-60-hour-vigil-at-zenith-energy-in-nw-portland-photos.html) that would enable tar sands oil to arrive by train to their city.
APPENDIX F
Climate Science Deniers Took Over BBC Radio 4 for a Morning During the Holidays

Some of the UK's leading climate science deniers took to the airwaves over the Christmas break, after former Telegraph editor Charles Moore was given the chance...

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Why Canadian Tar Sands Oil May Be Doomed

Justin Mikulka (/user/justin-mikulka) | October 25, 2018

Read time: 9 mins
At current prices, Canadian tar sands oil producers are losing money on every barrel of oil they dig out. Despite signs earlier this year the industry would “turn profitable in 2018,” a much more likely scenario at this point is a fourth straight year of losses.

Producers are forced to keep cranking out product and selling it at a loss to cover the massive costs required to start one of these sprawling unconventional oil operations, a point made painfully clear when Alberta wildfires in 2016 forced some tar sands operators to shut down.

“I do think they’ll start up quickly once the danger from the fire is gone because there is a lot of motivation to do that,” Jackie Forrest, an energy economist for Arc Financial Corp, told The Globe and Mail. “They have a lot of fixed costs so they’re going to be motivated to get some revenue to pay for those costs that aren’t going away.”
America Is Maxing out on Canadian Crude

American refiners certainly enjoy buying Canadian crude at such low prices. How low are the prices? As the Financial Post reported, in mid-October, Western Canadian Select (WCS) was $19 a barrel — approximately $50 a barrel cheaper than a barrel of the American oil standard known as Western Texas Intermediate (WTI).

Without a competing market in sight, American buyers likely will continue receiving huge discounts on Canadian oil. As Sandy Fielden, director of oil and products research at Morningstar, told Reuters in 2016: “If Canada can’t get their oil to another market besides the U.S. [market], you’ll always be a price taker, not a price maker.”

Even under these economic conditions, one company, Teck Resources, is proposing to build a new tar sands mining operation. Projections estimate the cost to produce a barrel of oil at this operation will be around $85 a barrel. That's quite the mismatch with what a barrel of Canadian crude oil is fetching these days, and doesn't bode well for a sustainable business model.

Another complicating factor is that even at such low prices, American refiners only want and need so much tar sands oil, which is a heavy, lower-quality oil. America is experiencing a boom in production of the light fracked crude oil from shale basins, which is not only more valuable to refiners but requires much lower transportation costs than importing crude from Alberta, the tar sands capital of North America.

As The Energy Mix reported recently: “Permian Basin oil is a far better fit for the only U.S. refiners capable of handling more bitumen [tar sands oil], and will likely be for at least the next decade.”

As an example of that preference, Exxon just announced plans to expand its Beaumont, Texas, refinery by 300,000 barrels per day, which would make it the largest refinery in America. This additional capacity is for light crude oil, not heavy Canadian oil.

Still, American refiners are importing, and refining, record amounts of Canadian oil right now, but at massively discounted prices compared to average global oil prices, which helps lead to huge profits.
To help extract itself from this difficult situation, Canada is looking to build pipelines, such as the still-uncertain Trans Mountain pipeline expansion, to transport its landlocked oil to tidewaters, where companies theoretically can sell the oil to Asia's rapidly growing market.

Never Get Involved in an Oil War With Saudi Arabia

Canada's tar sands pipeline plans have several fatal flaws. The first is that tar sands oil is heavy and not the most desirable oil on the market. The second is that Canada is late to the game, with some rather formidable competition from the U.S., which is exporting oil to Asia at ever increasing rates, and also from the Middle East.

While Canada's tar sands proven oil reserves are the third largest for any country in the world, Saudi Arabia holds the number two spot (Venezuela is number one). Unlike the stiff production costs Canadian tar sands operators face, Saudi Arabia has production costs in the range of $10 per barrel (https://money.cnn.com/2015/11/24/news/oil-prices-production-costs/index.html), Plus, Saudi Arabia is producing more desirable grades of oil and has easy access to ports, giving the country a strong competitive edge.

However, Saudi Arabia still needs to secure markets for its oil and has been striking deals and partnerships around the world to ensure its oil is the oil that meets future global demand. It has begun shipping oil to one of these joint venture projects in Malaysia (https://www.reuters.com/article/us-malaysia-aramco-oils-rms-aramco-plans-to-ship-first-crude-oil-to-malaysia-by-2010-sources-idUSKCN1LK1U4) and is helping finance projects in China (https://www.forbesmiddleeast.com/en/saudi-aramco-invests-in-chinese-petrochemical-refinery/).

This is all assuming a significant reduction in global oil consumption doesn’t occur in the coming decades in order to address the climate crisis. Years of successful pipeline protests and global oil economics may end up keeping a large portion of the Canadian tar sands oil “in the ground.”

Canadian Prime Minister Justin Trudeau (https://www.businessinsider.com/trudeau-gets-a-standing-ovation-at-energy-industry-conference-oil-gas-2017-3) most likely wouldn’t be pleased at that prospect. In 2017 he told an oil industry conference: “No country would find 173 billion barrels of oil in the ground and leave them there.” But a country might if the oil were sold at a loss.

Looking for Bailouts

A good indicator of the failed tar sands model is how many major oil companies sold their positions (https://environmentaldefence.ca/2017/03/14/seven-oil-multinationals-pulling-canadas-tar-sands/) in Canadian tar sands and took their losses (https://www.desmogblog.com/2017/03/22/what-oilsands-exodus-actually-means). Their main explanation? No one could make money on those projects at current oil prices.

The remaining companies apparently have to rely on government bailouts. The first bailout signaling trouble for the industry was when the Canadian government bought the Trans Mountain pipeline expansion (https://business.financialpost.com/commodities/energy/ottawa-buys-trans-mountain-pipeline-for-4-5-billion-but-can-it-sell-it) project from Texas-based Kinder Morgan for CAN $4.5 billion. A federal court ruled that the pipeline didn’t get the proper approvals (https://vancouversun.com/news/local-news/federal-court-of-appeal-quashes-approval-of-9-3-billion-trans-mountain-oil-pipeline-expansion), which means it is now in legal limbo and may not be built — but Kinder Morgan still gets its $4.5 billion. A big win for Kinder Morgan, perhaps less so for the people of Canada.

Embed from Getty Images (http://www.gettyimages.com/detail/930208686)
Moving oil by rail is more expensive than by pipeline but does offer the advantage of reaching ports where the oil could be exported — and a desperate Canadian oil industry has very few options.

**Technology Not the Savior**

Canadian tar sands oil had very different prospects in 2010. The American shale oil and gas revolution had just begun, and producers were trying to figure out which shale plays would actually produce oil. It did not seem like a threat to the massive Canadian tar sands oil industry at the time.

Meanwhile in Canada, the industry knew where the bitumen was and how much was there (a lot). In a 2010 article in *The Globe and Mail* (https://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/oil-sands-output-climbs-14-in-2009/article4321630/), Darin Barter, a spokesman for Alberta's Energy Resources Conservation Board, noted that unlike the traditional oil industry, exploration costs for the tar sands industry were "zero."

"We know the oil is there, the bitumen is there, the technology may not be there," Barter said in 2010, "But we all know how quickly technology moves forward when there is a financial reward at the end."

In 2018, the technology is definitely there. The bitumen can be mined and diluted and pumped through pipelines and into rail tank cars. But the financial reward that Barter was expecting technology to deliver has not materialized.

Almost 10 years later, the financial payout for tar sands oil looks less likely than ever.

[Main image: Fort McMurray, Alberta - Operation Arctic Shadows. (https://www.flickr.com/photos/kk/6863477149/in/photolist-bsv7CV-7wedxQ-rZP2j-BseS2w-7dEo14-brMxYr-r2P69j-89CBDS-V77Y9A-7dfHq-btWZZa-u6kWc-8p6Rzl-6DYsQ-WVoymF-3oipK3-6ZTg2X-4ZsnsG-7dEkj-g6Mjxe-6VzTi-kBr1yc-g8Feq-51R9cp-bt6WCN-5Tv45h-7semQ-4ZobpX-89Cjjo-gMsJ-38AaSg8-GjKbbh-4ZoaP-p3X3u2-agF16r-qadtTH4-4lj86c-btXyZe-4lj8uz-yby7V-VPPvom-8p6PWs-7wefrL-8p6Qdm-51VmEy-rkJpqE-btX5Dk-bsjFfe-pPnFHii-PSEgs)!](https://www.flickr.com/photos/kk/6863477149/in/photolist-bsv7CV-7wedxQ-rZP2j-BseS2w-7dEo14-brMxYr-r2P69j-89CBDS-V77Y9A-7dfHq-btWZZa-u6kWc-8p6Rzl-6DYsQ-WVoymF-3oipK3-6ZTg2X-4ZsnsG-7dEkj-g6Mjxe-6VzTi-kBr1yc-g8Feq-51R9cp-bt6WCN-5Tv45h-7semQ-4ZobpX-89Cjjo-gMsJ-38AaSg8-GjKbbh-4ZoaP-p3X3u2-agF16r-qadtTH4-4lj86c-btXyZe-4lj8uz-yby7V-VPPvom-8p6PWs-7wefrL-8p6Qdm-51VmEy-rkJpqE-btX5Dk-bsjFfe-pPnFHii-PSEgs)! Credit: Kris Krüg (https://www.ickr.com/photos/kk/6863477149/in/photolist-bsv7CV-7wedxQ-rZP2j-BseS2w-7dEo14-brMxYr-r2P69j-89CBDS-V77Y9A-7dfHq-btWZZa-u6kWc-8p6Rzl-6DYsQ-WVoymF-3oipK3-6ZTg2X-4ZsnsG-7dEkj-g6Mjxe-6VzTi-kBr1yc-g8Feq-51R9cp-bt6WCN-5Tv45h-7semQ-4ZobpX-89Cjjo-gMsJ-38AaSg8-GjKbbh-4ZoaP-p3X3u2-agF16r-qadtTH4-4lj86c-btXyZe-4lj8uz-yby7V-VPPvom-8p6PWs-7wefrL-8p6Qdm-51VmEy-rkJpqE-btX5Dk-bsjFfe-pPnFHii-PSEgs)! CC BY-NC-ND 2.0 (https://creativecommons.org/licenses/by-nc-nd/2.0/)
2019 Crude Oil Forecast, Markets and Transportation
CAPP’s annual *Crude Oil Forecast, Markets and Transportation* report provides a long-term outlook for Canadian crude oil production, and this year is projecting serious constraints over the forecast period from 2019 to 2035.
This constraint forecast is likely to continue with regulatory and supply-side challenges — both domestic and international — in the oil and gas industry. The oil and gas industry in Canada is facing significant challenges in terms of production, infrastructure, and market access. With the nation’s reserves of oil and gas, the industry still holds great potential for growth and development. However, recent years have seen a decline in production due to various reasons, including low oil prices and regulatory challenges. As a result, the industry is facing a critical period of transition, requiring strategic investments and innovative solutions to address the challenges.

The oil and gas industry in Canada is not only faced with the challenge of declining production but also with the need to adapt to changing market conditions. With the shift towards cleaner energy sources, the industry is looking for ways to diversify its operations and reduce its carbon footprint. This requires a comprehensive approach to technology development, infrastructure improvements, and market access strategies.

In summary, the oil and gas industry in Canada is facing a critical period of transition, requiring strategic investments and innovative solutions to address the challenges. The industry must adapt to changing market conditions and focus on developing cleaner energy sources to remain competitive in the global market.
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INTRODUCTION

In this, the 2019 edition of the Crude Oil Forecast, Markets and Transportation report, the Canadian Association of Petroleum Producers (CAPP) provides a constrained outlook for Canadian oil production from 2019 to 2035, as producers face a broad and increasing array of challenges. If these challenges are not successfully addressed then any meaningful increase in oil production will not be achievable. Ultimately reducing potential growth in Canadian GDP, business investment, exports, and jobs. Oil supply in Western Canada already exceeds the transport capacity of pipelines to serve external markets, with the result that Canadians are not receiving the full value for our resources. While rail will play an increasingly important role in transporting Western Canadian crude oil to regional refinery centers, significant additional pipeline capacity is needed for the Canadian industry to capture growing oil demand.

In addition to constraining regional market opportunities in the United States, with improved takeaway capacity Canadian producers would have the ability to serve global markets and fully realize Canada’s enormous resource potential. Improved takeaway capacity would allow Canadian producers to deliver increased volumes of heavy crude oil to the U.S. Gulf Coast at a time when other suppliers, such as Mexico and Venezuela, are reducing production of these crudes varieties. Pipeline access from Western Canada to Edmonton would provide Canadian producers with access to global markets, such as the Asia-Pacific region, where growth in refinery backstock demand is expected to be significantly higher than in North America. The ability for Western Canadian crude oil to gain market share and to meet future increasing oil demand depends on the successful completion of new pipeline projects. The current lack of certainty of timing and confidence in completion of new pipeline projects, paired with additional regulatory issues, has led to a constrained production outlook.

Due to transportation costs and crude quality differences, heavier crude oils in Western Canada, such as Western Canadian Select (WCS), should typically trade at a discount of about US$12 per barrel against West Texas Intermediate (WTI), the North American crude oil benchmark which is traded at Cushing, OK. Approaching half of this discount is the result of quality differences between heavy and light oil; the remainder reflects the level for Canadian crude to be transported up to distant U.S. refineries. At times in 2018, however, this crude oil price differential exceeded US$20 per barrel. This significantly larger differential was symptomatic of the lack of pipeline access out of the Western Canadian Sedimentary Basin (WCSB). Unable to find sufficient transportation for their production, producers consequently sold crude volumes at depressed prices, reducing producer revenues, government taxes and royalties collected, and Valuing Known Investment. Surging levels of storage in Western Canada were also the result of a lack of transportation alternatives out of the region.

Other heavy of producing countries are facing production declines due to aging infrastructure and geopolitical turmoil. The reduction in supply is leading to a b_Code pricing environment for heavy crudes in markets such as the U.S. Gulf Coast where refineries are capable of processing heavy crudes. Canada is missing an opportunity not only to gain market share but also to receive premium pricing for our resources. In response to the significant price differential in the fall of 2018, the Alberta government launched its Crude Oil Ordinance Program that established fines on the volumes of crudes that could be produced in the province during 2019. The program’s intent is to reduce aggregate production from the WCSB to a level that would allow producers to draw down storage while fully utilizing current refining capacity from Western Canada. Despite high inventories of crude that has built up while excess capacity from the market that capped production was over by the government to be a critical component of correcting the large price differentials that emerged in the second half of 2018. Following the implementation
of the program, crude oil price differentials have narrowed significantly; however, }

incentive is not a long-term solution.

Government initiatives such as the Crude Oil Cutback Program create challenges }

when constructing a forecast for production, and can further constrain the outlook. }

While crude oil differentials might be reduced in the short run, production limits }

may directly affect firms’ drilling programs as they reduce capital spending on new }

wells to ensure they remain within cutback limits. Similarly, oil sands operators }

may have to adjust the timing of additional projects or new phases in order to avoid }

exceeding cutback limits.

The investment outlook in Western Canada is unattractive due to the uncertainty }

from continued delays in obtaining increased market access. Delays and inefficient }

and duplicative regulations are affecting producers’ confidence and their willingness }

and ability to invest in the region. The Bank of Canada continues to identify a lack of market access }

in the sector as a drag on the Canadian economy. Conventional oil producers are }

expected to drill fewer wells in 2019 compared to either 2017 or 2018. Activity levels }

are not likely to show significant improvement without better market access. Capital }

spending in the oil sands is forecast to decline for a fifth consecutive year to $12 billion, }

which is approximately one-third of the investment levels seen in 2014 (Figure 1.1). }

Canadian GDP has been reduced due to lack of business investment and falling }

exports directly linked to the oil and natural gas industry.

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<td>2016</td>
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<td>2017</td>
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<td>2019</td>
<td>17.0</td>
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Production from oil sands projects, which involve substantial long-term financial commitments, are key drivers in the future growth prospects for Canadian oil sands production.

Companies have adjusted to the lower price of oil environment by substantially }

reducing their cost structure by anywhere from 35 to 55 percent. Yet, investment continues to be }

reduced due to pipeline delays, regulatory issues and reduced competitiveness. Producers need }

certainty and defined timelines. Without these assurances, the global competitiveness of Canada’s oil }

industry will be diminished, creating a significant barrier to future investment and }

putting Canadian jobs at risk. Potential federal legislation that would shift project approvals into the federal }

realm would stifle new developments, leading to even less investment and fewer jobs.

Without new pipeline capacity, producers are forced to move their product to }

markets using higher cost options such as rail, thereby driving up the discount in}

western Canadian oil prices.

Environment, Social, Governance (ESG): Continuous Improvement

There is an increased interest regarding environmental, social and governance (ESG) practices in Canada. Oil producers are committed to ESG with an understanding that for the energy sector, the ESG Environment is a focal priority. Companies are committed to lowering GHG emissions while minimizing other environmental impacts, in line with corporate goals of cost control, operating efficiency and being sustainable community partners.

Good governance (above) the environmental and social practice – both corporately and from a jurisdictional perspective. Canada and Canadian companies consistently rank among the highest in international ESG scores. Companies’ focus and disclosure on ESG performance demonstrates awareness and management of material business risks and opportunities for organizations.

A variety of research indicates that the oil sector is, in fact, a global leader in ESG practices, especially in the technology and innovation space.

- The average emissions intensity of oil extraction has fallen 21 percent since 2005. Oil sands life cycle emissions are nearing North American averages values.

- By 2030, new technologies and efficiencies deployed in the oil sands could result in up to a 27 percent reduction in the GHG intensity of oil sands extraction and upgrading and up to a 50 percent reduction in the GHG intensity of real oil sands.

- On a full-life cycle basis, limitations from production to consumption, substantial reductions would place these sources within the two to four percent, and live to seven percent respectively, of the average emissions intensity for crude oil refined in the U.S.

- The Canadian industry will reduce methane emissions by 60 percent from oil sands and natural gas operations by 2020.

- Innovation and collaboration are hallmark of the oil sands industry which have established a number of organizations to fund research and share results. CAPP’s report Competing Climate Policy: Supporting Investment and Innovation (May 2019) states:

  - Canadian Oil Sands Innovation Alliance (COSIA) launched in 2012, and as of March 2018 member companies shared more than 900 distinct technologies that cost more than $1.1 billion to develop.

  - Petroleum Technology Alliance Canada (PTAC) has launched more than 800 projects and has a roster of about 100 active research projects aimed at technology development.

  - Clean Resources Innovation Network (CRIN) allies Canada’s industry, universities, technology vendors, academic, research institutes, financing and government to advance the commercialization of innovative technologies.

  - CAPP’s report Toward a Shared Future: Canada’s Indigenous Peoples and the Oil Sands (October 2019) found that:

    - Between 2011 and 2018, the Fort McMurray Group of Companies (Indigenous-owned businesses located in the oil sands region) generated more than $2.2 billion in revenue, which has supported the community in becoming self-determining and a strong, active participant in the oil sands industry.

    - In 2015 and 2016, oil sands companies spent $3.5 billion in procurement from Indigenous-owned companies, providing $49.6 million in Indigenous community investment and $40.7 million to fund Indigenous consultation capacity.

A Joint Working Group (JWG) was convened in late 2017 as a forum for industry, federal and provincial governments to examine issues affecting competitiveness of Canada’s upstream oil and natural gas industry. According to the JWG report, the Canadian upstream petroleum industry’s workforce is becoming increasingly diverse. For example, a doubling of visible minorities; an increase of immigrants; to about 16 per cent of the sector’s workforce, six per cent of the workforce are Indigenous peoples, compared to four per cent for Canada’s overall workforce.
CRUDE OIL PRODUCTION AND SUPPLY FORECAST

Over the next two decades, the world’s population is expected to grow by nearly two billion while the global middle class is expected to nearly double. Countries will be more urbanized and industrialized, and will consume more energy than today. Canada thus has the potential to become an even more significant supplier in meeting global crude oil demand. Canada is the world’s sixth largest oil producer and is home to a vast 170 billion barrels of crude oil reserves. However, the path to realizing this potential is paved with challenges regarding uncertainty as to when or whether additional pipeline capacity will become available.

Total Canadian oil production, including petroleum and condensate, is expected to grow from 5.65 million barrels per day (b/d) in 2015 to 5.68 million b/d in 2016. Due to the need to supplement domestic oil supplies with imported volumes, the total supply from Western Canada is forecast to grow to 4.8 million b/d by 2020 from 4.7 million b/d in 2015. For comparison, in 2014 CAPP projected total supply from Western Canada would grow to 7.3 million b/d by 2016. This year’s constrained production outlook is due to inefficient and duplicative regulations, reduced investor and producer confidence, and uncertainty around additional transportation capacity.

2.1 Production and Supply Forecast Methodology

CAPP’s forecasts for Western Canadian conventional production and eastern Canadian production were both developed through an internal analysis of historical trends, expected operating activity, and discussions with industry stakeholders and government agencies.

To forecast oil sands production, CAPP surveyed oil sands producers in the first quarter of 2013 requesting the following information:

- Expected production for each project.
- Upgraded crude oil production volumes.
- Type and volume of diluent required to move heavy oil production to market.

Producers were asked to respond to this survey based on their company’s view of the price outlook, as well as recent policy developments including federal and provincial climate policies and the impacts of Alberta’s Carbon Management Program. The survey results were risk adjusted by taking into consideration each project’s stage of development. E.g., announced projects were often risk adjusted based on the extent to which projects are expected to ramp up production.

The natural gas price forecast was then assessed against national trends. No constraints were imposed to reflect any restrictions on the availability of condensate for blending purposes or the lack of transportation infrastructure, although company assessments of these issues may have impacted individual producer survey responses.

The volume of total crude oil supply delivered to pipelines and terminals is greater than total production because imported diluent, in addition to domestic supplies, is needed to meet the blending requirements that enable heavy oil to be transported by pipeline.

2.2 Canadian Production

Canadian crude oil is produced across the western Canadian provinces while the oil sands are located only in Alberta. Eastern Canada produces limited amounts of crude oil primarily from projects located offshore of Newfoundland and Labrador. The offshore fields in eastern Canada are not included in CAPP’s projections due to data limitations. Offshore production is expected to account for nearly 75 percent of total production (Figure 2.1).

![Figure 2.1: Canadian Oil Sands and Conventional Production](image_url)

Table 2.1

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Canada</td>
<td>4.22</td>
<td>4.51</td>
<td>4.71</td>
<td>4.91</td>
<td>0.68</td>
</tr>
<tr>
<td>Western Canada</td>
<td>1.84</td>
<td>1.80</td>
<td>1.82</td>
<td>1.86</td>
<td>0.05</td>
</tr>
<tr>
<td>Total Canada</td>
<td>6.06</td>
<td>6.30</td>
<td>6.53</td>
<td>6.77</td>
<td>0.74</td>
</tr>
</tbody>
</table>

*Historical data as of June 2015

Production in Eastern Canada is forecast to peak at 5.50 million b/d in 2016 before falling to 4.70 million b/d in 2020. Production growth in Eastern Canada is expected to be more than offset this decline, as it is forecast to increase by more than 1.4 million b/d, reaching 7.78 million b/d in 2020 from 6.36 million b/d in 2014 (Table 2.1).

2.3 Eastern Canada Production

Alberta and New Brunswick produce small volumes of crude oil, however most of the crude oil from Eastern Canada is produced from offshore Newfoundland and Labrador. The offshore fields in eastern Canada are not included in CAPP’s projections due to data limitations. Offshore production is expected to account for nearly 75 percent of total production (Figure 2.1).
High decline rates are associated with offline drilling as the larger, upfront capital costs and fixed operating costs result in maximizing production. However, offline production from mature fields is expected to decline rapidly. Production from associated satellite pools can extend the lives of the projects and slow the overall rate of decline. Relative to last year’s forecast, CAPP anticipates existing projects will slightly more productive than previously projected. It is probable that an additional new project could achieve first oil in 2015, boosting the production profile through the latter half of the forecast period (Figure 2.2).

2.4 Western Canada Production

Western Canada provides 66 per cent of Canada’s total production. The oil sands contributed nearly two-thirds of the 1.46 million bpd produced in Western Canada in 2016, and will be responsible for the 1.4 million bpd growth anticipated by 2035 (Table 2.3). Conventional production, including prone and condensate, will be stable and the forecast to contribute an average of more than one million bpd annually through the forecast period.

### Table 2.2: Atlantic Canada Projects and Recent Discoveries

<table>
<thead>
<tr>
<th>Project</th>
<th>Year Discovered</th>
<th>Estimated Recoverable Reserves (millions of barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mariner</td>
<td>2009</td>
<td>162 (Heavy oil)</td>
</tr>
<tr>
<td>Haywood</td>
<td>2013</td>
<td>Upper Evapante</td>
</tr>
<tr>
<td>Bay de Verde</td>
<td>2013</td>
<td>100 - 106 (Light oil)</td>
</tr>
</tbody>
</table>

### Table 2.3: Western Canada Crude Oil Production

<table>
<thead>
<tr>
<th>Period</th>
<th>2014</th>
<th>2015</th>
<th>2025</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude-oil</td>
<td>1.41</td>
<td>1.45</td>
<td>1.59</td>
<td>1.66</td>
</tr>
<tr>
<td>Petroleum</td>
<td>0.81</td>
<td>0.85</td>
<td>0.90</td>
<td>0.92</td>
</tr>
<tr>
<td>Gas</td>
<td>0.30</td>
<td>0.34</td>
<td>0.38</td>
<td>0.42</td>
</tr>
<tr>
<td>Total</td>
<td>2.52</td>
<td>2.64</td>
<td>2.97</td>
<td>3.06</td>
</tr>
</tbody>
</table>

CAPP anticipates existing projects will be slightly more productive through 2024 than previously projected.
2.4.2 Oil Sands

The oil sands resources are situated almost entirely in Alberta and can be delineated by the Athabasca, Cold Lake and Peace River deposits (Figures 2.5). In this constrained environment, oil sands production, which can be recovered either by mining or in situ projects, is forecast to grow by 1.34 million b/d by 2023 from 2.37 million b/d in 2018. From 2019 to 2021, annual oil sands production growth is expected to average four per cent. This growth rate is significantly less than half that of 2017 and 2018. Given the current regulatory environment and producers’ lack of confidence in market access conditions, from 2022 onward the average production growth in the oil sands is expected to be only two per cent annually.

Mining projects are large-scale in nature and require more upfront capital than smaller scale in situ projects, where production can be brought on in phases. The Fort Hills mining project started continuous production in January 2018 and ramped up to its 160,000 b/d in December 2018, production from mining operations will grow by approximately 475,000 b/d (Table 2.4). In situ production is forecast to yield 950,000 b/d of additional production (Figure 2.6) by 2016. Part of this includes CNOC’s international expansion at Long Lake, proposed to add 36,000 b/d, and Imperial Oil’s (Joffre’s) Inuvik project, which Imperial expects will reach production in 2023 and add 75,000 b/d.

Table 2.4: Oil Sands Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil Sands</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0.918</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>1.39</td>
<td>0.47</td>
</tr>
<tr>
<td>2018</td>
<td>1.86</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>2.33</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>2.78</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>3.28</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>3.90</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>4.69</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>5.64</td>
<td></td>
</tr>
</tbody>
</table>

Note: Forecast is based on existing projects.

Figure 3.2 Western Canada Conventional Crude Oil Production

Production of pentanes and condensate is forecast to grow significantly.

Figure 3.4 Western Canadian Pentanes and Condensate Production

Figure 3.6 Oil Sands Regions

Figure 3.8 Western Canada Oil Sands Production

(Please refer to the actual document for the figures and tables mentioned.)

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**Curtailment**

In December 2018, the Government of Alberta announced its Curtailed Oil Program that was applied to production commencing in January 2019 and will terminate on December 31, 2019. Initially the program limited production in Alberta to 3.5 million bbl/day with the intention to reduce enough shipping space to clear the large build-up of storage volumes that had occurred in the province. Once storage volumes have been substantially reduced, the program intends to allow higher production limits for the balance of 2019.

Curtailment is only applied to operator volumes in excess of 10,000 bbl/day and as such will have limited impacts on small producers. While these cuts may affect some of the smaller conventional producers, the majority of the impact is expected to affect oil sands producers, which typically have larger scale developments. Responding to market conditions and producer concerns regarding the safety issues surrounding cutting production, the government released the production cuts for the month of June to more than 3.7 million bbl/day.

This policy was the direct result of continued regulatory delay, resulting in a lack of market access. The dramatic slower pace of growth in production at the latter end of the forecast period, relative to recent history and the near-term outlook, is the result of the industry’s concerns around rising progress on new pipeline capacity and heightened levels of regulatory uncertainty. In addition, Canada’s fiscal and tax policies have been diverging from those in the US, resulting in challenges for Canadian producers competing with their American counterparts to attract investment capital.

**Upgrading**

The production volumes from oil sands projects are derived by combining new bitumen production and upgraded crude oil production from integrated projects. By volume, there is a generalized process associated with this upgrading process, which contacts mined bitumen into an upgraded light crude oil. The feedstock associated with upgrading volumes from oil sands projects without associated upgrader is accounted for in the calculation of supply volumes discussed in Part 3.5 below. Refer to Appendix A.1 for detailed production data.

**2.6 Western Canada Supply**

Crude oil supply refers to the crude oil that is delivered to the end use market. Conventional supply is projected to decline to 367,000 bbl/day in 2019 from 386,000 bbl/day in 2018. Upgraded light crude oil supply is expected to steady and is forecast to average 940,000 bbl/day over the outlook period. Oil Sands heavy supply will grow by 1.2 million bbl/day to reach 4.5 million bbl/day in 2019 from 3.9 million bbl/day in 2018 (Figure 2.3).

![Western Canada Oil Sands and Conventional Supply](image)

*Figures show Western Canada Oil Sands and Conventional Supply*

- **Regional Split**
  - *Interim Oil Supply* in Canada
  - *Forecast Oil Supply* in Canada
  - *Total Oil Supply* in Canada
  - *All Oil Supply* in Canada

On a monthly basis, supply volumes reported in Appendix A.2 are greater than the corresponding production shown in Appendix A.1 because the addition of imported crude volumes supplement domestic supplies used for blending both conventional heavy crude oil and oil sands bitumen that is not upgraded.

*Pattulace and condensate are the main sources of diluent, and when combined with bitumen result in heavy crude oil medium known as “dilbit.” Imports of condensate supplement domestic supplies and compensate for the shortfall between the blending demand and available domestic supplies. Synthetic bitumen, or “sydbit” results when other bitumen volumes are diluted with upgraded light crude oil. Blending for dilbit requires about a 7:3 bitumen to condensate blending ratio, while sour bitumen requires approximately a 10:10 ratio. Relatively small volumes of bitumen with a reduced diluent requirement is referred to as “sydbit.”*

CAPP’s forecast is not constrained by the availability of condensate mounts. As CAPP assumes new sources of condensate will be available to meet market requirements. Western Canadian pattulace and condensate production is growing, but in 2018 405,000 bbl/day of imported condensate, upgraded crude oil, and bitumen were still needed for blending.
The long-term pace of growth in the oil sands continues to be hampered by uncertainty and delays related to new pipeline capacity out of Western Canada. 

**Crude Oil Markets**

Today nearly all of Canada’s oil exports are delivered to U.S. refineries. In 2018, Canada exported more than 3.6 million b/d to the U.S. — less than one percent of exports were delivered to other markets. Domestic Canadian refinery markets account for about one million b/d, or 26 percent of total demand for Canadian production.

Figure 3.1 shows the relative sizes of the regional refinery markets in the U.S. and the respective sources of crude oil supplies. Refineries receive crude oil feedstock and process it into a variety of petroleum products such as transportation fuels such as gasoline, diesel, jet fuel, and even some heating fuels. The volume of total crude oil supplied to pipelines and markets is greater than total production because imported diluent, in addition to domestic supplies, is needed to meet the blending requirements that enable heavy oil to be transportable by pipeline.

---

Table 3.6 Western Canada Crude Oil Supply

| Million b/d | 2015 | 2016 | 2017 | 2018 | 2019 | Change
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>1.00</td>
<td>1.04</td>
<td>1.07</td>
<td>1.04</td>
<td>1.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>Heavy</td>
<td>3.20</td>
<td>3.00</td>
<td>2.80</td>
<td>2.60</td>
<td>2.40</td>
<td>-0.20</td>
</tr>
<tr>
<td>Total Supply</td>
<td>4.20</td>
<td>4.04</td>
<td>3.87</td>
<td>3.64</td>
<td>3.41</td>
<td>-0.23</td>
</tr>
</tbody>
</table>

*change from 2015 to 2016*
3.1 Canada

There are 17 refineries in Canada that have a collective crude oil refining capacity of 2.9 million b/d. In 2018, crude oil production actually processed by Canadian refineries totaled more than 1.7 million b/d, including 581,000 b/d of imported oil.

3.1.1 Western Canada

The nine refineries located in Western Canada (Table 3.1) comprise approximately 49 percent of Canada’s total crude oil refining capacity. Alberta and Saskatchewan refineries receive crude oil supplies exclusively from Western Canada, primarily by pipeline although some volumes are transported short distances by truck. Refineries in B.C. obtain some crude oil from within the province but most of B.C.’s supply comes from Alberta through the existing Trans Mountain pipeline, as well as some smaller volumes by rail. According to the NBEC, less than 10 percent of B.C.’s refined petroleum products are imported from the U.S.

Table 3.1 Refineries in Western Canada by Province

<table>
<thead>
<tr>
<th>Owner</th>
<th>Location</th>
<th>Crude oil processing capacity (b/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperial</td>
<td>Strathcona</td>
<td>191,000</td>
</tr>
<tr>
<td>Husky</td>
<td>Lloydminster</td>
<td>198,000</td>
</tr>
<tr>
<td>Suncor</td>
<td>Edmonton</td>
<td>142,000</td>
</tr>
<tr>
<td>Shell</td>
<td>Edmonton</td>
<td>92,000</td>
</tr>
<tr>
<td>Northern Lights Partnership</td>
<td>Sturgeon County</td>
<td>79,000 (68,000)</td>
</tr>
<tr>
<td>Alberta &amp; British Columbia (5 refineries)</td>
<td></td>
<td>823,000</td>
</tr>
<tr>
<td>British Columbia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pembina Pool</td>
<td>Cremona</td>
<td>65,000</td>
</tr>
<tr>
<td>Husky</td>
<td>Prince George</td>
<td>11,000</td>
</tr>
<tr>
<td>British Columbia &amp; Alberta (6 refineries)</td>
<td></td>
<td>462,000</td>
</tr>
<tr>
<td>Federal Co-operatives</td>
<td>Moose Jaw</td>
<td>110,000</td>
</tr>
<tr>
<td>Gibson (2 refineries)</td>
<td></td>
<td>110,000</td>
</tr>
<tr>
<td>Suncor</td>
<td>Edmonton</td>
<td>7,000</td>
</tr>
<tr>
<td>Shell</td>
<td>Edmonton</td>
<td>46,000</td>
</tr>
<tr>
<td>British Columbia &amp; Alberta (5 refineries)</td>
<td></td>
<td>533,000</td>
</tr>
</tbody>
</table>

Western Canada refinery demand increased to 562,000 b/d in 2014 from 545,000 b/d in 2013 due to the start-up of Phase One of the North West Redwater Partnership’s (NRW) refinery, which commenced operations in late 2014. Since startup, the refinery has processed synthetic crude oil to produce diesel. The refinery is working toward eventually processing heavier feedstocks; however, construction of its gasifier complex, the refinery will be able to use up to 100,000 b/d of bitumen or 75,000 b/d of oil sands as feedstock. This is the first refinery built in Canada since 1984 and has three potential expansion phases. Future expansions have received regulatory approval but timing of the remaining phases is uncertain.

3.1.2 Eastern Canada

There are eight refineries in Eastern Canada with collective crude oil refining capacity of 1.2 million b/d (Table 3.2). The capacity of these refineries accounts for 40 percent of Canada’s western refineries by 464,000 b/d. Because eastern refineries are not as well connected to domestic crude oil production supplies, these refineries are currently more reliant on imported crude to meet their needs. Refineries in Eastern Canada process primarily light crude oil and in 2016 received approximately half of their 1.1 million b/d of feedstock from foreign sources.

Eastern refinery access to western Canadian supplies and U.S. refinery production significantly improved after Enbridge received its Line 3 pipeline to flow west to east from Sarnia, Ontario to Montreal, Quebec. This move occurred in December 2015.

Refineries in Quebec and Atlantic Canada have limited access and consequently have access to crude oil supplies from a number of global alternatives. Irving Oil’s refinery in Saint John, N.B. can receive some western Canadian crude by rail, but Atlantic Canada refineries primarily rely on foreign imports to balance, supplemented by some Atlantic Canada production. The U.S. has been a large supplier of crude oil to Canada since 2013, and supplied about 65 percent of the total import demand in 2016. Saudi Arabia is also a major exporter of crude oil to Eastern Canadian refineries, supplying 21 percent of total import demand in 2016. Other countries supplying crude oil to these refineries include Nigeria, Azerbaijan, and Norway.

Table 3.2 Refineries in Eastern Canada by Province

<table>
<thead>
<tr>
<th>Owner</th>
<th>Location</th>
<th>Crude oil processing capacity (b/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperial</td>
<td>Marriott</td>
<td>119,000</td>
</tr>
<tr>
<td>Imperial</td>
<td>Sarnia</td>
<td>119,000</td>
</tr>
<tr>
<td>Suncor</td>
<td>Sarnia</td>
<td>73,000</td>
</tr>
<tr>
<td>Suncor</td>
<td>Sarnia</td>
<td>21,000</td>
</tr>
<tr>
<td>Suncor</td>
<td>Glace Bay</td>
<td>31,000</td>
</tr>
<tr>
<td>British Columbia &amp; Alberta (2 refineries)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlantic Canada</td>
<td></td>
<td>570,000</td>
</tr>
<tr>
<td>Irving</td>
<td>Saint John, N.B.</td>
<td>220,000</td>
</tr>
<tr>
<td>Irving (North Atlantic Refining LP)</td>
<td>Corner Brook, NL</td>
<td>120,000</td>
</tr>
<tr>
<td>Atlantic Canada &amp; Irving (7 refineries)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total production</td>
<td></td>
<td>852,000</td>
</tr>
</tbody>
</table>

14. CRUDE OIL MARKETS AND TRANSPORTATION
3.2 United States Key Refining Hubs

Canada is the largest foreign supplier of crude oil to the U.S., delivering 3.7 million bpd in 2016, which accounted for almost all of Canada’s exports. Given its immense reserves base, Canada has the potential to supply even larger volumes to the U.S. However, the ability to increase exports to this market is currently hampered by a lack of transportation capacity.

The U.S. Department of Energy divides the 50 states into five market regions called Petroleum Administration for Defense Districts (PADDs). These PADDs were originally created in the Second World War to help allocate crude oil from petroleum sources. Today, this division continues to be used when reporting data to describe U.S. crude markets, which have different characteristics attributable to their distinct regional locations.

As PADD II - Midwest

Currently the largest regional market in the U.S. for Canadian crude exports is the Midwest. In 2018, the 3.9 million bpd refining market imported 2.5 million bpd, or 65 percent of its crude of feedstock needs (Figure 3.1) with almost all those imports originating in Western Canada.

The heavy reliance on crude supplies from Western Canada is not surprising, as a number of refineries in PADD II have made significant investments in recent years to increase their ability to process heavy crude oils. Consequently, these refineries are expected to continue to rely almost exclusively on Western Canada for their heavy feedstock requirements, as they are well connected via pipelines to access crude oil from Western Canada.

PADD II also encompasses the largest commercial storage hub in the U.S. at Cushing, Oklahoma. Cushing is the main trading hub for U.S. crude oil and also the delivery point for New York Mercantile Exchange (NYMEX) traded futures contracts. The Energy Information Agency reports there are approximately 77 million barrels of working storage capacity at this hub. Oil that is initially delivered to this hub can ultimately be delivered to markets outside PADD II when taken out of storage. In recent years, additional pipeline capacity has been developed that allows this hub to deliver crude to the U.S. Gulf Coast, which are located in PADD III. Other primary market hubs within PADD II are located at Chicago, Minnesota and Wood River, Illinois. See Appendix C refinery map for locations.

As PADD III - U.S. Gulf Coast

The U.S. Gulf Coast is home to a vast refinery complex that comprises 48 refineries with a combined capacity of 3.9 million bpd. The majority of this capacity is located in two coastal states, Louisiana and Texas. Since 2010, U.S. consumption of domestic crude oil has increased in the U.S. Gulf Coast has grown dramatically, as the U.S. has seen a significant increase in production from its tight oil and shale resources. For example, since 2010, the Permian Basin has seen a fivefold increase in production, from less than one million bpd to more than four million bpd in early 2018. In 2018, domestic crude oil supplied 6.3 million bpd, or 69 percent of PADD III’s nine million bpd feedstock demand (Figure 3.3). In contrast, U.S. domestic supplies accounted for only 29 percent of regional demand in 2018.

Even though light sweet crude oil imports have been largely displaced by domestic production as a result of the U.S. shale boom, significant demand for heavy crude oil still remains. The U.S. Gulf Coast refinery complex has around two million bpd of heavy crude oil refining capacity.

While Venezuela and Mexico have historically been the dominant sources of heavy crude oil to the region, supplying 489,000 bpd (Venezuela) and 352,000 bpd (Mexico) in 2018, Canada has an opportunity to expand its share of this market. Today, Canada is in the process of shipping 41,000 bpd of heavy crude to the U.S. Gulf Coast in 2019, but share decline in crude oil production in both Venezuela and Mexico mean refineries in PADD III are seeking other sources of feedstock supply. In November 2018, Mexican crude oil production was 1.06 million bpd, a decline of 22 percent from production of 2.39 million bpd in January 2015. Production declines have been even more dramatic in Venezuela, with November 2018 production of 1.03 million bpd representing a decline of 47 percent from the 2.55 million bpd in January 2015.

Until the Keystone XL pipeline is available, the ability to replace supplies from Venezuela and Mexico will be challenging for Canadian producers. This is because Canadian producers must rely primarily on rail, which incurs higher transportation costs and potentially requires crude oil to be sold at a substantial discount in order to capture market share.

3.3 International

World demand for crude oil is expected to grow in the coming decades and Canada’s ability to provide additional supplies to meet this higher demand will depend on its ability to build the required market access infrastructure. According to the International Energy Agency’s World Energy Outlook 2016 (New Policies Scenario), global oil demand is projected to increase 12 percent from 2014 to 2040. Overall, energy demand will decrease in mature economies, but this will be more than offset by increases that reflect developing economies raising up to middle income economies. Per capita energy consumption in developing economies is expected to increase rapidly toward OECD levels as prosperity rises. The combined demand growth from China and India of 6.2 million bpd is equal to 70 percent of the projected world demand increase from 2017 to 2040 (Table 3.2).
3.4.1 IMO Impact

Upcoming changes to United Nations International Maritime Organization (IMO) regulations may have implications for the future demand of heavy, high-sulphur crude oil produced in Alberta's oil sands. The IMO has established new requirements for bunker fuel specifications that require sulphur emissions to fall from 3.5 per cent to 0.5 per cent by 2020. Global average bunker fuel sulphur content is currently about 2.45 per cent. In total, more than three million barrels of high-sulphur fuel oil (HSFO) bunkers will need to switch to 0.5 per cent sulphur fuel through blending.

The IMO standards create an uncertain outlook for the broader global refining sector, especially regarding how refiners will respond to a more sulphur-constrained global bunker fuel market. Spread or differential adjustments and light-heavy differentials will likely widen during the initial years following the changes in regulation, as there will be a higher premium on sweet crude over heavy sour crude that yield relatively more volumes of heavy residual fuel oil (which is used as a bunker fuel) during the refining process. The magnitude and duration of this impact is highly uncertain and depends on some key variables such as compliance and scrubber (exhaust gas cleaning systems) uptake in the maritime industry, and blending opportunities available to refiners.

3.4.4 Market Summary

While there is significant incremental market potential for Canadian producers in both the U.S. and the Asia-Pacific region, uncertainty around the timing of any additional pipeline capacity continues to frustrate producers in pursuit of these new opportunities.

Looking to the future, the bulk of Western Canada's growing heavy crude oil supplies are ideally suited for the U.S. Gulf Coast market due to the size of that region's heavy oil processing capacity and existing supply infrastructure to the region. As well, pipeline projects out of Western Canada would provide producers with much needed market flexibility and closer reliance on a single export market. This is especially important given the fact that the global markets exhibiting the greatest potential for growth in crude oil consumption lie beyond the U.S. and are found in Asia.
TRANSPORTATION

A well-established network of pipelines connects western Canadian crude oil producers to the North American refinery market. As early as 1980, the Interprovincial Pipeline Company (now Enbridge) began shipping western Canadian crude oil to the U.S. This pipeline network was expanded as production of crude oil from Western Canada has grown and the demand from both Canadian and U.S. refineries has increased. Yet, in recent years, regulatory timelines for pipeline development have become more stringent and the pipeline network no longer keeps pace with the demands of the market, resulting in producers facing substantial pipeline capacity constraints.

The existing pipeline infrastructure shown in Figure 4.1 is able to transport crude oil produced in Western Canada to Canadian markets as far east as Montréal, and to the West Coast. It also has the ability to transport these crude supplies to the U.S. Gulf Coast through interconnections with pipelines in the U.S. Midwest. At this existing network is now operating at full capacity and the timing of new pipeline capacity remains uncertain, producers are increasingly relying on rail transportation to deliver incremental production to market.

The price producers obtain for crude oil in any region is a function of the type of crude oil being produced and the transportation costs incurred for delivery from the production area. Pipelines are the preferred mode of shipping large volumes of crude oil long distances over land given the economics of scale. The associated costs of using rail is higher than pipelines or tankers over the same distance.

4.1 Crude Oil Pipelines Exiting Western Canada

At present, there is not enough crude oil capacity existing in Western Canada to meet the needs of producers. Both the Brattleboro-Maine and Trans Mountain pipelines continue to operate under appointments. This occurs when shipper negotiations exceed the pipeline’s capacity, as pipeline operators are forced to decrease shippers’ nominated volumes on a pro rata basis.

The combined aggregate capacity of major takeaway pipelines is more than four million b/d of crude oil from Western Canada. However, in 2015 about 3.5 million b/d of capacity was unavailable as a result of equipment being offline, constraining on downstream pipelines, capacity being allocated for transporting refined petroleum products, and U.S. Bakken crude oil production taking up space otherwise available for western Canadian production (Table 4.1).

In 2018, most of the 4.8 million b/d of western Canadian crude oil supplies were transported to markets by pipeline but excess volumes relied on rail.

Refineries in Alberta and Saskatchewan that require delivery from a short distance may receive volumes from region pipelines or trucks.

4.1 Major Existing Crude Oil Pipelines Exiting Western Canada

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>In Service</th>
<th>Outside Diameter (inches)</th>
<th>Distance (km)</th>
<th>2018 Annual Throughput (Gb/d)</th>
<th>Est. Capacity Available for Crude Oil Exit (Gb/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pembroke Mainline</td>
<td>Operating</td>
<td>24</td>
<td>1,147</td>
<td>300</td>
<td>270</td>
</tr>
<tr>
<td>Trans Mountain</td>
<td>Operating</td>
<td>24</td>
<td>1,181</td>
<td>300</td>
<td>170</td>
</tr>
<tr>
<td>Pembroke Express</td>
<td>Operating</td>
<td>24</td>
<td>1,205</td>
<td>200</td>
<td>249</td>
</tr>
<tr>
<td>TC Energy Keystone</td>
<td>Operating</td>
<td>36</td>
<td>364</td>
<td>300</td>
<td>581</td>
</tr>
<tr>
<td>Phase 1</td>
<td>Operating</td>
<td>36</td>
<td>364</td>
<td>300</td>
<td>581</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Operating</td>
<td>36</td>
<td>468</td>
<td>300</td>
<td>581</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Operating</td>
<td>36</td>
<td>700</td>
<td>300</td>
<td>581</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,182</td>
</tr>
</tbody>
</table>
4.2 Proposed Pipeline Systems

The next sections summarize the three proposed pipelines.

4.2.1 Line 3 Replacement Program
Line 3 is one of the Enbridge Mainline’s primary pipelines. The original capacity of the line was 700,000 b/d but due to age and safety issues, since 2008 it has operated under voluntary pressure restrictions that have reduced its capacity to 350,000 b/d, and now requires extensive maintenance to operate even at this reduced level. The proposed Line 3 Replacement Program would replace the pipeline and restore it to its original capacity. This pipeline will be essential to ensure continued service required by refineries in Minnesota and neighboring states, as well as Eastern Canada and the U.S. Gulf Coast.

The line was expected to be in service by the end of 2019 but with a delay in permits from the State of Minnesota the line will not be ready until the second half of 2020.

On June 3, 2019 the Minnesota Court of Appeals ordered further proceedings to consider the potential impact of an oil spill into the Lake Superior watershed.

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**Proposed Crude Oil Pipelines Exiting Western Canada**

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Outside Diameter (inches)</th>
<th>Inside Diameter (inches)</th>
<th>Service Date</th>
<th>Capacity (BBL/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enbridge Line 3 Replacement</td>
<td>36</td>
<td>1.659</td>
<td>2020</td>
<td>370</td>
</tr>
<tr>
<td>Trans Mountain</td>
<td>36</td>
<td>1.154</td>
<td></td>
<td>556</td>
</tr>
<tr>
<td>TC Energy Keystone XL</td>
<td>30</td>
<td>1.807</td>
<td>2020+</td>
<td>818</td>
</tr>
</tbody>
</table>

**Required Additional Capacity**

- 370,000 bbl/d of Canadian oil on the global market.

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**ENBRIDGE LINE 3 REPLACEMENT PROJECT (L3RP)**

- **370,000 bbl/d of Canadian oil on the global market.**
- **Initial Capacity:** 350,000 bbl/d
- **Length:** 1,669 kilometers
- **Diameter:** 36 inch replacing 34 inch
4.2 Trans Mountain Expansion Project

The Government of Canada issued an Order-in-Council to approve the Trans Mountain Expansion Project (TMEP) in November 2016. Prior to that, in May 2016, the NEB determined the project was in the Canadian public interest and recommended approval of the expansion. In January 2017 the B.C. Environmental Assessment Office issued an environmental assessment certificate for the project.

The expansion essentially involves building the existing pipeline between Edmonton, Alberta and Burnaby, B.C. and will increase capacity from 300,000 bbl/d to 890,000 bbl/d.

In August 2018 the Federal Court of Appeal issued a decision to cancel the Order-in-Council, which had approved the Certificate of Public Convenience and Necessity for the expansion project. The NEB held public hearings to reconsider project-related environmental effects of marine shipping and further engagement with Indigenous groups. In February 2019 the NEB delivered its reconsideration report to the Government of Canada; the NEB again recommended approval of the project finding it to be in the Canadian public interest. The project is subject to 196 conditions enforceable by the NEB.

In April 2019, the Government of Canada announced that a decision on TMEP will be made June 18, 2019. CAPP® expects a positive decision that will have enormous positive impacts on the Canadian economy by helping to alleviate market access constraints, resulting in increased producer and investor confidence, increased business investment and Canadian jobs, and an increase in exports. Construction beginning in the summer of 2019 should have the expansion in service by late 2022.

With improved market access, the Alberta government expects an incremental $10 billion in oil sands investment in the short term, leading to incremental production of 150,000 barrels per day of bitumen. This would increase the size of Alberta’s economy alone by 1.5 to 2 per cent by 2030. This investment in oil sands facilities would also create and sustain an average of 12,300 direct, indirect, and induced jobs across Canada through 2023 in addition to jobs associated with pipeline construction.a

Delays in the construction of TMEP cost Canadians $693 million every year.b

590,000
bbl/d of Canadian oil on the global market

Successful completion of TMEP will put an additional

COST: $1.4 billion (March 2017 estimate)
CAPACITY: 890,000 bbl/d
existing + 500,000 bbl/d (additional)
LENGTH: 1,183 kilometres
(DIAMETER: 36 inches
(13 ships and 20 year terms

1.183 kilometres
(DIAMETER: 36 inches
(13 ships and 20 year terms

a) Crude Oil Forecasts, Markets and Transporation (2018)
b) Crude Oil Forecasts, Markets and Transporation (2018)
4.2.3 Keystone XL

The proposed 346,000 bbl/d TC Energy Keystone XL (KXL) pipeline will run from Hardisty, Alberta to Cushing, Oklahoma. It can then connect to the existing Keystone system to transport Canadian crude to refineries on the U.S. Gulf Coast. The pipeline route passes through three U.S. states: Montana, South Dakota, and Nebraska.

In November 2019, a federal district court in Montana ordered that TC Energy cease construction on the KXL project until the U.S. State Department completed a further environmental review. However, in March 2019 a new Presidential Permit was issued, which could render the Montana proceedings moot as this new permit does not reference or directly tie to any environmental review.

TC Energy has the primary state permits needed from South Dakota but is still awaiting some water use permits from the South Dakota Department of Environment and Natural Resources. The Nebraska Supreme Court is expected to rule later in 2019 on KXL’s proposed alternative route through the state.

**Successful completion of KXL will put an additional 830,000**

Barrels of Canadian oil on the global market.

**ORLINE OIL FORESAET, MARKETS AND TRANSPORTATION | 27**
4.3 Crude by Rail
Rail transport of crude oil is expected to increase its railcar and capacity, but
"ramping up rail capacity is not a comprehensive solution. Rail offers an alternative
mode of transportation that industry will increasingly rely upon to transport crude
oil as new pipeline projects continue to face challenges and delays. Industry data
shows that approximately 233,000 railcar were transported to market by rail in 2015.
The highest reported average volume moved in a month in 2016 was 154,000 kbd
compared to 118,000 kbd in 2017. The greatest number of rail cars moving crude oil
in 2018 was 25,000 in November, compared to a previous historical peak of 17,777
in January 2014 (Figure 4.5).

Figure 4.5 Canadian Fuel Oil and Crude Petroleum Moved by Rail
by Volume and Main, 2012 to 2018

In 2016, Transport Canada, with the U.S. Department of Transportation Pipeline and
Hazardous Materials Safety Administration, announced new rail tank car requirements
including puncture resistant and thicker walls. Railcars with existing tank cars must be
complied by 2020, and all newly built cars must meet even more stringent
standards. As a result, both retrofitting and new tank cars are in short supply. While
CAPS supports stringent safety standards for tank cars, the shift to cars that meet
the safety standards will take time, further limiting the need for pipelines.

The rail loading capacity originating in Western Canada is 1.1 million b/d. However,
the current ability to move significant increased volumes of crude oil by rail is
limited and cannot accommodate sudden increases in demand caused by pipeline
maintenance or circumstances affecting pipeline operations. Some capacity that
was available to oil producers in 2014 has since been lost to shippers of other
commodities that have made long-term commitments. In order to significantly
increase rail capacity, rail companies will need time to invest in additional tank cars
and locomotives, and hire or train qualified staff. The Alberta Crude Oil Diluent
Program has had a dampening effect on rail export volumes.

Table 4.3 Rail Uploading Terminals in Western Canada

<table>
<thead>
<tr>
<th>Operator</th>
<th>Location</th>
<th>Capacity (b/d)</th>
<th>Scheduled Start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td></td>
<td>750,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Kinder Morgan/Imperial</td>
<td></td>
<td>250,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Gribble/VR Group</td>
<td></td>
<td>100,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Kinder/Keane Morgan</td>
<td></td>
<td>60,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Alberta</td>
<td></td>
<td>27,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Suncor</td>
<td></td>
<td>20,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Kinder/Keane Morgan</td>
<td></td>
<td>60,000</td>
<td>Operating since April 2016</td>
</tr>
<tr>
<td>Alberta</td>
<td></td>
<td>75,000</td>
<td>Operating since April 2016</td>
</tr>
</tbody>
</table>

4.4 Industry Growth Outside of Canada
Global investment in 2019 increased, particularly in the U.S., Gulf of Mexico, Europe,
and Brazil. In sharp contrast, Canadian crudes investment is down over 60 per cent
from 2014 levels.

Outside of Canada, the crude oil industry has been recovering from the oil price crash.
Despite 2014 and numerous countries have sanctioned significant projects. Other oil
producing regions have recognized that developing market access is a priority. The
sanctioned projects worth US$38.8 billion, Kazakhstan-US$34 billion, and Iraq-US$33.7
billion. Unlike Canada, where producers able to some of the world’s highest
environmental regulations, many of these countries have less or no environmental
regulations. The top three countries for spending on capital investment are Brazil,
Kazakhstan, and Russia, totaling over US$1.224 billion. None of these countries follow
the strict environmental standards Canadian producers do.
Numerous large oil companies have exited Canada after continual pipeline delays and increasingly inefficient and duplicative regulations.

The U.S. administration has aggressively streamlined regulations and re-adjusted tax rates. In sharp contrast to the experience in Western Canada, the growth in production in the U.S. has been facilitated by a significant increase in pipeline capacity with a number of pipeline projects recently completed and several more projects currently under construction to move crude oil to Gulf Coast refineries. In recent years, the production of crude oil in the Permian basin has increased from less than one million bbl in 2010 to more than 1.1 million bbl in 2018 (Table 4.4 and Figure 4.7). In addition, pipeline capacity currently under construction, a number of other proposals are in early stages of development.

Canada has an opportunity to deliver a lower cost, more reliable, and lower-carbon energy alternative to the U.S. The government is taking steps to ensure that the necessary infrastructure is in place to support the growing demand for oil and gas products. Existing pipelines in the Western Canada Sedimentary Basin (WCSB) and the Saskatchewan Oil and Gas Basin (SOGB) are unable to meet the demand for crude oil and natural gas.

### Transportation Summary

- **Figures 4.6 and 4.7 show the takeaway capacity from Western Canada vs. Supply.**
- The takeaway capacity is essential for the export of Canadian oil to global markets.

Existing pipeline infrastructure to transport crude oil production is at capacity and it is uncertain when additional pipeline capacity will become available. Rail is struggling to meet the increased demand from oil producers. This has led to the need for more efficient and cost-effective solutions, including the development of new pipelines and terminal facilities.
GLOSSARY

Asphalt plant A facility that processes crude oil into various types and grades of asphalt, ranging from asphaltic concrete, used as a binder for highway-grade asphalt, to paving tar.

API gravity A specific gravity scale developed by the American Petroleum Institute (API) for measuring the relative density or viscosity of various petroleum liquids.

Barrel A standard barrel is approximately equal to 35 imperial gallons (82 U.S. gallons) or approximately 159 liters.

Bitumen A heavy, viscous oil that must be processed extensively to convert it into a crude oil before it can be used by refineries to produce gasoline and other petroleum products.

Condensate A mixture of natural pentanes and heavier hydrocarbons. U.S. condensate is divided into two broad categories. The first is base condensate produced at or near the wellhead (other natural gas or crude oil). The second category is plant condensate, also known as NGLs, natural gasolines, pentanes plus or 65%, that remain suspended in natural gas at the wellhead and is removed at a gas processing plant. For purposes of this report, both categories are included in the term “condensate.” Both categories of condensate are substantially similar in composition but the U.S. EIA arbitrarily defines base condensate as crude oil and plant condensate as an NGL (pentane plus). Furthermore, the Department of Commerce – Bureau of Industry and Security (BIS) regulations also define base condensate as crude oil.

Crude oil (conventional) A mixture of pentanes and heavier hydrocarbons that is recoverable or recoverable at a well from an underground reservoir. It is liquid at the conditions under which its volume is measured or estimated and includes all other hydrocarbon mixtures so recoverable or recoverable except raw gas, condensate or bitumen.

Crude oil (heavy) Crude oil is divided, in this report, to be heavy crude oil if it has an API of 27° or less. No differentiation is made between sweet and sour crude oil that falls in this heavy category because heavy crude oil is generally sour.

Crude oil (medium) Crude oil is divided, in this report, to be medium crude oil if it has an API greater than 27° but less than 35°. No differentiation is made between sweet and sour crude oil that falls in this medium category because medium crude oil is generally sour.

Crude oil (light) A mixture of hydrocarbons, similar to crude oil, derived by upgrading bitumen from the oil sands.

Density The mass of matter per unit volume.

Dilbit Bitumen that has been reduced in viscosity through addition of a diluent (or solvent) such as condensate or naphtha.

Diluent Lighter viscosity petroleum products that are used to dilute bitumen for transportation in pipelines.

Extraction A process unique to the oil sands industry, in which bitumen is separated from its source (oil sands).

Feedstock In this report, feedstock refers to the raw material supplied to a refinery or oil sands upgrader.

Integrated mining project A combined mining and upgrading operation where oil sands are mined from open pits. The bitumen is then separated from the sand and upgraded by a refining process.

In situ recovery The process of recovering crude bitumen from oil sands by drilling.

Merchant upgrader Processing facilities that are not linked to any specific extraction project but is designed to accept raw bitumen on a contract basis from producers.

Oil Condensate, crude oil, or a constituent of raw gas, condensate, or crude oil that is recovered in processing and is liquid at the conditions under which its volume is measured or estimated.

Oil sands A mixture of sand and other rock materials containing crude bitumen or the crude bitumen contained in those sands.

Oil sands deposit A natural reservoir containing or appearing to contain an accumulation of oil sands separated or appearing to be separated from any other such accumulations. The AER has designated three areas in Alberta as oil sands areas.

Oil sands heavy In this report, Oil Sands Heavy includes upgraded heavy sour crude oil, and bitumen to which light oil feedstock (i.e., diluent or upgraded crude oil) have been added in order to reduce its viscosity and density to meet pipeline specifications.

Open season A period of time designated by a pipeline company to determine whether there is a firm need for a proposed project. Potential customers can indicate their interest/support by signing a transportation services agreement for capacity on the pipeline.

Petroleums plus A mixture mainly of pentanes and heavier hydrocarbons that ordinarily may contain some butanes and is related to the processing of raw gas, condensate or crude oil.

PADD Petroleum Administration for Defense District that defines a market area for crude oil in the U.S.

Refined petroleum products End products in the refining process (i.e., gasoline).

Syncrude A blend of bitumen and synthetic crude oil that has similar properties to medium sour crude oil.

Train (manifested) Manifested trains carry multiple cargos and make multiple stops. These are small group or single car loads.

Train (unit) Unit trains carry a single cargo and deliver a single shipment to one destination, lowering the cost and shortening the trip.

Upgrading The process that converts bitumen or heavy crude oil into a product with a lower density and viscosity.

West Texas Intermediate WTI is a light sweet crude oil, produced in the United States, which is the benchmark grade of crude oil for North American price quotations.
APPENDICES

Endnotes

1. AIPN API. Report. The Bank expects that the level of investment in the oil and gas sector in 2019 will be about 50 per cent lower than in 2017 plateau. This contraction follows the steep decline of roughly 50 per cent that occurred between 2014 and 2016. The Bank’s projections for production and exports of Canadian oil are anchored by transportation capacity rather than by an assumption about the price of Western Canadian Select.


3. BIS Markit, Governmental Gas Intensity of Oil Sands Production, September 2018.

4. BMO Capital Markets, ESG, You Know Me. Innovation and the Search for Friendly Oil, based on third-party data sources (Key Environmental Performance Index, Social Progress International’s Social Progress Index, World Bank Worldwide Governance Indicators Benchmarks), February 2019.


10. CAPE estimates based on Peter Economics analysis of the oil and natural gas industry’s economic impacts according to Statistics Canada’s Input-Output tables.


12. Ibid.


14. Figure 4.8 Notes. Capacity shown can be reduced by any extraordinary and temporary operating and physical constraints.

   1. AStarline capacity adjusted by operational downtime and capacity for IRP and U.S. Bakken crude oil.

   2. Keystone adjustment is 90% of nameplate capacity for maintenance downtime.

   3. Enbridge: contract capacity only due to downstream Pthy pipeline constraints.

   4. Trans Mountain (IRP) capacity requirements subtracted from nameplate capacity.

   5. Rangerbird and MLB River throughput capacity estimated at 167,000 bpd, which is the maximum realized annual crude oil throughput since 2016.

   6. Western Canadian refineries: approximate refinery intake is 50 bpd (Sturgeon refinery from 2014) and 60 bpd (includes 50 bpd (Sturgeon refinery from 2014)).
### APPENDIX A.1

**CAPP Canadian Crude Oil Production Forecast 2019 - 2035**

**June 2018**

**Table: Total Crude Oil Production by Province and Territorial Area (2018-2035)**

<table>
<thead>
<tr>
<th>Province</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
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<th>2032</th>
<th>2033</th>
<th>2034</th>
<th>2035</th>
<th>2036</th>
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</thead>
<tbody>
<tr>
<td><strong>EASTERN CANADA</strong></td>
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<td><strong>Alberta</strong></td>
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<tr>
<td><strong>Western Canada</strong></td>
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<tr>
<td><strong>Conventional Light &amp; Medium</strong></td>
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<tr>
<td><strong>Alberta</strong></td>
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<tr>
<td><strong>Saskatchewan</strong></td>
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**TOTAL CANADIAN**

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**TOTAL CANADIAN CRUDE OIL PRODUCTION**

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<th>2020</th>
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**Note:**

- Projections are based on the oil and gas outlook, the oil price reviewed in the report and the underlying assumptions in the model.

- The data is subject to change based on new information or revisions.

- The projections are intended to provide a broad overview of potential outcomes under different scenarios.

- The projections do not take into account all possible factors that could affect oil production.

- The projections are for informational purposes only and should not be used for investment decisions.

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## APPENDIX A.2

**GAPP Western Canadian Crude Oil Supply Forecast 2019 - 2035**

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<td>Light and Medium</td>
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<td>769</td>
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<td>337</td>
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<td>385</td>
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<td>701</td>
<td>726</td>
<td>759</td>
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<td>871</td>
<td>952</td>
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**Acronyms, Abbreviations, and Conversion Factors**

- API: American Petroleum Institute
- AER: Alberta Energy Regulator
- CAPP: Canadian Association of Petroleum Producers
- EIA: Energy Information Administration
- ITEO: International Energy Agency
- NEB: National Energy Board
- PASO: Petroleum Administration for Surface Oil
- OPEC: Organization of Petroleum Exporting Countries
- U.S. States: United States

**Conversion Factors**

- 1 barrel (bbl) = 42 gallons (gal)

**Notes**

1. Values are preliminary estimates.
2. Values are subject to revision.

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**Units**

- B/D: barrels per day

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**References**

CRUDE OIL FORECAST, MARKETS AND TRANSPORTATION
The Canadian Association of Petroleum Producers (CAPP) represents companies, large and small, that explore for, develop and produce natural gas and crude oil throughout Canada. CAPP’s member companies produce about 80 per cent of Canada’s natural gas and crude oil. CAPP’s associate members provide a wide range of services that support the upstream crude oil and natural gas industry. Together CAPP’s members and associate members are an important part of a national industry with revenues from oil and natural gas production of about $101 billion a year.
APPENDIX H
Wells, Wires, and Wheels – EROCI and the Tough Road Ahead for Oil

New research, led by Mark Lewis (https://docfinder.bnpparibas-am.com/api/files/1094E5B9-2FAA-47A3-805D-EF65EAD09A7F), our Global Head of our Sustainability Research, shows that oil needs a long-term breakeven price of USD 10 – 20/barrel to remain competitive in mobility.

- The economics of renewables are impossible for oil to compete with when looked at over the cycle
- Renewable electricity has a short-run marginal cost of zero, is cleaner environmentally, could readily replace up to 40% of global oil demand
- The oil industry should remember the fate of utilities

In a white paper published this week (https://docfinder.bnpparibas-am.com/api/files/1094E5B9-2FAA-47A3-805D-EF65EAD09A7F), Mark introduces the concept of the Energy Return on Capital Invested (EROCI), focusing on the energy return on a USD 100 bn outlay on oil and renewables where the energy is being used to power cars and other light-duty vehicles (LDVs).

For a given capital outlay on oil and renewables, how much useful energy at the wheel do we get?

This website uses cookies to improve your experience. We'll assume you're ok with this, but you can opt-out if you wish.

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Our analysis indicates that for the same capital outlay today, new wind and solar-energy projects in tandem with battery electric vehicles will produce 6x – 7x more useful energy at the wheels than will oil at USD 60/barrel for gasoline powered light-duty vehicles, and 3x – 4x more than will oil at USD 60/barrel for light-duty vehicles running on diesel.

Accordingly, the research calculates that the long-term break-even oil price for gasoline to remain competitive as a source of mobility is USD 9 – 10/barrel, and for diesel USD 17 – 19/barrel.

Oil has a massive flow-rate advantage, but this is time limited

The oil industry is so massive that the amounts available for purchase on the spot market can provide very large and effectively instantaneous flows of energy. By contrast, new wind and solar projects deliver their energy over a 25-year operating life. Nonetheless, we think the economics of renewables are impossible for oil to compete with when looked at over the cycle.

Economic and environmental benefits set to make renewables in tandem with EVs irresistible

The clear conclusion of our analysis is that if we were building out the global energy system from scratch today, economics alone would dictate that at a minimum the road-transportation infrastructure would be built up around EVs powered by wind- and solar-generated electricity

The tough road ahead for oil

With 36% of demand for crude oil today accounted for by light-duty vehicles and other vehicle categories susceptible to electrification, and a further 5% by power generation, the oil industry has never before in its history faced the kind of threat that renewable electricity in tandem with electric vehicles poses to its business model: a competing energy source that:

1. has a short-run marginal cost of zero,

2. is much cleaner environmentally,

3. is much easier to transport, and

4. could readily replace up to 40% of global oil demand if it had the necessary scale.
We conclude that the economics of oil for gasoline and diesel vehicles versus wind- and solar-powered EVs are now in relentless and irreversible decline, with far-reaching implications for both policymakers and the oil majors.

A warning from the European utility sector

If all of this sounds far-fetched, then the speed with which the competitive landscape of the European utility industry has been reshaped over the last decade by the rollout of wind and solar power – and the billions of euros of fossil-fuel generation assets that this has stranded – should be a flashing red light on the oil industry’s dashboard.

Click here to access the full version of the white paper ‘Wells, Wires, and Wheels… – EROCI and the Tough Road Ahead for Oil’.

To discover our funds and select the ones that meet your requirements, click here.

Any views expressed here are those of the author as of the date of publication, are based on available information, and are subject to change without notice. Individual portfolio management teams may hold different views and may take different investment decisions for different clients.
Oil production limit

A temporary limit of oil production to defend Alberta jobs and protect the value of Alberta's resources.

What's going on

Alberta produced more crude oil in 2018 than could be shipped for export by rail or pipeline. This affected storage levels, Canadian crude oil prices and other aspects of the market.

To protect the value of our oil, the Government of Alberta temporarily limited production to match export capacity to prevent Canadian crude from selling at large discounts.

Due to continuing pipeline delays, oil production limits remain necessary through 2020. The curtailment policy has also been adjusted to give industry more flexibility to make timely business decisions and reduce red tape for small producers.

Production limits

The oil production limit has been extended to December 31, 2020, with possible earlier termination. This limit will be monitored closely and adjusted to better match export capacity.

Monthly production limits for raw crude and bitumen are set at:

- October: 3.79 million barrels per day
- November: 3.80 million barrels per day
- December: 3.81 million barrels per day
- January: 3.81 million barrels per day
- February: 3.81 million barrels per day

Exemption for new conventional wells

Effective November 8, 2019, new wells drilled for conventional oil will be exempt from the production limit.

This exemption will encourage the drilling of new conventional oil wells, increased investment, and the creation of more jobs for Albertans.

Conventional oil is defined as any oil produced outside the oil sands designated areas and formations.

Special production allowance
Effective December 2019, operators can apply, on a monthly basis, to increase oil production – if the additional product is moved by new rail capacity – in order to meet increasing demand.

The special production allowance will give producers temporary curtailment relief equivalent to incremental increases in rail shipment. This short-term approach will help address the continued lack of takeaway capacity caused by pipeline delays that are negatively impacting Alberta’s oil and gas sector.

Under this special allowance:

- all additional product must be moved out of the province by new rail capacity and producers cannot overproduce their allowance
- volumes moved under an allowance by rail cannot be applied to pipelines

**How to apply**

Operators who decide to apply for a special production allowance will submit an application to Alberta Energy.

If approved, a Ministerial Order will be issued and include all terms and conditions that the operator is subject to.

Operators will be held accountable through info provided during the application process, as well as validation after the production month concludes.

**Industry information**

The Alberta Energy Regulator administers the production limit on behalf of the government. The government’s authority to limit production ends December 31, 2020.

Under the formula that determines how space is allocated under the production limit, each company’s baseline production level is based on its highest level during their best single month from November 2017 to October 2018.

- production limits apply to both oil sands and conventional oil, it does not apply to pentanes or natural gas
- the first 20,000 barrels produced by each operator are exempt
- refining operations can access the oil supply required to meet their refining needs as there is still significant oil available

An AER panel will review company-specific concerns and make policy recommendations back to the Government of Alberta. The panel can be reached at curtailment@aer.ca.

**Industry information**

- [Special Production Allowance Application Form](#) (PDF, 371 KB)
- [Special Production Allowance Application Data Form](#) (XLSX, 50 KB)
- [Special Production Allowance Volume Verification Officer's Certificate](#) (PDF, 438 KB)
- [Special Production Allowance Terms and Conditions](#) (PDF, 34 KB)
- [Presentation to Industry - December 6, 2018](#) (PDF, 455 KB)
Timeline

- December 2, 2018
  Mandatory curtailment announced.

- January 2019
  Production limit first established at 3.56 million barrels per day.

- February 2019
  Production increased by 75,000 barrels per day to a total of 3.63 million barrels per day.

- April 2019
  Production increased by 25,000 barrels to a total of 3.66 million barrels per day.

- May 2019
  Production increased by 25,000 barrels to a total of 3.68 million barrels per day.

- June 2019
  Production increased by 25,000 barrels to a total of 3.71 million barrels per day.

- July 2019
  Production maintained at a total of 3.71 million barrels per day.

- August 2019
  Production increased by 25,000 barrels to a total of 3.74 million barrels per day.

- August 20, 2019
  Adjustments to curtailment policy announced.

- September 2019
  Production increased by 25,000 barrels to a total of 3.76 million barrels per day.

- October 2019
  October 1, 2019
  - Production increased to a total of 3.79 million barrels per day.
Policy changes took effect to:
- give producers 2 months notice of any changes to production limits, where possible
- increase the base limit of production to 20,000 barrels a day – up from 10,000
- give the Minister of Energy the ability to set production limits after a merger or acquisition
- extend provision for single operator oil sands facilities minimum operations in winter to December 31, 2020 and include December

October 28, 2019
- Special production allowance announced to allow permits operators to produce above their curtailment order, as long as this extra production is shipped out of Alberta through additional rail capacity.

November 2019
Production increased to a total of 3.80 million barrels per day.

November 8, 2019
- Announced the exemption of newly drilled conventional oil wells from production limits.

December 2019
Production increased to a total of 3.81 million barrels per day.

January 2020
Production maintained at a total of 3.81 million barrels per day.

February 2020
Production maintained at a total of 3.81 million barrels per day.
CALGARY, Dec. 19, 2019 (Canada NewsWire via COMTEX) -- Enbridge Inc. (ENB) ENB, +0.97% (Enbridge or the Company) submitted today an application to the Canada
The application for contracted and uncommitted service includes the associated terms, conditions and tolls of each service which would be offered in an open season following approval by the CER. The tolls and services will replace the current tolling settlement that is in place until June 30, 2021.

"We are moving to a contracted Mainline system in response to what our customers have been asking us for and for the benefit of the entire industry," said Guy Jarvis, Enbridge Executive Vice President, Liquids Pipelines. "Today's application is based on significant input and advice from every corner of our industry and almost two years of extensive negotiation with shippers to recognize the needs of various customers in a balanced way."

"Shippers representing approximately 70 per cent of the Mainline's current throughput support our approach, as evidenced by the letters included within our application", said Jarvis. "The most important part of this offering will be to secure long-term demand for Canadian crude oil while ensuring that all interested shippers can participate in a fair and transparent open season process."

The attached backgrounder provides additional information on the benefits Mainline transportation contracting will have for shippers.

Forward-Looking Information
Forward-looking information, or forward-looking statements, have been included or incorporated by reference in this news release to provide information about Enbridge Inc. ("Enbridge" or the "Company") and its subsidiaries and affiliates, including management's assessment of Enbridge and its subsidiaries' and affiliates' future plans and operations. This information may not be appropriate for other purposes. Forward-looking statements are typically identified by words such as "anticipate", "expect", "project", "estimate", "forecast", "plan", "intend", "target", "believe", "likely" and similar words suggesting future outcomes or statements regarding an outlook. Forward-looking information or statements included or incorporated by reference in this document include, but are not limited to, statements with respect to the proposed Canadian Mainline contract offering, including the benefits and timing thereof and the process and timetable to receive applicable governmental, regulatory and other approvals, including the approval of the Canada Energy Regulator.

Although Enbridge believes these forward-looking statements are reasonable based on the information available on the date such statements are made and processes used to prepare the information, such statements are not guarantees of future performance and readers are cautioned against placing undue reliance on forward-looking statements. By their nature, these statements involve a variety of assumptions, known and unknown risks and uncertainties and other factors, which may cause actual results, levels of activity and achievements to differ materially from those expressed or implied by such statements.
forward-looking statements, as they may impact current and future levels of demand for the Company's services. Similarly, exchange rates, inflation and interest rates impact the economies and business environments in which the Company operates and may impact levels of demand for the Company's services and cost of inputs, and are therefore inherent in all forward-looking statements. Due to the interdependencies and correlation of these macroeconomic factors, the impact of any one assumption on a forward-looking statement cannot be determined with certainty.

Enbridge's forward-looking statements are subject to risks and uncertainties, including, but not limited to customer and regulatory approvals and other risks and uncertainties discussed in this news release and in the Company's other filings with Canadian and United States securities regulators. The impact of any one risk, uncertainty or factor on a particular forward-looking statement is not determinable with certainty as these are interdependent and Enbridge's future course of action depends on management's assessment of all information available at the relevant time. Except to the extent required by applicable law, Enbridge assumes no obligation to publicly update or revise any forward-looking statements made in this news release or otherwise, whether as a result of new information, future events or otherwise. All subsequent forward-looking statements, whether written or oral, attributable to Enbridge or persons acting on the Company's behalf, are expressly qualified in their entirety by these cautionary statements.

About Enbridge Inc

Enbridge Inc. is a leading North American energy infrastructure company. We safely and reliably deliver the energy people need and want to fuel quality of life. Our core businesses include Liquids Pipelines, which transports approximately 25 percent of the crude oil produced in North America; Gas Transmission and Midstream, which transports approximately 20 percent of the natural gas consumed in the U.S.; and Utilities and Power Operations, which serves approximately 3.7 million retail customers in Ontario and Quebec, and generates approximately 1,750 MW of net renewable power in North America and Europe. The Company's common shares trade on the Toronto and New York stock exchanges under the symbol ENB. For more information, visit www.enbridge.com
CORPORATE PARTICIPANTS

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John K. Whelen  Enbridge Inc. - Executive VP & CFO
Jonathan Gould  Enbridge Inc. - Director, IR
Vern Yu  Enbridge Inc. - Executive VP & CDO

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Russell Payne

PRESENTATION

Operator

Welcome to the Enbridge, Inc. business update. My name is Candice, and I'll be your operator for today's call. (Operator Instructions) Please note that this conference is being recorded. I'll now turn the call over to Jonathan Gould, Director of Investor Relations. Jonathan, you may begin.

Jonathan Gould  Enbridge Inc. - Director, IR

Great. Thank you, Candice. Good morning, and welcome to Enbridge Inc’s business update call where we’ll be discussing the corporate simplification transactions that have been proposed and announced earlier today. With me this morning are Al Monaco, President and CEO of Enbridge Inc.; John Whelen, Executive Vice President and Chief Financial Officer; and Vern Yu, Executive Vice President and Chief Development Officer. So as per usual, this call is webcast and I encourage those listening on the phone to follow along with the supporting slides. A replay of the call will be available later this morning and a transcript will be posted to the website shortly thereafter. In terms of the Q&A, we will prioritize calls from the investment community only. If you're a member of the media, please direct your inquiries to our communications team, who will be happy to respond immediately. We're going to target keeping the call to half-an-hour today and may not be able to get to everybody, so please limit your questions to 1 and a follow-up as necessary. But as always, we will ensure that our Investor Relations team will be available for your follow-up questions afterwards.

Now before we begin, I will just point out that we may refer to forward-looking information on today's call. By its nature, this information contains forecast assumptions and expectations about future outcomes. So we remind you that it's subject to risks and uncertainties affecting every business, including ours. This slide includes a summary of the significant factors and risks that could affect Enbridge and its affiliates and are discussed more fully in our public disclosures filings available on both the SEDAR and EDGAR systems. So with that I'll now turn the call over to Al Monaco.
Al Monaco - Enbridge Inc. - President, CEO & Director

Thanks, Jonathan. Good morning, and thanks for joining us at this very early time. As you saw, from the news release this morning, we've made formal proposals to the boards of each of our sponsored vehicles; SEP, EEP, EEQ and ENF, to acquire all of their outstanding public equity securities. This is being done through separate all-share transactions, so we can think of it as a roll-up of our sponsored vehicles into Enbridge.

I'll make a few comments and then we'll open it up for Q&A. Although, we're restricted in what we're able to say as we expect to be in discussions with the independent special committees of the sponsored vehicle boards shortly. Most of you know, that Enbridge has had a long history with sponsored vehicles dating back to 1991, when EEP was formed to hold our U.S. liquids mainline system. Lots of activity since then and last year even, we took in SEP as part of the Spectra transaction. We've been very strong sponsors of these vehicles and taken numerous actions to support them over the years for the benefit of public unit holders of the sponsored vehicles and Enbridge shareholders, including right up to a few months ago, by eliminating the IDRs at SEP. For a good portion of their history our sponsored vehicles provided an attractive alternative source of funding and were effective in optimizing our overall cost to capital.

In short, they were a very good way to maximize the value of our assets and grow our pipeline business. Even after our supportive and streamlining actions recently it's clear that these advantages no longer exist. When we rolled out our 3-year plan in December, we made it clear that one of our priorities was to further streamline and simplify our corporate structure and that we're evaluating whether that could be done on a win-win basis for the benefit of both sponsored vehicle equity holders and Enbridge.

Since then, we've been further -- we've seen a further weakening in the MLP market generally, and in our case, being prohibited to access capital. In addition to investor preferences moving away from high-payout vehicles, the cumulative impact that reduced or eliminated tax allowance put more pressure on both EEP and SEP, as it did on other MLPs, with a proportion of cost-to-service base rates. And in Canada, ENF’s cost of funding has increased to the point where its growth will be challenged. And ENF, in our view, is no longer a cost effective source of funding for Enbridge. So with that context there are several important and powerful benefits to Enbridge with the sponsored vehicle roll-up. These benefits will be realized by current Enbridge shareholders and it's our expectation also by the sponsored vehicle holders, who would become ENB owners with these transactions.

First, it simplifies the corporate structure so that all of our core liquids and natural gas assets are investable to a streamlined Enbridge, where the stability, predictability and growth in cash flows are even more transparent. Having all of our core assets under 1 roof will further surface the value of these highly strategic and irreplaceable systems, which should attract a premium valuation.

Second with the roll-up, we're acquiring more of what we already own, which we believe are the best energy infrastructure assets in the business, which carry a uniquely low risk profile.

Third, it's clear that with the recent FERC tax policy and U.S. tax reform changes, holding our assets in MLP structures is no longer advantageous for Enbridge. The roll-up of these MLPs will ensure we maximize cash flow by recovering tax allowance.

Fourth, and this is important, it's positive from a credit and funding perspective, as 100% of the cash flows generated by our assets, would be kept in the family and not paid out in third-party distributions. And we also retain cash flow to support capital investment.

And finally, we are not expecting a change to the 3-year DCF per share outlook, and we expect positive impacts post 2020, from tax and other synergies. We also see our proposals as an excellent outcome for the holders of SEP, EEP, EEQ and ENF, relative to their stand-alone outlooks and value. With the share exchange it's a one-time opportunity for our sponsored vehicle investors, not only to maintain interest in the assets they already own today, but also to participate in a very bright future as Enbridge shareholders. They would have a stake in a well-diversified asset base across the pipeline utility space in North America, with excellent commercial underpinning in these businesses, more opportunity to grow and significantly enhanced liquidity and balance sheet strength.

In the case of EEP, EEQ and SEP, the roll-ups eliminate the risk that they would face on a standalone basis, being reduced cash flow from the tax allowance changes, a weaker credit profile and a compromised distribution outlook. And their assets would move from a punitive structure to a
more efficient one. In the case of ENF, public shareholders there would enjoy ownership in premier gas transmission and gas utility franchises, in addition to what they already own and greater liquidity converting their holdings from a complex income fund structure into ownership of a leading streamlined shareholding in Enbridge. And finally, it’s clear that the sponsored vehicles will be challenge going forward in raising cost-effective capital, thereby affecting their ability to grow.

So to summarize, we believe the roll-up makes sense for both Enbridge and the sponsored vehicles. We believe the proposed exchange ratios for each of the sponsored vehicles reflects fair value relative to their stand-alone values and allows owners of all of these entities to participate in the combined benefits of the roll-up. We’re very pleased to be making these proposals to simplify our corporate structure and take action to mitigate risks raised by the recent FERC and tax reform changes, among other things. We’re looking forward to discussing the merits of each proposal with their respective sponsored vehicle independent committees.

And this last slide we’re putting up is really just a recap of the key priorities that we’ve been talking about since we rolled out our 3-year plan. We just reviewed this at our first quarter call. You can see we’re making very good progress. And now with this proposal to roll-up the sponsored vehicles, you can see that we’re moving things along well. So again, for the Q&A session, here we recognize that you got questions and will have more over the coming weeks, please note though that we will restrict our responses as we expect to be engaging with each of the special committees. It’s important that we allow them sufficient time for consideration of the proposals. And we will share information with you as appropriate. So with that, I’m going to hand it back over to the operator to open up the lines for the Q&A.

**QUESTIONS AND ANSWERS**

**Operator**

(Operator Instructions) And our first question comes from Jeremy Tonet of J.P. Morgan.

**Andrew Ramsay Burd** - *JP Morgan Chase & Co, Research Division - Analyst*

It is actually Andy on for Jeremy. Congratulations on the announcement. I heard a reiteration of the DCF per share guidance to 2020 in your remarks, but what about the dividend growth expectations to 2020? Is that reiterated too? And then also do you plan on sustaining the current EEP distribution until the close of this? And also maintain the SEP growth guidance that you’ve given previously until the close of these transactions?

**Al Monaco** - *Enbridge Inc. - President, CEO & Director*

Okay. So on the first part of that, the answer is yes. I mentioned DCF, but that also applies to the other metrics as well being the dividend growth rate as well the credit metrics and other key parts of the guidance that we talked about. So, yes to that part. Let me see, what was the second question?

**Andrew Ramsay Burd** - *JP Morgan Chase & Co, Research Division - Analyst*

Distribution...

**Al Monaco** - *Enbridge Inc. - President, CEO & Director*

All right, on the distributions, yes sorry. On the distributions as we referred to last time on the call, we would keep our distributions in place for 2018 or obviously, if the transactions close before then, then that wouldn’t be the case. But that is the plan for 2018, simply because we’ve got the cash flow in hand, and we are in good shape to continue to pay those distributions.
APPENDIX L
An Analysis of The Enbridge Financial Assurances Offered to the State of Michigan

On Matters Related To

The Operation of The Enbridge Line 5 Pipeline
At the Straits of Mackinac

Prepared For

The State of Michigan
The Michigan Department of Attorney General
The Michigan Department of Environment, Great Lakes and Energy
The Michigan Department of Natural Resources

By

American Risk Management Resources Network, LLC

October 29, 2019
Section I: Executive Summary

To avoid unfunded response costs and property and personal injury damages arising from a rupture of Enbridge Line 5 at the Straits of Mackinac (Straits), the State of Michigan, the Michigan Department of
Attorney General, the Michigan Department of Environment, Great Lakes, and Energy and the Michigan Department of Natural Resources (the State) has commissioned this risk financing analysis to evaluate the ability of Enbridge companies to pay for the costs and damages that a rupture of Line 5 may cause.

This report presents an analysis of the current and future ability of various Enbridge companies to pay up to $1.878 billion in U.S. dollars for costs and damages arising from the potential release of petroleum products from the 66-year-old, Enbridge owned and operated, dual pipelines running under the Straits of Mackinac (Line 5).

In 1953 the State of Michigan granted an easement to a U.S. subsidiary company of Enbridge, Inc. to build and operate two pipelines under the Straits of Mackinac. Enbridge, Inc. is a Canadian company with global operations. Enbridge, Inc. is not a party to the Easement, only the company that was granted the Easement (Grantee) and its successors are obligated by its terms.

The Easement requires the Grantee of the Easement, and its successors, to indemnify the State for all costs and damages caused to persons or property arising out of the company’s operations at the Straits and to maintain a liability insurance policy, bond or surety, in form and substance acceptable to the State, in the amount of at least $1,000,000.

Beginning in 2017, representatives of Enbridge companies and representatives from the State of Michigan entered into three agreements (The Agreements) relating to Line 5 in Michigan. Within the Second and Third Agreements, certain Enbridge business entities (Signatories) agreed to provide Financial Assurances to the State of Michigan up to $1.878 billion U.S. dollars. The 1953 Easement does not have a provision for using the assets of the Signatories, which is essentially self-insurance, to back-up the indemnity requirements. To the contrary, the 1953 Easement makes specific reference to requiring the Grantee and its successors to maintain comprehensive general liability insurance, bonds or surety on the dual pipelines. In 1953 none of these specified financial instruments would have contained pollution exclusions. The effects of pollution exclusions are accounted for in our recommended insurance requirements.

Upon analysis of the financial resources of Enbridge, Inc. in August of 2019, we find that Enbridge, Inc. currently has the capability to fund $1.878 billion for the potential damages caused by a petroleum product release from Line 5. However, we do not recommend the acceptance of Enbridge, Inc. assets as evidence of Financial Assurance unless Enbridge Inc. becomes a signatory to The Agreements with the State.

Due to the corporate structure of Enbridge, Inc., only the assets of the Signatories are obligated by The Agreements. We have reached this conclusion based on the sworn November 9th, 2018 testimony of Mr. Chris Johnston. That testimony was provided in an evidentiary hearing for the Minnesota Public Utilities Commission (PUC). The PUC hearing pertained to the siting of a new Enbridge Line 3 which is not related to Line 5.

However, important insights into the corporate structure of Enbridge that is directly related to Line 5 can be gleaned from this testimony. Mr. Johnston is the Chief Financial Officer of Enbridge Energy Partners, L.P. Enbridge Energy Partners L.P. is the largest U. S. based operation of Enbridge, Inc. and is an actual Signatory to the Agreements. Enbridge Energy Partners L.P. is also the successor company to the Enbridge company that was granted the Easement in 1953. As the CFO of the U.S. operations of Enbridge, Inc. and the lead Signatory to the Agreements, Mr. Johnston is a credible expert on the company structure of Enbridge, Inc. and its U.S. operations.

In the Minnesota PUC hearing, Mr. Johnston testified that Enbridge, Inc. is not contractually obligated to stand behind the indemnity agreements of a subsidiary. The 2018 10-K report of Enbridge, Inc. indicates that the Signatory’s to the Agreements on Line 5 are all subsidiaries of Enbridge, Inc.
The State of Michigan is only holding an indemnity obligation from the Signatories in the Second and Third Agreements and the Easement; those companies are Enbridge Energy, Limited Partnership, Enbridge Energy Company, Inc. and Enbridge Energy Partners, L.P. Therefore, unless Enbridge, Inc. becomes a signatory to the Agreements, the financial resources of Enbridge, Inc. in Canada should not be used to verify the $1.878 billion financial assurance amount as required in the Agreements.

Only the Signatories and their respective successors are obligated by these Agreements. Therefore, only the assets of the Signatories to the Agreements should be used to verify the financial assurance amount.

The Signatories and the flow of revenues and liability within the Enbridge corporate structure is detailed in the schematic in Appendix A. What this schematic shows is that while revenues flow up to the parent company of a subsidiary, liabilities stay at the subsidiary level. This is the typical corporate structure of a parent company with operating subsidiaries and is reflective of Enbridge, Inc. and its subsidiaries.

Based on the last historical publicly available financial information on the Signatories, which is found in the 2018 September 10-Q of Enbridge Energy Partners L.P., the Signatories did not have $1.878 billion in liquid assets, credit facilities and insurance for the damages arising from a rupture of Line 5.

The liquid financial resources of the Signatories based on September of 2018 10-Q information are shown in Appendix C. We used September 2018 for this comparison of assets between the Signatories and Enbridge Inc. because it is no longer possible to evaluate the financial resources of Enbridge Energy Partners L.P. using publicly available information.


We noted that in October 2019, the assets of Enbridge, Inc. were used in the Financial Assurance Verification Form supplied to the State as required under the Second and Third Agreements. However, Enbridge, Inc. is not a party to the 1953 Easement or a Signatory to the subsequent Agreements. Based on the testimony of Mr. Johnston, the contribution of funds under an indemnity agreement made with a subsidiary would appear to be to be a purely voluntary endeavor for Enbridge, Inc.

We did not evaluate the cost recovery provisions in the environmental laws of the United States in the light of foreign corporation status of Enbridge, Inc. for this report.

Based on our research for this report, we recommend enhancing the indemnity obligations for the operators of Line 5 at the Straits. To accomplish this goal, in summary we recommend:

1. Obtaining an indemnity obligation from Enbridge, Inc., the Canadian based holding company of the Signatories to the Second and Third Agreements.

2. Being more specific on the source of the information to be provided on the Financial Assurance Verification Form, which was agreed to in the Second and Third Agreements.

3. Requiring more specific types and amounts of liability insurance on the dual pipelines, with the State named as an Additional Insured on those policies.
4. Develop a pre-agreed upon process to eliminate the loss exposure arising from Line 5 operation if the available prescribed assets of the Signatories dip below $1.878 billion U.S. dollars at any point in the future.

5. Based on more recent third-party projected cost studies, further evaluate the adequacy of the $1.878 billion minimum level of financial assurance.

Section II  Our Scope of Work

ARMR.Net has been directed to evaluate if Enbridge entities have the resources to pay up to $1.878 billion for the costs and damages caused by a release of petroleum products from the dual pipelines at the Straits of Mackinac.

To this end this report will:

1. Evaluate the risk bearing capacity and financial resources available to respond to, remediate, and pay compensation for all damages that could result from a worst-case release of petroleum products from Line 5 at the Straits of Mackinac and to satisfy the indemnification obligations under the 1953 Easement and subsequent Agreements.

2. Evaluate the adequacy and reliability of the Financial Assurance Verification Form provided by Enbridge business entities to the State of Michigan in 2019 and, to make recommendations to create a reliable and resilient Financial Assurance Verification Form, including detailed insurance specifications.

3. Provide perspective on the scope, adequacy, and dependability of the indemnity obligations assumed by the Grantee of the 1953 Easement.

4. Provide perspective on the projected ability of Enbridge business entities to satisfy the indemnity agreement to the State of Michigan over the next 7 to 10 years.

Section III Findings

Our findings are:

1. Estimates on the potential costs arising from a release of petroleum products from Line 5 at the Straits range from an Enbridge supplied estimate of $300 million, to a $1.878 billion estimate from
the *Independent Risk Analysis for the Straits Pipeline* analysis, to a $45 billion\(^1\) estimate from a Michigan State University study on the projected costs.

Our report does not analyze the accuracy or reliability of the various potential cost estimates of a petroleum product release from Line 5. However, the range of possible damage costs arising from a release of petroleum products from Line 5 strikes us as extremely broad, and $1.878 billion is on the low end of the possible range. The higher range cost studies appear to have been prepared after the $1.878 billion financial assurance threshold amount was agreed to in the Second Agreement. In light of the wide range of possible damage costs in the various studies, we question the reliability of the $1.878 billion risk funding target used for this study. But we offer no opinion on the $1.878 billion being the right amount.

2. If Line 5 ruptured today, Enbridge, Inc. has the financial capacity to voluntarily pay up to $1.878 billion to fund an environmental clean-up and to compensate victims. However, based on the historical financial records, the U.S. based Signatories would not have enough resources to fund a loss event of this magnitude; without a voluntary financial bailout from the Canadian parent company.

3. With 275 operating subsidiaries listed in the Enbridge, Inc.’s 2018 10-K report, the Enbridge corporate structure enables the Canadian holding company Enbridge, Inc. to avoid liability for the U.S. based subsidiary’s liabilities.\(^2\) The original Grantee of the 1953 Easement was required to indemnify the State. All of the Signatories\(^3\) to the 1953 Easement and the First, Second and Third Agreements are U.S. companies. The State of Michigan is not contractually indemnified by the Canadian company Enbridge, Inc.

In the absence of a contractual indemnity from Enbridge, Inc. only the assets of the obligated parties (The Signatories) should be used for the completion of the Financial Assurance Verification Form.

The financial resources of the U.S. based Signatories are impossible to verify using publicly available information because after 2018 these companies no longer file 10-K or 10-Q financial statements. The Signatory companies are 100% controlled subsidiaries of Enbridge, Inc. today. Therefore, receiving an indemnity obligation from Enbridge, Inc. is essential to facilitate objective verification of the $1.878 billion of financial resources based on publicly available financial reports.

4. The Financial Assurance parameters agreed to in the Second and Third Agreements\(^4\) lack the specificity to be accurate, reliable and easily verifiable by a third party. Therefore, we recommend modifications to the metrics used in the 2018 Financial Assurance Verification Form as shown in Appendix C.

5. The Enbridge business model is facing new challenges that could affect the ability of the firm overtime to pay for clean-up costs and other damages caused by a release of petroleum products from Line 5 at the Straits.

Even among its peers in the oil and gas business, Enbridge, Inc. and its Subsidiaries face unique risks and challenges in their business model which have the potential to adversely impact the risk bearing ability of the firm over time.

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1 “Oil Spill Economics: Estimates of the Economic Damages of an Oil Spill in the Straits of Mackinac in Michigan” – Addendum A – 11/20/2018 by Nathan Brugnone, MS and Robert B. Richardson, Ph.D.
4 Included in Appendix B
These risks and challenges include:

- To earn its profits, Enbridge transports crude oil that is primarily extracted from tar sands in northern Alberta. Crude oil extracted from tar sands (bitumen) has a unique set of environmental issues not associated with other sources of crude oil. The extracted synthetic crude oil is transported through thousands of miles of high-pressure pipelines, some of those lines, like Line 5, are at the end of their useful life cycle and need to be decommissioned or removed and replaced. Although Line 5 does not transport tar sands derived crude oil, the overall business of Enbridge, Inc. is heavily weighted to transporting tar sands derived products. The general financial well-being of Enbridge, Inc. and therefore its ability to pay for the costs and damages caused by petroleum releases through self-insurance is heavily dependent on the market viability of tar sands oil.

- To reach consumer markets, the Enbridge lines run across land in the United States that is subject to American Indian treaty rights. Resistance to the use of tar sands oil by non-government organizations including Native Americans, is making maintaining and replacing old lines or creating new routes for existing lines across lands subject to treaty rights increasingly difficult for the company.

- The U.S. demand for tar sands derived crude oil is expected to decrease over time. Most of the historical sales of tar sands derived oil has been to consumers in the United States. However, new forms of extracting oil, including fracking, has created an excess supply of crude oil and natural gas in the United States. Tar sands derived oil competes in a global market for crude oil. Many producers of crude oil have lower production costs, have lower transportation costs to bring crude oil to the market of end users and have a smaller total carbon footprint per barrel than tar sands derived oil.

- With the U.S. market saturated with local supply, the Enbridge, Inc. 2018 10-K references future plans to supply crude oil to India and China. These countries are a long distance from the tar sands of Alberta. The distance to these consumer markets add transportation costs and carbon footprint loading to tar sands derived crude oil that the competitors of Enbridge entities do not have.

These risks and challenges entwined within the Enbridge business model cannot be eliminated through good management of its core business. We expect that over time these operational challenges in the Enbridge business model will have an even greater impact on the financial results of Enbridge entities in a carbon constrained world, which in our opinion is likely. Although Enbridge, Inc. could self-insure a $1.878 billion petroleum product clean-up in the Straits this year that does not mean the company will be able to do so in the foreseeable future. Therefore, it will be necessary for the State of Michigan to monitor the financial condition of the relevant Enbridge business entities annually over the operational life of Line 5 through the Straits.

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Section IV   Background Information on Enbridge Operations and The Obligations To The State of Michigan

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5 2019 CAPP Forecast page 13 section 3.3 International
6 Enbridge. Inc 2018 10-K pg. 16
Enbridge, Inc. is one of the largest firms in Canada. It has a complex corporate structure listing 275 operating subsidiaries in its 2018 10-K report to the U.S. Securities and Exchange Commission.

Enbridge, Inc. is a profitable company, earning approximately $2.475 billion U.S.\(^7\) in profits and generating $7.877 billion U.S.\(^8\) in cash in 2018. We will be using Canadian dollars to U.S. dollars at a conversion rate of .75 for simplicity in this report.

The core business of Enbridge is highly dependent on the market demand for tar sands derived oil. We did note in conducting the research for this report that the future business forecasts for Enbridge tend to focus on the future supply of tar sands derived oil with little or no mention of the future demand for this source of fossil fuel\(^9\). If demand for tar sands derived oil decreases over time, the ability of Enbridge to self-insure for damages resulting from a rupture of Line 5 would also decrease, potentially relatively rapidly.

The History Of The Indemnity Obligation In The 1953 Easement and, The First Agreement, Second Agreement and Third Agreement

On April 23, 1953 the State of Michigan and Lakehead Pipeline Company, Inc. (Lakehead) a subsidiary of Enbridge, Inc. in Canada entered into an Easement that allowed Lakehead to construct, lay and maintain pipelines over, through, under and upon certain lake bottom lands for the purpose of transporting petroleum and other products.

Per the 1953 Easement, in paragraph J., Lakehead agrees to indemnify and hold harmless the State of Michigan “from all damage or losses caused to property (including property belonging to or held in trust by the State of Michigan), or persons due to or arising out of the operations or actions of Lakehead, its employees, servants and agents”.

Within Paragraph J. of the 1953 Easement, Lakehead agrees to the following relative items for this report:

1. Maintaining a comprehensive bodily injury and property liability policy, bond or surety in the amount of at $1,000,000, and
2. A surety bond in the sum of $100,000 that is in force for the life of the agreement.

Both of these items must be in place for as long as Lakehead and its successor companies operate the pipelines and until the abandonment of the Dual Pipes installed across the Straits is completed.

The 1953 Easement and the Second and Third Agreements do not enable the State of Michigan to access the assets of Enbridge, Inc. under an indemnity agreement. Only the assets of the actual Grantee of the 1953 Easement and its successors and the Signatories to the Second and Third Agreements are contractually obligated to back the indemnity obligations; those signatories do not include Enbridge, Inc., the holding company in Canada. We reached this conclusion based on prior sworn testimony of the CFO of Enbridge Energy Partners, L.P. on November 9, 2017 in Minnesota. Per Mr. Johnston’s testimony, Enbridge, Inc. is not obligated to pay for the liabilities of its U. S. based operating subsidiary companies, nor will a contract with a subsidiary of the company obligate Enbridge, Inc. to the terms of the contract\(^{10}\).

\(^7\) Enbridge, Inc.’s 2018 10-K Consolidated Statements of Comprehensive Income
\(^8\) Enbridge, Inc.’s 2018 10-K Consolidated Statements of Cash Flow
\(^{10}\) Chris Johnston Testimony pg. 73 lines 2-6. Evidentiary Hearing – Line 3 Volume 6A – 11/9/2017
There have been multiple name changes, consolidations and mergers in the Enbridge business operations over the years. Appendix A provides a Corporate Organizational Chart showing current and historical Signatories to the Easement and subsequent Agreements. The schematic also shows how profits and liabilities flow through the Enbridge organizational structure. Typical of corporate structures involving a parent company and subsidiaries, profits flow upstream to the parent company and liabilities stay planted at the subsidiary level.

The 1953 Easement has been supplemented with Agreements three times in recent years, with the First Agreement occurring in 2017. In just over a year, there were two other Agreements between the State of Michigan and the Enbridge Signatories.

**The First Agreement** was made on November 27, 2017 between the State and Enbridge Energy, Limited Partnership and Enbridge Energy Company, Inc. (formerly known as Lakehead Pipeline Company, Inc.), which is referred to as “Enbridge” for this section. The First Agreement was to “provide clarity as to the State’s expectations concerning the safety and integrity of Line 5”.

Most of the agreed to requirements were for Enbridge businesses to do evaluations of and to produce reports/analyses of Line 5, including the Dual Pipelines. The Agreement included action items to help prevent a spill and develop response plans in the event there was a spill. It also included a requirement that Enbridge would look into alternative methods to crossing the Straits.

**The Second Agreement** was made on October 3, 2018 between the State of Michigan, the Michigan Department of Environmental Quality, and the Michigan Department of Natural Resources, referred to as the “State” in this section, and Enbridge Energy, Limited Partnership, Enbridge Energy Company, Inc. and Enbridge Energy Partners, L.P. referred to as “Enbridge” for this section.

The Second Agreement updated, supplemented and superseded the First Agreement. Under the Second Agreement, Enbridge either clarified or provided the information they agreed to provide in the First Agreement. The Second Agreement also added two new parameters to the First Agreement. The two new parameters were financial assurance and continuation of additional measures to enhance the safety of Line 5 in Michigan.

The Second Agreement included a provision addressing Paragraph J. in the 1953 Easement that required Enbridge to indemnify the State and to carry at least $1,000,000 of comprehensive general liability insurance, bond or surety for liability for bodily injury or property damage and a surety bond for $100,000. To address the indemnity requirements in the 1953 Easement the Enbridge Signatories agreed to provide assurances that it had and would maintain $1.878 billion of liquid financial assets to pay for an oil spill from Line 5.

It should be noted that under the 1953 Easement there is no mention of using company self-insurance, in lieu of liability insurance, a bond or surety to back up the indemnity obligations in the lease. The $1.878 billion U.S. dollar threshold amount was the estimated quantifiable damages from a most likely worst-case scenario found by the *Independent Risk Analysis for the Straits Pipelines.* Enbridge agreed to provide evidence of the minimum of $1.878 billion in liquid assets to the State on a Financial Assurance Verification Form. See Section VI of this report for a discussion on this form.

The Second Agreement stipulated that if Signatories to the Agreement verified that there was access to $1.878 billion, the Signatories would be compliant with paragraph J. in the initial 1953 Easement. It is

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note-worthy that Enbridge, Inc. is not a signatory to this agreement and that the Second Agreement does not make changes the 1953 Easement itself.

In the first Financial Assurance Verification Form supplied by Enbridge representatives, the assets of Enbridge, Inc. were used to show that the Signatories to the Agreement had liquid assets to meet the $1.878 billion threshold amount of financial resources as set forth in the Second Agreement. As previously noted, Enbridge, Inc. is not obligated by contract to the State of Michigan to contribute any money to an oil spill in the Straits of Mackinac.

**The Third Agreement** was signed on December 19, 2018.

In this agreement the Signatories agreed to an annual adjustment of $1.878 billion financial assurance level based on the inflation based on the Producer Price Index (PPI) on October 1, 2019. The PPI measures the increased cost to make/supply a product. It is our understanding that the State of Michigan currently considers the Third Agreement to be null and void. For the purposes of this report that would mean the escalation clause for the amount of financial assurance to be maintained by the Signatories would not be effective.

**Section V  Recommendations**

1. The State of Michigan needs to obtain an indemnity agreement from Enbridge, Inc. in Canada to pay for all costs and damages associated with a potential rupture of Line 5. It is not insignificant that Enbridge, Inc. is a foreign corporation based in Canada. Money held in Canada may not be as accessible as assets held by a company in the U.S. would be. We have not investigated or evaluated the complications that Enbridge, Inc. being a foreign corporation may create in an indemnity agreement with the State of Michigan.

2. The Financial Assurances Verification Form with our recommended metrics should be evaluated by the State at least annually, and should the Signatories fail to provide the required amount of Financial Assurances at any point in time, a clear path to the elimination of the hazard associated with operating Line 5 should be predetermined and agreed upon. A recommended revised Financial Assurance Verification Form is discussed in Section VI in this report and the evaluation metrics for completing the Form are provided in Appendix C.

3. The recommended amounts and types of Liability Insurance including modern and verifiable insurance requirements are Shown in Section VII.

4. In light of the more recent studies on the projected damages costs resulting from a rupture of Line 5 at the Straits, the $1.878 billion financial assurance threshold requirement should be reevaluated.

In our opinion, $1.878 billion as the threshold amount for financial assurance appears based on the available studies to be on the low end of the range of potential damage costs resulting from a rupture of Line 5 under the Straits. There are economic impact studies from 2018 concluding that the damages incurred from a rupture of Line 5 at the Straits could cost $45 billion including clean-up costs, natural resources damages and economic damages\(^{12}\). In sharp contrast, Enbridge representatives estimated the clean-up cost of a Line 5 rupture at only $300 million, which represents a deviation in projected costs of over 1300-fold at the $45 billion cost projection. We

\(^{12}\) “Oil Spill Economics: Estimates of the Economic Damages of an Oil Spill in the Straits of Mackinac in Michigan” – Addendum A – 11/20/2018 by Nathan Brugnone, MS and Robert B. Richardson, Ph.D.
have not been tasked with evaluating the reasonableness of the potential damage cost estimates for a breach of Line 5 at the Straits of Mackinac, nor are we qualified to do so. However, a 1300-fold differential between the high and low cost estimates is too much of a range for a reliable risk financing planning report. We have assumed $1.878 billion was the right number for our report but have little confidence that is the right projected cost number given the wide range of projected costs and where $1.878 billion falls within the range.

Section VI  Financial Assurance Verification Form

Paragraph J. in the 1953 Easement requires that the Enbridge Signatories indemnify the State of Michigan and that the Signatories maintain comprehensive general liability insurance, a bond or surety to back that obligation.

The 1953 Easement does not mention the use of self-insurance to back up the indemnity obligation to the State. The use of self-insurance was agreed upon by the parties to the Second Agreement. In that Agreement, the Signatories agreed to file with the State the Financial Assurance Verification Form on an annual basis. The template for this agreed upon verification form is shown in Appendix C.

The 2019 Financial Verification Form in Appendix C. includes the items that will be reviewed each year under the current agreement:

1. Cash
2. Credit Facility (available liquidity as at [date])
3. Other Resources Available in 30-60 days (explain)
4. Insurance
5. Surety Bonds
6. Parent/Affiliate Guarantees (from Parent Co. to Authorization Holder)
7. Other Financial Resources (explain)

Based on the October 2019 Verification Form that representatives of Enbridge provided under the Second Agreement, Enbridge only included information on numbers 1 through 4 above, and for that reason, those are the financial assurances that we have evaluated for this report.

The submitted 2019 Verification Form shows that Enbridge, Inc. has $9.45 billion U.S. dollars of short-term financial assurance mechanisms and $940 million in general liability insurance that includes time element/sudden and accidental pollution coverage. In total, these amounts are well in excess of the required $1.878 billion U.S. of financial assurance in the Second Agreement.

In the 2019 Verification Form, Enbridge, Inc., although not being a signatory to the 1953 Easement or to any of the Agreements, represented the following financial resources:

Cash: $0.525 billion – As shown in Enbridge, Inc.’s 10-Q2
Credit Facility: Available Letters of Credit $4.2 billion – As shown in Enbridge, Inc.’s 10-Q2
Other Resources: Accounts Receivable $4.725 billion – As Shown in Enbridge, Inc.’s 10-Q2
Insurance: General Liability insurance $940 million
No separate information on the financial resources of the Signatories to Second Agreement was provided. We have previously discussed the importance of having Enbridge, Inc. as a signatory to the indemnity agreement in Section’s I and III of this report.

**Evaluating the Financial Assurance Verification Form Each Year**

The financial assurances of the Signatories should be verified annually from the information contained in audited financial statements. If Enbridge, Inc. was a Signatory, the company’s 10-K report should be used to evaluate compliance with the financial assurance requirements.

The evaluated criteria in the Financial Assurance Verification Form are found in these areas of the Enbridge, Inc. 10-K today:

1. Cash or equivalent – Part 1, Section 1, Financial Statements: Consolidated Statement of Financial Positions
2. Credit Facilities (Available credit for the next 12 months) – Part 1, Section 1, Financial Statements: Debt, Credit Facility
3. Accounts receivable and other – Part 1, Section 1, Financial Statements: Consolidated Statement of Financial Positions (accounts receivable and other)
4. Specified Insurance - Specified insurance will be verified by referencing the Certificate of Insurance that must be provided as shown in the recommended insurance requirements in Appendix E.

If the Signatories are not publicly traded in the U.S., an audited Statement of Financial Position for the Signatory Enbridge company or companies could be used to prepare the Financial Assurance Verification form.

**The Property Plant and Equipment Assets Are Not Useful Measures for Financial Assurance**

Enbridge, Inc. does have assets owned by subsidiary companies in the U.S. in the form of property, plant and equipment. These assets could potentially be attached to satisfy a judgement against the firm. However, for the reasons stated below, we have made no accounting of these fixed assets in our evaluation of the ability of the Signatories to fund $1.878 billion in losses as a result of a rupture of Line 5.

In our evaluation of the financial resources available to the Enbridge Signatories to pay for oil spills, we noted that generally accepted accounting principles tend to overvalue pipeline assets and to undervalue the environmental legacy liabilities of firms in the oil pipeline business. This is especially true when a pipeline is not transporting oil to produce profits.

Pipeline assets like other forms of fixed assets have a book value based on what was paid for the pipeline, minus depreciation. In contrast to most types of fixed assets, a pipeline permanently not pumping oil has no value to anyone. In fact, the cash value of an idle pipeline can be less than zero, if the costs to decommission or remove the idle pipes are taken into account. Those kinds environmental

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legacy costs for its U.S. subsidiaries are not being accounted for in the Enbridge financial statements. This creates a situation where the book value of a pipeline company's assets is not reflective of their actual cash market value. Cash and insurance proceeds are what is needed to pay for an oil spill clean-up and other damages.

The future costs of removing idle pipelines from the ground are not immaterial and may be unavoidable new costs in the Enbridge business model in the near future. For example, in the negotiations over the replacement of Line 3 in Minnesota, the Public Utility Commission made the removal of the old Line 3 at the discretion of the landowners, a condition of the permit for the new Line 3.

In another example of pipeline removal costs, in a lawsuit filed by the Bad River Band of Chippewa in Wisconsin, which is discussed further in Appendix J, the Band seeks the complete removal of the existing Line 5 on their reservation.

The removal of pipes from the ground is expensive. Enbridge testimony in Minnesota on the replacement of Enbridge Line 3 was that it costs on average $855 per foot to remove pipelines from the ground. At $855 per foot it would cost approximately $23 billion to remove all the Enbridge companies buried pipes in the U.S. alone. The $23 billion in potential environmental legacy costs is not shown as a liability in the firm's books, nor is the firm required to do so by generally accepted accounting rules, or by the U.S. regulations in effect on pipelines.

For these reasons, the value of property, plant and equipment, as shown in the Consolidated Statements of Financial Position, is not an accurate picture in time of the firm's ability to pay for environmental damages that it may cause as a result of a rupture in Line 5. Therefore, we have left the fixed assets of Enbridge businesses out of the Financial Assurance Verification form.

Section VII  Recommended Insurance

Insurance is an efficient financial mechanism to pay for otherwise unaffordable loss events. One of the benefits of insurance from the State's perspective is liability insurance coverage survives the bankruptcy of the named insured. In addition, the insurance underwriting process itself produces a benefit for all the stakeholder's in Line 5 by engaging global knowledge sharing on the risks of pipelines through the international reinsurance marketplace.

We recommend that at a minimum Enbridge, Inc. carries a Minimum of $900,000,000 in Liability insurance. This Liability insurance can be a combination of ISO Comprehensive General Liability Insurance with coverage for sudden and accidental pollution liability and Environmental Impairment Liability (EIL) coverage. The minimum amount of EIL coverage that must be maintained within the $900,000,000 is $25,000,000 covering Line 5 at the Straits. The EIL insurance requirement includes an option for a $50,000,000 policy aggregate limit of liability if the EIL coverage applies to more than just Line 5 at the Straits. The master insurance coverage on Enbridge, Inc. can be used to fulfill this insurance requirement.

14 Chris Johnston Testimony pg. 30 Lines 7-9 Evidentiary Hearing – Line 3 Volume 6B – 11/9/2017
15 Enbridge Inc.'s 2018 10-K
The recommended insurance requirements for Line 5 at the Straits take into account past public court testimony provided by Enbridge representatives regarding the scope of the liability insurance currently carried by the firm.

Reconciling The Insurance Required In The 1953 Easement to Modern Insurance Coverage

Comprehensive general liability insurance is a key component in the Financial Assurance Verification Form. Ideally, 100% of the worst-case loss exposure of Line 5 could be insured. However, there is likely not enough liability insurance in the world to fund a $1.878 billion pollution loss resulting from a rupture of Line 5.

Previous sworn testimony provided by Enbridge in Wisconsin and Minnesota is that the firm purchases as much comprehensive general liability insurance as it can in the world insurance marketplace. In the 2018 10-K report, that was $940,000,000 in general liability insurance. We find this Enbridge testimony credible. Therefore, liability insurance with coverage for pollution releases from Line 5 can only supplement the other sources of funds available to Enbridge entities to meet the agreed upon $1.878 billion financial assurance amount.

The scope of the recommended liability insurances and the annual verification process of that insurance by the State during the operation of Line 5 is addressed within the insurance recommendations in Appendix E.

The recommended insurance requirements in Appendix E take into account the 1953 Easement language requiring comprehensive general liability insurance, and the general liability insurance that Enbridge has testified in recent court proceedings that it carries today. The recommended insurance requirements also encompass modern methods to verify the types and amounts of liability insurance that Enbridge carries.

Enbridge has provided testimony in Wisconsin and Minnesota that the information contained within the company’s insurance policies is a trade secret. We respect that Enbridge would want to keep its trade secrets out of the public eye and have accommodated Enbridge on this point in the insurance recommendations. In place of an annual review of its actual insurance policies, we recommend that the prescribed Certificate of Insurance as shown in Appendix E be used to evidence the liability insurance carried by Enbridge, Inc. Providing a Certificate of Insurance to interested parties is the customary way that evidence of insurance is provided by businesses. The prescribed Certificate of Insurance is designed to make the compliance with the insurance requirements easy for the State to verify.

The Requirement for Comprehensive General Liability Insurance In The 1953 Easement

The 1953 Easement makes a specific reference to comprehensive general liability insurance. In 1953 “comprehensive” general liability insurance in the U. S. and Canada was not referring to a specific insurance industry standard policy form. Also in 1953 there was no reference to coverage for pollution as a cause of loss in the common general liability insurance policies sold to businesses in that time frame. Pollution exclusions and exceptions to pollution exclusions in general liability insurance policies developed decades later in the insurance business.

The title of “comprehensive” general liability insurance and having coverage for pollution liability took on a specific meaning in 1973. In that year the Insurance Services Offices (ISO), the largest standard policy form setting organization in the U.S., created the ISO Comprehensive General Liability insurance policy form as the new industry standard general liability insurance policy.

In addition to a new official name for the policy, there were a number of changes in coverage that were incorporated into Comprehensive General Liability policy form. One the most significant changes to the
industry standard Comprehensive General Liability policy was a new exclusion for losses arising from
the release or escape of pollutants was added to the policy. The pollution exclusion in the policy had an
exception built into it, the exclusion would not apply if the release or escape of pollutants was sudden
and accidental.

In 1973 for the first time in history, Comprehensive General Liability insurance with coverage for sudden
and accidental pollution liability took on specific meaning in the insurance business.

The scope of Enbridge, Inc.’s general liability insurance coverage for sudden and accidental pollution
liability was the subject of legal proceedings in multiple Wisconsin courts for over three years. A core
issue in these legal proceedings was does Enbridge carry general liability insurance that meets Wisconsin
Statute 59.70 (25). This statute prohibits a county in Wisconsin from requiring additional insurance on
an interstate pipeline if the pipeline company carries the requisite insurance as specified in the statute.

The Wisconsin statute reads:

“INTERSTATE HAZARDOUS LIQUID PIPELINES. A county may not require an
operator of an interstate hazardous liquid pipeline to obtain insurance
if the pipeline operating company carries comprehensive general
liability insurance coverage that includes coverage for sudden and
accidental pollution liability.” (emphasis added)

The underlined part of this statute is an exact match to the ISO Comprehensive General Liability
insurance policy in both name and scope of coverage for sudden and accidental pollution liability.
This is the only industry standard general liability insurance policy that provides an exact match to
the Wisconsin statute.

After more than three years in multiple Wisconsin courts, on June 27, 2019, based on the sworn
testimony of Enbridge representatives that the company carries liability insurance that meets the
requirements of this statute, the Wisconsin Supreme Court ruled that Enbridge carries the insurance
specified in Wisconsin Statute 59.70 (25).

To avoid years of potential litigation in Michigan courts over the scope of Enbridge’s trade secret
comprehensive general liability insurance coverage, the recommended insurance requirements for Line
5 as shown in Appendix E specifically mirror the scope of insurance coverage required in Wisconsin
Statute 59.70 (25).

The standard ISO Comprehensive General Liability insurance policy form is shown in Appendix F for
reference. The coverage in the Comprehensive General Liability insurance policy for sudden and
accidental pollution events can clearly be seen as an exception to the exclusion f. in the policy.

Exclusion f. in the Comprehensive General Liability policy reads;

   Exclusions

   This insurance does not apply:

   f. to bodily injury or property damage arising out of the discharge, dispersal,
      release or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic
      chemicals, liquids or gases, waste materials or other irritants,
      contaminants or pollutants into or upon land, the atmosphere or any
      water course or body of water; but this exclusion does not apply if such
Contrary to the common perception that these policies would only provide coverage for a fast or quick pollution event, due to precedent case law developed over decades of insurance coverage litigation, the coverage provided under the ISO Comprehensive General Liability policy is not limited to fast or quick pollution releases measured with the passage of time.

The coverage for pollution liability under a Comprehensive General Liability policy is extraordinarily broad. Comprehensive General Liability insurance policies have paid for pollution claims where the pollution events took place over decades.

As long as Enbridge, Inc. carries ISO Comprehensive General Liability insurance that automatically includes coverage for sudden and accidental pollution liability under Exclusion f., the need for true Environmental Impairment Liability insurance on Line 5 is diminished a great deal. The relatively low amount of Environmental Impairment Liability in the recommended insurance requirements reflects the expansive coverage provided for pollution losses in the ISO Comprehensive General Liability insurance policy.

Planning For Contingencies

It is common practice for large companies like Enbridge to purchase insurance policies that cover all of the company’s operations. This practice introduces the possibility that a loss in Canada for example could exhaust the available insurance coverage for a subsequent loss at Line 5. The recommended insurance requirements anticipate this contingency.

We recommend that Enbridge, Inc. must at all times maintain a minimum of $300,000,000 of recoverable insurance limits including coverage for sudden and accidental pollution releases arising from Line 5 at the Straits. Within that $300,000,000 of liability insurance at least $25,000,000 must be in the form of Environmental Impairment Liability insurance. Enbridge, Inc. may use a combination of ISO Comprehensive General Liability with sudden and accidental pollution liability and Environmental Impairment Liability insurance coverage to meet the insurance requirements set forth in Appendix F. The $300,000,000 of recoverable insurance limits can be specific to Line 5 at the Straits.

Ideally, we would require $1.878 billion in Environmental Impairment Liability insurance to cover a rupture in Line 5 and not be dependent upon a General Liability insurance policy that excludes pollution unless the pollution event is sudden and accidental, or relying on self-insurance in any way to back up an indemnity obligation to the State. However, the global insurance marketplace for genuine environmental insurance does not have $1.878 billion in capacity. Our recent survey of the insurance marketplace for genuine Environmental Impairment Liability insurance showed market capacity was just over $400,000,000 in potential limits of liability. Not all of that environmental liability insurance would be available for purchase on a crude oil pipeline. The recommended insurance requirements reflect the practical constraints in the global insurance business and are designed to be achievable.

Why Environmental Impairment Liability Insurance Is Required in Addition to Comprehensive General Liability Insurance

Environmental Impairment Liability insurance fills the coverage gaps created by pollution exclusions in general liability insurance policies.
The general liability insurance policies sold in 1953 did not contain pollution exclusions. Therefore, any general liability insurance policy that has a pollution exclusion of any type would not fulfill the minimum insurance requirements in the 1953 Easement calling for “comprehensive general liability”.

Since the early 1970’s, virtually all general liability insurance policies in North America, including Canada, have contained pollution exclusions. Therefore, to meet an insurance specification written in 1953 for general liability insurance on a pipeline which would have been silent on pollution as a cause of loss, it is necessary to purchase Environmental Impairment Liability (EIL) insurance to fill the coverage gap created by the pollution exclusion in all general liability insurance policies sold today. Even the ISO Comprehensive General Liability insurance policy has a pollution exclusion as previously discussed.

The recommended insurance requirements shown in Appendix E. include a specification for $25,000,000 of Environmental Impairment Liability (EIL) insurance on Line 5. According to the Consumer Price Index, the present value of $1,000,000 in 1953 is $23,000,000 today. We recommended $25,000,000 Environmental Impairment Liability to match the insurance industry custom of increasing insurance limits in $5,000,000 increments.

Since the Comprehensive General Liability insurance that Enbridge carries today has a pollution exclusion, technically the EIL coverage limits should match the general liability policy limits if the exact terms of the 1953 Easement were followed. We have not recommended this approach in the insurance requirements because such a requirement would be impossible to comply with.

It should be noted that the $1,000,000 limit of liability in the 1953 Easement insurance requirement was intended to set the minimum amount of required insurance. The idea behind requiring Comprehensive General Liability insurance in the Easement was to back the indemnity obligations of the Signatories. The stakeholders in the Second Agreement have acknowledged that the loss exposure from Line 5 is much greater than $25,000,000.

**The Advantages Of Purchased Insurance**

The requirement for actual insurance which is not self-insurance in the 1953 Easement should not be overlooked. A requirement for some amount of purchased insurance versus self-insurance insurance, which is allowed for in the Second Agreement, will enable the State to receive real time feed-back on if the global insurance market thinks Line 5 is insurable or not. The insurability of the line will serve as “the canary in the coal mine” risk indicator for the State.

The Environmental Impairment Liability insurance requirement acts as a form of expert independent third party risk evaluation. If Line 5 is low risk, Enbridge should have ready access to environmental insurance that is relatively low cost from an insurance market place with over $400 million in limits of liability capacity. If Enbridge is unable to purchase this relatively low amounts of Environmental Impairment Liability insurance, that situation would provide an early warning sign to the State of Michigan that professional risk evaluators (insurance underwriters) feel that Line 5 at the Straits is too risky to insure.

Another early warning is provided by requiring the State to receive 60 days’ Notice of Cancellation or Non-Renewal on the Comprehensive General Liability and Environmental Impairment Liability policies. If an insurance policy is cancelled or nonrenewed in the future, the State will get an early warning that the underwriters have changed their minds about the insurability of Line 5 at the Straits.
By requiring that the State of Michigan be an Additional Insured under the liability insurances on Line 5, the State of Michigan gains the additional benefit of having direct access to very broad and reliable insurance coverage for pollution damages arising from Line 5.

Section VIII   The Long Term View On The Operation of Line 5

This section of the report discusses some of the business challenges that Enbridge business entities will face during the foreseeable future of Line 5 at the Straits. These challenges in what could be a relatively short period of time have the potential to undermine the ability of Enbridge to pay through self-insurance the costs associated with a release of petroleum products from Line 5.

Changes in social norms and a heightened awareness of the human impact on the planet is affecting the Enbridge business model in profound ways that the company has not had to deal with in the past. For example, in two permit applications that would have been routine for Enbridge 10 to 20 years ago; one was a building permit to add a pumping station to an existing pipeline, and one was a permit to replace an existing line; Enbridge had to fight local resistance to the Enbridge development plans all the way to the State Supreme Courts in Wisconsin and Minnesota. When routine business maintenance matters require the State Supreme Court to resolve disputes with neighbors, the writing is on the wall that there are fundamental challenges to the old business model of Enbridge company’s underfoot.

The Coal industry’s experience with challenges to its core business value proposition illustrates what the impact of changing environmental awareness and concerns in the general population can do across an entire segment of the energy economy. Coal as a source of fossil fuel is relatively dirty compared to natural gas. Natural gas is in over supply in the U.S., it costs little to produce, and it is relatively cheap to transport and use. Coal does not compete well against natural gas over pollution concerns, its carbon footprint or on cost. After over a 100 years of robust business, furnishing most of the energy needs in the US, “Approximately 44% of U.S. coal now comes from companies that have declared bankruptcy sometime in the last four years.”16 All fossil fuel-based companies will be subject to the same economic pressures over time as society moves to reduce the greenhouse footprint of energy sources and gravitate to use relatively clean sources of energy.

In the spectrum of potential crude oil supplies, tar sands derived crude oil displays some common traits with coal. The profits of Enbridge are closely tied to the consumption of tar sands derived crude oil which has unusually high environmental impacts relative to other sources of fossil fuels. Therefore, the robust business results of Enbridge in the past and therefore the firm’s ability to self-insure environmental risks may not endure indefinitely into the future.

The Enbridge Business Model Incorporates Systemic Risks Which Cannot Be Avoided

Some of the challenges to the Enbridge business model are detailed below:

1. The risk of a rupture of Line 5 at the Straits is in an extremely high consequence location for an inland oil pipeline with potential damage costs well in excess of all available funding sources for Enbridge entities.

2. The relatively high carbon loading associated with tar sands derived crude oil and the corresponding work of environmentalists to completely eliminate the use of tar sands derived oil as a fossil fuel

16 Varinsky, Dana (December 9, 2016) Business Insider, Nearly Half of U.S. Coal is Produced by Companies that have Declared Bankruptcy – and Trump won’t fix that; http://www.businessinsider.com/us-coal-bankruptcy-trump-2016-12
source is already having impacts on the operations of Enbridge, Inc. As a source of fossil fuel, tar sands derived oil is relatively inefficient on a total carbon footprint basis. This is because it takes a relatively high amount of fossil fuel derived energy to heat the water, to produce the steam needed, to produce a gallon of tar sands derived crude oil, to put into the pipeline. For this reason, people concerned about the greenhouse effect of carbon dioxide are mobilizing in increasing numbers to completely eliminate tar sands oil consumption.

Appendix H illustrates an activist group chartering buses to protest the Enbridge pipeline terminal in Duluth, Minnesota. Michigan is mentioned in the announcement. These activities by forward thinking environmentalist will make it more difficult for Enbridge to earn money trading in and transporting tar sands oil in the future.

3. The relative distance to end users of the petroleum products that Enbridge transports is not competitive on a cost basis to other sources of crude oil closer to the end users. The Enbridge, Inc. 2018 10-K mentions that demand from India and China will lead to future demand for the services of Enbridge. We have no expertise in oil markets, but shipping relatively expensive tar sands derived crude oil on ships to India and China does not make sense to us. Both countries are heavily focused on renewable energy sources, they are both a great distance from northern Alberta, and there are ample supplies of crude oil that cost much less to get out of the ground closer to India and China.

The shortest route to China from Alberta is through British Columbia. However, Enbridge lines do not run west, nor is it likely that Enbridge will ever be able to build a new line to the west of Alberta to ship product for the China market.

The existing Trans Mountain Pipeline which does run west from the tar sands was built in 1953, extending 715 miles from Alberta across the Rocky Mountains to Vancouver, British Columbia. It carries 300,000 barrels per day.

The proposed expansion plan for the existing Trans Mountain Pipeline to ship tar sands derived oil to the west was opposed by 59 Canadian tribes and First Nations, and 22 local governments in British Columbia. The First Nations undertook several lawsuits in opposition to the expansion. At the same time the collapse in global oil prices in 2014 made it unlikely that earlier projections of tar sands oil production would any longer come to fruition. Kinder Morgan, the lead investor, confirmed the project may be "untenable". In 2018, in efforts to overcome the financial and legal challenges to the expansion, the Canadian government had to step in to finance the expansion project.

Considering the difficulties encountered in expanding an existing pipeline to carry tar sands oil to the west, it does not appear as if Enbridge could build a new pipeline of its own. Without an Enbridge pipeline to the west, the only way Enbridge will be transporting oil for the China market is through U.S. ports to the South and East. Looking at a globe, moving oil to the south and east of Alberta is not the most direct way to move product to China. Transporting oil thousands of additional miles to reach end users adds hard dollar and potential carbon footprint costs to the tar sands oil that the competitors of Enbridge oil supplies would not have. Therefore, the viability of the business expansion plans to ship tar sands derived oil to China are questionable in our opinion.

17 Enbridge. Inc 2018 10-K pg. 16
India as a consumer of tar sands oil from Alberta also does not make a lot of sense to us. Oil from the middle east requires about half the production cost of tar sands oil, and middle east oil has the potential to be in over supply when the producing countries want it to be. Middle east oil is also much closer to the end users in India than the northern Alberta tar sands.

4. Other sources of crude oil have a lower cost of production. Using steam to extract the oil from sand adds costs to produce a barrel of tar sands derived crude oil. As shown in Appendix I, tar sands oil has a relatively high cost of production when compared to alternative sources of crude oil. If the market price of crude oil dips below $44 a barrel for an extended period of time, the supply of tar sands derived oil would be expected to decrease, adversely affecting Enbridge's revenues and profits.

5. The extractive process for tar sands oil in Alberta is basically surface mining, which has extreme and long lived local environmental impacts on the land. This is another reason that environmentalists thousands of miles away seek to totally eliminate the use of tar sands derived oil products.

6. Indian Treaty Rights including eviction actions for Line 5 at the Bad River Indian Reservation in Wisconsin, as discussed in Appendix J of this report, illustrates how quickly contemporary treaty rights can alter a business plan for Enbridge.

The major feeder pipelines from Canada cross into the United States into lands that are subject to treaties formed in the 1800’s. These treaties give Native Americans certain rights to the lands. In more contemporary times, various Native American Bands in the United States have perfected those rights in court. As a result of the precedent and evolving case law on Treaty Rights, Enbridge faces legal challenges in the U. S. as the firm attempts to replace pipelines that were installed more than 50 years ago across land that is subject to treaties with Native Americans.

The right of ways and easements used by Enbridge to access U.S. markets and international shipping ports are being challenged by Native Americans in yet untested legal theories regarding treaty rights. Treaty rights established in courts over the past 20 years have the potential to severely restrict the ability of Enbridge to move product and therefore earn revenues in a relatively short period of time.

Of particular importance for this report, if Line 5 is shut down at the Bad River Reservation in Wisconsin as further discussed below, unless and until Enbridge is able to re-route Line 5 around the reservation there will be no throughput of oil in Line 5 in Michigan including at the Straits of Mackinac.

In our opinion, the 10-K financial reports of Enbridge, Inc. tend to downplay the potential effects of Treaty Rights on its business model. For example, Enbridge comments on its replacement for Line 3 on page 73 of the 2018 10-K.

“United States Line 3 Replacement Program
The MNPUC approved the Certificate and Route Permit and denied petitions to reconsider the decisions. All related Certificate conditions have been finalized and are being addressed. In addition, agreement was reached with the Fond du Lac Band of Lake Superior Chippewa granting a new 20 year easement for the entire Mainline including the Line 3 Replacement Project through their Reservation. The remaining permit applications have been submitted to the various federal and state agencies, including the United States Army Corps of Engineers (Army Corps), the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency and other local government agencies in Minnesota.
We anticipate that the agencies will process all of these applications in the coming months, and with timely approvals continue to expect an in-service date for the project before the end of 2019”.

From this project update, which was not untrue when it was written just ten months ago, a reader of the 2018 10-K would conclude the replacement of Line 3 would be coming on-line shortly.

However, the reality is the permit for the replacement Line 3 was appealed at the Minnesota Supreme Court. There were also two other actions opposing Line 3 filed at the Minnesota court of appeals, one of the appeals had been made by the Minnesota Department of Commerce. The emergence of three appeals after the PUC approval paints a different picture of the Line 3 replacement permitting process than what is expressed in the 10-K from just 10 months ago.

In another example of a disclosed risk in the 2018 10-K that does not fully reflect the developing reality 10 months later, the 2018 10-K discusses a dispute between the Bad River Band of Chippewa. “On January 4, 2017, the Tribal Council of the Bad River Band of Lake Superior Tribe of Chippewa Indians (the Band) issued a press release indicating that the Band had passed a resolution not to renew its interest in certain Line 5 easements through the Bad River Reservation. Line 5 is included within our mainline system. The Band’s resolution calls for decommissioning and removal of the pipeline from all Bad River tribal lands and watershed and could impact our ability to operate the pipeline on the Reservation. Since the Band passed the resolution, the parties have agreed to ongoing discussions with the objective of understanding and resolving the Band’s concerns on a long-term basis.”

In their lawsuit, The Bad River Indian Band in Wisconsin alleges that Enbridge Line 5 since 2013 has been trespassing on its reservation property. If the lawsuit is successful, not only would Enbridge forgo the revenues derived by shipping petroleum products in Line 5, the cost to remove just 10 miles of existing Line 5 pipe within the reservations could cost $855 per foot or $45,000,000. The 10-month-old Enbridge, Inc. 10-K report does not reflect the potential removal costs or the gravity of the eviction lawsuit at the Bad River Reservation.

In its report to shareholders Enbridge says it may need to reroute Line 5 around the reservation. It does not mention how difficult that can be. Based on the Enbridge experience in permitting a new Line 3 through Indian treaty rights-controlled territories in Minnesota, getting a replacement route for Line 5 will not be as easy as it was 50 years ago.

Section IX       Qualifications of the Author

This report has been authored by David J. Dybdahl, CIC, CPCU, ARM, MBA with the help of researchers.

Mr. Dybdahl has extensive experience in environmental risk management and insurance. He holds a bachelor’s and a master’s degree in risk management and insurance from the University of Wisconsin Madison, where he has been a guest lecturer on environmental risk management and insurance topics for over 35 consecutive years.

20 Chris Johnston Testimony regarding the cost to remove pipelines from the ground pg. 30 Lines 7-9 Evidentiary Hearing – Line 3 Volume 6B – 11/9/2017
He has authored the chapters on environment insurance and risk management in over 30 insurance textbooks including the chapter on Environmental Insurance in the Chartered Property and Casualty Underwriter (CPCU) 4, *Commercial Liability, Risk Management and Insurance* textbook, and authored and edited the chapters "Environmental Loss Control" in the *Associate in Risk Management* (ARM) textbook and the chapter on environmental claims in the *Associate in Claims* textbook. His Curriculum Vitae is attached in Appendix D.

Mr. Dybdahl’s past consulting work includes advising and providing technical information on environmental insurance to the U.S. Department of Defense, the U.S. Environmental Protection Agency, the U.S. Department of Justice and the U.S. Department of Energy. Directly related to this work for The State of Michigan, he was the author of *An Insurance and Risk Management Report on the Proposed Enbridge Pumping Station* which was prepared for The Dane County Zoning and Land Regulation Committee and submitted for review on April 8, 2015 and he prepared in 2018 the *Risk Financing and Insurance* report on the replacement of Enbridge Line 3 for the Department of Commerce in the State of Minnesota. Many of the risk and insurance topics associated with Enbridge Line 61 in Dane County and Line 3 in Minnesota parallel the risks and insurance topics associated with Line 5 in Michigan.

Mr. Dybdahl has served as an expert witness in both state and federal courts on over two billion dollars in litigated and arbitrated insurance coverage cases involving mostly environmental damage losses. In his profession as an insurance broker, he has placed thousands of environmental insurance policies into the global insurance marketplace. These environmental insurance policies insured risks ranging from mold in a single-family home, to the clean-up operations of the Chernobyl nuclear disaster in the Ukraine for the World Bank in London. He has worked with environmental insurance products on a day to day basis for over 35 years.
Appendix A
In the Minnesota proceedings of the PUC, Judge O’Reilly asks, “the Applicant cannot bind Enbridge, Inc. its parent, ultimate parent company, to any financial issues in this case?” Mr. Johnston’s response, “That’s correct”
Appendix B
SECOND AGREEMENT BETWEEN THE STATE OF MICHIGAN, MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY, AND MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENBRIDGE ENERGY, LIMITED PARTNERSHIP, ENBRIDGE ENERGY COMPANY, INC., AND ENBRIDGE ENERGY PARTNERS, L.P.

This Second Agreement is entered between the State of Michigan, the Michigan Department of Environmental Quality, and the Michigan Department of Natural Resources (collectively referred to herein as “the State”), AND Enbridge Energy, Limited Partnership, Enbridge Energy Company, Inc., formerly known as Lakehead Pipe Line Company, Inc., and Enbridge Energy Partners, L.P. (collectively referred to herein as “Enbridge”) concerning those segments of Enbridge’s Line 5 pipeline (“Line 5”) that are located within the State of Michigan. This Second Agreement results from, and is intended to fulfill, the parties’ obligations under Paragraph I.H. of the first Agreement between the State and Enbridge, entered November 27, 2017 (“First Agreement”), in which the parties agreed to pursue a further agreement to address Line 5’s crossing of the Straits of Mackinac (“Straits”).

WHEREAS, the segments of Line 5 located within Michigan extend 547 miles, from the border of Wisconsin near Ironwood, Michigan to Marysville, Michigan, where it crosses the St. Clair River to the border with Sarnia, Ontario (“St. Clair River Crossing”);

WHEREAS, the segments of Line 5 located within Michigan must be operated and maintained in compliance with all applicable laws that are intended to protect the public health, safety, and welfare and prevent pollution, impairment, or destruction of the natural resources of the State of Michigan, including the unique resources of the Great Lakes;

WHEREAS, the continued operation of Line 5 through the State of Michigan serves important public needs by providing substantial volumes of propane to meet the needs of Michigan citizens, supporting businesses in Michigan, and transporting essential hydrocarbon products, including Michigan-produced oil to Michigan and regional refineries and manufacturers;

WHEREAS, the State issued an “Easement” to Lakehead Pipeline Company, Inc. (“Lakehead”), subsequently renamed Enbridge Energy Company, Inc., on April 23, 1953 pursuant to Act No. 10, PA 1953 “for the purpose of erecting, laying, maintaining and operating” an approximate 4-mile segment of Line 5 across the Straits upon determining that such crossing would “be of benefit to all of the people of the State of Michigan and in furtherance of the public welfare”;

WHEREAS, in accordance with the Easement, Enbridge constructed two parallel pipelines, each 4.09-miles long (referred to herein as the “Dual Pipelines”) across the Straits in
1953 (referred to as the “Straits Crossing”), and since that time continues to operate and maintain such pipelines consistent with the terms of the Easement as part of Line 5 to transport light crude oil, synthetic crude oil, and natural gas liquids;

WHEREAS, on September 3, 2015, Enbridge and the State entered an agreement under which Enbridge affirmed that it does not and will not transport heavy crude oil through the Dual Pipelines;

WHEREAS, the State and Enbridge recognize that the Straits Crossing and the St. Clair River Crossing (collectively “Crossings”) are located in the Great Lakes and connecting waters that include and are in proximity to unique ecological and natural resources that are of vital significance to the State and its residents, to tribal governments and their members, to public water supplies, and to the regional economy, and the Crossings are also present in important infrastructure corridors;

WHEREAS, the State and Enbridge recognize that other important ecological and natural resources are located near other segments of Line 5 that cross or approach other waters of the State that are also of vital significance to the State and its residents, to tribal governments and their members, to public water supplies, and to the regional economy;

WHEREAS, in the First Agreement, the State and Enbridge established additional measures with respect to certain matters related to Enbridge’s stewardship of Line 5 within Michigan and the transparency of its operation;

WHEREAS, in accordance with Paragraph I.A. of the First Agreement, Enbridge has enhanced its coordination with the State concerning the operation and maintenance of Line 5 located in the State of Michigan;

WHEREAS, in accordance with Paragraph I.B. of the First Agreement, Enbridge timely requested pre-application consultations and applied for all U.S. and Canadian authorizations and approvals necessary to replace Line 5’s crossing of the St. Clair River by the use of a horizontal directional drill method;

WHEREAS, under the circumstances specified in Paragraph I.C. and Appendix 1 to the First Agreement, Enbridge has discontinued Line 5 operations in the Straits during sustained adverse weather conditions;

WHEREAS, Enbridge has completed its evaluation of underwater technologies to enhance leak detection and technologies to assess coating condition of the Dual Pipelines and has
submitted the results of such evaluations to the State, in accordance with Paragraph I.D. of the First Agreement;

WHEREAS, Enbridge has submitted to the State an evaluation of measures to mitigate potential vessel anchor strike, in accordance with Paragraph I.E. of the First Agreement;

WHEREAS, Enbridge has submitted to the State an evaluation of alternatives to replace the Dual Pipelines, in accordance with Paragraph I.F. of the First Agreement;

WHEREAS, Enbridge has worked in coordination with the State to identify and evaluate water crossings by Line 5 and to assess measures to minimize the likelihood and/or consequences of a release at each water crossing location, in accordance with Paragraph I.G. of the First Agreement;

WHEREAS, the evaluations carried out pursuant to the First Agreement have identified near-term measures to enhance the safety of Line 5, and a longer-term measure – the replacement of the Dual Pipelines – that can essentially eliminate the risk of adverse impacts that may result from a potential release from Line 5 at the Straits;

WHEREAS Enbridge has recently implemented and committed to continue additional measures to enhance the safety of Line 5; and

WHEREAS, the State acknowledges that the stipulations specified in this Second Agreement are intended to further protect ecological and natural resources held in public trust by the State of Michigan, and that the terms of this Second Agreement will both protect the ecological and natural resources held in public trust by the State and provide clarity as to State’s expectations concerning the safety, integrity, and operation of Line 5.

NOW, THEREFORE, the parties agree as set forth below.

I. STIPULATIONS

Enbridge and the State agree to the following measures, which are designed, among other things, to increase coordination between the State and Enbridge concerning the operation and maintenance of Enbridge’s Line 5 pipeline located in the State of Michigan, including further enhancing the safety of its operation and reducing the risk of adverse impacts that may result from a potential release from Line 5 at the Straits in the interest of the citizens of Michigan.

A. Continued Coordination Between the State and Enbridge: In order to continue coordination with the State concerning the operation and maintenance of Line 5 located in the
State of Michigan, and to facilitate the implementation of the measures described at Paragraphs B-K below, the parties agree as follows:

1. The State will further provide designated representatives to participate in the stewardship and transparency consultations and communications to be carried out under this Second Agreement.

2. Enbridge will work cooperatively with the State to: (a) make available to the State’s representative data and other materials generated under this Second Agreement, including but not limited to geologic, engineering, or other technological information concerning Line 5 located in the State of Michigan and Enbridge’s implementation of the measures described herein; and (b) all requested information in Enbridge’s possession concerning the operation, integrity management, leak detection, and emergency preparedness for Enbridge’s Line 5 pipeline located in the State of Michigan. The State recognizes, and to the extent provided by applicable law will accommodate, Enbridge’s interest in protecting from disclosure critical energy infrastructure and other confidential information protected from disclosure by law.

3. Enbridge and representatives designated by the State agree to meet semi-annually to discuss any changes to engineering parameters, risks, new technologies, and innovations pertaining to the operation and maintenance of Line 5 located within the State of Michigan. One such semi-annual meeting shall include subject matter experts from Enbridge and the State to review matters relating to pipeline integrity, emergency response and preparedness for Line 5 located within the State of Michigan.

B. Replacement of Line 5 St. Clair River Crossing: Consistent with Paragraph I.B. of the First Agreement, Enbridge timely met its obligations under the First Agreement by filing applications seeking all state, U.S. federal and Canadian authorizations and approvals necessary for the replacement of the St. Clair River Crossing by use of a horizontal directional drill (“HDD”) method. No later than 180 days after obtaining all state, U.S. federal, and Canadian authorizations and approvals necessary to replace Line 5’s crossing of the St. Clair River by the use of a HDD method, Enbridge will initiate the work identified in the applications necessary to replace that segment of Line 5.
C. **Discontinuation of Line 5 Operations in the Straits During Sustained Adverse Weather Conditions:** Until such time that the Dual Pipelines are replaced, Enbridge has and will continue to temporarily shut-down the operation of the Dual Pipelines while “Sustained Adverse Weather Conditions,” as that term is defined in Appendix 1 to this Second Agreement, remain in effect in the Straits, using the procedure set forth in Appendix 1. Additionally, should median wave heights in the Straits over a continuous 60-minute period exceed 6.5 feet in height based upon “Near-real time Data” or in its absence, “Modeled Data,” as those terms are defined in Appendix 1, Enbridge shall ensure that at least one Enbridge employee is available and capable of traveling to the Line 5 North Straits valve station in less than 15 minutes. Enbridge will notify the State when the Line 5 Dual Pipelines have been shut down due to “Sustained Adverse Weather Conditions” and again when the Line 5 Dual Pipelines are restarted. Further, the State is planning to install radar technology that will provide additional near real-time data regarding wave height at the Straits. The State and Enbridge agree that when those data become available, they will be shared with Enbridge and applied to the procedures set forth in Appendix 1 and this Paragraph. Any modification to Appendix 1 to account for the use of radar technology data shall not require a written Amendment to this Second Agreement under Section II below.

D. **Underwater Technologies to Enhance Leak Detection and Technologies to Assess Coating Condition of the Dual Pipelines:** Based upon the evaluation performed pursuant to Paragraph I.D. of the First Agreement, Enbridge will conduct a Close Interval Survey (“CIS”) of the Dual Pipelines every two years, so long as the Dual Pipelines remain in operation. Enbridge plans to conduct a CIS on the Dual Pipelines in 2018, and shall complete the next CIS within two calendar years from the date on which that CIS is conducted by Enbridge, and then every two calendar years thereafter.

E. **Implementation of Measures to Mitigate Potential Vessel Anchor Strike:** The United States Coast Guard (“Coast Guard”) has proposed the establishment of a Regulated Navigation Area pursuant to 33 CFR 165 in the Straits of Mackinac that would prohibit vessels from anchoring or loitering within that Area without Coast Guard authorization. 83 Federal Register 37780 (August 2, 2018). In order to assist the Coast Guard in monitoring compliance with that regulation, Enbridge agrees to provide one-time funding of up to $200,000 to be used for the acquisition and installation of video cameras at the Straits.

F. **Replacement of Dual Pipelines in a Straits Tunnel:** Pursuant to Paragraph I.F. of the First Agreement, Enbridge prepared and submitted to the State the report entitled Alternatives for replacing Enbridge’s dual Line 5 pipelines crossing the Straits of Mackinac (June 15, 2018) (“Alternatives Analysis”). That Alternatives Analysis concluded that construction of a tunnel beneath the lakebed of the Straits connecting the upper and lower peninsulas of Michigan, and the placement in the tunnel of a new oil pipeline, is a feasible alternative for
replacing the Dual Pipelines, and that alternative would essentially eliminate the risk of adverse impacts that may result from a potential oil spill in the Straits (hereinafter “Straits Tunnel”). The State and Enbridge agree to promptly pursue further agreements discussed under Paragraph I.G below for the design, construction, operation, management, and maintenance of the Straits Tunnel in which a replacement for the Dual Pipelines could be located (“Line 5 Straits Replacement Segment”).

G. Further Agreements for a Straits Tunnel: The State has proposed that, together with housing the Line 5 Straits Replacement Segment, the Straits Tunnel could accommodate multiple utilities, including but not necessarily limited to: electric transmission lines, and facilities for transmitting data and telecommunications (collectively “Utilities”). The State and Enbridge agree to initiate discussions, as soon as practicable, to negotiate a public-private partnership agreement with the Mackinac Bridge Authority (“Authority”) with respect to the Straits Tunnel for the purpose of locating the Line 5 Straits Replacement Segment and, to the extent practicable, Utilities in that Tunnel (hereinafter “Tunnel Project Agreement”). The Tunnel Project Agreement shall include provisions under which the Authority will provide property necessary for the construction of the Straits Tunnel, in return for which Enbridge would: (a) fund the design and construction of the Straits Tunnel; (b) construct the Straits Tunnel; and (c) construct the Line 5 Straits Replacement Segment to be located within the Tunnel. Such agreement shall also provide that the Authority shall: (a) obtain or support Enbridge in obtaining the necessary permits, authorizations, or approvals necessary for the construction and operation of the Tunnel and the Line 5 Straits Replacement Segment; and (b) upon completion of the construction of the Straits Tunnel, the Authority shall assume ownership of the Straits Tunnel. Simultaneous with the execution of such agreement, the Authority would execute a lease or other agreements to: (a) authorize Enbridge’s use of the Straits Tunnel for the purpose of locating the Line 5 Straits Replacement Segment for as long as the Line 5 Straits Replacement Segment shall be in operation by Enbridge; (b) provide that Enbridge will operate and maintain the Straits Tunnel during the term of the lease on terms to be agreed; and (c) specify the conditions under which Utilities may gain access to the Straits Tunnel. Provided that the agreements discussed in this Paragraph I.G. are executed by the Authority and Enbridge, the State and Enbridge would simultaneously enter into an agreement expressly confirming Enbridge’s rights to operate the Dual Pipelines under the terms of the Easement during the construction of the Straits Tunnel and Line 5 Replacement Straits Segment, subject to compliance with the terms of the agreements described in Paragraph I.G. and applicable laws. Any failure to reach the further agreements contemplated by this Paragraph I.G. shall not alter any existing rights Enbridge has under the Easement.

H. Permanent Deactivation of the Dual Pipelines: Enbridge agrees that following completion of the Straits Tunnel and after the Line 5 Straits Replacement Segment is constructed
and placed into service by Enbridge within the Straits Tunnel, Enbridge will permanently deactivate the Dual Pipelines. Consistent with Paragraphs E, H, and Q of the Easement, the procedures, methods, and materials for replacement, relocation, and deactivation of the Dual Pipelines are subject to the written approval of the State, which the State agrees shall not be reasonably withheld. At a minimum, any portion of the Dual Pipelines that remains in place after deactivation shall be thoroughly cleaned of any product or residue thereof and the ends shall be permanently capped to the satisfaction of the State, which shall not be unreasonably withheld. The State and Enbridge agree that decisions regarding the method of deactivation, including potential removal of the Dual Pipelines should take into account short- and long-term effects of the deactivation method options and associated sediment and water quality disturbance on natural resources, particularly fishery resources, in proximity to the Straits. The options include: (a) abandoning in place the entire length of each of the Dual Pipelines; or (b) removing from the Straits the submerged portions of each of the Dual Pipelines that were not fully buried in a ditch and placed under cover near the shoreline of the Straits at the time of initial construction.

I. Line 5 Water Crossings Other Than the Straits: Pursuant to Paragraph I.C. of the First Agreement, Enbridge prepared and submitted to the State the Report entitled *Enhancing Safety and Reducing Potential Impacts at Line 5 Water Crossings* (June 30, 2018) (“Water Crossing Report). As described in the Water Crossing Report, Enbridge and representatives of the State jointly identified and prioritized a total of 74 Line 5 water crossings in Michigan other than the Straits and organized them into 11 area groupings, detailed in Tables 1 and 2 in Appendix A to the Report. The Water Crossing Report assessed available mitigation measures to: (a) minimize the likelihood of potential releases (leak prevention); and (b) reduce the consequences of potential releases if they were to occur. Based on that assessment, the Report identified a series of specific Action Items to address both of those objectives and proposed time frames for their implementation (Report, pp 18-24). They include measures related to: (a) Enbridge’s Mainline Integrity program; (b) Enbridge’s Geohazard Management Program; (c) Pipeline Damage Prevention; (d) Emergency Response; and (e) Environmental Management. As reflected in the Water Crossing Report, the Action Items include, among other things, measures that are intended to increase by an order of magnitude Enbridge’s leak prevention safety targets for certain water crossings.

In addition to completing all of the Action Items identified in the Report, the parties have agreed upon two projects at water crossings on which preparatory work shall immediately begin. These specific mitigation measures to be implemented in the near term at certain locations as are specified in Appendix 2 of this Second Agreement.

Enbridge shall implement the Action Items as described in the Report, and as supplemented in this Second Agreement and the Summary contained in Appendix 2 to this Second Agreement, provided that the State and Enbridge may mutually agree in writing to modify Action Items, as well as any
tangible follow-up actions, tasks, or mitigation measures associated with the Action Items, as necessary to accommodate site conditions and industry best practices. Any such modifications do not require a written Amendment to this Second Agreement under Section II below. To the extent they differ: (i) the terms of any modification to the Action Items takes precedence over this Second Agreement; (ii) the terms of this Second Agreement takes precedence over those of Appendix 2; and (iii) those terms of Appendix 2 take precedence over those of the Report.

J. Financial Assurance: The State commissioned the final Independent Risk Analysis for the Straits Pipelines (Meadows, et al., September 15, 2018) (hereinafter “Independent Risk Analysis”) to assess a worst-case discharge from the Dual Pipelines, including the cost of responding to that worst-case discharge. Enbridge strongly disagrees with the methods and conclusions of the Independent Risk Analysis report, and nothing in this Second Agreement shall be construed to constitute Enbridge’s acceptance of those methods and conclusions. Enbridge nonetheless agrees that, so long as it continues to operate the Dual Pipelines, the Enbridge entity or entities that own and operate Line 5, or the parent companies of such Enbridge entity(ies), will maintain in force financial assurance mechanisms that meet or exceed the $1,878,000,000 estimate of Enbridge’s potential total quantifiable response liability for a worst-case discharge from the Dual Pipelines that is identified in the Independent Risk Analysis. To demonstrate compliance with this requirement, on an annual basis Enbridge will file with the State updated financial assurance information in a format similar to that provided in Appendix 3. Enbridge further agrees that, upon the request by the State, it will on an annual basis, make available to the State for inspection and review information regarding the amount, availability, and changes to liability insurance that it maintains. The State agrees that Enbridge’s compliance with the requirements under this Paragraph I.J. satisfies its financial assurance obligations specified under Paragraph J of the Easement.

K. Continuation of Additional Measures to Enhance the Safety of Line 5 in Michigan: Enbridge has in recent years undertaken a variety of additional measures to enhance the safety of Line 5 in Michigan and to improve its emergency preparedness and response capabilities. Such measures, as listed in Appendix 4 to this Agreement, include but are not limited to: (i) the purchase and placement of additional emergency response equipment; (ii) the positioning of permanent personnel in proximity to the Straits; and (iii) improvements to personnel response times to manually close valves in proximity to the Straits. Enbridge agrees that it will continue to implement the measures listed in Appendix 4 so long as it continues to operate the portions of Line 5 to which they apply.

II. AMENDMENT

The State or Enbridge may propose in writing that this Second Agreement be amended. The State and Enbridge agree to consult in good faith in an effort to reach agreement on any proposed
amendment. Except as provided in Paragraph I.G., any amendment agreed to by the State and Enbridge shall be effective on the date that any written amendment is executed by the State and Enbridge.

III. DISPUTE RESOLUTION

The State and Enbridge agree that, should any dispute arise under this Second Agreement, the State and Enbridge shall in good faith attempt to resolve the dispute through informal negotiations. If the parties are unable to informally resolve such a dispute, either party may initiate proceedings in a court of competent jurisdiction to resolve the dispute.

IV. TERM AND TERMINATION

The terms of this Second Agreement shall remain in effect until the commitments in Paragraphs I.B., I.E. - I.I. above are fulfilled, except that the obligations in Paragraphs I.A., I.C., I.D., I.J., and I.K. shall continue, subject to the terms set forth in those Paragraphs, unless and until the Second Agreement terminates automatically. This Second Agreement shall terminate automatically upon the voluntary discontinuation of service by Enbridge of Line 5 through the State of Michigan.

V. COMPLIANCE WITH APPLICABLE LAW

The State and Enbridge acknowledge and agree that Enbridge’s operation of Line 5 remains subject to the requirements of all applicable state and federal law, the Easement, the September 3, 2015 Agreement with the State that prohibits Enbridge from transporting heavy crude oil on Line 5 within the State of Michigan, and the terms of any easement granted by the State for Line 5 and agree that nothing in this Second Agreement is intended to relieve Enbridge of its obligation to comply with or waive any rights that Enbridge and the State may have under such laws or to supersede or displace applicable state law, regulation or requirement, or any federal law, regulation, or requirement that is applicable to the operation or maintenance of Line 5, including but not limited to the Pipeline Safety Act (including its preemption provisions); the Protecting Our Infrastructure of Pipelines and Enhancing Safety Act of 2016 (Public Law 114-183); any regulation or order issued by PHMSA or any other federal agency; or the Consent Decree entered into between Enbridge and the United States in United States v. Enbridge Energy, Limited Partnership, et al., No. 1:16-cv-914, ECF No. 14 (E.D. Mich., entered May 23, 2017), which specifies certain investigation, integrity management, leak detection, valve placement, and emergency response measures to prevent discharges of oil or hazardous substances into or upon the waters of the United States or adjoining shorelines.

VI. ENTIRE AGREEMENT

This Second Agreement constitutes the whole of the Agreement between the parties concerning those portions of Enbridge’s Line 5 located in the State of Michigan. This Second Agreement supersedes in its entirety the First Agreement.
VII. EXECUTION

This Second Agreement may be executed in counterparts without the necessity that the Parties execute the same counterpart, each of which will be deemed an original, but which together will constitute one and the same agreement. The exchange of copies of this Second Agreement by electronic or hard-copy means shall constitute effective execution and delivery thereof and may be used in lieu of the original for all purposes.

VIII. NO THIRD PARTY BENEFICIARIES

This Second Agreement is intended for the exclusive benefit of the parties hereto and their respective successors. Nothing contained in this Second Agreement shall be construed as creating any rights or benefits in or to any third party. This Second Agreement does not give rise to a private right of action for any person other than the parties to this Second Agreement.

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FOR THE STATE OF MICHIGAN

Name: Rick Snyder Title: Governor
Dated: ____________________________
Title: Director, Michigan Department of Natural Resources
Dated:

Name: Heidi Grether
Title: Director, Michigan Department of Environmental Quality
Dated:
Appendix 1

Enbridge Line 5 – Sustained Adverse Weather Conditions Procedure

This Appendix is designed to facilitate an effective emergency response to a potential release incident by specifying procedures for a systematic approach by Enbridge to temporarily shut down Line 5 in the Straits of Mackinac during Sustained Adverse Weather Conditions. Enbridge shall maintain a record of its use of the procedure and make it available to the State. If an alternate source of near-real time wave height data such as the radar system planned by the State becomes available following the execution of this agreement, Enbridge and the State will work cooperatively to revise this Appendix to account for the alternative data source.

Definitions:

Sustained Adverse Weather Conditions: Conditions in which median wave heights in the Straits of Mackinac over a continuous 60-minute period are greater than 8 feet based on “Near-real Time Data,” or in its absence “Modeled Data.”

Near-real Time Data: The wave height data derived from Buoy 45175 (Mackinac Straits West) of the Great Lakes Research Center of Michigan Technological University’s Upper-Great Lakes Observing System (UGLOS) and/or alternate data sources such as radar data, as mutually agreed by the State and Enbridge through a modification of this Appendix.

Modeled Data: Modeled wave height data based on real-time data inputs that is available on the NOAA Great Lakes Coastal Forecasting System (GLCFS) Nowcast model at a representative point in the Straits.

Forecasted Data: Data available on the NOAA Great Lakes Coastal Forecasting System Forecast model at a representative point in the Straits.

Enbridge Line 5 Procedures – Sustained Adverse Weather Conditions

<table>
<thead>
<tr>
<th>Step #</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enbridge or Enbridge Consultant (collectively “Enbridge Monitor”) will continuously monitor Near-real Time Data, or in its absence Modeled Data, to identify Sustained Adverse Weather Conditions at the Straits.</td>
</tr>
<tr>
<td>2</td>
<td>When Sustained Adverse Weather Conditions are forecasted based on Forecasted Data, the Enbridge Monitor will inform the Control Center Operations Shift Supervisor, at which point the Control Center Operations will prepare for the potential that an unplanned shut down of Line 5 at the Straits may be required.</td>
</tr>
<tr>
<td>Step</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>3</td>
<td>When Near-real Time Data, or in its absence Modeled Data, indicate that Sustained Adverse Weather Conditions are occurring at the Straits, the Enbridge Monitor will immediately contact the Control Center Operations Shift Supervisor.</td>
</tr>
<tr>
<td>4</td>
<td>The Control Center Operations Shift Supervisor will promptly call the Enbridge Great Lakes On-Call Manager to advise them that Sustained Adverse Weather Conditions exist at the Straits.</td>
</tr>
<tr>
<td>5</td>
<td>The Enbridge Great Lakes On-Call Manager will request, no later than 15 minutes after being notified in Step 4 above, that the Control Center Operations shutdown Line 5. If real time conditions in the Straits determined by the Enbridge Great Lakes On-Call Manager indicate Sustained Adverse Weather Conditions do not exist, the Great Lakes On-Call Manager will advise the Control Center Operations Shift Supervisor that Line 5 should not be shutdown. In that event, the Enbridge Monitor will continue to monitor conditions as per Step 1 for changes that indicate that Sustained Adverse Weather conditions may be present and the other Steps in this Appendix shall be followed should the Enbridge Monitor determine that such conditions are present.</td>
</tr>
<tr>
<td>6</td>
<td>Unless advised otherwise by the Enbridge Great Lakes On-Call Manager as per Step 5 above, Control Center Operations will perform a controlled emergency shut down of Line 5 and isolate the segment across the Straits.</td>
</tr>
<tr>
<td>7</td>
<td>While shut down, the Enbridge Monitor will continuously monitor Near-real Time Data, or in its absence Modeled Data, to identify the continuance of Sustained Adverse Weather Conditions at the Straits.</td>
</tr>
<tr>
<td>8</td>
<td>When Near-real Time Data, or in its absence Modeled Data, indicates the Sustained Adverse Weather Conditions no longer exist at the Straits, the Enbridge Great Lakes On Call Manager and Control Center Operations Admin On Call will authorize the restart of Line 5.</td>
</tr>
<tr>
<td>9</td>
<td>Control Center Operations will safely restart Line 5.</td>
</tr>
</tbody>
</table>

**Communications Protocol:**

Enbridge shall immediately notify the State of Michigan as follows: (i) when median wave heights in the Straits over a continuous 60-minute period exceed 6.5 feet in height based upon “Near-real time Data” or in its absence, “Modeled Data,” as those terms are defined in Appendix 1, and Enbridge has acted to ensure that at least one Enbridge employee is available and capable of traveling to the Line 5 North Straits valve station in less than 15 minutes; (ii) when Line 5 has been temporarily shut down in the Straits of Mackinac due to Sustained Adverse Weather Conditions, as per Step 6 above; and (iii) when Line 5 has been safely restarted in the Straits of Mackinac, as per Step 9 above. Any notification required under this provision shall be made by email to a specified email address provided to Enbridge by the State of Michigan.
Appendix 2

Action Items for Water Crossings Other than the Straits

A. Additional Near-Term Items

1. Mitigate potential geohazard at the following water crossings:
   a. Point Aux Chenes (3)-restore depth of cover and stabilize bank to prevent further erosion:
      i. Work with State Technical Team to select method, design and schedule within 3 months from the effective date of this Agreement.
      ii. Apply for all necessary permits within 6 months from the effective date of this Agreement.
      iii. Complete construction of mitigation measures within 12 months after receipt of permits.
   b. Tributary to Paint River – Address exposed section of pipeline:
      i. Work with State Technical Team to select method, design and schedule within 3 months of the effective date of this Agreement.
      ii. Apply for all necessary permits within 6 months from the effective date of this Agreement.
      iii. Complete construction of mitigation measures within 12 months after receipt of permits.

2. Accelerated field work to evaluate crossings with potential need for geohazard remediation. Additional information to be gathered for the following crossings within 6 months from the effective date of this Agreement:
   a. Whitefish River - MP 1358
   b. Rapid River – MP 1356
   c. Tributary to Southwest Branch Fishdam River – MP 1373
   d. Elm Creek – MP 1691
   e. East Branch Black River – MP 1442
   f. East Mile Creek – MP 1436
   g. Paquin Creek – MP 1448
   h. Pointe Aux Chenes River (1) – MP 1466
   i. West Branch Paquin Creek – MP 1447
   j. West Mile Creek – MP 1436
   k. Red Creek – MP 1563
Based on evaluations, remedial measures, if needed, may include: depth of cover restoration; bank and bed armoring; or pipeline lowering or replacement. These remedial measures will be implemented as follows:

i. Work with State Technical Team for method selection, design and schedule within 6 months from the effective date of this Agreement.

ii. Apply for all necessary permits within 12 months from the effective date of this Agreement.

iii. Complete construction of remedial measures within 12 months after receipt of permits.

B. Action Items in Report

<table>
<thead>
<tr>
<th>Preventive and Mitigative Measures</th>
<th>Time to Complete (months)</th>
<th>Number of locations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leak Prevention Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Increase Safety Targets Within Grouping Areas</td>
<td>6</td>
<td>All</td>
</tr>
<tr>
<td>2. Engineering Assessment</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>3. Baseline Geohazard Assessment</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>4. Depth of Cover/Bathymetric Survey</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>5. Perform Detailed Scour Study</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>6. Replacement/Lowering</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>7. Outreach to local government officials involved in construction activities near waterbodies</td>
<td>6</td>
<td>All</td>
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## Consequence Mitigation Measures

<table>
<thead>
<tr>
<th></th>
<th>Action Description</th>
<th>Tackle</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Review Emergency Response Training and Exercise Communication Plan</td>
<td>6</td>
<td>All</td>
</tr>
<tr>
<td>9</td>
<td>Establish Additional Emergency Response Tactical Control Points</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Collaborative Review of Emergency Response Tactical Control Points</td>
<td>9</td>
<td>All</td>
</tr>
<tr>
<td>11</td>
<td>Update Environmental Sensitivity Maps with State Sensitivity Data</td>
<td>12</td>
<td>All</td>
</tr>
<tr>
<td>12</td>
<td>Review Emergency Response Aquatic Invasive Species Inspection Procedure</td>
<td>12</td>
<td>All</td>
</tr>
<tr>
<td>13</td>
<td>Conduct Baseline Environmental Studies - Rare Wetland Communities</td>
<td>18</td>
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## Biology Mitigation Studies

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<thead>
<tr>
<th></th>
<th>Action Description</th>
<th>Tackle</th>
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<tbody>
<tr>
<td>14</td>
<td>Fisheries</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>15</td>
<td>Freshwater Mussels</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>16</td>
<td>Biological Integrity</td>
<td>18</td>
<td>11</td>
</tr>
</tbody>
</table>
## Appendix 3
### Enbridge Financial Assurance Verification Form for Calendar Year [Insert]

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$ (as per EI’s consolidated Q_20 balance sheet – cash &amp; cash equivalents)</td>
<td>$</td>
<td>1 day</td>
</tr>
<tr>
<td>Credit Facility (available liquidity as at [date]) Note 1</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Other Resources Available in 30-60 Days (explain)</td>
<td>$ (as per EI’s consolidated Q_20 balance sheet – accounts receivable and other)</td>
<td>$</td>
<td>30-60 days</td>
</tr>
<tr>
<td><strong>Total Short-Term</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Insurance</td>
<td>General Liability Insurance, includes Time Element Reporting Pollution (sudden and accidental) coverage currently US$[Insert] Note 2</td>
<td></td>
<td>Note 3</td>
</tr>
<tr>
<td>Surety Bonds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent/Affiliate Guarantees (from Parent Co. to Authorization Holder)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Financial Resources (explain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Enbridge utilizes the commercial paper markets in both Canada and the U.S. as a cost effective source of short term liquidity. The commercial paper programs are fully backstopped by the Credit Facilities and the availability of such is reflected net of any commercial paper outstanding.

2. The reflected insurance amount represents the limit for coverage that is maintained by EI for the specified calendar year, and for which EEP is named as an insured under that policy, thereby enabling EEP to obtain insurance recoveries for events covered under the policy. The insurance amount is reviewed and renewed on an annual basis and is subject to insurance market conditions and experience that may impact the breadth and limit of coverage available.

3. The insurance coverage maintained by EI provides any Enbridge entity covered under that policy, such as EEP, with eventual recovery of monies which that Enbridge entity has paid because of its legal liability for direct third-party bodily injury and property damage caused by the release and that financial recovery can extend over a period of months and years.
Appendix 4

Enhanced Safety and Emergency Response Capabilities

Enbridge has, in recent years, undertaken a variety of additional measures to enhance the safety of Line 5 and to improve its emergency preparedness and response capability at the Straits of Mackinac, in the Great Lakes, and throughout Michigan. Enbridge agrees that it will continue these measures so long as it continues to operate the portions of Line 5 to which they apply. These measures include, but are not limited to:

**Equipment:**

a. Enbridge recently strengthened its already robust emergency response capabilities for the Great Lakes by adding more than $7 million of emergency response equipment to be staged at the Straits of Mackinac. This equipment can be deployed in the Straits and throughout the Great Lakes as necessary. The new equipment includes, but is not limited to:
   - 10,000 feet of Sea Sentry Boom - heavy duty open water containment boom which is fit for service in the presence of ice and rough waters. This boom can withstand wave action to eight feet.
   - 1,000 feet of Fire Boom, necessary for an in situ burning response.
   - Lamor Ice Skimmers (the first deployment in North America)
   - Nofi Current Busters

b. The company holds annual boom deployment exercises in the Great Lakes.

c. Valve Closure Gang boxes, which includes the necessary equipment to execute a manual valve closure, have been located at North Straits valve site and pre-located at each pump station along Line 5.

**Personnel:**

d. Enbridge established a Pipeline Maintenance (PLM) Crew at St. Ignace adding five employees in addition to the Enbridge employee permanently based in the Straits of Mackinac area. This crew augments crews already stationed along Line 5 in Ironwood, Escanaba, Indian River, and Bay City.

e. Enbridge recently agreed to purchase a building in St. Ignace that will house its local operations employees. The new facility is less than 10 minutes from the North Straits valve site.

f. Enbridge has implemented Incident Command System (ICS) role specific training for its Regional team and Operations Leadership individuals.

**Response time:**

The company improved personnel response time for manual closing of valves at the North Straits valve site to under an hour, and with a target time of no more than 45 minutes – no matter what time of day or weather condition. Manual closing of the valves would be necessary only if all other redundant systems on Line 5 at the Straits would fail. The redundant systems include:

1. Dedicated 24/7 remote operational control of the pipelines from the Enbridge Control Center. All valves can be remotely opened and closed by the
Control Center. If there is a power failure at the North Straits site resulting in communications loss with the Control Center, an automatic back-up generator on-site will restore power and allow communications with the Control Center.

2) The pipelines at the Straits are equipped with automatic shut-off valves which will close within three minutes should a threshold pressure loss occur in the pipelines. These closures would be independent of and could not be overridden by any Control Center action. In the unlikely event that communications with the Control Center is lost due to a power outage and the backup generator fails, and the automatic valves fail to operate properly, valves can be closed manually.
THIRD AGREEMENT BETWEEN THE STATE OF MICHIGAN, MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY, AND MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENBRIDGE ENERGY, LIMITED PARTNERSHIP, ENBRIDGE ENERGY COMPANY, INC., AND ENBRIDGE ENERGY PARTNERS, L.P.

This Third Agreement is entered between the State of Michigan, the Michigan Department of Environmental Quality, and the Michigan Department of Natural Resources (collectively referred to herein as "the State"), AND Enbridge Energy, Limited Partnership, Enbridge Energy Company, Inc., formerly known as Lakehead Pipe Line Company, Inc., and Enbridge Energy Partners, L.P. (collectively referred to herein as "Enbridge") concerning those segments of Enbridge’s Line 5 pipeline ("Line 5") that are located within the State of Michigan. This Third Agreement results from, and is intended to fulfill, the parties' obligations under Paragraph I.G. of the Second Agreement between the State and Enbridge, entered October 3, 2018 ("Second Agreement"), in which the parties agreed to pursue further agreements to address Line 5's crossing of the Straits of Mackinac ("Straits").

WHEREAS, the Second Agreement affirms that the segments of Line 5 located within Michigan must be operated and maintained in compliance with all applicable laws that are intended to protect the public health, safety, and welfare and prevent pollution, impairment, or destruction of the natural resources of the State of Michigan, including the unique resources of the Great Lakes, and requires specified measures to further protect ecological and natural resources held in public trust by the State of Michigan;

WHEREAS, the Second Agreement remains in effect and the parties wish to supplement it pursuant to Paragraph I.G. of that Agreement by entering into this Third Agreement addressing the operation, replacement, and decommissioning of the existing Dual Pipelines at the Straits, conditioned upon and in conjunction with, an Agreement between Enbridge and the Mackinac Straits Corridor Authority ("Authority") to design, construct, operate, and maintain a utility tunnel at the Straits to accommodate a replacement for the Dual Pipelines and other utilities ("Tunnel Agreement");

WHEREAS, on December 19, 2018, Enbridge and the Authority entered into the Tunnel Agreement.

The Parties hereby agree as follows:
Article 1 Definitions and Interpretation

1.1. Definitions

(a) "1953 Easement" means the "Straits of Mackinac Pipe Line Easement [granted by the] Conservation Commission of the State of Michigan to Lakehead Pipe Line Company, Inc. (Lakehead) executed April 23, 1953.

(b) "Authority" means the Mackinac Straits Corridor Authority.

(c) "Bare Metal" means any area on the Dual Pipelines where the metal pipe is visually exposed and in direct contact with water.

(d) "Day" means a calendar day unless expressly stated to be a business day. In computing any period of time under this Third Agreement, where the last Day would fall on a Saturday, Sunday, or U.S. federal holiday or Michigan state holiday, the period shall run until the close of business of the next business day.

(e) "Dual Pipelines" means the 4.09-mile portion of Enbridge's Line 5 pipeline consisting of two 20-inch diameter seamless pipelines that cross the Straits.

(f) "Enbridge Board of Directors" means the Enbridge Inc. Board of Directors.

(g) "Enbridge" means Enbridge Energy, Limited Partnership or its successors and assigns.

(h) "Government Approval" means all permissions, consents, approvals, certificates, permits, licenses, agreements, registrations, notices, exemptions, waivers, filings, and authorizations (whether statutory or otherwise) required by law.

(i) "Heavy Crude Oil" means any liquid petroleum with an American Petroleum Institute gravity index of less than 22 degrees, including, but not limited to, diluted bitumen.

(j) "Line 5" means the Enbridge light crude and natural gas liquids pipeline that extends from Superior, Wisconsin, through the Upper Peninsula of Michigan to the Lower Peninsula of Michigan and then across the U.S.-Canada international boundary to Sarnia, Ontario, Canada.

(k) "PPI" means the Producer Price Index for Finished Goods published each year by the U.S. Department of Labor, Bureau of Labor Statistics or any lawful successor agency thereto.


(m) "State of Michigan" means the State of Michigan and the Departments of Environmental Quality and Natural Resources.

(n) "Straits of Mackinac" or "Straits" means that segment of water between the
upper and lower peninsulas of Michigan that connects Lake Michigan and Lake Huron.

(o) "Straits Line 5 Replacement Segment" means that segment of 30-inch pipe that is to be constructed, operated, and maintained within the Tunnel to connect to Enbridge's existing Line 5 pipeline on either side of the Straits so as to serve as a replacement to the Dual Pipelines.

(p) "Tunnel" has the meaning set forth in the description provided in Section 6.1 of the Tunnel Agreement.

(q) "Tunnel Agreement" means the agreement entered into on December 19, 2018 between Enbridge and the Mackinac Straits Corridor Authority.

1.2. In this Third Agreement unless the context otherwise requires:

(a) the words "including," "includes," and "include" will be read as if followed by the words "without limitation";

(b) the meaning of "or" will be that of the inclusive "or," that is meaning one, some or all of a number of possibilities;

(c) a reference to any Party includes each of their legal representatives, trustees, executors, administrators, successors, and permitted substitutes and assigns, including any Person taking part by way of novation;

(d) a reference to this Third Agreement or to any other agreement, document, or instrument includes a reference to this Third Agreement or such other agreement, document or instrument as amended, revised, supplemented or otherwise modified from time to time;

(e) a reference to any Governmental Entity, institute, association or body is: (i) if that Governmental Entity, institute, association or body is reconstituted, renamed or replaced or if the powers or functions of that Governmental Entity, institute, association or body are transferred to another organization, a reference to the reconstituted, renamed or replaced organization or the organization to which the powers or functions are transferred, as applicable; and (ii) if that Governmental Entity, institute, association or body ceases to exist, a reference to the organization which serves substantially the same purposes or objectives as that Governmental Entity, institute, association or body;

(f) words in the singular include the plural (and vice versa) and words denoting any gender include all genders;

(g) headings are for convenience only and do not affect the interpretation of this Third Agreement;

(h) a reference to this Third Agreement includes all Schedules, Appendices, and Exhibits;

(i) a reference to a Section or Schedule is a reference to a Section or Schedule of or to the body of this Third Agreement;

(i) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding
meaning.
Article 2 Representations

2.1. Authority - Signatories for each Party represent that they have authority to enter into this Third Agreement.

Article 3 Relationship to Tunnel Agreement

3.1 Agreements Mutually Dependent - This Third Agreement is premised upon the existence, continued effectiveness of, and Enbridge's compliance with the Tunnel Agreement, under which Enbridge is required to design, construct, and operate and maintain the Tunnel to accommodate the Straits Line 5 Replacement Segment that will replace the Dual Pipelines.

Article 4 Continued Operation of Dual Pipelines Pending Completion of Tunnel and Activation of Line 5 Replacement Segment

4.1 The State agrees that Enbridge may continue to operate the Dual Pipelines, which allow for the functional use of the current Line 5 in Michigan, until the Tunnel is completed, and the Straits Line 5 Replacement segment is placed in service within the Tunnel, subject to Enbridge's continued compliance with all of the following:

(a) The Second Agreement;
(b) The Tunnel Agreement;
(c) This Third Agreement;
(d) The 1953 Easement; and
(e) All other applicable laws, including those listed in Section V of the Second Agreement.

4.2 Provided that Enbridge complies with Section 4.1 above, the State agrees that:

(a) The work done and to be done at the water crossings pursuant to the Second Agreement adds protections to the health, safety, and welfare of Michiganders and increases protection for Michigan's environment and natural resources.

(b) Enbridge's compliance with Article 5 below demonstrates compliance with the specified conditions of the 1953 Easement.

(c) The replacement of the Dual Pipelines with the Straits Line 5 Replacement Segment in the Tunnel is expected to eliminate the risk of a potential release from Line 5 at the Straits.

(d) In entering into this Third Agreement, and thereby authorizing the Dual Pipelines to continue to operate until such time that the Straits Line 5 Replacement Segment is placed into service within the Tunnel, the State has acted in accordance with and in furtherance of the public’s interest in the protection of waters, waterways, or bottomlands held in public trust by the State of Michigan.
(e) Based on currently available information, the State is not aware of any violation of the 1953 Easement that would not be addressed and cured by compliance with Section 4.1 and Article 5 of this Agreement.

4.3 Additional measures to assure integrity of Dual Pipelines:
(a) Enbridge will implement an enhanced inspection regime for the Line 5 Dual Pipelines beginning in 2024 or sooner as specified in Appendix 1, attached to his Third Agreement, and continuing while the Line 5 Dual Pipelines are still in use. If the Line 5 Dual Pipelines are still in use in 2026, Enbridge will conduct a hydrotest (or an equally reliable alternative technology for confirming integrity and material strength) of the Line 5 Dual Pipelines unless the Tunnel and the Straits Line 5 Replacement Segment are expected to be completed and operational on or before December 31, 2026. Reports of the inspections will be made available to the State of Michigan for review. The inspection regime as described will be used to evaluate whether agreed upon technical criteria are being met.

The enhanced inspection regime and the agreed upon criteria are specified in attached Appendix 1.

(b) Enbridge agrees that it will not assert that these additional measures required under this Third Agreement or the measures regarding Line 5 water crossings other than the Straits required under Paragraph I.I. of the Second Agreement are preempted by federal law or otherwise unenforceable.

Article 5 Compliance with 1953 Easement

5.1 Financial Assurance:
(a) Until the Dual Pipelines are permanently decommissioned, Enbridge will maintain compliance with the requirements of Paragraph I.J of the Second Agreement, supplemented and modified as follows:

(i) The $1,878,000,000 minimum amount will be annually adjusted for inflation based on the PPI on October 1, 2019 and each year thereafter.

(ii) Enbridge will file with the State updated financial assurance information on an annual basis in a format consistent with Appendix 3 to the Second Agreement, beginning thirty (30) days after the effective date of this Third Agreement.

(iii) Enbridge will promptly notify the State in writing of any material change concerning the financial assurance information provided under Section 5.1(a)(ii). A material change shall be any change in the financial status of Enbridge that may prevent Enbridge from complying with Section 5.1(a)(i).
(b) The State agrees that if Enbridge meets the requirements under Section 5.1 (a) of this Third Agreement, Enbridge will be deemed to satisfy its financial assurance obligations specified under Paragraph J of the 1953 Easement.

5.2 Pipeline Coatings:
(a) Enbridge is committed to completing the implementation of the State-approved plan for visual inspection of pipeline coatings at all locations on the Dual Pipelines where screw anchor supports have been installed. Enbridge will promptly repair the coating at any and all locations where Bare Metal is identified as a result of such visual inspection. Enbridge will take all reasonable efforts to complete implementation by October 30, 2019.
(b) Enbridge will, not later than March 31, 2019, submit to the State for review and approval, a work plan to, in conjunction with the Close Interval Surveys required under Section I.D of the Second Agreement, visually inspect pipeline coatings at sites to be specified in the work plan along the Dual Pipelines and to repair the coating at any and all sites where Bare Metal is identified. The work plan will include a proposed implementation schedule. Enbridge will implement the State-approved plan in accordance with the approved schedule.
(c) If at any time, any other area(s) of coating damage along the Dual Pipelines where Bare Metal exists is identified, Enbridge will repair the identified area(s) as soon as practicable thereafter. Enbridge will notify the State within thirty (30) days after any Bare Metal is identified, and again thirty (30) days after the Bare Metal is repaired.
(d) The State agrees, based upon currently available information, that Enbridge's compliance with the requirements under this Section 5.2 satisfies the requirements of Paragraph A (9) of the 1953 Easement.

5.3 Maximum Span of Unsupported Pipe:
(a) Based upon currently available information, there are no locations along the Dual Pipelines where the span or length of unsupported pipe exceeds the seventy-five (75) feet maximum specified in Paragraph A (10) of the 1953 Easement.
(b) Until the Dual Pipelines are permanently decommissioned, Enbridge will continue to visually inspect the Dual Pipelines at least every two (2) calendar years to verify that no unsupported spans exceed the specified maximum. If at any time an unsupported span exceeding the maximum is identified, Enbridge will, within thirty (30) days after receiving the final report from the third-party contractor performing such inspection where a span exceedance is identified, submit to the State for review and approval, a work plan to promptly eliminate the
exceedance through installation of additional anchor supports or other suitable means. Enbridge will implement the work plan as soon as practicable after receiving all necessary federal or State permits or approvals required to conduct work to eliminate the exceedance.

(c) As additional means of preventing exceedances of the maximum span, Enbridge will continue to implement the span management measures included in the federal Consent Decree, as amended, while the federal Consent Decree remains in effect.

(d) The State agrees, based upon currently available information, that Enbridge's compliance with the requirements under this Section 5.3 satisfies the requirements of Paragraph A (10) of the 1953 Easement.

Article 6 Construction and Operation of Straits Line 5 Replacement Segment

6.1 Enbridge will design, construct, operate, and maintain the Straits Line 5 Replacement Segment within the Tunnel:
   (a) At its own expense; and
   (b) In compliance with all applicable laws and regulations and the terms of the Tunnel Agreement and the Tunnel Lease to be issued by the Authority under the Tunnel Agreement.
   (c) Nothing under this Third Agreement shall be construed to provide the State with authority over the design, operation, or maintenance of the Straits Line 5 Replacement Segment.

6.2 Enbridge will not transport Heavy Crude Oil through the Straits Line 5 Replacement Segment.

6.3 When Enbridge ceases use of the Straits Line 5 Replacement Segment, it will permanently deactivate the Straits Line 5 Replacement Segment in compliance with all applicable laws and regulations and Section 3.3 of the Tunnel Lease.

Article 7 Permanent Deactivation of Dual Pipelines

7.1 Enbridge agrees that as soon as practicable following completion of the Tunnel and after the Straits Line 5 Replacement Segment is constructed and placed into service by Enbridge, Enbridge will cease operation of the Dual Pipelines and permanently deactivate the Dual Pipelines.
7.2. Consistent with Paragraphs E, H, and Q of the 1953 Easement, the procedures, methods, and materials for replacement, relocation, and deactivation of the Dual Pipelines are subject to the written approval of the State, which the State agrees shall not be unreasonably withheld. At a minimum, any portion of the Dual Pipelines that remains in place after deactivation shall be thoroughly cleaned of any product or residue thereof and the ends shall be permanently capped to the satisfaction of the State, which shall not be unreasonably withheld.

7.3 The State and Enbridge agree that decisions regarding the method of deactivation, including potential removal of the Dual Pipelines should take into account short- and long-term effects of the deactivation method options and associated sediment and water quality disturbance on natural resources, particularly fishery resources, in proximity to the Straits. The options include: (a) abandoning in place the entire length of each of the Dual Pipelines; or (b) removing from the Straits the submerged portions of each of the Dual Pipelines that were not fully buried in a ditch and placed under cover near the shoreline of the Straits at the time of initial construction.

Article 8 Delay Events

8.1 Enbridge's performance under this Third Agreement shall be excused as a result of any Delay Event. For purposes of this Third Agreement, "Delay Event" is defined as any event arising from causes beyond the control of Enbridge, any entity controlled by Enbridge, or any of Enbridge's contractors, that delays or prevents the performance of any obligation under this Third Agreement, despite Enbridge's best efforts to fulfill the obligation. "Best efforts to fulfill the obligation" includes using best efforts to address the effects of any such event: (a) as it is occurring; and (b) following its occurrence, such that the delay and any adverse effects of the delay are minimized.

8.2 Automatic Delay Events - The Parties agree that the following circumstances automatically constitute a Delay Event:

(a) The inability to undertake activities required under this Third Agreement due to the need to obtain a Government Approval or other legal authorization required to undertake such activities.

(b) Acts of God, war, terrorist acts, pandemics, strikes, civil disturbances, and other causes beyond the reasonable control of Enbridge.

(c) Unavailability of necessary materials or equipment because of industry-wide shortages.

(d) An injunction or other judicial or governmental order preventing the timely performance of the obligation.
8.3 Other Delay Events - The Parties further agree that any other circumstance included within the definition of Delay Event in Section 8.1 may on a case-by-case basis be determined by Enbridge and the State to constitute a Delay Event.

8.4 Notice - If a Delay Event occurs, Enbridge will notify the State of the Delay Event within a reasonable time after Enbridge is aware that a Delay Event has occurred. The notice will describe the Delay Event, the anticipated duration of the Delay Event, if known, and the efforts taken by Enbridge to minimize the delay and any adverse effects of the delay.

8.5 Disputes - Any dispute between the Parties relating to the existence or duration of a Delay Event will be resolved in accordance with Article 9, Dispute Resolution.

Article 9 Dispute Resolution

9.1 Except as otherwise specified in this Third Agreement, the Parties agree to the following procedures to resolve all disputes between them arising under this Third Agreement.

9.2 Informal Dispute Resolution - First, designated representatives of the Parties will engage in good faith efforts to informally resolve the dispute for a period of up to sixty (60) days, provided that the Parties may mutually agree in writing to extend that period.

9.3 Optional Mediation - If the dispute is not resolved informally though Section 9.2, the Parties may, though mutual written agreement, select a neutral mediator to facilitate the resolution of the dispute. Unless otherwise agreed, the parties will equally share the costs of the mediator's services.

9.4 Judicial Dispute Resolution - If the dispute is not resolved informally though Section 9.2, or, if applicable, through Section 9.3, either Party may submit the dispute to a court of competent jurisdiction for resolution.

Article 10 Termination

10.1 Term. This Third Agreement shall remain in effect until such time that the Dual Pipelines are decommissioned, unless terminated in accordance with 10.2 or 10.3 below.

10.2 Termination by the State. The State may terminate this Agreement if: (i) after being notified in writing by the State of any material breach of this Agreement, Enbridge fails to commence remedial action within ninety (90) days to correct the identified breach or fails to use due diligence to complete such remedial action within a reasonable time thereafter; (ii) the dispute resolution procedures of Article 9 are followed with respect to the breach; and (iii) the final judicial resolution of the dispute is in favor of the State's position that the
Agreement should be terminated.

10.3 Termination by Enbridge. Enbridge may terminate this Agreement:
(a) By written notice to the State if: (i) Enbridge has involuntarily ceased operation of the existing Line 5 Dual Pipelines as a result of a court order or at the direction of a Governmental Entity at any point during the design or construction of the Tunnel; or (ii) Enbridge has voluntarily chosen to permanently cease operations on the existing Line 5 Dual Pipelines at any point during the design or construction of the Tunnel;
(b) If: (i) after being notified in writing by Enbridge of any material breach by the State of this Agreement, which shall include but not be limited to any unreasonable impairment by the State of Enbridge’s ability to construct the Tunnel or construct, operate, and maintain the Straits Line 5 Replacement Segment within the Tunnel in accordance with the Tunnel Agreement and the Lease, the State has failed to commence remedial action within ninety (90) days to correct the identified breach or impairment or failed to use due diligence to complete such remedial action within a reasonable time thereafter; (ii) the dispute resolution procedures of Article 9 are followed with respect to the breach; and (iii) the final judicial resolution of the dispute is in favor of Enbridge’s position that the Agreement should be terminated.

10.4 Survival.

The assurances provided in Section 4.2 above shall survive in the event of termination of this Third Agreement, under Sections 10.3(6) and (c).

Article 11 Amendment

This Third Agreement may be amended only through written agreement executed by authorized representatives of both Parties.

Article 12 Notices

12.1 Unless otherwise agreed to by the Parties, all notices, submissions, or communications required under this Agreement must be in writing and served either by personal service, by prepaid overnight courier service or by certified or registered mail to the address of the receiving Party set forth below (or such different address as may be designated by such Party in a notice to the other Party, from time to time). Notices, consents, and requests served by personal service shall be deemed served when delivered. Notices, consents, and requests sent by prepaid overnight courier service shall be deemed served on the day received, if received during the recipient's normal business hours, or at the beginning of the recipient's next business day after receipt if not received during the recipient's normal business hours. Notices, consents, and requests sent by certified or registered mail, return receipt requested,
shall be deemed served ten (10) business days after mailing.
As to the State of Michigan:

Attn: Deputy Director
Michigan Department of Environmental Quality
525 W. Allegan
Post Office Box Lansing,
MI 48909-7528

Attn: Natural Resource Deputy
Michigan Department of Natural Resources
525 W. Allegan
Post Office Box 30028 Lansing,
MI 48909-7528

As to Enbridge:

Attn: Vice President of U.S. Operations, Liquids Pipelines
7701 France Avenue South, Suite 600-Centennial Lakes Park I
Edina, MN 55435

With a copy to Corporate Secretary
5400 Westheimer Court
Houston, TX 77056

With a copy to Director of Great Lakes Region
222 Indianapolis Blvd., Suite 100
Schererville, IN 46375

With a copy to Associate General Counsel U.S. Law 26
East Superior Street, Suite 309
Duluth, MN 55802
And an emailed copy to legalnotices@enbridge.com

12.2 Notice of any change by a Party of the designations or addresses listed in Section 12.1 above will be promptly provided to the other Party
Article 13 No Third-Party Beneficiaries

13.1 This Third Agreement is intended for the exclusive benefit of the Parties hereto and their respective successors. Nothing contained in this Third Agreement shall be construed as creating any rights or benefits in or to any third party. This Third Agreement does not give rise to a private right of action for any person other than the Parties to this Third Agreement.

Article 14 Miscellaneous

14.1 Approvals under this Third Agreement - Each Party agrees that whenever this Third Agreement provides for it to approve, concur with, or jointly act with the other Party, such approval, concurrence, or joint action will not unreasonably be withheld.

14.2 Good Faith - The Parties agree to act in good faith in the interpretation, execution, performance, and implementation of this Third Agreement.

14.3 Execution. This Third Agreement may be executed in counterparts without the necessity that the Parties execute the same counterpart, each of which will be deemed an original, but which together will constitute one and the same agreement. The exchange of copies of this Tunnel Agreement by electronic or hard-copy means shall constitute effective execution and delivery thereof and may be used in lieu of the original for all purposes.

14.4 Governing Law. This Third Agreement shall be construed, interpreted, and applied in accordance with the laws of the State of Michigan without reference to its conflict of laws rules.

14.5 Entire Agreement. This Third Agreement and Schedules hereto, contain all covenants and agreements between the State and Enbridge relating to the matters set forth in this Third Agreement.

14.6 Severability. If any provision of this Agreement will be held illegal, invalid, or unenforceable by a court of competent jurisdiction, the same will not necessarily affect any other provision or provisions herein contained or render the same invalid, inoperative, or unenforceable, and the Parties will expeditiously negotiate in good faith in an attempt to agree to another provision or provisions (instead of the provision which is illegal, inoperative or unenforceable) that is legal, operative, and enforceable and carries out the Parties' intentions under this Agreement.
Article 15 Assignment

15.1 Either Party may assign, charge, or transfer its rights or obligations under this Third Agreement provided that it obtains the written consent of the other Party.

FOR THE STATE OF MICHIGAN

\[
\text{\underline{Rick Snyder}} \\
\text{Name: Rick Snyder} \\
\text{Title: Governor} \\
\text{Dated:} \\
\]

(Keith Creagh)

Title: Director, Michigan Department of Natural Resources
Dated:

Name:
Title: Director, Michigan Department of Environmental Quality
Dated:
FOR ENBRIDGE ENERGY, LIMITED PARTNERSHIP BY:
ENBRIDGE PIPELINES (LAKEHEAD) L.L.C.
AS MANAGING GENERAL PARTNER

Nm
Title: Vice President, U.S. Operations
Dated:

Name: John Swanson
Title: Vice President, Major Projects, Execution
Dated:

Name: Al Monaco
Title: Authorized Signatory for Enbridge Pipelines (Lakehead) L.L.C.
Dated:

FOR ENBGE ENERGY COMPANY, INC,

Brad Shamla
Title: Vice President, U.S. Operations
Dated:

Name: John Swanson
Title: Vice President, Major Projects, Execution
Dated:

uno: Guy Jarvis
Title: Executive Vice President – Liquids Pipelines
Dated: 12/19/2018
FOR ENBRIDGE ENERGY PARTNERS, L.P.
BY: ENBRIDGE ENERGY MANAGEMENT, L.L.C. AS DELEGEE OF ITS GENERAL PARTNER

Name: Brad Shamla
Title: Vice President, U.S. Operations
Dated:

Name: John Swanson
Title: Vice President, Major Projects, Execution
Date
Appendix 1

Enbridge Dual Pipelines Inspection and Operational Requirements Through Decommissioning
<table>
<thead>
<tr>
<th>Description</th>
<th>Existing Requirement</th>
<th>May 2017 Consent Decree Requirements</th>
<th>Proposed Requirements of Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Inspection</td>
<td>§195.412 Inspection of rights-of-way and crossings under navigable waters; inspect</td>
<td>Subsection VII.E., Paragraphs 68.c. and 68.f. require visual inspection of the pipelines by July 31, 2016 and at intervals not to exceed 24 months thereafter until termination of the Consent Decree.</td>
<td>Starting in 2024, visual inspection (ROV, AUV) of the lines once per calendar year, completed by July 31.</td>
</tr>
<tr>
<td></td>
<td>surface conditions at intervals not exceeding 3 weeks, but at least 26 times each</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>calendar year; except for offshore pipelines, inspect each crossing under a navigable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>waterway to determine the condition of the crossing at intervals not exceeding 5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Span Management Program</td>
<td>§195.110 External Loads- Provide support for anticipated external loads; supports</td>
<td>Current requirements are set forth under Subsection VII.E., Paragraph 68, and any modification thereto.</td>
<td>Consistent with Consent Decree requirements and to begin when Consent Decree ends.</td>
</tr>
<tr>
<td></td>
<td>must not cause excess localized stresses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline Movement Investigation</td>
<td>If a crack feature requiring repair is identified, Subsection VII.E., Paragraph 72</td>
<td>If a crack feature requiring repair is identified, Subsection VII.E., Paragraph 72 requires an investigation to determine whether the cause of cracking is related to pipeline movement; if so, Enbridge must develop and complete corrective measures as soon as practicable, but no later than 270 days after completing the investigation.</td>
<td>Consistent with Consent Decree requirements and to begin when Consent Decree ends.</td>
</tr>
<tr>
<td>Quarterly Inspection Using Acoustic Leak</td>
<td>Subsection VII.E., Paragraph 73 requires quarterly inspection using an acoustic tool</td>
<td>Subsection VII.E., Paragraph 73 requires quarterly inspection using an acoustic tool capable of detecting small leaks and, if a leak is found, requires shutdown, isolation and repair of the leaking line</td>
<td>Consistent with Consent Decree requirements and to begin when Consent Decree ends.</td>
</tr>
<tr>
<td>Detection Tool</td>
<td>capable of detecting small leaks and, if a leak is found, requires shutdown, isolation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Existing Requirements PHMSA - 49 CFR part 195</th>
<th>May 2017 Consent Decree\1 Req\1irements</th>
<th>Proposed Req\1, requirements State of. Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Testing</td>
<td>§195.452Q)(5)(ii)- Pressure test conducted in accordance with 49 CFR Part 195, Subpart E is an acceptable Integrity Assessment method</td>
<td>Subsection VII.C. requires submittal of testing plan and schedule to U. S.EPA and sets out specific test procedures; hydrostatic pressure testing of the Line 5 Dual Pipelines was successfully completed in 2017</td>
<td>Conduct hydrostatic pressure test or equally reliable alternative technology to confirm pipeline integrity and material strength in 2026</td>
</tr>
<tr>
<td>Cathodic Protection</td>
<td>§195.571- Cathodic protection must comply with NACE SP 0169, which requires protection levels of-850 mV (CSE)</td>
<td></td>
<td>Starting in 2024, maintain cathodic protection levels at or below -950 mV (CSE)</td>
</tr>
<tr>
<td>Close Interval Survey</td>
<td></td>
<td></td>
<td>Starting in 2024, conduct CIS once every year, not to exceed 15 months</td>
</tr>
<tr>
<td>Integrity Assessment Intervals</td>
<td>§195.452(j)(3) - Five years, not to exceed 68 months</td>
<td>Subsection VII.D.(VI) - For crack inspections, no more than one-half of the shortest remaining life of any unrepaired crack feature; for corrosion inspections, no more than one-half of the shortest remaining life of any corrosion feature; no more than five years</td>
<td>Starting in 2024, annual geometry, corrosion and circumferential crack inspections and assessments, using best available technology.</td>
</tr>
<tr>
<td>Temporary Pressure Reduction or Pipeline Shutdown</td>
<td>§195.452(h)(i) and (ii) - Pressure reduction based on calculated safe operating pressure of anomaly or, if this cannot be calculated, 80% of the highest sustained operating pressure in the 60 days prior to the ILI; use to provide safety for Immediate Repair Conditions and other repairs for which schedules cannot be met; notify PHMSA if pressure reduction will exceed 365 days</td>
<td>Subsections VII.D.(III), (IV) and (V) establish requirements and timing for identification of ILI report features requiring excavation based on calculated burst pressure, remaining life, and other unique characteristics, and for establishing pressure restrictions to provide safety until digs and repairs are complete</td>
<td>Consistent with Consent Decree requirements and to begin when Consent Decree ends.</td>
</tr>
<tr>
<td>Description</td>
<td>Existing Requirements</td>
<td>May 2017 Consent Decree Requirements</td>
<td>Proposed Requirement State of Michigan</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Schedules for Evaluation and Remediation of ILI-indicated Anomalies</td>
<td>See below</td>
<td>Subsection VII.D.(V) sets out criteria and timelines governing excavation, repair and imposition of pressure restrictions for crack features (Table 1, pp 55-56), corrosion features (Table 2, pp 60-62), dents and other geometric features (Table 4, pp 67-68), and intersecting or interacting feature types (Table 5, pp 70-71)</td>
<td>Consistent with Consent Decree requirements and to begin when Consent Decree ends.</td>
</tr>
<tr>
<td>• Metal loss greater than 80% of nominal wall regardless of dimensions</td>
<td>§195.452(h)(4)(i)(A) - Immediate Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
<tr>
<td>• Metal loss greater than 50% of nominal wall regardless of dimensions</td>
<td>New Requirement</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
<tr>
<td>• Calculated burst pressureless than established maximum operating pressure (MOP) at anomaly location</td>
<td>§195.452(h)(4)(i)(B) - Immediate Repair Condition - Suitable remaining strength calculation methods include, but are not limited to, ASME/ANSI 831G and PRCI PR-3-805 (R-STRENG)</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
<tr>
<td>• Dents</td>
<td>§195.452(h)(4)(i)(C)- Immediate Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pressure restriction of 80% of last 60-day high pressure.</td>
</tr>
<tr>
<td>• Calculated safe operating pressure less than established MOP at anomaly location</td>
<td>§195.452(h)(4)(ii)(C)-180-Day Repair Condition - Suitable remaining strength calculation methods include, but are not limited to, ASME/ANSI 831G and PRCI PR-3-805 (R-STRENG)</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
</tbody>
</table>
### Table: Existing and Proposed Requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Existing Requirements</th>
<th>May 2017 Consent Decree’ Requirements</th>
<th>Proposed Requirements State of Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>• An area of general corrosion with a predicted metal loss greater than 50% of nominal wall</td>
<td>§195.452(h)(4)(iii)(E)-180-Day Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
<tr>
<td>• Predicted metal loss greater than 50% of nominal wall that is located at a crossing of another pipeline, or is in an area with widespread circumferential corrosion, or is in an area that could affect a girth weld</td>
<td>§195.452(h)(4)(iii)(F)-180-Day Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and pipeline shutdown</td>
</tr>
<tr>
<td>• A potential crack indication that when inspected is determined to be a crack</td>
<td>§195.452(h)(4)(iii)(G)-180-Day Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition and follow Consent Decree requirements for crack remediation</td>
</tr>
<tr>
<td>• A gouge or groove greater than 12.5% of nominal wall thickness</td>
<td>§195.452(h)(4)(iii)(l)-180-Day Repair Condition</td>
<td></td>
<td>Starting in 2024, immediate Repair Condition</td>
</tr>
<tr>
<td>• Anomalies in addition to those listed above that could impair the integrity of the pipeline</td>
<td>§195.452(h)(4)(iv) - Other Repair Conditions - schedule for remediation as appropriate (per engineering analysis); see §195.452 Appendix C for guidance concerning other conditions to evaluate</td>
<td></td>
<td>Follow PHMSA requirements</td>
</tr>
</tbody>
</table>

### Immediate Repair Condition

Upon learning of an immediate repair condition indicated by in-line inspection, Enbridge agrees to make the condition safe by operating pressure reduction or pipeline shutdown (see Inspection and Operational Requirements Table), and to notify the State of the condition within 24 hours. Enbridge will proceed with planning, permitting, inspection, and necessary repair of the condition as expeditiously as practicable subject to permitting requirements and weather/ice conditions in the Straits of Mackinac. Once the feature is fully assessed, repaired or mitigated, Enbridge will notify the State and may return the pipeline to normal operating pressures.
Appendix C
**Most Recent Enbridge Financial Assurance Verification Form -**  
**Source; Enbridge, Inc’s 2019 10-Q2**

<table>
<thead>
<tr>
<th></th>
<th>Enbridge, Inc.</th>
<th>Availability (business days - estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash or cash equivalents</td>
<td>$ .525 billion</td>
<td>1 day</td>
</tr>
<tr>
<td>Credit Facility</td>
<td>$ 4.2 billion</td>
<td>1-3 days</td>
</tr>
<tr>
<td>(available liquidity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Resources available in 30-60 Days (explain)</td>
<td>$ 4.725 billion</td>
<td>30-60 days</td>
</tr>
<tr>
<td><strong>Total Short - Term</strong></td>
<td>$ 9.45 billion</td>
<td></td>
</tr>
</tbody>
</table>

**Insurance**  
$940,000,000  
(Comprehensive General Liability with sudden and accidental pollution liability coverage)

**Notes:**  
1. Converted dollar amounts from Canadian dollars to U.S. dollars - .75 conversion  
2. Assumed Enbridge, Inc. is a signatory  
3. Assuming specified insurance – Enbridge did not include their insurance in the 10-K  
4. Can’t find Enbridge Energy Partners, L.P.’s available credit facility availability in Enbridge, Inc.’s to 10-K’s credit facility
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash or cash equivalents</td>
<td></td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>Credit Facility (available liquidity)</td>
<td></td>
<td></td>
<td></td>
<td>1-3 days</td>
</tr>
<tr>
<td>Accounts receivable and other</td>
<td></td>
<td></td>
<td></td>
<td>30-60 days</td>
</tr>
<tr>
<td><strong>Total Short - Term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensive General Liability with sudden and accidental pollution coverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Impairment Liability Minimum of $25,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. If Enbridge, Inc. is a Signatory, then only the Enbridge Inc. column needs to be completed.
2. All non-insurance dollar amounts should be represented in U.S. dollars in billions.
3. Cash or cash equivalents can be located in the 10-K provided in Part 1, Section 1, Financial Statements: Consolidated Statement of Financial Positions.
4. Credit facility (available liquidity) can be located in the 10-K in Part 1, Section 1, Financial Statements: Debt, Credit Facilities.
5. Accounts receivable and other can be located in the 10-K in Part 1, Section 1 Financial Statements: Consolidated Statement of Financial Positions.
6. Specified insurance must be verified by the Certificate of Insurance which is signed by a state licensed insurance agent that holds a Charter Property and Casualty Underwriter professional designation.
### Sample Financial Assurance Verification Form For the Signatories Alone

This Sample was completed based on the last available 10-Q Report of the Signatories
As filed with the United States Securities and Exchange Commission in September 2018

| Current Signatories |  |  |  |  |
|---------------------|-----------------|-----------------|-----------------|
| **Document** | Not Filed with the U. S.SEC | Not Filed with the U. S.SEC | 2018 10-Q3 |
| **Cash** | Not Available | Not Available | $ |
| **Credit Facility (Available Liquidity)** | Not Available | Not Available | $ |
| **Other Resources Available (30-60 days)** | Not Available | Not Available | $ |
| **Total Short-Term** |  |  |  |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insurance</strong></td>
<td>Not available to verify in the Enbridge Partners 10-K</td>
</tr>
</tbody>
</table>

**Notes:**

1. This is what a 2018 Financial Assurance Verification Form from the Signatories would have looked like based on the last available 10-K reports of the Signatories.
2. The last financial report of any of the Signatories was filed with the SEC was from September 2018.
3. Amounts shown are converted from Canadian dollars to U.S. dollars - .75 conversion
4. Amounts are in millions
Appendix D
Curriculum Vitae
David J Dybdahl Jr. CPCU, ARM, MBA
July 1, 2019

Personal Information
Address
4901 Pinecone Circle
Middleton, Wisconsin 53562

Contacts
Direct line (608) 836-9567
Mobile (608) 513-6101
Home (608) 798-1676
E-mail dybdahl@amr.net

II. Work Experience
1999 to Present
American Risk Management Resource Network, LLC. Principal,
ARMR.Network is a specialty environmental insurance brokerage firm and Managing General Agency with underwriting authority of $5,000,000. Our customized insurance products are sold through hundreds of insurance agencies in the United States and Canada. Over the past 32 years I have worked on the placement of literally thousands of environmental insurance policies both as the placing broker and as the Global Environmental Practice Leader of Willis, the third largest insurance brokerage firm in the world.

Insurance and risk management consulting assignments at ARMR.Network include; providing risk management support services to county and state governments on oil pipelines, writing the insurance specifications and conducting the insurance compliance reviews for the bidders on five hundred million dollars of fixed price environmental remediation services, serving as an expert witness on disputed environmental insurance claims with amounts in dispute totaling over 2.3 billion dollars, compiling the history of the environmental insurance market complete with reconstructive pricing and underwriting guidelines for individual risks from 1980 to date, creating business plans for environmental insurance sales in insurance brokerage firms, developing new insurance products complete with policy forms, pricing models and underwriting guidelines, environmental risk management consulting on insurance issues associated with mold damages, proof of financial responsibility financial product efficacy analysis for the federal government, facilitating culture change in insurance brokerage operations and internet based knowledge sharing platforms.


1999 to Present
The Society of Environmental Insurance Professionals, Founder
The Society of Environmental Insurance Professionals was created in 1999 to enhance the use of environmental insurance as a risk management tool. I created the organization by developing the business plan and soliciting the cooperation and financial support from the leading underwriters and brokers of environmental insurance. ERRA produces educational seminars on current environmental risk management issues, produces newsletters, and hosts an internet based environmental risk resources library.

ERRA is a federally registered not for profit 501, c. 3. educational organization and has been approved in over thirty states for continuing education credits in insurance and law.
2002 International Risk Group, President
IRG is the insurance branch of a leading brownfield development corporation.

2001 Aon, Mid West Environmental Insurance Director
I worked as an environmental risk management resource in the environmental practice of the second largest insurance brokerage firm in the world.

1990 to 1999
Willis Global Environmental Practice, Managing Director
I created the first functioning fully staffed environmental resource group in a major brokerage firm. The Willis Environmental Practice served as a technical resource to the insurance brokers of Willis. Our activities in the environmental practice included broker training, joint client calls, gathering market intelligence, assembling pricing benchmarks, trouble shooting on difficult insurance placements and claim issues, managing insurance company relationships, and quality assurance on hundreds of environmental insurance placements. Over this time period the Global Environmental Practice at Willis produced over $250,000,000 in environmental insurance premiums for thousands of clients.

Willis pioneered the development of multi-disciplined technical resource supported environmental insurance Practice Group in the insurance brokerage business. Employing environmental engineers, lawyers, industrial hygienists and environmental insurance experts, the Environmental Practice was able to deliver specialized environmental risk management expertise to the field offices, which enabled Willis brokers to develop innovative solutions to complex environmental risk management problems.

During this time frame the book of environmental business grew from less than one million dollars in commissions in 1990 to over fourteen million dollars in 1999. The Willis environmental practice consistently outperformed the overall environmental insurance industry in terms of growth on an annual basis. The basic design of the multi-disciplined resource supported environmental practice has set the standard for the insurance brokerage industry and has been copied by the major competitors of Willis. Significant environmental insurance placement innovations that were pioneered in the Willis Environmental Practice between 1990-1999 included designing and placing the insurance on the Clean-Up of Chernobyl on a wrap up for contractors working for the World Bank in London, designing the first contractor controlled, fully insured liability buy out for a superfund site, insuring the Clean-Up of the Oak Ridge, TN. nuclear weapons facility for Bechtel, insuring the Clean-Up of the Hanford, WA nuclear weapons facility for Fluor Daniel, insuring the design professional liability and environmental liabilities of the Los Angeles County Mass Transit Authority subway/light rail construction project and designing and implementing the first contract specific, fully cost reimbursed environmental liability insurance wrap up programs for EPA superfund contractors.

1998 to 1999
Willis Corroon America, Chief Knowledge Officer
I worked on a team to create a corporate knowledge sharing culture and intranet platform at Willis. In this role I was the corporate staff person in charge of coordinating all of the specialty Practice Groups within the firm. As the Chief Knowledge Officer, I served on the twenty person executive committee of Willis Corroon Americas.

1983 to 1990
Corroon and Black, Insurance Brokers, Vice President
As a retail insurance broker in Milwaukee, Wisconsin I built and serviced a multi-line book of commercial insurance business. Most accounts were in the environmental services sector with a particular emphasis on EPA Superfund contractors and waste transporters.

From 1985 through 1989 I qualified for the “Exceptional Producer” award, the company’s highest sales performance award. Only 1% of the sales force qualified for this award in five consecutive years.

In 1986 I developed the first professional liability insurance policy to specifically insure environmental loss exposures for engineers working on environmental remediations.
In 1986 I pioneered the development of the Contractors Pollution Liability product line working as a consultant to the EPA’s Superfund Contractors Indemnification Task Force.

1982 to 1983  
**Frank B Hall, Insurance Broker, Producer**  
This was an all lines insurance production position. I specialized in group programs for environmental insurance.

1980 to 1982  
**Risk Treatment Services, Consultant**  
RTS performed captive management services for twelve Colorado based captive insurance companies. My responsibilities there included review of state financial filings for insurance company operations and feasibility studies.  
As an insurance consultant to Johns Manville in asbestos litigation in 1981 I reconstructed their insurance program from 1932 to 1980 and answered interrogatories for the ensuing insurance coverage litigation. Insurance archiving for historical insurance coverage on toxic tort claims later became a profession onto itself.

**III. Recent Consulting, Expert and Fact Assignments**

Review the procurements of Fixed Price Remediation’s for the U.S. Army Environmental Center. The contract value was $500,000,000. Washington DC and Omaha.

Develop a business plan to create a specialty wholesale insurance broker on a national scale, projects in Colorado and Illinois.

Insurance Product Development: develop risk evaluation models, design insurance policy forms and underwriting guidelines for environmental insurance covering mold and products liability related damages. New York.

Evaluated cost proposals for fixed price remediation insurance packages, private clients in Texas and California

Expert on insurance coverage issues related to cost cap/stop loss environmental insurance policies, two cases, New Jersey/ California

The availability and pricing of environmental insurance on a property transfer in 1995, Illinois

The availability of environmental insurance from 1987 to 1995 for insurance recovery allocations on uninsured years, Alabama

The availability of environmental insurance from 1987 to 1997 for uninsured years, Washington

The availability of environmental insurance on a property transfer in 1997 and 1998, risk advisor’s professional liability claim for $189,000,000, California

Environmental insurance coverage and cost comparison between bidders for a brownfield development, premiums ranged from $14,000,000 to $90,000,000, California

Analyze carrier insolvency and the efficacy of proof of financial responsibility mechanisms. Washington, DC, U.S. Environmental Protection Agency/ U.S. Department Of Justice

Analyze the efficacy of proof of financial responsibility mechanisms. Washington, DC U. S.EPA/U. S.DOJ, California Solid Waste Board
Alleged brokerage negligence in the procurement of closure and long-term care insurance. South Carolina

Defend alleged broker negligence in the procurement of environmental insurance. California, Missouri, Florida

Provide insurance coverage litigation support for a disputed cost cap insurance claim. Federal Court, New York, Insurance coverage litigation support on a cost cap policy Illinois, Engineers Professional Liability insurance coverage litigation, New Jersey.

Provide expert risk management testimony on a pipeline in Wisconsin and Minnesota

IV. Expert Witness Cases

McClandless Fuels, Inc.
v.
Progressive Fuels, Inc., et al.
April 2001
Superior Court, New Jersey Law Division, Gloucester County Docket No. C-107-91
For the defense, on the availability of the environmental insurance.

Steadfast Insurance Company
v.
Santa Clarita, LLC.
May 2001
Superior Court of the State of California, County of Los Angles
For the defense, as a witness provided by the insurance broker.

South Carolina Department of Health
v.
Commerce and Industry Insurance Company, et al.
December 2002
U.S. District Court for the District of South Carolina, Charleston Division
For the plaintiff, coverage under GL policies for proof of financial responsibility certificates of insurance.

Illinois Department of Transportation
v.
Harris Bank Barrington, NA. et al.
Cook County Illinois, Case no. 99 L 51227
October 2002
For the Plaintiff, Estimate the cost of environmental insurance in prior years.

Frazier Exton Development, LP
v.
Kemper Environmental, et al.
U.S. District Court, New York,
Manhattan September 2003
For the Defense, the coverage provided in an environmental insurance policy

Safety-Kleen Corporation, et al.
v.
MIMS International, Inc
March 2003
U.S. District Court for the District of South Carolina, Columbia Division
For the plaintiff, Insurance company solvency issues on proof of financial responsibility.
Global Oil Production, LLC.
v. Evanston Insurance Company et al.
December 2003
Superior Court of Los Angeles, Central District
For the defense, Insurance agent professional liability.

David A. Jungerman
v.
Neal S. Clevenger
v.
Oliver Insurance Agency, Inc. et al.
December 2003
Circuit Court of Jackson County, Missouri, at Independence
For the defense, Insurance agent professional liability.

Safety-Kleen Corp., et al.
v. MIMS International Inc. (D.S.C.)
Expert for the plaintiff regarding the availability of financial assurance insurance for hazardous waste sites
March 2004

Indian Harbor Insurance Company
v.
The Lampson & Sessions Co.
United States District Court
Southern District of New York
03-CV-9861 (JGK)
For the defense regarding errors in a rewritten policy form being transferred to a new insurance company.
June 2005

Ispat Inland Inc
v.
Kemper Environmental, Ltd.
For the defense regarding the application process for environmental insurance
October 2006

Southern New Jersey Rail Group
v.
Lumbermans
Civ. No 06-4946
Witness for the defense regarding a denied loss based on the extension of a policy term

Republic Services, Inc.
v.
American International Specialty Lines Insurance Company
United States District Court
Southern District of Florida
Ft. Lauderdale Division
Case Number 07-21991
Expert for the plaintiff in a denied claim involving environmental insurance on a landfill.
February 2009

Rogers Corporation
v.
Chartis Specialty Insurance
January 2014
For the Defense, The covered loss under the Pollution Legal Liability policy.

NYSEG
v.
Century
Expert for the defense on historical Environmental Insurance Availability
March 2016

Hexcel Corporation
v.
Allianz Underwriters Insurance Company
Expert for the defense on historical Environmental Insurance Availability
March 2016

Illinois Union Insurance Company
v.
Sunflower Development, LLC
Expert for the plaintiff to explain how remediation stop loss and environmental impairment liability insurance interface
May 2016

LIU International Underwriters
v.
Texas Brine
Expert for the plaintiff determining if underlying insurance policies were paid to the attachment point
November 2016

Indian Harbor Insurance Company
v.
Texas Brine
Expert for the plaintiff in a denied claim involving environmental insurance on a Brine Storage Pit
November 2016

King County
v.
Travelers Et. AL
Expert for the defendant on the availability of historic Environmental Insurance
February 2019

Novum Structures, LLC
v.
Aon Risk Services Central, Inc
Expert for the defendant in a denied claim involving the purchase of appropriate insurance coverage
June 2019
V. Publications

R&R Magazine, Insuring Your Risk in Master Service Agreements, May 13, 2019

International Risk Management Institute, Avoid Common Errors with Environmental Risks and Insurance, April 2019

The Rough Notes Company, Inc., Environmental Impairment Liability, February 26, 2019

International Risk Management Institute, Avoid Insurance Broker Professional Liability Losses from Environmental Risk, January 2019

R&R Magazine, Today’s Insurance Market for Restoration and Remediation Contractors, January 1, 2019

The Rough Notes Company, Inc., Opportunities in Contractors Pollution Liability, December 28, 2018

The Rough Notes Company, Inc., The Longest Exclusion, October 29, 2018

R&R Magazine, Managing the Risks in Master Service Agreements, Part 1, October 18, 2018

ASLI 164, Surplus Lines Insurance Products, 4th ed., 2018

R&R Magazine, Claim Frequency Kills Part 2, August 2018

R&R Magazine, Claim Frequency Kills Part 1, July 2018

International Risk Management Institute, The Sudden and Accidental Pollution Coverage Myth, June 2018

International Risk Management Institute, Insuring Farmers for Environmental Damage Claims, March 2018

International Risk Management Institute, Insuring Indoor Environmental risks in Commercial Property, January 2018

CPCU 520, Commercial Liability Insurance and Risk Management, 3rd ed., 2017

International Risk Management Institute, Avoiding Insurance Coverage Litigation for Pollution Losses, September 2017

International Risk Management Institute, Mold Tops Environmental Impairment Policy Claims, June 2017

R&R Magazine, CAT Claims: Financial Ruin or Financial Success, April 2017

International Risk Management Institute, Avoid Common Mistakes That Lead to Uninsured Environmental Loss, March 2017


International Risk Management Institute, Environmental Risks and Insurance: Looking Back and Forward, January 2017


International Risk Management Institute, Changing Environmental Insurers: Use Caution, October 2016


International Risk Management Institute, A Big Picture on Environmental Insurance, July 2016
R&R Magazine, Knowing the Risks & reaping the Rewards of Biohazard Cleanup, July 2016


IA Magazine, 8 Environmental Coverage Mistakes-and How to Avoid Them, January 2016


International Risk Management Institute, Environmental Insurance: Just the Facts, October 2015

R&R Magazine, The Bright Future of Roofing Restoration, October 2015

International Risk Management Institute, A User's Guide to Pollution Exclusions and Environmental Insurance, September 2015


International Risk Management Institute, Avoiding Common Insurance Certificate Errors, July 2015


R&R Magazine, How to Get Paid When Lenders Are Loss Payees, March 2015

International Risk Management Institute, State Supreme Court Changes the Game on Pollution Exclusions and Environmental Insurance, March 2015

IA Magazine, Pollution Exclusions Hit the Family Farm, February 2015

R&R Magazine, Insuring Bio-Remediation Work, January 2015


International Risk Management Institute, Insurance Coverage for Losses Arising from the Ebola Virus, December 2014

R&R Magazine, The Super Bright Future of Restoration Contracting, October 2014

R&R Magazine, Roof Repair Leads to $1 Million Mold Claim: An Insurance Claim Case Study, October 2014

Property Casualty 360, What Every Adjuster Should Know About Fungi/Bacteria Exclusions, September 2014

International Risk Management Institute, Contractors Environmental Liability Insurance: Claims-Made versus Occurrence, July 2014
International Risk Management Institute, Common Myths about Contractors Environmental Insurance, June 2014


International Risk Management Institute, Rational CPL Insurance Specifications, March 2014


International Risk Management Institute, Contractual Risk Transfer for Contamination Risks, January 2014

ASLI 164, Surplus Lines Insurance Products, 2nd ed., 2013

R&R Magazine, Beware! Your Category 3 Water Jobs Are Likely Uninsured, November 2013

R&R Magazine, A Two-Step Solution to Managing the Risk of Subcontractors, September 2013

International Risk Management Institute, Revealing the Dark Secrets of Category 3 Water Exclusions, September 2013


R&R Magazine, Tis' the Season for Insurance Renewal, November 2012

R&R Magazine, Helping with the Hurricane Sandy Aftermath? Here's Insurance Information You Need to Know, November 2012


R&R Magazine, Managing Risks in Contracts, July 2012

Brownfields Insurance Article, History and Uses of Environmental Risk Insurance, July 2012

R&R Magazine, Marketing Your Restoration Business through Claims Networks, May 2012


R&R Magazine, Are You Feeling Lucky? November 2011

R&R Magazine, A perfect Insurance Storm is Brewing: Brace for a Wild Ride, May 2011

Environmental Claims Journal, Dirt is a Pollutant, Water is too! March 2011
ARM 55, Risk control, 1st ed., 2005

Cleaning Specialist Magazine, Insurance and the Restoration Contractor, April 2005

Cleaning Specialist Magazine, Mold Forces Restoration Contractors to Face a New insurance Reality, March and April 2005 editions


Associate in Risk Management textbook, I was the contributing author on the Environmental Loss Control chapter, which is part of the course material for the Associate in Risk Management professional designation revised in 2005.


CPCU Agent and Broker Solutions, Mold Exclusions + Broker E and O Exposure, June/ August/September 2003 editions

Journal of Property Management, Under Coverage, Mold and Terrorism Exclusion’s, May /June 2003


Coverage Corner, Environmental Impairment Liability, Society of Environmental Insurance Professionals, Spring 2001

The Effects of Technology on Traditional Roles and Relationships in the Insurance Industry, CPCU Society, 1999, Information Technology Section


Institute of Inspection, Cleaning and Restoration Certification, 1999


John Liner Review, Pollution Exclusions and Environmental Insurance, 1994

Associated General Contractors Environmental Risk Management Handbook, Insurance Issues chapter, 1993


Risk Management Magazine, Action-Reaction, Why the insurance industry will not be able to avoid superfund claims with new pollution exclusions. 1987
I am widely quoted as an authority in environmental insurance and have been quoted in the Wall Street Journal, New York Times, Business Insurance, National Underwriter, Independent Agent, Rough Notes and numerous other trade publications.

VI. Educational Background

<table>
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<tr>
<th>School Attended</th>
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<th>Year</th>
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<tr>
<td>The National Alliance</td>
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<td>American Institute For CPCU</td>
<td>Chartered Property and Casualty</td>
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<tr>
<td>Insurance Institute of America</td>
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<td>ARM*</td>
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<td>University of Wisconsin Madison</td>
<td>Risk Management and Finance</td>
<td>MBA</td>
<td>1981</td>
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<td></td>
<td>BBA</td>
<td>1978</td>
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* I have since become the contributing author of the textbook materials on environmental insurance and risk management for these courses. The original course materials with edits have been used in over 30 text books on insurance
** I created the environmental risk management and insurance module for the liability insurance and risk management course in the School of Business at UW-Madison. I have presented this lecture at the UW for thirty-two consecutive years.

Recent Professional Development Courses Attended

Certified Insurance Counselor 3 day courses; Insurance Company Operations, Property Insurance, Liability Insurance, Package Insurance Products,

Society Of Environmental Professionals annual meetings, 2016, 2017, 2018, 2019


University of Wisconsin-Madison, College of Engineering, Adjusting water damage claims with an Emphasis on Mold, 2003

Milwaukee School of Engineering,
Mold-Contamination of Buildings: Causes and Related Insurance and Legal Issues December 2002

University of Wisconsin-Madison, College of Engineering
Mold Related Problems in Buildings, November 2002, April 2003
VII. Teaching Positions and Lectures

Insurance Agent Professional Errors and Omissions Risk Management, Independent Insurance Agents and Brokers of America/ Swiss Re approved instructor

Faculty of the National Alliance for Insurance Education & Research

University of Wisconsin School of Business, Guest lecturer 1981-2019

Insurance Agent Continuing Education approved provider in multiple states 2000-current

CPCU, Instructor, Accounting and Finance, 1985, 1986, (National award winning)

Denver College, Introduction to Accounting, 1982

Lectures (not a comprehensive list, I have presented over 400 lectures at conferences and for insurance agents, architects and lawyers continuing education credits)

Unbelievable Fantastic Fun With Pollution Exclusions; National Alliance Advanced Rubles Mega Seminar 2019

Environmental Risk Management and Insurance, University of Wisconsin-Madison school of Business Sustainability Risk Management course, 2008-2019

Sustainability Risk Management; Risk and Insurance Management Society annual meeting 2008


Wisconsin Associated General Contractors seminars, Mold Related Insurance issues, February, September 2003


University of Wisconsin- Extension, Madison, College of Engineering, four guest lectures on environmental insurance and risk management issues related to water intrusion in buildings.

EPA-National Brownfields Convention, 2002, the Use of Environmental Insurance in Environmental Legacy Solutions

CPCU, National Teleconference- E-Commerce and the Insurance Industry

University of Wisconsin-Madison, Business School, Risk Management and Insurance Department, I have been a guest lecturer for twenty-eight consecutive years on environmental risk management topics.

Vanderbilt University, MBA Course, Environmental Insurance and Risk Management, four presentations

Risk and Insurance Management Society (RIMS) National Conventions, nine presentations. Rims local chapters, five presentations. In 2007 the first presentation to national RIMS on the topic of Sustainability Risk Management.
Managing Mold Risks in a Post Exclusion Era

VI. Insurance Industry Committees

Lead environmental insurance resource for the 234,000-member Independent Insurance Agents and Brokers Association

Member of the Board of Directors of the 55,000+ member Institute of Inspection Cleaning and Restoration Certification

Chairman of the National Association of Insurance Brokers, Environmental Sub Committee on Superfund reform.

Participant in the U. S.EPA insurance industry committee on Pollution Liability

Lead Member of the U. S. EPA Superfund Contractor Indemnification Task Force
This work lead to the development of the Contractor Pollution Liability line of insurance

CPCU, National Public Relations Committee Task Force 2007 and Milwaukee Chapter, Public Relations Director, (National Award Winning 1982)
Appendix E

Recommended Insurance Requirements

And

Certificate of Insurance
Recommended Liability Insurance Requirements

The master insurance program for all of the Enbridge Inc operations may be used to fulfill this insurance requirement for $900,000,000 U.S. of the specified liability insurance coverages as detailed below.

Any combination of Comprehensive General Liability Insurance with coverage for sudden and accidental pollution liability and Environmental Impairment Liability (EIL) Insurance can be utilized to attain the $900,000,000 of coverage for Line 5 at the Straits. However, within the $900,000,000 of liability insurances there must be a minimum of $25,000,000 of EIL coverage on Line 5 at the Straits.

If loss payments and reserved amounts from claims reported during the policy term lead to remaining recoverable limits of less than $300,000,000 on Line 5, notice of insufficient liability insurance limits remaining must be supplied to the Certificate of Insurance holder.

The recoverable limits of liability insurance for a loss on Line 5 at the Straits at any point in a policy term shall at a minimum be $300,000,000. Within the $300,000,000 a minimum of $25,000,000 shall be EIL insurance.

If Enbridge, Inc. at any point in time fails to carry Comprehensive General Liability insurance with coverage for sudden and accidental pollution liability as an exception to the pollution exclusion f., Enbridge, Inc. must carry Environmental Impairment Liability insurance on Line 5 at the Straights in the amount of at least $300,000,000 in limits of Liability.

Comprehensive General Liability Insurance With Coverage For Sudden and Accidental Pollution Liability

Coverage must be provided on the COMPREHENSIVE GENERAL LIABILITY policy form as shown in Appendix F or its equivalent.


Coverage shall apply to the premises, operations, products and completed operations of Line 5.

Coverage shall be provided for Bodily Injury Liability, Property Damage Liability and Defense costs.

Any restrictive base endorsements to the policy specifically pertaining to Line 5 shall be disclosed on the Certificate of Insurance and a copy of the endorsement that restricts coverage shall be attached to the Certificate of Insurance.

Exclusion f. pollution in the standard ISO Comprehensive General Liability insurance policy form in Appendix F. cannot be altered by endorsement to the policy.
Insurance must be provided by an insurer with an A.M. Best’s rating of at least A, XIII or as approved by The State of Michigan. Beginning at a self-insured retention of no more than $50,000,000 per loss, the insurance companies providing this insurance cannot be controlled, owned or operated by Enbridge entities.

The policy shall provide contractual liability coverage.

Coverage shall be extended by endorsement to The State of Michigan as an Additional Insured.

This insurance shall be Primary and Non-contributory to any insurance The State of Michigan may have available.

Any rights of subrogation against the State of Michigan shall be waived.

The policy cannot contain an “Insured vs. Insured” exclusion applying to the State of Michigan as an Additional Insured.

The policy shall obligate the insurer through a “notice of cancellation or non-renewal” endorsement to provide 60 days’ notice of cancellation or nonrenewal to the Certificate of Insurance holder in the State of Michigan.

**Environmental Impairment Liability Insurance**

Environmental Impairment Liability Insurance, Site Pollution Liability Insurance or the equivalent.

Insured Location: The Line 5 dual pipelines and connected terminals at the Straits of Mackinac.


Coverage shall not contain any exclusions or limitations of coverage for specific pollutants or contaminants found in petroleum products.

If the policy is written on a “Claims Made” basis the “retro date” on the policy must be set to the beginning of inception date of the first policy purchased. The “retro date” cannot be advanced on subsequent renewals of the coverage.

Insurance must be provided by an insurer with an A.M. Best’s rating of at least A, XII or as approved by the State of Michigan. The insurance companies providing this insurance cannot be controlled, owned or operated by Enbridge.
Coverages to be included:

- On and Off-site Clean-up expenses
- Damages to Natural Resources
- Emergency response cost to at least $5,000,000
- Bodily Injury Liability
- Property Damage Liability
- This coverage can be excess over other valid and collectable insurance and the deductible or self-insured retention amounts of any valid and collectable underlying insurances

Minimum Limit of Liability: $25,000,000 per loss (U.S. Dollars)

If a policy covering more locations than Line 5 at the Straits of Mackinac is utilized to fulfill this insurance requirement, the policy shall have a reinstatement of limits purchase option of $25,000,000 or an annual aggregate of $50,000,000. This coverage extension may be limited to apply only to Line 5 at the Straits of Mackinac.

The policy shall obligate the insurer through a “notice of cancellation or non-renewal” endorsement to provide 60 days’ notice of cancellation or nonrenewal to the Certificate of Insurance holder in the State of Michigan.

The policy shall have coverage for contractual liability and the State of Michigan shall be an additional insured.

This insurance shall be Primary and Non-contributory to any insurance The State of Michigan may have available.

Any rights of subrogation against The State of Michigan shall be waived.

The policy cannot contain an “Insured vs. Insured” exclusion applying to The State of Michigan as an Additional Insured.

The maximum self-insured retention on this policy shall be $5,000,000 and the recoverable full limits of liability shall be excess of the self-insured retention.

The EIL coverage can be excess coverage over other valid and collectable insurance available to Enbridge.

**Evidence of Insurance**

Within 10 days of the renewal of its liability insurance, Enbridge shall furnish a certificate of insurance which exactly matches the sample Certificate of Insurance shown below.

This Certificate of insurance shall be signed by a licensed insurance producer who holds the Chartered Property and Casualty Underwriter (CPCU) professional designation.
The items detailed below can be included on an Acord 101 Form.


There are no special exclusions to the standard policy form pertaining to Line 5 at the Straits of Mackinac.

The State of Michigan is included as an additional insured.

**COVERAGE**

- **Environmental Impairment Liability**
  - TBD
  - TBD

**LIMITS**

- Each Occurrence: $900,000,000
- Aggregate: $900,000,000

**EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.**

**IMPORTANT:** If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed.

**IF SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).**

**CERTIFICATE OF LIABILITY INSURANCE**

**DATE (MM/DD/YYYY):**

**INSURED**

- **Named Insured**
  - Address

**INSURER(S) AFFORDING COVERAGE**

- **INSURER A:** Company A
- **INSURER B:** Company B
- **INSURER C:**
- **INSURER D:**
- **INSURER E:**
- **INSURER F:**

**CERTIFICATE HOLDER CANCELLATION**

**CANCELLATION**

- **Director**
  - Department of Natural Resources
  - Executive Division
  - P.O. Box 30028
  - Lansing, MI 48909

**SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.**

**AUTHORIZED/REPRESENTATIVE**

The must be signed by a Licensed Insurance Producer holding a CPCU Professional Designation and so noted.

**DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)**

- The State of Michigan is included as an additional insured.
- There are no special exclusions to the standard policy form pertaining to Line 5 at the Straits of Mackinac.

**CERTIFICATE HOLDER**

- **Person Completing Certificate**
- **Insurer:**
  - INSURER A: Company A
  - INSURER B: Company B
  - INSURER C:
  - INSURER D:
  - INSURER E:
  - INSURER F:

**ADDRESS:**

- **Phone:**
- **Fax:**

**Policy Limits**

- **Commercial General Liability**
  - Each Occurrence: $900,000,000
  - Aggregate: $900,000,000

- **Auto Liability**
  - Bodily Injury (Per person): $900,000,000
  - Bodily Injury (Per accident): $900,000,000

- **Umbrella Liability**
  - Each Occurrence: $900,000,000

- **Workers’ Compensation and Employers’ Liability**
  - E.L. Each Accident: $25,000,000
  - E.L. Disease - E. Employee: $25,000,000
  - E.L. Disease - Policy Limit: $25,000,000
Appendix F
COMPREHENSIVE GENERAL LIABILITY INSURANCE

I. COVERAGE A — BODILY INJURY LIABILITY

The company will pay on behalf of the insured all sums which the insured shall become legally obligated to pay as damages because of

A. bodily injury or

B. property damage

COVERAGE B — PROPERTY DAMAGE LIABILITY

The company will pay on behalf of the insured all sums which the insured shall become legally obligated to pay as damages because of

A. bodily injury or

B. property damage

to which this insurance applies, caused by an occurrence, and the company shall have the right and duty to defend any suit against the insured seeking damages on account of such bodily injury or property damage, even if any of the allegations of the suit are groundless, false or fraudulent, and may make such investigation and settlement of any claim or suit as it deems expedient, but the company shall not be obligated to pay any claim or judgment or to defend any suit after the applicable limit of the company’s liability has been exhausted by payment of judgments or settlements.

Exclusions

This insurance does not apply:

(a) to liability assumed by the insured under any contract or agreement except an incidental contract; but this exclusion does not apply to a warranty of fitness or quality of the named insured’s products or a warranty that work performed by or on behalf of the named insured will be done in a workman-like manner;

(b) to bodily injury or property damage arising out of the ownership, maintenance, operation, use, loading or unloading of

(1) any automobile or aircraft owned or operated by or rented or loaned to any insured, or

(2) any other automobile or aircraft operated by any person in the course of his employment by any insured;

but this exclusion does not apply to the parking of an automobile on premises owned by, rented to, or controlled by the named insured or the ways immediately adjoining, if such automobile is not owned by or rented or loaned to any insured;

(c) to bodily injury or property damage arising out of

(1) the ownership, maintenance, operation, use, loading or unloading of any mobile equipment while being used in any prearranged or organized racing, speed or demolition contest or in any stunt- ing activity or in practice or preparation for any such contest or activity or (2) the operation or use of any snowmobile or trailer designed for use therewith;

(d) to bodily injury or property damage arising out of and in the course of the transportation of mobile equipment by an automobile owned or operated by or rented or loaned to any insured;

(e) to bodily injury or property damage arising out of the ownership, maintenance, operation, use, loading or unloading of

(1) any watercraft owned or operated by or rented or loaned to any insured, or

(2) any other watercraft operated by any person in the course of his employment by any insured;

but this exclusion does not apply to watercraft while ashore on premises owned by, rented to or controlled by the named insured;

(f) to bodily injury or property damage arising out of the discharge, dispersal, release or escape of smoke, vapors, aerosol, fumes, acids, alkalis, toxic chemicals, liquides or gases, waste materials or other irritants, contaminants or pollutants into or upon land, the atmosphere or any water course or body of water; but this exclusion does not apply if such discharge, dispersal, release or escape is sudden and accidental;

(g) to bodily injury or property damage due to war, whether or not declared, civil war, insurrection, rebellion or revolution or to any act or condition incident to any of the foregoing, with respect to

(1) liability assumed by the insured under an incidental contract, or

(2) expenses for first aid under the Supplementary Payments provision;

(h) to bodily injury or property damage for which the insured or his indemnitee may be held liable

(1) as a person or organization engaged in the business of manufacturing, distributing, selling or serving alcoholic beverages, or

(2) if not so engaged, as an owner or lessor of premises used for such purposes, if such liability is imposed

(i) by, or because of the violation of, any statute, ordinance or regulation pertaining to the sale, gift, distribution or use of any alcoholic beverage, or

(ii) by reason of the selling, serving or giving of any alcoholic beverage to a minor or to a person under the influence of alcoholic beverage or which causes or contributes to the intoxication of any person;

but part (ii) of this exclusion does not apply with respect to liability of the insured or his indemnitee as an owner or lessor described in (2) above;
to any obligation for which the insured or any carrier as his insurer may be held liable under any workmen's compensation, unemployment compensation or disability benefits law, or under any similar law;

(j) to bodily injury to any employee of the insured arising out of and in the course of his employment by the insured or to any obligation of the insured to indemnify another because of damages arising out of such injury; but this exclusion does not apply to liability assumed by the insured under an incidental contract;

(k) to property damage to

   (1) property owned or occupied by or rented to the insured;

   (2) property used by the insured, or

   (3) property in the care, custody, or control of the insured or as to which the insured is for any purpose exercising physical control;

but parts (2) and (3) of this exclusion do not apply with respect to liability under a written sidetrack agreement and part (3) of this exclusion does not apply with respect to property damage (other than to elevators) arising out of the use of an elevator at premises owned by, rented to, or controlled by the named insured;

(l) to property damage to premises alienated by the named insured arising out of such premises or any part thereof;

(m) to loss of use of tangible property which has not been physically injured or destroyed resulting from

   (1) a delay in or lack of performance by or on behalf of the named insured of any contract or agreement, or

   (2) the failure of the named insured's products or work performed by or on behalf of the named insured to meet the level of performance, quality, fitness or durability warranted or represented by the named insured;

but this exclusion does not apply to loss of other tangible property resulting from the sudden and accidental physical injury to or destruction of the named insured's products or work performed by or on behalf of the named insured after such products or work have been put to use by any person or organization other than an insured;

(n) to property damage to the named insured's products arising out of such products or any part of such products;

(o) to property damage to work performed by or on behalf of the named insured arising out of the work or any portion thereof, or out of materials, parts, or equipment furnished in connection therewith;

(p) to damages claimed for the withdrawal, inspection, repair, replacement, or loss of use of the named insured's products or work completed by or for the named insured or of any property of which such products or work form a part, if such products, work or property are withdrawn from the market or from use because of any known or suspected defect or deficiency therein;

(e) to property damage included within:

   (1) the explosion hazard in connection with operations identified in this policy by a classification code number which includes the symbol "x";

   (2) the collapse hazard in connection with operations identified in this policy by a classification code number which includes the symbol "c";

   (3) the underground property damage hazard in connection with operations identified in this policy by a classification code number which includes the symbol "u".

II. PERSONS INSURED

Each of the following is an insured under this insurance to the extent set forth below:

(a) if the named insured is designated in the declarations as an individual, the person so designated but only with respect to the conduct of a business of which he is the sole proprietor, and the spouse of the named insured with respect to the conduct of such a business;

(b) if the named insured is designated in the declarations as a partnership or joint venture, the partnership or joint venture so designated and any partner or member thereof but only with respect to his liability as such;

(c) if the named insured is designated in the declarations as other than an individual, partnership, or joint venture, the organization so designated and any executive officer, director, or stockholder thereof while acting within the scope of his duties as such;

(d) any person (other than an employee of the named insured) or organization while acting as real estate manager for the named insured; and

(e) with respect to the operation, for the purpose of locomotion upon a public highway, of mobile equipment registered under any motor vehicle registration law,

   (i) an employee of the named insured while operating any such equipment in the course of his employment, and

   (ii) any other person while operating with the permission of the named insured any such equipment registered in the name of the named insured and any person or organization legally responsible for such operation, but only if there is no other valid and collectible insurance available, either on a primary or excess basis, to such person or organization;

provided that no person or organization shall be an insured under this paragraph (e) with respect to:

(1) bodily injury to any fellow employee of such person injured in the course of his employment, or

(2) property damage to property owned by, rented to, in charge of or occupied by the named insured or the employer of any person described in subparagraph (ii).
This insurance does not apply to bodily injury or property damage arising out of the conduct of any partnership or joint venture of which the insured is a partner or member and which is not designated in this policy as a named insured.

III. LIMITS OF LIABILITY

Regardless of the number of (1) insureds under this policy, (2) persons or organizations who sustain bodily injury or property damage, or (3) claims made or suits brought on account of bodily injury or property damage, the company’s liability is limited as follows:

Coverage A—The total liability of the company for all damages, including damages for care and loss of services, because of bodily injury sustained by one or more persons as the result of any one occurrence shall not exceed the limit of bodily injury liability stated in the declarations as applicable to “each occurrence.”

Subject to the above provisions respecting “each occurrence”, the total liability of the company for all damages because of (1) all bodily injury included within the completed operations hazard and (2) all bodily injury included within the products hazard shall not exceed the limit of bodily injury liability stated in the declarations as “aggregate”.

Coverage B—The total liability of the company for all damages because of all property damage sustained by one or more persons or organizations as the result of any one occurrence shall not exceed the limit of property damage liability stated in the declarations as applicable to “each occurrence”.

Subject to the above provision respecting “each occurrence”, the total liability of the company for all damages because of all property damage to which this coverage applies and described in any of the numbered subparagraphs below shall not exceed the limit of property damage liability stated in the declarations as “aggregate”.

(1) all property damage arising out of premises or operations rated on a remuneration basis or contractor’s equipment rated on a receipts basis, including property damage for which liability is assumed under any incidental contract relating to such premises or operations, but excluding property damage included in subparagraph (2) below;

(2) all property damage arising out of and occurring in the course of operations performed for the named insured by independent contractors and general supervision thereof by the named insured, including any such property damage for which liability is assumed under any incidental contract relating to such operations, but this subparagraph (2) does not include property damage arising out of maintenance or repairs at premises owned by or rented to the named insured or structural alterations at such premises which do not involve changing the size of or moving buildings or other structures;

(3) all property damage included within the products hazard and all property damage included within the completed operations hazard.

Such aggregate limit shall apply separately to the property damage described in subparagraphs (1), (2), and (3) above, and under subparagraphs (1) and (2), separately with respect to each project away from premises owned by or rented to the named insured.

Coverages A and B—For the purpose of determining the limit of the company’s liability, all bodily injury and property damage arising out of substantially the same general conditions shall be considered as arising out of one occurrence.

IV. POLICY PERIOD; TERRITORY

This insurance applies only to bodily injury or property damage which occurs within the policy territory.
Appendix G
Appendix H
This from Sierra Club in Wisconsin

We have buses from across Wisconsin to the event in Duluth! On September 28, there will be a rally, march, and gathering to join in community and send a clear message to the Michigan Governor and state agencies: **Midwesterners stand together to protect what we love and say STOP Line 3 and other pipelines that threaten our water, climate, and communities.**

**Where:** Park, Duluth  
**When:** Saturday September 28, 2019

[Reserve your spot on the bus!](#)
There several different sources of the cost premium for unconventional Canadian tar sands oil. Here is a summary of those estimates. Note that while these estimates do incorporate the fact that heavy crude like tar sands oil incurs more costly refinery costs, it is not clear that they fully incorporate tar sands oil more distant and complicated transportation costs to U.S. refineries, including the greater pipeline capacity constraints in shipping oil from Alberta to the Midwest and Texas, which frequently require rail haul that is three times more expensive (approximately $30/barrel compared to $10/barrel).

RYSTAD (2019)

Global liquid supply curve
Real Brent Break-even price, USD/bbl

Source: Rystad Energy UCube
Figure 1. Cost curve of global oil production in 2030, with Canadian fields identified.

Prices are listed in Brent crude terms. The calculation of breakeven price for each field includes any discount for the actual price received by each producer; for example, oil sands projects are assumed to receive between $5 to $15 less per barrel compared to the Brent prices shown, to account for quality differences relative to other crudes. Dots along bottom axis show global 2-degree-consistent oil demand per Harvey (2017) and Jaccard et al (2018), plus oil demand in the IEA’s Sustainable Development Scenario (SDS), New Policies Scenario (NPS), and Current Policies Scenario (CPS).

Source: Rystad Energy (Rystad Energy 2017), plus oil demand scenarios from IEA (IEA 2017), Simon Fraser University (Jaccard et al. 2018), and University of Toronto (Harvey 2017)

SEI, Confronting Carbon Lock-in: Canada’s Oil Sands (2018)
The left hand bar represents the least cost initial mining at the surface. As those deposits are exhausted, the more expensive deposits must be mined and steam assisted, as represented in the right hand bar.
<table>
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<th>2014</th>
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(source: Annual Report 2014 if already published, otherwise company websites)
IHS MARKIT (2016)

WTI based breakeven price economics of greenfield oil sands projects in 2015

Estimates are based on average operating conditions over first three quarters of 2015. Additional costs for blending, taxes and royalties are included and would be in addition to sustaining capable in chart but are not shown for simplicity.

IHS, Production cost and the Canadian oil sands in a lower price environment (2016)
In addition the energy and financial press has discussed the subject of the Alberta tar sands oil fields economic disadvantages, of which some examples follow.


REUTERS
Canada’s oil sands survive, but can’t thrive in a $50 oil world Nia
Williams

Oct 18 2017

CALGARY, Alberta (Reuters) - Canada’s oil sands producers are stuck in a rut.

The nation’s oil firms are retrenching, with large producers planning little or no further expansion and some smaller projects struggling even to cover their operating costs.

As the era of large new projects comes to a close, many mid-sized producers - those with fewer assets and producing less than 100,000 barrels of oil a day in the oil sands - have shelved expansion plans, unable to earn back the high start-up costs with crude at around $50 per barrel. Larger Canadian producers, meanwhile, focus on projects that in the past were associated with smaller names.

The last three years have seen dozens of new projects mothballed and expansions put on hold, meaning millions of barrels of crude from the world’s third-largest reserves may never be extracted.

Where industry groups in 2014 expected Canada’s oil sands output to more than double to nearly 5 million barrels per day (bpd) by 2030, that forecast has been knocked down to 3.7 million bpd.

This follows a spell of consolidation that has seen foreign majors sell off more than $23 billion in Canadian assets in a year and turn to U.S. shale patches such as the Permian basin in Texas, which produce returns more quickly and where proximity to refiners means the barrels fetch a better price.

“We cannot compete with that huge sucking noise to the south that is called the Permian. Investment dollars are spiraling away down there,” Derek Evans, chief executive of small oil sands producer Pengrowth Energy (PGF.TO) told Reuters in an interview.

Permian production rose 21 percent in 12 months through July compared to a 9 percent increase in Alberta’s oil sands, according to Canadian and U.S. government data.

COSTLY STARTUP PHASE

Mid-sized producers are hurting the most, due to start-up costs that far exceed those in other major
producing areas. Oil sands producers have slashed operating costs by a third since 2014, but building a new thermal project - in which steam is pumped as deep as one kilometer (1094 yards) underground to liquefy tar-like bitumen and bring it to the surface - requires U.S. crude benchmark at around $60 a barrel to break even, analysts estimate.

The North American benchmark West Texas Intermediate crude CLc1 has traded between $42 and $55 a barrel so far this year. The U.S. Energy Information Administration forecasts it will average $49.69 a barrel in 2017 and $50.57 a barrel next year.

There are around half a dozen thermal projects in the costly start-up phase, when engineers steadily increase steam pressure to bring a reservoir’s production up to full capacity.

One of those is Athabasca Oil Corp’s (ATH.TO) Hangingstone project. It was originally conceived as a 80,000 bpd project, but instead will bring output to only 12,000 bpd from the current 9,000 bpd. The project can break even with U.S. crude prices of at least $53 a barrel, meaning right now Athabasca keeps losing money on Hangingstone production. Size is crucial in the oil sands; the more bitumen a company can squeeze out of a plant, the lower fixed costs per barrel will be.

“(Athabasca) was a company built when oil was $100 a barrel. In those days we were going to find funding for joint ventures and build greenfield projects to a massive size. The reality is the world changed,” chief executive Rob Broen told Reuters.

Quarterly filings show why smaller players are struggling. Transportation and marketing costs at Hangingstone, along with the cost of natural gas used to produce steam to extract oil, and other operating costs are much higher compared with Cenovus Energy’s (CVE.TO) Christina Lake project, one of the highest-quality and biggest bitumen reservoirs in the oil sands.

Pengrowth’s development plans are on hold as well, Evans said, because the company needs U.S. crude to stay at $55 for a sustained period to justify investment in its 14,000 bpd Lindbergh thermal project, at one point intended to grow as large as 40,000 bpd.

THE BIG GO SMALL

Large producers have pulled back in response to lower global prices as well. For example, Suncor Energy’s (SU.TO) 194,000 bpd Fort Hills mine, due to start producing oil by the end of this year, is the company’s last megaproject.

Canadian Natural (CNQ.TO) restarted construction on its 40,000 bpd Kirby North project last November, one of a handful of smaller projects to start producing in 2019.

Other companies like MEG Energy (MEG.TO) are planning expansions at existing sites in 20,000 bpd “modules” rather than starting large new projects from scratch. But even such more modest investments are out of reach for smaller companies like Athabasca and Pengrowth.
“It’s very hard (for a small company) to drag itself out of the financing black hole it would have to get in to build a project to start with,” said Nick Lupick, an analyst at AltaCorp Capital. “A large company can take that on their balance sheet without having to leverage too highly.”

Why Canadian Tar Sands Oil May Be Doomed Read time: 9 mins
By Justin Mikulka • Thursday, October 25, 2018 - 13:03 Fort McMurray, Alberta, Canada, tar sands oil operations

At current prices, Canadian tar sands oil producers are losing money on every barrel of oil they dig out. Despite signs earlier this year the industry would “turn profitable in 2018,” a much more likely scenario at this point is a fourth straight year of losses.

Producers are forced to keep cranking out product and selling it at a loss to cover the massive costs required to start one of these sprawling unconventional oil operations, a point made painfully clear when Alberta wildfires in 2016 forced some tar sands operators to shut down.

“I do think they'll start up quickly once the danger from the fire is gone because there is a lot of motivation to do that,” Jackie Forrest, an energy economist for Arc Financial Corp, told The Globe and Mail. “They have a lot of fixed costs so they're going to be motivated to get some revenue to pay for those costs that aren’t going away.”

In the face of such challenging economics, what are Canadian tar sands producers doing? Tapping more oil than ever.

In June 2018 Canada set a new record for exporting oil to the U.S., hitting well over three million barrels per day. This record coincided with another one for oil exported by rail from Canada to the U.S. The U.S. is currently the only major market for Canadian crude, with 99 percent of its exports going to either U.S. refineries or ports for export.

Source: U.S. Energy Information Administration America Is Maxing out on Canadian Crude

American refineries certainly enjoy buying Canadian crude at such low prices. How low are the prices? As the Financial Post reported in mid-October, Western Canadian Select (WCS) was $19 a barrel — approximately $50 a barrel cheaper than a barrel of the American oil standard known as Western Texas Intermediate (WTI).

Without a competing market in sight, American buyers likely will continue receiving huge discounts on Canadian oil. As Sandy Fielden, director of oil and products research at Morningstar, told Reuters in 2016: “If Canada can’t get their oil to another market besides the U.S. [market],
you’ll always be a price taker, not a price maker.”

Even under these economic conditions, one company, Teck Resources, is proposing to build a new tar sands mining operation. Projections estimate the cost to produce a barrel of oil at this operation will be around $85 a barrel. That's quite the mismatch with what a barrel of Canadian crude oil is fetching these days, and doesn't bode well for a sustainable business model.

Another complicating factor is that even at such low prices, American refineries only want and need so much tar sands oil, which is a heavy, lower-quality oil. America is experiencing a boom in production of the light fracked crude oil from shale basins, which is not only more valuable to refineries but requires much lower transportation costs than importing crude from Alberta, the tar sands capital of North America.

As The Energy Mix reported recently: “Permian Basin oil is a far better fit for the only U.S. refineries capable of handling more bitumen [tar sands oil], and will likely be for at least the next decade.”

As an example of that preference, Exxon just announced plans to expand its Beaumont, Texas, refinery by 300,000 barrels per day, which would make it the largest refinery in America. This additional capacity is for light crude oil, not heavy Canadian oil.

Still, American refineries are importing, and refining, record amounts of Canadian oil right now, but at massively discounted prices compared to average global oil prices, which helps lead to huge profits for American refiners.

Yet another complication for tar sands producers is that, as The Energy Mix highlighted, “In reality, virtually every refinery in America that buys heavy crude is operating at full capacity. That is why there are no buyers willing to pay higher prices.”

Economics 101. If supply is higher than demand, prices go down. And sellers in that market have to take whatever price they can get, even if that means selling at a loss.

To help extract itself from this difficult situation, Canada is looking to build pipelines, such as the still-uncertain Trans Mountain pipeline expansion, to transport its landlocked oil to tidewaters, where companies theoretically can sell the oil to Asia's rapidly growing market.

Never Get Involved in an Oil War With Saudi Arabia

Shell tar sands mine in Alberta
Shell Jackpine tar sands mine in 2014. Credit: Julia Kilpatrick, Pembina Institute, CC BY-NC-ND 2.0

Canada’s tar sands pipeline plans have several fatal flaws. The first is that tar sands oil is heavy and not the most desirable oil on the market. The second is that Canada is late to the game, with some rather formidable competition from the U.S., which is exporting oil to Asia at ever increasing
rates, and also from the Middle East.

While Canada’s tar sands proven oil reserves are the third largest for any country in the world, Saudi Arabia holds the number two spot (Venezuela is number one). Unlike the stiff production costs Canadian tar sands operators face, Saudi Arabia has production costs in the range of $10 per barrel. Plus, Saudi Arabia is producing more desirable grades of oil and has easy access to ports, giving the country a strong competitive edge.

However, Saudi Arabia still needs to secure markets for its oil and has been striking deals and partnerships around the world to ensure its oil is the oil that meets future global demand. It has begun shipping oil to one of these joint venture projects in Malaysia and is helping finance projects in China, South Africa, India, Pakistan, and South Korea. French oil company Total SA is also partnering with the state-owned Saudi Aramco on a huge refinery and petrochemical complex in eastern Saudi Arabia.

Saudi Aramco even owns the largest oil refinery in America, in Port Arthur, Texas, where it processes large amounts of oil imported from Saudi Arabia. Aramco's plans to expand the facility are centered on petrochemical production, an area many oil producers see as the future for growth in the business and not one that will require tar sands oil as feedstock.

In the near term, Canada faces competition with America's booming fracked oil trade, and in the long term, Saudi Arabia is locking up deals to supply the foreign markets Canada eventually hopes to reach if it can ever build pipelines to export its oil. Even then, The Energy Mix predicts that Canada would require prices of “upwards of U.S. $100 per barrel for decades.”

This is all assuming a significant reduction in global oil consumption doesn't occur in the coming decades in order to address the climate crisis. Years of successful pipeline protests and global oil economics may end up keeping a large portion of the Canadian tar sands oil “in the ground.”

Canadian Prime Minister Justin Trudeau most likely wouldn't be pleased at that prospect. In 2017 he told an oil industry conference: “No country would find 173 billion barrels of oil in the ground and leave them there.” But a country might if the oil were sold at a loss.

Looking for Bailouts

A good indicator of the failed tar sands model is how many major oil companies sold their positions in Canadian tar sands and took their losses. Their main explanation? No one could make money on those projects at current oil prices.

The remaining companies apparently have to rely on government bailouts. The first bailout signaling trouble for the industry was when the Canadian government bought the Trans Mountain pipeline expansion project from Texas-based Kinder Morgan for CAN $4.5 billion. A federal court ruled that the pipeline didn’t get the proper approvals, which means it is now in legal limbo and may not be built — but Kinder Morgan still gets its $4.5 billion. A big win for Kinder Morgan, perhaps less so for the people of Canada.
Trudeau and the Canadian oil industry need this pipeline if they have any hopes of exporting tar sands oil to Asia. Energy East, the other large pipeline designed for exports, was canceled in 2017. As the delays continue and the economics remain unfavorable for Canadian tar sands, other suppliers such as Saudi Arabia are securing future oil export markets.

More recently — indicating how desperate the situation is for tar sands producers — Alberta Premier Rachel Notley pitched the idea that the Canadian government should invest in the oil-by-rail business to help tar sands producers, which sounds a lot like corporate welfare to support a failing business model.

This request comes despite oil producer Cenovus signing a deal in September to move more of its oil by rail, and this deal reportedly isn’t the only one of its kind. Canada is set up to move far more oil-by-rail than ever before, despite the obvious risks to safety and environment.

Moving oil by rail is more expensive than by pipeline but does offer the advantage of reaching ports where the oil could be exported — and a desperate Canadian oil industry has very few options.

Technology Not the Savior

Canadian tar sands oil had very different prospects in 2010. The American shale oil and gas revolution had just begun, and producers were trying to figure out which shale plays would actually produce oil. It did not seem like a threat to the massive Canadian tar sands oil industry at the time.

Meanwhile in Canada, the industry knew where the bitumen was and how much was there (a lot). In a 2010 article in The Globe and Mail, Darin Barter, a spokesman for Alberta’s Energy Resources Conservation Board, noted that unlike the traditional oil industry, exploration costs for the tar sands industry were “zero.”

“We know the oil is there, the bitumen is there, the technology may not be there,” Barter said in 2010, “But we all know how quickly technology moves forward when there is a financial reward at the end. “

In 2018, the technology is definitely there. The bitumen can be mined and diluted and pumped through pipelines and into rail tank cars. But the financial reward that Barter was expecting technology to deliver has not materialized.

Almost 10 years later, the financial payout for tar sands oil looks less likely than ever.
With Some Tar Sands Oil Selling at a Loss, Why Is Production Still Rising?
Canadian oil producers can’t address the downturn by slowing production without huge losses, so they now sell at a loss economically and for the climate.
By Phil McKenna, InsideClimate News Feb 23, 2016

The Syncrude tar sands site, on April 27, 2015 outside of Fort McMurray, Canada. Tar sands oil production in Canada is expected to increase by 9 percent in 2016, even though the oil currently sells for less than the cost of production. That's because the wells can't be shuttered without significant financial losses.

Like a supertanker unable to make quick turns, production from tar sands in the Canadian oil patch continues to increase despite prices so low producers have to sell their output at a loss.

The industry's inability to cut production could have a profound impact on the climate as well as corporate bottom lines. Despite reductions in greenhouse gas emissions across Canada, continued tar sands oil production will most likely keep the nation from meeting targets it set as part of the international climate accord agreed to in Paris.

Energy-intensive tar sands production in Canada that requires steam to liquefy and extract the oil is expected to increase by 9 percent in 2016, according to the Canadian National Energy Board. Yet the oil currently sells for less than the cost of production when transportation costs are figured in, according to a detailed analysis by RBN Energy LLC, an industry consulting firm.

"It's not very pretty right now," said Phil Flynn, senior energy analyst at the PRICE Futures Group, who was not part of the analysis. "Some of these companies are losing money on every barrel."

Alberta's tar sands are the third-largest oil reserve in the world after Venezuela and Saudi Arabia. Proven reserves in Alberta total 166 billion barrels, 24 times the amount consumed by the U.S. in 2014, according to the U.S. Energy Information Administration. Tar sands yield a heavy, thick, low-quality oil that requires significantly more energy to extract and refine than conventional crude. Producing tar sands oil emits three to four times more greenhouse gases than ordinary oil, according to a 2008 U.S. Department of Energy report.

"Tar sands are some of the most carbon-intensive oil sources in the world barrel-for-barrel," said Anthony Swift, an attorney with the Natural Resources Defense Council who focuses on tar sand development.

When crude oil prices were hovering around $100 a barrel five years ago, the tar sands industry
could project attractive returns on investment in extracting and transporting the oil to market by rail or pipeline. But with the fracking-driven energy glut of recent years, the price of tar sands crude has plunged to $20 a barrel, obliterating the economic calculations that launched the industry.

The RBN Energy analysis focused on transportation costs. Pipeline capacity limitations and growing production volumes are increasingly forcing producers to transport tar sands oil to Gulf Coast refineries by rail, which costs about $6 a barrel more than pipelines would charge.

As of Feb. 8, producers paid an estimated $20.50 a barrel to ship the oil to Houston, first by truck and then by rail, but received just $20 a barrel for the product. When the cost of chemicals required to dilute the crude to make it less viscous were factored in, producers lost $2.74 a barrel, according to the analysis. Producers able to ship by pipeline came out slightly better, making $2.97 per barrel after transportation fees.

However, the cost to keep energy-intensive production facilities running is $5 a barrel, on top of the transportation costs, RBN Energy estimated.

"Whichever way you look at it, there are some operations that are now losing money on every barrel," the report concluded.

Suncor Energy, Canada's largest oil producer, reported a net loss of $2 billion in the fourth quarter of 2015. Imperial Oil, another tar sands giant, reported earnings of $1.1 billion in 2015, down from $3.8 billion from a year earlier.

"It's not going to continue for the long run because the money is going to run out," Flynn said. "You can't pump more barrels of oil and make up for it in volume. At some point something's going to give."

Yet tar sands production has continued to increase because the wells represent long-term investments that can't be shuttered without significant financial losses.

"This is like a toboggan going down a hill," said Maurice Dusseault, a petroleum engineering professor at the University of Waterloo in Ontario. "You can't stop a third of the way down very easily and then start up again. You've got to stick it through to the end of the project."

Unlike hydraulic fracturing wells, which can be brought online quickly and play out quickly, tar sands wells typically take several years to complete and then produce steadily for decades.

Most Canadian oil sands production uses a process called steam-assisted gravity drainage. It requires significant upfront costs, including natural-gas fired steam production facilities, and can take as much as seven months to reach peak production. And if the steam process is stopped, it creates a vacuum inside the reservoir that floods the production well with water and is irreversible.

"We don't really know how to shut down a steam chamber and start it up again without massive
losses," Dusseault said. "If you say, 'Well look, prices are low, I've got to shut down,' then you are basically adopting a much bigger financial penalty when you start up again."

Sticking with tar sands production, however, comes at tremendous environmental costs.

"The expanding tar sands sector and emissions from that are the chief reason that Canada has missed its climate targets to date and is not on track to hit its 2030 target," Swift said.

In November, the provincial government of Alberta announced a plan to cap tar sands emissions at 100 million metric tons of carbon a year. The cap hasn't been implemented and would still allow for substantial growth, Swift said.

"Over the long term it's difficult to see how Canada will meet its 2030 and 2050 goals without a fairly rapid peak in the emissions of tar sands and an effort to phase down those emissions," Swift said.

In its final supplemental environmental impact statement on the Keystone XL pipeline, which would have significantly expanded low-cost transportation capacity to Gulf Coast refineries, the U.S. State Department concluded that the pipeline would not impact the volume of oil sands production. The 2014 assessment, however, assumed oil wouldn't drop below $75 a barrel. At that price it would be economically viable to ship tar sands by rail if cheaper pipeline transport were not available.

"Their analysis suggested that at oil prices above $75 a barrel, tar sands expansion could happen with or without pipelines like Keystone XL," Swift said. "What we've found is with oil prices below $75 a barrel, it's absolutely clear that the existence of cheap transport capacity is a make-or-break issue for companies deciding whether to green-light new tar sands projects or not."

The lack of cheap transportation and the current glut of oil could bring all new projects to a standstill.

A report published Monday by the International Energy Agency concluded that peak production might not be far off.

"We are likely to see continued capacity increases in the near term, with growth slowing considerably, if not coming to a complete standstill, after the projects under construction are completed," according to the report.

The conclusion was based on the high cost of tar sands production, lack of pipeline capacity, and heightened environmental concerns.

"Nobody is happy," Swift said of the current situation. "That is one of the reasons why there is so much focus on preventing more investment in the sector."
Appendix J
Sixty-six years ago, in 1953, Enbridge’s predecessor company, Interprovincial Pipe Line Company (and its U.S. subsidiary, Lakehead Pipeline Company), constructed a pipeline across the top of Wisconsin and Michigan, including under the Mackinac Straits, to transport crude oil and natural gas liquids from its tank farm in Superior, Wisconsin to a refinery in Sarnia, in Ontario, Canada. Another company pipeline carried the product to Superior from Edmonton, Canada, and across Minnesota, (see FIGURE 1).

The pipeline ran under privately owned land. To receive permission to construct on private land, it acquired easements through contract, condemnation, or contract under the threat of condemnation. Generally, the contracts had a term of 20 years, and were routinely renewed by mutual consent, in 20 year intervals since then, until the last re-up in 2013, when one leaseholder refused to do so in one segment in Wisconsin.

That segment consists of easements for 11 parcels on the Bad River Band’s reservation, which lies on the southern shore of Lake Superior, just to the east of the city of Ashland.

FIGURE 1. Map of Line 5 from Superior to Sarnia.

FIGURE 2. Map of location of Bad River Band Reservation
Outside of the reservation proper, the Bad River Band retains rights under its ceded territory, where other sections of Line 5 run, and where they still retain the legal right to hunt and fish. Those ceded land rights would be threatened if there is a leak where Line 5 crosses lakes, rivers, streams and wetlands in those territories.

Because the Bad River Band determined that the risks of an accident were too great to the tribe to allow the pipeline to continue operating, when the easements came up for renewal in 2013, it refused to agree, and entered into mediation, which proved to be unproductive.

In 2019, The Bad River Band filed a lawsuit demanding that Enbridge stop pumping oil through Line 5 across their reservation and remove the pipe and restore the land, as is provided in the original easement. The suit’s citation is Bad River Band v. Enbridge et al, Case No. 3:19-CV-602 (W.D.Wis.), filed July 23, 2019. A copy is attached.

FIGURE 3. Map of ceded territories in Upper Midwest, with Bad River Band of Chippewa a in blue
At the core of the Complaint is the fact that the easement expressly compels Enbridge to remove its pipeline in the event an easement term is not renewed. Taken from the Complaint:

57. The easements under which the pipeline was installed on the Bad River Reservation in the 1950s were renewed in the 1970s and again in 1993.

58. By their express terms, fifteen of the easements that were renewed in 1993 were “limited as to tenure for a period not to exceed 20 (Twenty) years, beginning on June 3, 1993, and ending on June 2, 2013[.]” The Band holds between a forty-percent and a ninety-percent ownership interest in eleven of the fifteen parcels to which the now-expired easements attached.

59. Those easements further expressly required as follows:

> At the termination of this Grant of Easement, [Enbridge] shall remove all materials, equipment and associated installations within six months of termination, and agrees to restore the land to its prior condition.

> Such restoration may include, but not be limited to, filling, leveling, and seeding the right of way area.

60. Enbridge accordingly was under a legal duty to cease the flow of oil across the parcels by June 2, 2013, and to remove the pipeline from those parcels and to restore them to their prior condition within six months, or by December 2, 2013. Following that date, Enbridge had no legal right to use or possess any portion of those lands. (See Complaint, p. 20.)

The lawsuit provides as its substantive basis a detailed description of the risks of an accident posed by even new pipelines, nonetheless ones built 66 years ago after six decades of operating stresses. The risks included the economic, social and environmental consequences to the Bad River Band from an accident on Line 5 (see Complaint, pp. 4-24).

It makes three legal claims, under public nuisance law (federal and state), trespass law, and ejection (see Complaint, pp. 48-50). For relief, it seeks a declaratory judgment under the nuisance and trespass claims and an order of removal of the pipeline (see Complaint, p. 51).
Pipeline Incidents Continue to Impact Residents

December 7, 2018 / 3 Comments / in Articles, Data and Analysis / by Matt Kelso, BA

Pipelines play a major role in the oil and gas extraction industry, allowing for the transport of hydrocarbons from well sites to a variety of infrastructure, including processing plants, petrochemical facilities, power generation plants, and ultimately consumers. There are more than 2.7 million miles of natural gas and hazardous liquid pipelines in the United States, or more than 11 times the distance from Earth to the moon.

With all of this infrastructure in place, pipelines are inevitably routed close to homes, schools, and other culturally or ecologically important locations. But how safe are pipelines,
Safety talking points

In an attempt to assuage these fears, industry representatives and regulators tend to throw around variants of the word “safe” quite a bit:

*Pipelines are the safest and most reliable means of transporting the nation’s energy products.*
— Keith Coyle, Marcellus Shale Coalition

*Although pipelines exist in all fifty states, most of us are unaware that this vast network even exists. This is due to the strong safety record of pipelines and the fact that most of them are located underground. Installing pipelines underground protects them from damage and helps protect our communities as well.*
— Pipeline and Hazardous Materials Safety Administration (PHMSA)
[https://primis.phmsa.dot.gov/comm/PipelineBasics.htm]

*Pipelines are an extremely safe way to transport energy across the country.*
— Pipeline 101 [http://www.pipeline101.org/Are-Pipelines-Safe]

*Knowing how important pipelines are to everyday living is a big reason why we as pipeline operators strive to keep them safe. Pipelines themselves are one of the safest ways to transport energy with a barrel of crude oil or petroleum product reaching its destination safely by pipeline 99.999% of the time.*

But are pipelines really safe?

Given these talking points, the general public can be excused for being under the impression that pipelines are no big deal. However, PHMSA [https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data] keeps records on pipeline incidents in the US, and the cumulative impact of these events is staggering. These incidents are broken
1. Gas Distribution (lines that take gas to residents and other consumers), and
2. Gas Transmission & Gathering (collectively bringing gas from well sites to processing facilities and distant markets), and
3. Hazardous Liquids (including crude oil, refined petroleum products, and natural gas liquids).

Below in Table 1 is a summary of pipeline incident data from 2010 through mid-November of this year. Of note: Some details from recent events are still pending, and are therefore not yet reflected in these reports.

<table>
<thead>
<tr>
<th>Report</th>
<th>Incidents</th>
<th>Injuries</th>
<th>Fatalities</th>
<th>Evacuees</th>
<th>Fires</th>
<th>Explosions</th>
<th>Damages ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Distribution</td>
<td>934</td>
<td>473</td>
<td>92</td>
<td>18,467</td>
<td>576</td>
<td>226</td>
<td>381,705,567</td>
</tr>
<tr>
<td>Gas Transmission &amp; Gathering</td>
<td>1,069</td>
<td>99</td>
<td>24</td>
<td>8,614</td>
<td>121</td>
<td>51</td>
<td>1,107,988,837</td>
</tr>
<tr>
<td>Hazardous Liquids</td>
<td>3,509</td>
<td>24</td>
<td>10</td>
<td>2,471</td>
<td>111</td>
<td>14</td>
<td>2,606,014,109</td>
</tr>
<tr>
<td>Totals</td>
<td>5,512</td>
<td>596</td>
<td>126</td>
<td>29,552</td>
<td>808</td>
<td>291</td>
<td>4,095,708,513</td>
</tr>
</tbody>
</table>

Based on this data, on average each day in the US 1.7 pipeline incidents are reported (a number in line with our previous analyses [https://www.fractracker.org/2016/11/updated-pipeline-incidents/]), requiring 9 people to be evacuated, and causing almost $1.3 million in property damage. A pipeline catches fire every 4 days and results in an explosion every 11 days. These incidents result in an injury every 5 days, on average, and a fatality every 26 days.

Data shortcomings

While the PHMSA datasets are extremely thorough, they do have some limitations. Unfortunately, in some cases, these limitations tend to minimize our understanding of the true impacts. A notable recent example is a series of explosions and fires on September 13, 2018 in the towns of Lawrence, Andover, and North Andover, in the Merrimack Valley region.
of Massachusetts. Cumulatively, these incidents resulted in the death of a young man and the injuries to 25 other people. According to early reports [https://www.masslive.com/expo/news/erry-2018/09/ee2f59ae5c3543/heres-what-we-know-so-far-abou.html], as gas distribution lines became over-pressurized. The preliminary PHMSA report [https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/foia/69456/incident-20180092-col-gas-ma-original-003.pdf] lists all of these Massachusetts fires as a single event, so it is counted as one fire and one explosion in Table 1. As of the November 14 download of the data, property damage has not been calculated, and is listed as $0. The number of evacuees in the report also stands at zero. This serves as a reminder that analysis of the oil and gas industry can only be as good as the available data, and relying on operators to accurately self-report the full extent of the impacts is a somewhat dubious practice.
This map shows pipeline incidents in the US from 1/1/2010 through 11/14/2018. Source: PHMSA. One record without coordinates was discarded, and 10 records had missing decimal points or negative (-) signs added to the longitude values. A few obvious errors remain, such as a 2012 incident near Winnipeg that should be in Texas, but we are not in a position to guess at the correct latitude and longitude values for each of the 5,512 incidents.

Another recent incident occurred in Center Township, a small community in Beaver County, Pennsylvania near Aliquippa on September 10, 2018. According to the PHMSA Gas Transmission & Gathering report, this incident on the brand new Revolution gathering line caused over $7 million in damage, destroying a house and multiple vehicles, and required 49 people to evacuate. The incident was indicated as a fire, but not an explosion. However, reporting by local media station WPXI [https://www.wpxi.com/news/top-stories/gas-line-explosion-forces-evacuations-destroys-home-in-beaver-county/830784520] quoted this description from a neighbor:

A major explosion, I thought it was a plane crash honestly. My wife and I jumped out of bed and it was just like a light. It looked like daylight. It was a ball of flame like I've never seen before.

From the standpoint of the data, this error is not particularly egregious. On the other hand, it does serve to falsely represent the overall safety of the system, at least if we consider explosions to be more hazardous than fires.

**Big picture findings**

Comparing the three reports against one another, we can see that the majority of incidents (64%) and damages (also 64%) are caused by hazardous liquids pipelines, even though the liquids account for less than 8% of the total mileage [https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-mileage-and-facilities] of the network. In all of the other categories, however, gas distribution lines account for more than half of the cumulative damage, including injuries (79%), deaths (73%), evacuees (62%), fires (71%), and explosions (78%). This is perhaps due to the vast network (more than 2.2 million miles) of gas distribution mains and service lines, as well as their nature of taking these hazardous products directly into populated areas. Comparatively, transmission and hazardous liquids lines ostensibly attempt to avoid those locations.

**Is the age of the pipeline a factor in incidents?**
Among the available attributes in the incident datasets is a field indicating the year the pipeline was installed. While this data point is not always completed, there is enough of a sample size to look for trends in the data. We determined the age of the pipe by subtracting the year the pipe was installed from the year of the incident, eliminating nonsensical values that were created when the pipeline age was not provided. In the following section, we will look at two tables for each of the three reports. The first table shows the cause of the failure compared to the average age, and the second breaks down results by the content that the pipe was carrying. We’ll also include a histogram of the pipe age, so we can get a sense of how representative the average age actually is within the sample.

A. Gas distribution

Each table shows some fluctuation in the average age of pipeline incidents depending on other variables, although the variation in the product contained in the pipe (Table 3) are minor, and may be due to relatively small sample sizes in some of the categories. When examining the nature of the failure in relation to the age of the pipe (Table 2), it does make sense that incidents involving corrosion would be more likely to afflict older pipelines, (although again, the number of incidents in this category is relatively small). On average, distribution pipeline incidents occur on pipes that are 33 years old.

When we look at the histogram (Figure 1) for the overall distribution of the age of the pipeline, we see that those in the first bin, representing routes under 10 years of age, are actually the most frequent. In fact, the overall trend, excepting those in the 40 to 50 year old bin, is that the older the pipeline, the fewer the number of incidents. This may reflect the massive scale of pipeline construction in recent decades, or perhaps pipeline safety protocol has regressed over time.

![Age of Pipeline - Histogram](image-url)
### Table 2. Average age of pipe and cause for failure in gas distribution line incidents

<table>
<thead>
<tr>
<th>Cause of Failure</th>
<th>Incidents - Total</th>
<th>Incidents - Pipe Age Known</th>
<th>Avg. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Failure</td>
<td>18</td>
<td>15</td>
<td>53</td>
</tr>
<tr>
<td>Equipment Failure</td>
<td>47</td>
<td>41</td>
<td>30</td>
</tr>
<tr>
<td>Excavation Damage</td>
<td>271</td>
<td>239</td>
<td>32</td>
</tr>
<tr>
<td>Incorrect Operation</td>
<td>62</td>
<td>51</td>
<td>34</td>
</tr>
<tr>
<td>Material Failure Of Pipe Or Weld</td>
<td>63</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Natural Force Damage</td>
<td>72</td>
<td>61</td>
<td>42</td>
</tr>
<tr>
<td>Other Incident Cause</td>
<td>96</td>
<td>53</td>
<td>41</td>
</tr>
<tr>
<td>Other Outside Force Damage</td>
<td>305</td>
<td>227</td>
<td>28</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>934</strong></td>
<td><strong>743</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

### Table 3. Average age of pipe and material being transported in gas distribution lines

<table>
<thead>
<tr>
<th>Product</th>
<th>Incidents - Total</th>
<th>Incidents - Pipe Age Known</th>
<th>Ave. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Age of pipeline histogram for gas distribution line incidents between 1/1/2010 and 11/14/2018. Incidents where the age of the pipe is unknown are excluded.
B. Gas Transmission & Gathering

Transmission & Gathering line incidents occur on pipelines routes that are, on average, five years older than their distribution counterparts. Corrosion, natural force damage, and material failures on pipes and welds occur on pipelines with an average age above the overall mean, while excavation and “other outside force [https://primis.phmsa.dot.gov/comm/FactSheets/FSOtherOutsideForce.htm]” incidents tend to occur on newer pipes (Table 4). The latter category would include things like being struck by vehicles, damaged in wildfires, or vandalism. The contents of the pipe does not seem to have any significant correlation with the age of the pipe when we take sample size into consideration (Table 5).

The histogram (Figure 2) for the age of pipes on transmission & gathering line incidents below shows a more normal distribution, with the noticeable exception of the first bin (0 to 10 years old) ranking second in frequency to the fifth bin (40 to 50 years old).

It is worth mentioning that, “PHMSA estimates that only about 5% of gas gathering pipelines [https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%20Geo%20Location%22.%22State%20Name%22&val1=%22%22] are currently subject to PHMSA pipeline safety regulations.” My correspondence with the agency verified that the remainder is not factored into their pipeline mileage or incident reports in any fashion. Therefore, we should not consider the PHMSA data to completely represent the extent of the gathering line network or incidents that occur on those routes.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Natural Gas</th>
<th>Other Gas</th>
<th>Propane Gas</th>
<th>Synthetic Gas</th>
<th>(Blank)</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Gas</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane Gas</td>
<td>11</td>
<td>7</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetic Gas</td>
<td>1</td>
<td>1</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Blank)</td>
<td>57</td>
<td>29</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>934</strong></td>
<td><strong>743</strong></td>
<td><strong>33</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2. Age of pipeline histogram for transmission & gathering line incidents between 1/1/2010 and 11/14/2018. Incidents where the age of the pipe is unknown are excluded.

Table 4. Average age of pipe and cause for failure in gas transmission & gathering line incidents

<table>
<thead>
<tr>
<th>Cause of Failure</th>
<th>Incidents Total</th>
<th>Incidents - Pipe Age Known</th>
<th>Ave. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Failure</td>
<td>220</td>
<td>212</td>
<td>46</td>
</tr>
<tr>
<td>Equipment Failure</td>
<td>327</td>
<td>271</td>
<td>25</td>
</tr>
<tr>
<td>Excavation Damage</td>
<td>135</td>
<td>126</td>
<td>52</td>
</tr>
<tr>
<td>Incorrect Operation</td>
<td>59</td>
<td>52</td>
<td>26</td>
</tr>
<tr>
<td>Material Failure Of Pipe Or Weld</td>
<td>122</td>
<td>119</td>
<td>51</td>
</tr>
<tr>
<td>Natural Force Damage</td>
<td>82</td>
<td>76</td>
<td>32</td>
</tr>
<tr>
<td>Other Incident Cause</td>
<td>60</td>
<td>46</td>
<td>30</td>
</tr>
</tbody>
</table>
### C. Hazardous Liquids

The average incident on hazardous liquid lines occurs on pipelines that are 27 years old, which is 6 years younger than for distribution incidents, and 11 years younger than their transmission & gathering counterparts. This appears to be heavily skewed by the equipment failure and incorrect operation categories, both of which occur on pipes averaging 15 years old, and both with substantial numbers of incidents. On the other hand, excavation damage, corrosion, and material/weld failures tend to occur on pipes that are at least 40 years old (Table 6).

In terms of content, pipelines carrying carbon dioxide happen on pipes that average just 11 years old, although there are not enough of these incidents to account for the overall departure from the other two datasets (Table 7).

<table>
<thead>
<tr>
<th>Product</th>
<th>Incidents Total</th>
<th>Incidents – Pipe Age Known</th>
<th>Ave. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Gas</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Landfill Gas</td>
<td>1</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>1024</td>
<td>916</td>
<td>38</td>
</tr>
<tr>
<td>Other Gas</td>
<td>9</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>(Blank)</td>
<td>34</td>
<td>29</td>
<td>38</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1069</td>
<td>954</td>
<td>38</td>
</tr>
</tbody>
</table>
The overall shape of the histogram (Figure 3) is similar to that of transmission & gathering line incidents, except that the first bin (0 to 10 years old) is by far the most frequent, with more than 3 and a half times as many incidents as the next closest bin (40 to 50 years old). Operators of new hazardous liquid routes are failing at an alarming rate. In descending order, these incidents are blamed on equipment failure (61%), incorrect operation (21%), and corrosion (7%), followed by smaller amounts in other categories. The data indicate that pipelines installed in previous decades were not subject to this degree of failure.

Figure 3. Age of pipeline histogram for hazardous liquid line incidents between 1/1/2010 and 11/14/2018. Incidents where the age of the pipe is unknown are excluded.

Table 6. Average age of pipe and cause for failure in hazardous liquid line incidents

<table>
<thead>
<tr>
<th>Cause of Failure</th>
<th>Incidents – Total</th>
<th>Incidents – Pipe Age Known</th>
<th>Avg. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Failure</td>
<td>711</td>
<td>465</td>
<td>42</td>
</tr>
<tr>
<td>Equipment Failure</td>
<td>1589</td>
<td>879</td>
<td>15</td>
</tr>
<tr>
<td>Excavation Damage</td>
<td>126</td>
<td>107</td>
<td>46</td>
</tr>
</tbody>
</table>
### Table 7. Average age of pipe and material being transported in hazardous liquid lines

<table>
<thead>
<tr>
<th>Product</th>
<th>Incidents - Total</th>
<th>Incidents - Pipe Age Known</th>
<th>Avg. Pipe Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biofuel / Ethanol Blends</td>
<td>4</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>CO₂ (Carbon Dioxide)</td>
<td>50</td>
<td>40</td>
<td>11</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>1764</td>
<td>1090</td>
<td>25</td>
</tr>
<tr>
<td>Highly Volatile Liquids*</td>
<td>546</td>
<td>383</td>
<td>23</td>
</tr>
<tr>
<td>Refined Petroleum Product</td>
<td>1145</td>
<td>641</td>
<td>32</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>3509</strong></td>
<td><strong>2156</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>

* Highly volatile liquids are transported as liquids but would revert to a gaseous state in ambient conditions, including natural gas liquids like ethane, propane, and butane.
When evaluating quotes, like those listed above, that portrays pipelines as a safe way of transporting hydrocarbons, it's worth taking a closer look at what they are saying. Are pipelines the safest way of transporting our nation's energy products? This presupposes that our energy must be met with liquid or gaseous fossil fuels. Certainly, crude shipments by rail [https://en.wikipedia.org/wiki/Lac-M%C3%A9gantic_rail_disaster] and other modes of transport are also concerning, but movements of solar panels and wind turbines are far less risky.

Does the industry have the “strong safety record” that PHMSA proclaims? Here, we have to grapple with the fact that the word “safety” is inherently subjective, and the agency’s own data could certainly argue that the industry is falling short of reasonable safety benchmarks.

And what about the claim that barrels of oil or petroleum products reach their destination “99.999% of the time? First, it's worth noting that this claim excludes gas pipelines, which account for 92% of the pipelines, even before considering that PHMSA only has records on about 5% of gas gathering lines [https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%20Geo%20Location%22.%22State%20Name%22&val1=%22%22] in their pipeline mileage calculations. But more to the point, while a 99.999% success rate sounds fantastic, in this context, it isn't good enough, as this means that one barrel in every 100,000 will spill.

For example, the Dakota Access Pipeline [https://en.wikipedia.org/wiki/Dakota_Access_Pipeline] has a daily capacity of 470,000 barrels per day (bpd). In an average year, we can expect 1,715 barrels (72,030 gallons) to fail to reach its destination, and indeed, there are numerous spills reported in the course of routine operation on the route. The 590,000 bpd Keystone pipeline leaked 9,700 barrels [https://www.reuters.com/article/us-transcanada-pipeline-leak/keystone-pipeline-leak-in-south-dakota-about-double-previous-estimate-paper-idUSKBN1HE0T7] (407,400 gallons) late last year in South Dakota, or what we might expect from four and a half years of normal operation, given the 0.001% failure rate. In all, PHMSA’s hazardous liquid report lists 712,763 barrels (29.9 million gallons) were unintentionally released, while an additional 328,074 barrels (13.8 million gallons) were intentionally released in this time period. Of this, 284,887 barrels (12 million gallons) were recovered, meaning 755,950 barrels (31.7 million gallons) were not.

Beyond that, we must wonder whether the recent spate of pipeline incidents in new routes is a trend that can be corrected. Between the three reports, 1,283 out of the 3,853 (32%) incidents occurred in pipelines that were 10 years old or younger (where the year the
One wonders why regulators are allowing such shoddy workmanship to repeatedly occur on their watch.

By Matt Kelso [https://www.fractracker.org/author/matt-kelso/], Manager of Data and Technology, FracTracker Alliance

Tags: explosion, fire, gas leak, incident, MA, map, Massachusetts, PA, Pennsylvania, petrochemicals, PHMSA, pipeline age, pipeline incident, pipeline safety, pipelines, safety, spill

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Share this entry
b. Iachman
January 6, 2019 at 9:58 pm

It is probable that the first 10 years of operation of a pipeline accounts for more incidents because the flaws in construction and operating equipment happen sooner rather than later. If equipment survives the initial period (in this case 10 years) it is less likely to fail until decades of use and corrosion have taken their toll.

Reply

Courtney
January 2, 2019 at 12:35 pm

Is it possible to normalize the data? The absolute number of incidents isn't informative. The number could be higher for pipelines 0-10 years old than 50-60 years old because there are more pipelines or because they fail at a greater rate. In the past PHMSA has normalized the number of incidents to per 10,000 miles of pipe.

Reply

Erica Jackson
January 3, 2019 at 2:07 pm

It's definitely important to consider the fact that pipeline construction has increased in scale over time, which likely contributes to the high number of incidents we're seeing in newer pipelines. We didn't normalize the data for each age bracket in this particular article, but the data is out there: https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-summary-statistics.

Looking at the stats on average age of a pipeline for each cause of failure shows that equipment failure and incorrect operation frequently impact newer pipelines—suggesting that poor safety protocol is also to blame.

Reply
APPENDIX N
Leak in Keystone pipeline spills 9,000 barrels of oil in North Dakota

It’s the second significant spill on the Keystone system since 2017, when around 4,700 barrels spilled in South Dakota.

More than 9,000 barrels of oil are estimated to have spilled from a leak in the Keystone Pipeline in northeastern North Dakota, the company said. It's the second significant spill in two years in the pipeline that runs from Canada's tar sands region and through seven U.S. states.

Crews shut down the pipeline after the leak was discovered Tuesday night, Karl Rockeman, North Dakota's water quality division director, told the Associated Press. The oil spill affected a wetlands area.

TC Energy, formerly known as TransCanada and which operates the pipeline, said Thursday that an estimated 9,120 barrels of oil, enough to fill half of an Olympic-sized swimming pool, was released in the spill.
Using that initial estimate, that amounts to around 383,000 gallons. The company says it won’t know the exact amount until oil recovery has been finished.

The leak occurred near the company's facilities near Edinburg, a community of around 200 people in Walsh County around 60 miles northwest of Grand Forks, TC Energy said. The North Dakota Department of Environmental Quality said the leak was 3 miles northwest of Edinburg.

"Our emergency response team contained the impacted area, and oil has not migrated beyond the immediately affected area,” TC Energy said in an earlier update.

It said that crews remain focused on oil recovery and will then make repairs to the pipeline. Crews are using vacuum trucks and backhoes to recover the oil, it said.

Rockeman told the AP that some wetlands were affected, but not any sources of drinking water.

In November 2017, more than 200,000 gallons of oil – around 4,700 barrels – leaked in South Dakota. The leak occurred in a sparsely populated area of Marshall County, near Amherst in the northeastern part of the state.

The $5.2 billion pipeline is designed to carry crude oil across Saskatchewan and Manitoba, and through North Dakota, South Dakota, Nebraska, Kansas and Missouri on the way to refineries in Patoka, Illinois, and Cushing, Oklahoma, and it can handle 23 million gallons daily.

TC Energy is also seeking to build the Keystone XL pipeline that would begin in Hardisty, Alberta, and go to Steele City, Nebraska.

Because the pipeline would cross an international border, the U.S. State Department is collecting public comments on its revised environmental impact statement for the pipeline, NPR reported Thursday. An Oct. 4 entry in the Federal Register says the public comment period is expected to end on Nov. 18.

The Keystone XL proposal was rejected by the Obama administration in 2015, but approved by the Trump administration in 2017.

TC Energy says the XL pipeline will create jobs during construction as well as other benefits.

It says on its website it wants to start construction in 2020, and that construction will take around two years.

Environmental groups and others have opposed the project. The Sierra Club said in a statement Wednesday that the spill from the Keystone 1 pipeline is one of a dozen spills in its first year of operation.
"We don’t yet know the extent of the damage from this latest tar sands spill, but what we do know is that this is not the first time this pipeline has spilled toxic tar sands, and it won't be the last," Sierra Club Beyond Dirty Fuels associate director Catherine Collentine said.

"We've always said it's not a question of whether a pipeline will spill, but when, and once again TC Energy has made our case for us," Collentine said.

Greenpeace USA tweeted of the spill: "Brought to you by the corporation that wants to build the much larger #KXL pipeline and have it cut right through the Midwest," referring to the Keystone KL.

Sen. Bernie Sanders, I-Vermont, who is running for the Democratic presidential nomination, in a tweet Thursday accused President Donald Trump of ignoring science and putting profits ahead of the environment.

"As president, I will shut down the Keystone Pipeline that should never have been built in the first place," Sanders said.

**CORRECTION** (Nov. 1, 2019, 11:29 a.m. ET): An earlier version of this article misstated the name of the county where the leak occurred. It is Walsh County, not Wash. It also misstated the year in which construction on the pipeline is slated to begin. It’s 2020, not 2010.

Phil Helsel

Phil Helsel is a reporter for NBC News.

Associated Press contributed.