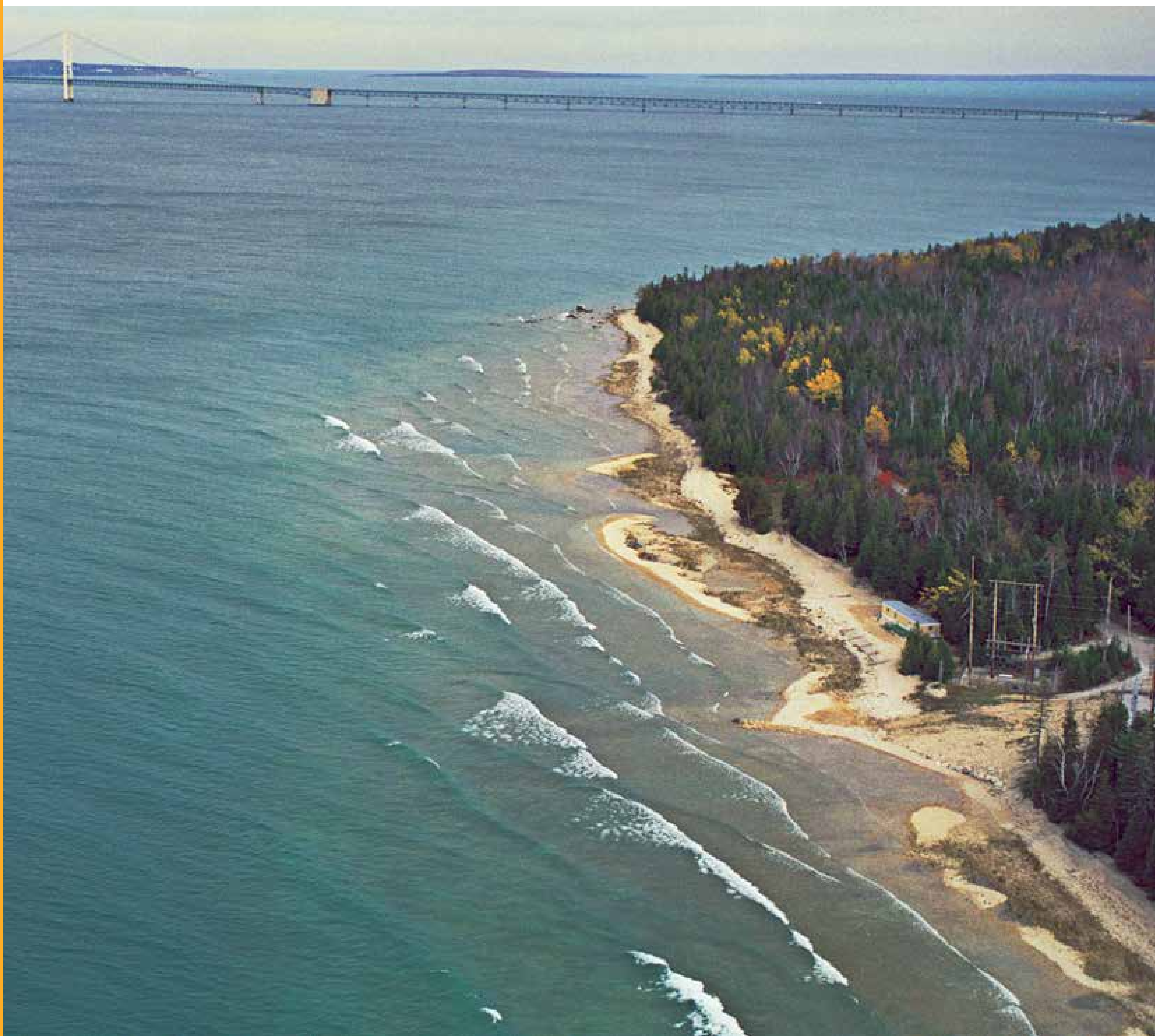
Enbridge Energy, Limited Partnership

Operational Reliability Plan

Line 5 and Line 5 Straits of Mackinac Crossing



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Operational Reliability Plan

1.0 Executive Summary

Maintaining the safety and reliability of Line 5 over its 60 years of operation has been Enbridge's goal and achieved through continued application of industry-leading operations and monitoring programs utilizing human resources and leading-edge technology providing multiple layers of protection and reliability.

In fact, the safety and operational reliability of our pipelines is the very foundation for our business and is recognized as critical to assuring the Company's ongoing success.

Toward this end, an Operational Reliability Plan (ORP) on Line 5 has been prepared herein. Line 5 is a 645-mile Enbridge Energy, Limited Partnership-owned pipeline that delivers natural gas liquids (NGLs) and light crude oil from Superior, Wisconsin, through Michigan and under the Straits of Mackinac and St. Clair River ending in Sarnia, Ontario, Canada.

This ORP provides a technical review of Line 5's operations and maintenance history, examines factors impacting the pipeline's integrity and management, and demonstrates its strong safety and operational performance.

We pay special attention to the Straits of Mackinac, recognizing the tremendous environmental sensitivity of the area. While the likelihood of a leak in the Straits is low, Enbridge recognizes the consequences are very significant. It's important to note there has never been a leak in the Line 5 Straits of Mackinac crossing and the pipeline remains in excellent condition.

When the Line 5 Straits crossing was constructed in 1953, the pipe was engineered to meet unique design requirements through assistance from the Department of Naval Architecture & Marine Engineering at the University of Michigan as well as the Department of Civil Engineering at Columbia University.

The Line 5 design continues to have excellent longevity due to the following:

- **Extra heavy wall thickness pipe was used and a very rigid inspection process was conducted during its manufacture and installation;**
- **An excellent coating and cathodic protection system has prevented external corrosion;**
- **Low internal corrosion susceptibility;**
- **Seamless pipe and low pressure cycling to avoid cracking;**
- **Pipe is supported with anchor devices to counter the effects of water currents;**
- **The pipe is operated at very low stress (less than 25 percent of the design capability of the pipelines), resulting in a safety factor that is well over and above that of ordinary onshore pipelines;**
- **The lines are buried at depths that protect it from moving ice packs; and**
- **Regular inspections with in-line inspection tools as well as divers and remote operated vehicles confirm that the crossing exhibits minimal signs of deterioration and is in nearly as-new condition.**

Enbridge maintains a significant focus on leak detection and emergency response at the Straits crossing. For the Straits of Mackinac, Enbridge has developed a Tactical Response Plan Response Plan that was shared with both the United States Coast Guard (USCG) and the response contractor for the Great Lakes operating area, Marine Pollution Control. Enbridge is also currently planning for a USCG area Preparedness For Response Exercise Program (PREP) full scale exercise as the lead industry exercise partner to take place in September 2014 at the Indian River. This exercise includes USCG, US Environmental Protection Agency (EPA), local county emergency managers, Michigan DEQ and many other stakeholders. The focus of the area exercise will be to exercise the containment strategies in the Tactical Response Plan for the Indian River and to establish a single display of relevant "operational information".

Enbridge has taken a number of extra steps to further enhance the safety and reliability of Line 5, especially through the Straits, including:

- **The increase of the frequency of inspections and other mitigation efforts beyond regulatory requirements;**
- **Utilizing additional diagnostic technologies adopted from the offshore oil and gas production industry to further gather information about the integrity of the lines;**
- **Reducing unsupported span lengths under water to less than 75 feet using screw anchor supports;**
- **Partnering with Michigan Tech University to develop an Autonomous Underwater Vehicle (AUV), that will complement existing Remote Operating Vehicles (ROVs) and accommodate increased inspections;**
- **Utilizing 3rd party expertise (DNV GL) to complete a risk assessment of the operation at the Straits;**
- **Developing a water current modeling study to examine the effect of currents on the pipelines; and**
- **Commissioning an engineering assessment to explore the feasibility of applying additional external leak detection and real-time damage-detection technology on the Straits crossing.**

Aside from their natural beauty, Michigan's water resources are integral to the health, quality of life and economy of the people in the State of Michigan, providing more than 666,000 jobs. Several villages draw drinking water from the Straits and cargo freighters and passenger ferries use it as a passageway. Sport anglers chase salmon and trout, while commercial crews harvest whitefish and perch for restaurants. For its part, Enbridge's four wholly-owned or operated pipelines — including Lines 5, 6B, 17 and 79 — and Vector Pipeline also provide significant economic benefit to the state.

In 2013, Enbridge paid more than $21 million in property, sales, use, and income taxes in Michigan. More than 250 Michiganders are employed or contracted with Enbridge, all of who play an important role in maintaining the safety and reliability of our pipelines and facilities. The NGLs transported through Line 5 (nearly half of the line's throughput) include propane that is delivered to the state to heat homes and fuel vehicles and industry.

Enbridge transports, generates and distributes energy across North America, and employs more than 11,000 people in Canada and United States. **We operate the world's longest and most complex crude oil and liquids transportation system — delivering an average of 2.2 million barrels each day**. Additionally, we transport close to 100 separate commodities, including more than 10 types of refined products. On any single day, Enbridge is the largest single conduit of crude oil into the United States.

Enbridge continues to build on a foundation of operational excellence by adhering to a strong set of core values — Integrity, Safety, and Respect — that reflect what is truly important to us. The values represent the basis by which decisions are made, as a company and as individual employees, every day.

2.0 Terms, Definitions and Acronyms

CPM — Computational Pipeline Monitoring. A sophisticated computer-based system that continuously monitors changes in the calculated volume of oil between two fixed points on the system, utilizing measurements and pipeline data.

CP System — Cathodic Protection system. A method of corrosion management that uses low-level electrical currents to prevent the occurrence of corrosion.

ELDER — External Leak Detection Experimental Research. A test apparatus — the first tool of its kind in the world — to evaluate external leak detection technologies.

EPA — U.S. Environmental Protection Agency.

ERAP — Emergency Response Action Plan.

Feature — An electronic measurement reported by in-line inspection describing the condition of the pipe at any location. Measurements include those related to the occurrence of potential corrosion, cracks, or dents.

GRI — Gas Research Institute.

Hydrostatic Pressure Testing — Testing the strength of the pipe by pressuring it with water at a level that is significantly higher than its normal operating pressure.

ICP — Integrated Contingency Plan. A plan providing guidance to Enbridge personnel during emergency response activities.

In-line inspection Tool — Sophisticated devices that travel through the pipeline and scan for all types of integrity features and defects. The devices contain a range of sensors, computers, data storage and other components similar to what is utilized in the medical, nuclear, aviation and many other industries. The devices identify and measure features over the full circumference of the pipeline and over its entire length.

LEPC — Local Emergency Planning Committee.

LPM — Line Pressure Monitor. An alarm system that monitors station discharge and suction pressures and can initiate operator alarms, set-point reductions, unit shutdowns, or entire line shutdowns as necessary to avoid overpressure situations.

MOP — Maximum Operating Pressure.

NEB — Canada's National Energy Board.

PHMSA—Pipeline and Hazardous Materials Safety Association.

PLC — Programmable Logic Controller. The PLC's main function is to protect the pipeline from abnormal operating conditions including overpressure and electrical surges, by automatically shutting down and locking out the appropriate equipment.

SCADA — Supervisory Control and Data Acquisition. A computer system for gathering and analyzing real-time data used to monitor and control a plant or a piece of equipment. For pipelines, SCADA systems control devices such as pumps and valves to safely manage the flow of oil through the pipeline system according to required pressures and flow rates.

SMYS — Specified Minimum Yield Strength. This is the maximum design strength of the pipe. The pipe is operated below this level by a safety margin in accordance with regulations.

3.0 Introduction

Built in 1953, Line 5 is 645 miles long; beginning at the Enbridge terminal in Superior, Wisconsin and servicing Wisconsin and Michigan as it runs across the Upper Peninsula and down to eastern Michigan before it ends at Enbridge's terminal in Sarnia, Ontario. Line 5 has the capacity to transport up to 540,000 barrels per day (bpd) of light crude oil, light synthetic crude and natural gas liquids (NGLs), including propane.

As shown in Figure 1, from the terminal in northern Wisconsin, the 30-inch diameter Line 5 travels east across Michigan's Upper Peninsula (around the Great Lakes) until it reaches the Straits of Mackinac, linking Lakes Huron and Michigan. The Straits crossing consists of two 20-inch parallel pipelines, which lay securely deep under water and then come ashore where the two 20-inch lines once again join into a single 30-inch line on land. Finally, Line 5 runs southeast through the state's Lower Peninsula before eventually terminating at Sarnia, Ontario in Canada.

Line 5 facilities in Michigan include a terminal and tankage at Gould City and Bay City, and pump stations and related facilities at Gogebic, Iron River, Rapid River, Manistique, Naubinway, Mackinaw, Indian River, Lewiston, West Branch, North Branch, and Marysville.

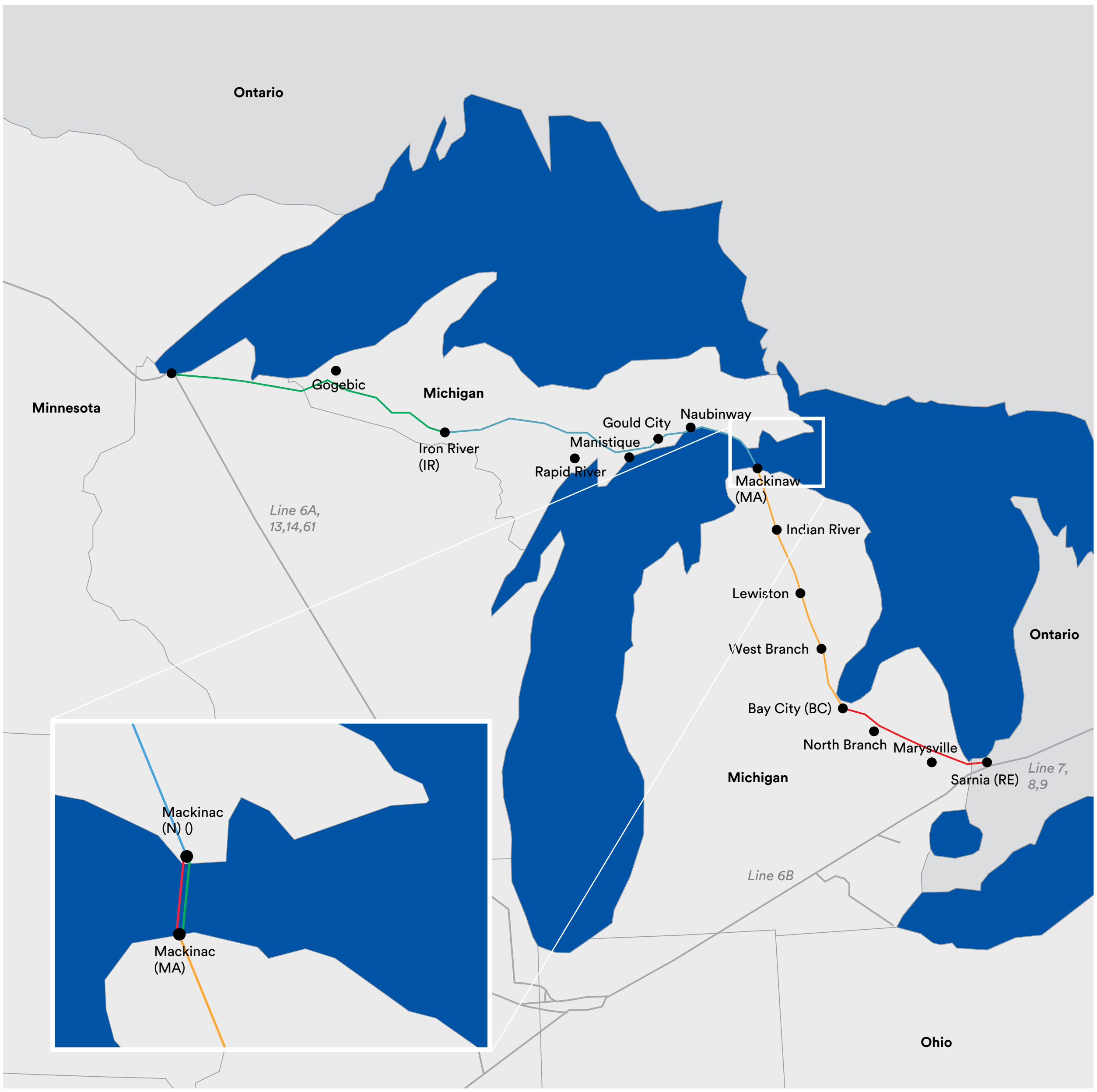


Figure 1. Line 5 and Line 5 Straits of Mackinac crossing

Line 5 is an important link in Enbridge's U.S. Mainline System. The entire U.S. System is part of the world's longest petroleum pipeline and has operated for more than 60 years. The Enbridge U.S. system is a primary transporter of crude oil and liquid petroleum in the United States, consisting of approximately 5,100 miles of pipe with diameters ranging from 12 inches to 48 inches. Additionally, the system has 64 pump station locations with a total of approximately 920,000 installed horsepower and 72 crude oil storage tanks with an aggregate capacity of approximately 14 million barrels.

The Mainline System transports crude oil commodities including light, medium and heavy crude oil. Line 5 transports primarily NGL and light crude. Propane, one component of NGL, is one of the products transported on Line 5, serving communities in Wisconsin and Michigan. Aside from helping to heat homes, NGLs are also used to produce a variety of consumer goods, such as clothing and medical equipment as well as in the manufacture of vehicles and tires, an important economic driver of Michigan's automobile industry.

3.1 Line 5 Construction

In 1953, when Line 5 was constructed, the Conservation Commission of the State of Michigan was the regulatory body. They required specific design guidelines that met or exceeded standards of the day.

Enbridge has always ensured pipeline integrity begins with precision manufacturing and testing and, when Line 5 was constructed, we hired one of the most respected firms in the world – U.S.-based Bechtel Corporation – to provide the engineering, procurement, and construction management of the pipeline. Founded in 1898, Bechtel has been on the forefront of engineering and construction for 116 years. It is a multinational company with hundreds of projects around the world and counts the Hoover Dam along the Nevada/Arizona border among its signature projects.

The underwater contractor for the Straits was Merritt-Chapman & Scott, which also built one of the most important projects of that decade — the bridge over the Straits of Mackinac, Michigan's single largest infrastructure asset and one of the world's most impressive suspension bridges.

A variety of materials and construction techniques can be utilized for pipelines. A summary of the Line 5 construction specifications is contained within Table 1 at the end of this report. The design, materials, and construction methods utilized on Line 5 are recognized, to this day, as providing highly reliable, very long-term service.

Enbridge Line 5 right-of-way near Michigan's Straits of Mackinac

3.2 Straits of Mackinac Construction

One of the most notable achievements during construction of the 645-mile Line 5 was the 4.6-mile crossings of the Straits of Mackinac in up to 220 feet of water. Engineering specialists from Bechtel, the Department of Naval Architecture & Marine Studies of the University of Michigan, as well as the Civil Engineering Department of Columbia University came together to address the challenge. With safety as the paramount factor, those experts decided to cross the Straits with two parallel 20-inch lines. A number of key safety features were included in the design and initial operation of the two lines that have proven to be very valuable in ensuring the long-term safety of the pipeline:

- **The pipes were manufactured from special steel. Typical pipe fabrication technique involves the shaping of tubes from steel plate but the pipe at the Straits was formed from a molten "billet" as seamless piping;**
- **The minimum wall thickness of the pipe, 0.812 inch (nearly one inch), is much thicker and substantially over-engineered relative to the actual needs of the pipeline or today's regulatory requirements;**
- **The pipe was externally coated with a fiber-reinforced, enamel coating recognized as one of the most superior pipeline protection materials[1];**

- **Hydrographic surveys, test boring and echo soundings of the area were used to ensure the appropriate location for the two lines; and**
- **The pipes were laid in a dredged ditch until they were in at least 65 feet of water depth, in order to avoid anchor strikes or ice action.**
- **Past 65 feet of depth they were laid on the floor of the Straits in a straight line. Recent studies have concluded the risk of an anchor drop or drag impacting the pipeline at its exposed depths is highly unlikely.**

1 This external coating is no longer used in pipeline construction because modern materials provide equal protection but with better factory production properties.

The pipes were welded together on shore into long sections and then floated across the water by a winch located on the opposite shore. Pontoons were banded to the line to lighten its weight in the water. Once the crossing section was pulled across the Straits, the lines were slowly lowered onto a previously prepared "bed" on the floor of the Straits.

That procedure was completed in a highly controlled fashion, ensuring the pipes stayed within their allowable bending and span limits.

When the line was laid, it was also pressure tested (Hydrostatic Pressure Testing) several times at more than twice the line's Maximum Operating Pressure (MOP) and up to four times its normal operating pressure. The MOP of the Straits of Mackinac has not been increased since construction.

Enbridge Line 5 right-of-way (middle of photo) as it approaches the Straits of Mackinac

4.0 Pipeline Operations and Monitoring

Enbridge relies on both human resources and technology to ensure the safe operation of Line 5, 24 hours a day, seven days a week.

In 2011, Enbridge opened a new world-class, modernized Control Center in Edmonton, Alberta, providing a work environment that is specifically designed to enhance the safety and reliability of pipeline operations by creating optimal conditions to support our operators as they conduct critical around-the-clock operations and monitoring.

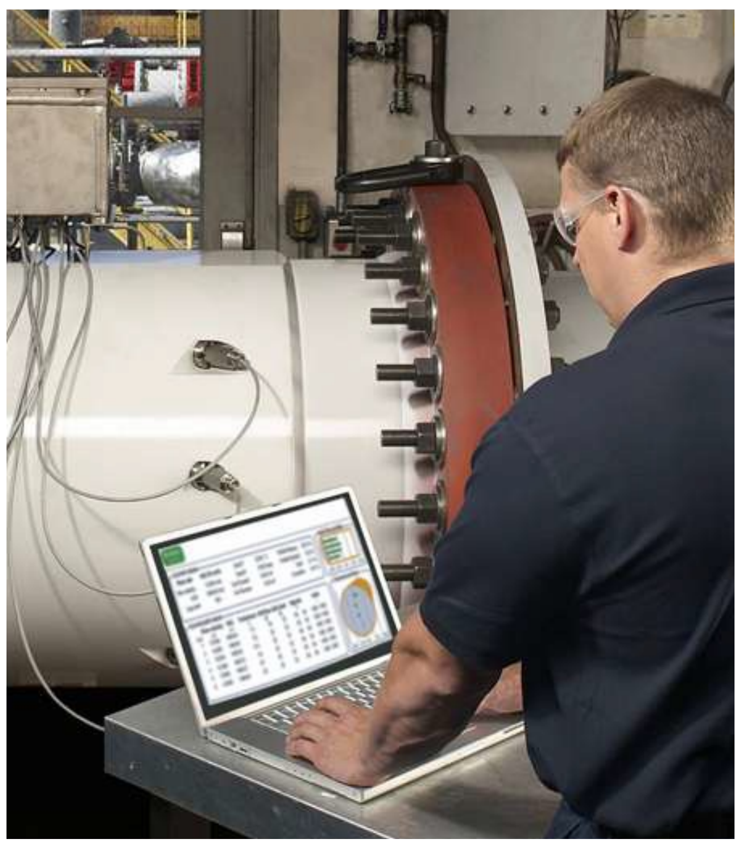
Pipelines, including Line 5, are monitored around the clock by operators in our state-of-the-art control center

4.1 Leak Detection

The safety and operational reliability of our pipelines and facilities is the very cornerstone of our business, and no incident will ever be acceptable to Enbridge. To meet the goal of zero incidents, Enbridge monitors pipelines for possible leaks using four primary methods, each with a different focus and featuring differing technology, resources, and timing. Used together, these methods provide multiple layers of protection and comprehensive leak detection capabilities.

- Pipeline Controller. Enbridge's Pipeline Controller monitors pipeline conditions, such as pipeline pressure, 24/7 through the SCADA system, which is designed to identify and raise an alarm in response to unexpected operational changes such as pressure drops, which may indicate a leak.
- Computational pipeline monitoring. The CPM system provides a sophisticated computer model of Enbridge's pipelines that continuously monitors changes in the calculated volume of oil between two fixed points on the system. If the calculated volume of oil is less than expected, an alarm is triggered in Enbridge's Control Centre and the cause of the alarm is immediately investigated.
- Scheduled line-balance calculations. Enbridge calculates oil inventory at fixed intervals to identify unexpected losses of pipeline inventory that may indicate a possible leak.
- Visual surveillance and odor reports. Reports are provided by third parties and from Enbridge's aerial and ground line patrols. Enbridge typically conducts aerial line patrols every two weeks on its entire system. Third-party reports are handled through a toll-free 1-800 emergency hotline, which the affected public and local emergency officials are made aware of through Enbridge's public awareness program.

All alarms and leak triggers (including column separation) generated by Enbridge leak detection systems and all leak triggers identified by Enbridge controllers are assumed to be leaks until they are conclusively proven otherwise. It is important to note that column separations form around the highest elevation points on a pipeline. In contrast, the line that runs under the Mackinac Straits is the lowest elevation point on Line 5. The section that flows under the Mackinac Straits is not prone to material column separation due to the elevation profile of the line.



Ultrasonic flow meter technician is undergoing a detailed calibration process to ensure optimal accuracy of the flow meter for leak detection purposes

At the Straits of Mackinac, Enbridge has established additional pipeline control elements. Line 5 has remotely operated shut-off valves along the entire line, and specifically at the upstream and downstream shores of the Straits. Both lines running under the Mackinac Straits are also protected by local low pressure shutdown logic that will initiate a cascade shutdown of Line 5 and isolate the lines under the straits in the event that a leak in either line creates a low pressure condition. The segments would be isolated within approximately three minutes from the time that the low pressure is detected. Additionally, the facility at the Straits of Mackinac has redundant systems that will ensure communication and valve actuation are available in the event of a main power interruption.

Enbridge continuously improves its capability to detect leaks on its pipelines. Over the last several years, we have focused significant time and resources in several areas to improve overall capability and system performance in both human resources and technology.

Since 2011, changes introduced to the leak detection systems resulted in further improvements of CPM system reliability and alarm performance on Line 5. In 2013, leak detection analysts in the control center underwent additional training, including team-based training and unannounced fluid withdrawal tests that evaluated the system performance including the operators and leak detection analysts. Further improvement of CPM reliability continues to be a focus for the area, with 2014 (year to date) seeing additional reliability improvements.

5.0 Integrity Management Program

When properly built, operated, and maintained, pipelines can have an indefinite life, and it is common for pipeline operators to manage their assets as such by pre-emptively repairing the infrastructure. That strategy of indefinite operating life span is not unique to steel pipelines, and similar operating approaches are applied to other types of steel structures, such as bridges and buildings.

Compared to most types of engineered infrastructure, pipelines are a relatively simple structure with very sophisticated diagnostic and assessment technologies and methods.

Enbridge applies all of the most advanced integrity methods and also drives ongoing improvements through the following actions:

- **Participating in the development of national standards, industry-recommended practices, and leading industry forums;**
- **Partnering with vendors and industry to lead and fund technology advancements; and**
- **Examining programs from other high-risk industries and applying the practices that enable them to operate as highly reliable organizations.**

All of Enbridge's mainline systems are inspected and examined using the most sophisticated techniques, including in-line inspection (ILI) tools. While Enbridge has always been one of the biggest users of technology and technical resources for pipeline integrity, the events and learnings related to the 2010 Marshall Michigan incident (Line 6B), the worst pipeline release in Enbridge's history, showed that even the use of the best industry practices of the time were insufficient. As a result, substantive improvements have been made to the Enbridge integrity management practices, advancements that Enbridge is sharing globally and applying on Line 5.

Welder is conducting pipeline repair as part of Enbridge's Integrity Management Program.

5.1 Line 5 Integrity Management

In its more than 60 years of operating pipelines, Enbridge has identified the main causes for pipeline deterioration and has taken steps to reduce the incidence and impact of each of these mechanisms across the system, including Line 5. The primary integrity threats are as follows:

- **Cracking (long seam, girth weld, stress corrosion cracking)**
- **Third-Party/Mechanical damage**
- **Corrosion**
- **Geohazards/Pipe Movement**

Programs are established to prevent, monitor, and mitigate for all of those threat types. Enbridge uses many diagnostic tools to examine the condition of pipelines and pre-empt defects from affecting the safe operation of the pipeline. The most important diagnostic information is gathered through the use of ILI tools that travel through the pipes using sensors also utilized in other critical industries such as medical, nuclear, aviation, and others. Given the relatively simple shape of pipe, a tube, those sensors can be conveniently applied to measure the condition of the entire pipeline with high precision.

In-line inspections have been frequently conducted along Line 5, including the Straits, as listed in Table 2. Results of the integrity programs over the years are explained in this section as are plans for ongoing work. Specific detail is provided on the Straits of Mackinac.

5.2 Corrosion Management Program

The Enbridge Integrity Management Program is designed to address the prevention, inspection, and mitigation of corrosion that can occur both externally and internally to the pipe. Prevention is achieved by using anti-corrosion coatings; the application of low electrical currents that protect steel against corrosion (known as CP); the use of chemicals injected into the flow of oil that prevent internal corrosion; and cleaning pipes on the inside with in-line devices known as "cleaning pigs." Routine monitoring and mitigation takes the form of in-line inspection followed by field investigation and repair activities.

External Corrosion

The external coatings on Line 5 is still today recognized as being one of the most successful coating systems applied on pipelines worldwide. The particular material, an extract of coal or asphalt, is highly impermeable to water and is reinforced with a fiber wrapping for added strength. The material is no longer in use because modern materials are more easily applied in factory settings and are safer from a worker health perspective. In any case, any pipeline originally installed with those materials is viewed to provide superior long term integrity performance.

In addition to the high performance coating system on Line 5, regular CP surveys are performed to determine the state of the CP system and to evaluate the overall protection levels and coating condition. As a result of the excellent coating system on Line 5, including the Straits, and in combination with the cathodic protection system, there is a very low level of external corrosion on the pipeline.

Internal Corrosion

Enbridge transports crude oils that contain trace amounts of water, suspended solids, and bacteria. Under certain operating conditions (such as low flow rates/low turbulence) those materials can settle to the pipe floor to create localized corrosive conditions.

The first defense against internal corrosion includes tariff specifications that limit the amount of non-oil constituents to less than 0.5 percent by volume — one of the most stringent quality specifications for crude oil transmission in North America. Every batch of oil that enters the Enbridge system is sampled and tested to evaluate conformance to that quality specification. Enbridge maintains the authority to impose sanctions on shippers who deliver crudes not meeting that quality standard — including locking them out of the Enbridge system.

Although the majority of the trace non-oil constituents in crude oil are harmlessly transported through the pipeline system without accumulating, Enbridge regularly conducts evaluations of pipeline operation to assess the potential for corrosive conditions to develop.

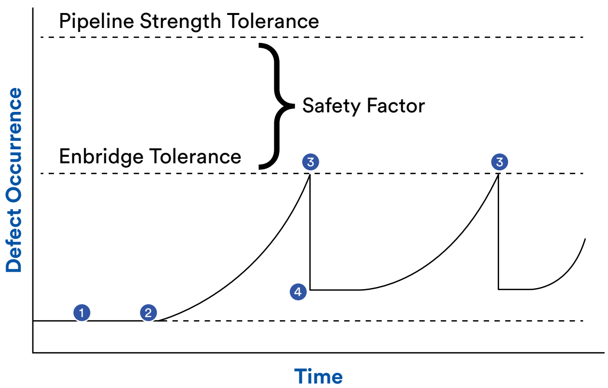
Through the detailed Internal Pipe Corrosion (IPC) susceptibility analysis, the internal corrosion hazard to Line 5 has been assessed to be low. The following factors were considered in the analysis:

- **Line 5 ships light conventional products (NGL & light crudes) which carry less sediment and water;**

- **ILI programs, which have been used on Line 5 since the 1970s, have been reliable and effective in managing metal loss on the line and the growth rates have been demonstrated to be low; and**
- **Product flow flushes sediment/water out of the pipeline.**

If Enbridge determines that a pipeline has an elevated susceptibility to internal corrosion due to the possibility of accumulating sediment or water, additional monitoring and prevention programs are implemented. Additional monitoring may include direct corrosion monitoring (using coupons, electric field mapping, ultrasonic wall measurement), or increased in-line inspection frequency; or indirect monitoring (such as chemical/biological analysis of pipeline fluids and pig solids). Additional prevention programs include cleaning and/or inhibition treatments.

Figure 2: Proper maintenance Assures Asset Longevity (indefinite life)



1 Existing benign flaws in a new pipeline (No impact on pipe safety)

2 Potential onset of flaw growth

3 Pipeline is revalidated through ILI monitoring & mitigation of flaws determined to be defects

4 Remaining flaws, well below safety factor, that are monitored through ongoing program

Corrosion Inspection

Detailed information regarding the pipeline's integrity condition is obtained through high-resolution in-line inspections. **Line 5 continues to be inspected and assessed with state-of-the-art technology to monitor, identify, and mitigate potential threats associated with corrosion**. A total of 25 high-resolution metal loss inspections have been completed on the line since the mid-1990s. Most recently all segments were inspected for corrosion in either 2012 or 2013. Our Integrity Management Program requires in-line inspection programs to include repair and correlation excavations based on the most recent defect assessment criteria being utilized. In general, corrosion features that have a determined failure pressure that falls within the operational safety factor or are deeper than 50 percent of the pipe wall thickness are identified for excavation and assessment.

On Line 5 corrosion is predominantly shallow in depth and minor in overall severity, and external corrosion is more prevalent than internal corrosion. All features with depth greater than 50 percent through wall have been repaired.

The ILI re-inspection intervals are planned such that anomalies can be identified and mitigated before they pose threats to the line, depicted graphically in Figure 2. The established programs that manage internal and external corrosion on the Enbridge pipeline system meet or exceed the current Pipe Strength Tolerance defined by the MOP of each pipeline.

In-Line Inspection Metrics

The metal loss metrics, including total number and per mile frequency on Line 5 are summarized in the chart shown below. As shown in the table below, there were no features found during the recent inspections that encroached on the operating pressure. No features fell within the repair criteria. Six features were found with depth greater than 50 percent that require monitoring through the ongoing program. The frequencies shown in the table are considered to be very low, demonstrating that the performance of the corrosion management program has been effective.

Metal Loss Condition Summary

General Metal Loss Rupture Pressure Ratio (RPR)		
Flaws Near Pipe Strength Tolerance	Flaws Meeting Enbridge Repair Tolerance	Flaws to be Monitored
0	0	6
0.000/mi	0.000/mi	0.009/mi

Corrosion Growth Rates

Corrosion growth rates are calculated in order to provide insight into the current and future integrity condition of the pipeline and to support the monitoring and mitigation planning.

Industry standards offer guidelines regarding typical corrosion growth rates (CRG). The chart below contains a summary of CGRs found in industry guidelines and/or standards and are compared against rates on Line 5 and the Straits of Mackinac.

Industry Guidelines for CGR Compared to Line 5 CGRS

Standard/Guideline	Recommendations
NACE RP0102	0.3mm/yr: 80% confidence max rate with 'good' CP
ASME B31.8S	0.31mm/yr max rate for active corrosion in low resistivity soils
GRI-00/0230	0.56mm/yr for pitting; 0.3mm/yr for general corrosion
Line 5 Avg. Rates - External Corrosion	0.038mm/yr – 0.068mm/yr
Line 5 Avg. Rates - Internal Corrosion	0.018mm/yr – 0.046mm/yr
Line 5 Straits of Mackinac - Int. and Ext. Corrosion	No observed corrosion growth

The industry rates are much higher than the typical rates for external corrosion on Line 5, which indicates that Line 5 corrosion growth rates are low. This is consistent with the low number of repairable features identified through in-line inspections.

The growth rates used for in-line inspection re-assessment interval determination take all these values into account and a judgment is made regarding the most appropriate CGR values that balances the Line 5 CGR experience with industry experience.

5.3 Cracking Management Program

Enbridge is committed to being at the forefront of technological developments and research relating to cracking and its diagnosis. **Cracking is a phenomenon that can occur in metals, including pipeline steel. There are rigorous programs in place for monitoring and managing cracking, which entails a focus on ILI and other diagnostic tools, field investigations, laboratory testing, reliability analytics, and ensuring smooth pipeline operation**.

Cracking Prevention

The primary forms of cracking that typically require active management on pipelines are environmentally assisted cracking, such as Stress Corrosion Cracking (SCC), and cracking at the longitudinal weld (the seam that runs the length of the pipe).

SSC is initiated by similar environmental conditions as external corrosion and benefits from the prevention and mitigation techniques employed for external corrosion such as a robust external coating and the cathodic protection system.

The management of pressure cycling is important because it is the primary driving force of fatigue crack growth. Pressure cycling is one of the many operational factors a liquids pipeline company has to monitor as part of their pipeline integrity cracking program. The operational source of those cycles can be complex but often include planned start/stops, mid-point injections or deliveries, flow rate changes, and unplanned line outages. Enbridge monitors all operational lines on a monthly basis for pressure cycling risks. Once the risks are identified, we establish a pressure cycling mitigation plan to ensure continued safe operation of the asset. The plan addresses required modifications to the existing operational philosophy or what physical modifications are required to the system to reduce pressure cycling. Pressure cycling on Line 5 is minor.

Crack Inspection

Line 5 has been inspected with best available crack inspection technology with the current monitoring and mitigation programs developed based on all lessons learned from Enbridge's integrity management experience, in particular through the learnings of the 2010 Marshall, Michigan incident. Most recently, in 2011, all on-shore segments of Line 5 were inspected with high-resolution crack tools. Each of the inspections were followed by field investigations that expose the pipe for confirmation of inspection results and the application of repairs where required.

The Crack Inspection Program for the entire length of Line 5 consists of the following activities:

- A regular routine comprehensive assessment using an ultrasonic crack detection ILI tool;
- Engineering analysis to assess the current fitness-for-service of each anomaly identified by the inspection (i.e., immediately following the latest crack detection ILI run);
- Excavation and repair programs to assess and mitigate selected anomalies and validate the crack inspection data. In addition to specific excavation programs based on the ultrasonic crack detection ILI tool, Enbridge also examines the pipe for crack-related features during its excavation programs based on other ILI technologies; and
- Engineering analysis to assess the continued fitness-for-service of the line (i.e., takes into consideration subsequent growth from fatigue and environmental-assisted cracking versus the maximum pressure at that location). That includes pressure cycle monitoring to ensure appropriate re-inspection intervals.

GE US Duo Crack Inspection Tool

Line 5 In-Line Inspection Metrics — Cracking

The table below summarizes the results of the recent crack inspections on Line 5. The data is separated into 3 categories based on feature depth. The first column contains the features that may be minor crack defects or simply ultrasonic reflections from imperfections in the pipe. All pipe will contain some anomalies or imperfections and most will never grow or represent a threat. Some of these are investigated, but generally these are monitored repeatedly for growth through future inspections. The second category contains features that are evaluated for possible "field investigation" based on a detailed assessment of the feature's severity. The third category represents priority features that are all targeted for field assessment and repair, as required. As shown in the immediate table, there were no features in this category on Line 5. For reference, typical wall thickness of pipe on Line 5 ranges from 0.312" to 0.500". The pipe within the Straits of Mackinac is 0.812".

Line 5 In-Line Inspection Metrics — Cracking

	Depth of ILI Crack Tool Anomalies		
Feature Depth	0.040" - 0.080"	0.080" - 0.120"	> 0.120"
# Features	661	48	0
# Features per Mile	1.032/mi	0.070/mi	0.000/mi

All crack features from the crack inspection program that met Enbridge excavation criteria have been repaired as required, ensuring the continued fitness for service of the line. For those features that remain, all are minor and do not impact the safety factor of the pipeline at all or for many years into the future. All sections of Line 5 will be re-inspected every three years to address any growth in features from fatigue.

Line 5 Hydrotesting

Hydrostatic Pressure Testing, which involves pressurizing the pipeline with water to proactively detect failure or leaks, has been performed in recent years on two sections of Line 5. Station piping hydrotesting was conducted at several Line 5 pump stations in 2004. In 2012, a hydrotest was conducted on two segments of the on-shore portions of the Line 5 mainline to validate the increase of the overall line capacity by 50,000 BBLs per day. No leaks or failures occurred during this test, which applied pressures much higher than maximum pressures the pipeline experiences during normal operations. This result provided further confirmation of the reliability and effectiveness of the integrity management program.

Hydrotesting is a somewhat destructive way to confirm the integrity of a pipeline. Some anomalies may survive the test, but grow and fail in the near future. For that reason, this integrity assessment method is done selectively. In-line inspections are a preferred method because they provide more broad-based diagnostic information without exerting stress to the pipe.

5.4 Third-Party/Mechanical Damage Management

Enbridge strives to prevent any dents, scrapes and other damage to pipes and facilities during construction and operation or by third parties (such as backhoe strikes). **To prevent third-party damage, Enbridge has a comprehensive public awareness program in place to engage landowners, community members, and first responders to ensure that they are aware of our pipelines and related facilities.**

There have been historical failures associated with mechanical damage on Enbridge pipeline systems, including Line 5, making this an important hazard to be managed. The lessons learned from each past incident have helped improve the Enbridge mechanical damage program.

Third-Party Damage Prevention

Prevention is a key component to Enbridge's approach to mitigating the potential for mechanical damage to occur as a result of third-party damage.

The Enbridge Lands Services Department uses a comprehensive Right of Way (ROW) monitoring and stakeholder awareness program to prevent damage to the pipeline system. Components of the program include:

- **Visable and frequent signage;**
- **Participation in local One-Call organizations;**
- **Participation in industry community awareness programs;**
- **Depth of cover surveys; and**
- **ROW patrols.**

Public Awareness Program

Through our U.S. Public Awareness Program, Enbridge provides information on an annual basis to emergency and public officials, affected public (the people who live, work, and congregate near our pipelines and facilities), excavators, farmers and schools near our areas of operation in accordance with federal regulations. In most cases Enbridge goes above and beyond regulatory requirements. As part of the public awareness program, Enbridge also provides information to marine companies and plans to enhance our messaging to include the risk of pipeline damage caused by anchor drops across the Straits of Mackinac.

Key messages provided through the public awareness program include the purpose and reliability of pipelines, what we do to maintain the pipelines and associated facilities, the importance of calling 811 — the national toll-free "Call Before You Dig" number, and how to recognize a potential pipeline emergency, contact Enbridge, and respond or react.

Mechanical Damage Inspection

Mechanical damage sustained by the pipeline, whether it is residual from construction, experienced due to pipe or soil settlement post construction, or created by undetected third-party contact, can be reliably detected by ILI.

The primary technology used to detect and identify mechanical damage is the geometry (caliper) ILI tool, which physically measures variances in the internal diameter of the pipeline to identify geometry features indicative of mechanical damage and reports dents, buckles, and ovalities. In addition to identifying features in the pipeline, modern technologies have the ability to characterize those features in shape (plain, smooth, symmetrical, sharp, multi-apex), circumferential orientation (top side vs. bottom side and proximity to long seam welds), axial position (distance from nearest girth weld), and depth. The caliper technology can be supplemented with data from metal-loss or crack detection technology to provide additional characterization of mechanical damage features.

The monitoring and identification of mechanical damage on Line 5 has been achieved through multiple high-resolution Caliper ILIs that are routinely conducted on each of the segments.

Enbridge reliably operates pipelines across a variety of terrains. Terrain can play a significant role in the number of dents in a given pipeline. For instance, the segment of Line 5 between Superior and Mackinac traverses rocky terrain and has a proportionately higher population of dent features. Likewise, the segment of Line 5 at the Straits of Mackinac, which crosses a smoother water bottom, has no recorded dents >two percent. Two percent represents the reporting threshold in the caliper ILI tools. Enbridge investigates all features that meet field assessment criteria set out in the regulations and Enbridge procedures. The table below provides a graphical comparison of dents per mile, and the total dent population for all Line 5 segments.

Dent Condition Summary Line 5 (Dents > 2%)

Pipeline Segment	Superior to Iron River	Iron River to Straits	West Straits	East Straits	Straits to Bay City	Bay City to Sarnia
# Features	144	258	0	0	14	8
# Features per mile	0.829/mi	1.266/mi	0.000/mi	0.000/mi	0.892/mi	0.076/mi

5.5 Geohazard/Pipeline Movement Management

Line 5 runs through a geographically diverse area comprised of slopes and river crossings and other terrain that requires careful attention to prevent geotechnical ground movement. Those geohazards are effectively managed through a combination of monitoring, assessment, and remediation when required. **The details of the Enbridge Slope, River Crossing, and Pipeline Movement Management processes for Line 5 are described below.**

Geotechnical Hazard Management

The Enbridge system has been surveyed for geotechnical hazards utilizing external specialists and each area is cataloged. Routine ROW inspections are conducted bi-weekly in an effort to detect any area where instability might exist, for example at steep-sided sloped areas. In the event that slope instability is identified on or near the pipeline corridor, Enbridge engineers and/or a geotechnical specialist assess the site. Based on that specialist review, it is evaluated whether the observed movement might affect the pipeline. Those evaluations may lead to additional monitoring initiatives such as:

- Supplemental ROW patrols;
- Scheduled geotechnical specialist inspections; and
- Slope instrumentation installations.

Alternatively, those assessments may lead to remediation requirements such as slope improvements, pipeline stress relief, or line relocation.

River Crossing Management

Enbridge monitors river crossings through a combination of ROW patrols, depth of cover surveys and engineering site visits as required. Approximately 3000 water crossings have been field inspected. ROW inspections identify threats such as high water levels, river scour, debris, pipeline exposure, or other phenomenon that may affect the crossing integrity. Any such findings are communicated to Enbridge engineers and assessed for mitigation requirements. Depth of cover surveys are conducted every 10 years at minor crossings that exhibit lesser exposure risks, and every five years at major crossings. If a survey identifies low cover near a river crossing, the crossing is assessed for remediation requirements. The assessment includes evaluation of any ILI anomalies, unsupported spans, potential loading, river conditions, crossing location, and consideration of landowner consultations. **Some examples of remediation options are pipeline armoring, line lowering, or line re-routing**. While closely managed, Geohazards have been determined, due to the relatively flat profile, to not be a significant risk for Line 5.

5.6 Integrity Management at the Straits of Mackinac

Firstly, it is important to note there has never been a leak in the underwater pipelines in the Straits of Mackinac and the pipelines remains in excellent condition. That is achieved through Enbridge's ongoing integrity management efforts.

Enbridge has identified the Straits as a high consequence area (HCA) that poses special risks and concerns for pipeline operations. As a result the section of Line 5 that runs underwater is protected by multiple layers of defense, procedures, and devices.

Enbridge regularly inspects the Straits crossing using both remote operated vehicles (ROVs) and state-of- the-art in-line inspection tools. **ROV external inspections are conducted every two years**, providing the thorough review of the exterior of the pipe and its immediate environment, assessing any unsupported spans, damage to the external coating, and support systems. These inspections are extraordinary, both in their frequency and the thorough review of the exterior of the pipe and its immediate environment. **The most recent ROV assessment took place in 2012, and another is scheduled for summer 2014**. Other, third party video, recently posted on a part of the Straits do not contain threats and have mischaracterized certain conditions as signs of damage.

Internal inspections take place at least every five years utilizing multiple technologies that assess every square inch of the pipe for features that could impact its structural integrity. For example, the inspections conducted in 2012 included a GEOPIG, which detects potential deformation and movement by measuring possible dents, wrinkles, buckles, and ovalities, as well as accurately measuring the line's geospatial position. An MFL (magnetic flux leakage) inspection was also conducted which detects corrosion and pitting in the pipe wall. GEOPIG inspections as well as two different ILI tools performing circumferential crack inspections will be run in 2014, and again in 2018.

In compliance with the requirement by PHMSA and by following Enbridge operations and maintenance procedures, Enbridge personnel also perform aerial line patrols along the pipeline route at regular intervals at the Straits. The interval for aerial line patrol at the Straits is every two weeks, and not to exceed three weeks. The air patrols are another means to confirm the physical integrity of the pipelines of the Straits of Mackinac.

To date, no pipeline repairs have been required at the Straits, demonstrating that the pipeline designs have been performing exceptionally well. The following describes the condition assessment of the lines crossing the Straits:

- There is a low susceptibility to internal corrosion due to clean commodities and a "self-cleaning" flow rate. The external coating has performed particularly well through the Straits of Mackinac preventing the occurrence of external corrosion.
- Similarly, there have been no dents reported by geometry inspections, confirming that mechanical damage has not posed a hazard over the last 60 years of operation.
- Stress Corrosion Cracking (SCC), requires both a corrosive environment and high stress. However, neither element is present in the pipelines through the Straits, which have an excellent coating and operate at less than 25 percent of their design capacity.
- The four-plus miles of pipes through the Straits are of a seamless pipe construction, reducing to zero any potential for long-seam cracking, an integrity hazard that requires active management on many on-shore pipelines, including other portions of Line 5 pipeline.
- The Straits of Mackinac portion of Line 5 is unique given their location under water. As such, the types of third-party damage to be managed at this location are different than elsewhere on Line 5. Anchor strikes are the primary concern and are mitigated in several ways. Ship traffic in the area is modest and the lines are located in a no-anchoring zone. A utility corridor designates the pipelines locations on the National Oceanic and Atmospheric Administration (NOAA) navigation charts for commercial vessels. There are also lighted "No Anchor Zone" signs near both shores over the pipelines as a public warning. Most importantly, however, the heavy thickness of the pipe walls makes puncture highly unlikely. A recent third-party assessment modeled the scenario of an anchor drop from a large lake freighter directly striking the pipeline. The results demonstrate that due to the high ductility of the pipe steel combined with the heavy wall thickness, the anchor strike, while it may cause some flattening of the pipe, is highly unlikely to puncture. That facet of the design was intentional as it allows damage to be absorbed while still containing the oil until a repair can be performed. The likelihood of such an event occurring, however, is very low as evidenced by the absence of mechanical damage having occurred in the 60 years of operation.
- Ice scour (disturbance because of moving ice packs) has also been effectively managed through the design. As mentioned earlier in this report, the pipes were laid in a dredged ditch until they were in at least 65 feet of water depth.
- All girth welds were radiographed and pressure tested before the line was installed resulting in a low risk of defects within the girth welds (the circumferential weld that joins one section of pipe to another). The potential for fatigue of these welds over time is also low due to the active management of unsupported spans. Enbridge is also conducting girth-weld crack inspections in 2014 to positively evaluate the current condition of these welds, utilizing technologies employed by the offshore oil and gas industry.
- Since construction Enbridge has employed a span management program, monitoring the length of unsupported spans and repairing as necessary. Early on spans were mitigated utilizing grout bags. In approximately 2002, Enbridge decided to engineer a safer and more permanent solution to counteract the currents and prevent washouts, and began installing screw anchor pipe supports on span lengths that approached the determined safe distance of 140 feet. These anchors are ten-foot-long steel screws that are augured into the lake bed on either side of the lines and hold a steel saddle that permanently supports the lines. Over the subsequent 12 years, after installation of the screw anchors, Enbridge has yet to observe any washout of those very durable supports.

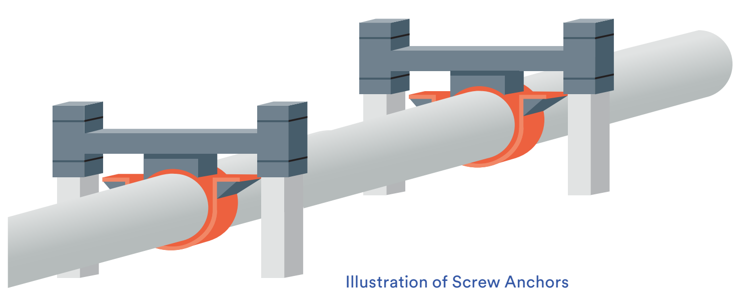


Illustration of Screw Anchors installed on a water bottom

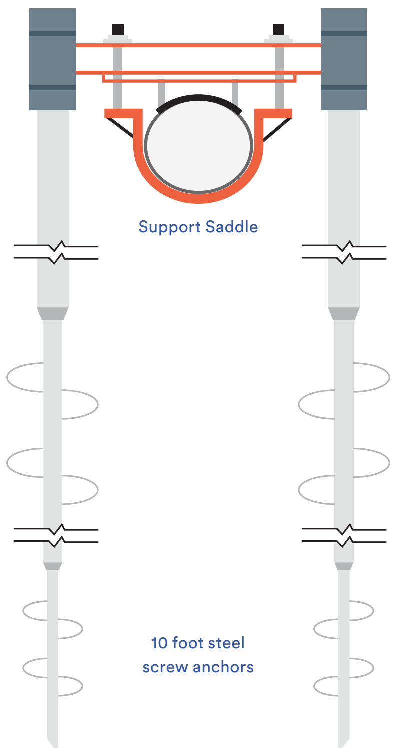


Illustration of Screw Anchor Technology
(viewed in direction of pipeline)

Federal regulation requires that underwater laterals such as the Straits pipelines be inspected every five years. Enbridge instead chose a more conservative, voluntary inspection cycle of two years. During our regular two-year underwater inspections, if we should find any wash out of existing earthen supports, we install new, screw anchor pipe supports at the affected location(s), ensuring a permanent support solution. The maximum spans we have discovered in the last ten years are approximately 90 feet, or about 64 percent of the maximum safe span distance. As a result of the support installation program that ended in 2012, Enbridge achieved an average span length of less than 75 feet, or a "two times" safety factor.

- With the additional anchors to be installed in 2014 and the existing supports, the average span distance will drop to less than 50 feet or, on average, a "three times" safety margin. This safety margin is reflective of the environmental importance of this significant water crossing. Since their construction, the pipelines have undergone 17 sub-marine pipeline inspections. After 1972, inspections were conducted at least every five years as required by the Department of Transportation (DOT) regulations (49 CFR 195). In the last several years Enbridge has increased this frequency of inspections to every two years.

5.7 Learnings from Historical Leaks

Enbridge is fully committed to continuously improving pipeline system reliability with the goal of achieving zero failures. Integrity programs are designed to eliminate pipeline ruptures and minimize leaks. This is done, in part, by focusing on the conditions that have been known to cause pipeline failures in the past and then working to minimize risk.

No matter what the size or location of a release, Enbridge takes every incident very seriously and treats it as a top priority to respond to the incident and fully examine the cause. Every incident is fully investigated to determine the root causes and contributing factors. Those findings, as well as those of regulators and other agencies, are incorporated into actions focused on improving management systems. Incident response effectiveness is also reviewed to identify areas of improvement. Furthermore, to help enhance the overall safety of the industry, Enbridge shares the lessons learned with stakeholders within Enbridge, across industry and with regulators and first responders.

The pipelines through the Straits of Mackinac have not experienced any leaks in six decades of operation. While other portions of Line 5 have experienced failures, Enbridge's efforts in leading industry advancement in areas of prevention, monitoring, and mitigation have over the years resulted in a significant and steady reduction in events on Line 5 to achieve our final target of zero releases.

Enbridge's participation in aggressive and robust public awareness efforts and campaigns, along with the industry efforts to promote the one-call notification requirements and 811, the national "call before you dig" number, have greatly reduced the potential for third-party damage events. There has not been a leak on Line 5 caused by a third-party in 17 years, demonstrating the effectiveness of these damage prevention programs.

Equipment within pump stations and terminals can also be a source of leaks. These may occur at pump seals or bolted pipe connections, for example. These leaks are easily detected, and usually represent a very small volume, and the sites are quickly restored. While facility leaks do occur, Enbridge, through our Path to Zero program, is committed to continuously reducing the number of leaks on our system with the ultimate goal of zero incidents.

Enbridge operates and manages all our facilities and pipelines, including Line 5, in a safe and responsible manner. **The significant reduction in failures to the on-shore segments of Line 5 reflects our continuous**

learning from past events and demonstrates that investments in technology and processes to enhance our integrity programs are producing results.

5.8 Pipeline Replacement

As part of the Pipeline Integrity Management Process, pipe replacement is considered within a suite of long-term integrity management strategies. Accordingly, an integrity assessment of the pipelines based on the intelligence gathered through the inspection activities noted in this report are done on an annual basis to consider integrity management options such as partial, segmental or full pipeline replacement.

The pipeline replacement assessments are completed in accordance with Enbridge's Procedure for Pipeline Replacement Assessments, which looks at feature density as it relates to impacts on risk and reliability.

At this time, Line 5 is not being considered for replacement as the integrity and operational reliability is most efficiently addressed, with the least disruption to landowners and the environment, through targeted assessments and repairs. Through the completion of targeted repairs, defects are removed from the pipeline, restoring it to "as new" condition. If the deterioration of the pipeline is light, due to effective prevention measures such as the coating and cathodic protection system, the pipeline can be maintained through inspection and repairs indefinitely. As described earlier, age is not an indicator of reliability.

At the Straits of Mackinac, the integrity of the lines is closely monitored to ensure continued high reliability. **Pipelines across the Straits remain in excellent condition and, other than continued inspection and span maintenance, have not seen any deterioration requiring repair activities.**

6.0 Incident Management/ Emergency Response:

While the goal is first and foremost to prevent all incidents, Enbridge also has a comprehensive incident response and environmental mitigation plans in place to respond rapidly and completely if a release occurs. Protocols are based on the principle of keeping people and communities safe and protecting the environment. Every incident is taken very seriously and treated as a top priority, no matter what the size or location of the release.

Each of Enbridge's business units has emergency preparedness and response plans in place to minimize the impact of an incident and comply with regulatory requirements.

Enbridge also works closely with first responders and communities, including the local police and fire departments, to ensure they are aware of our systems and what they should — and should not do — in the event of an emergency.

In a release scenario, emergency response procedures are carried out to shut down and isolate the source, notify the appropriate government and regulatory agencies, contain the substance as appropriate, and manage potential environmental and safety impacts.

That is achieved by having emergency equipment located at strategic locations on Line 5 including the Straits of Mackinac as well as numerous other sites. Enbridge also has response agreements with specialty contractors, such as Marine Pollution Control (MPC), at the Straits, for oil spill removal organization duties. MPC, an Oil Spill Response Organization (OSRO), is also the preferred contractor for the USCG for oil spills in the Straits area. They are capable of a tactical response for the Straits, following industry best practice aand are certified by the USCG for specific capabilities for the Great Lakes operating area. .

In 2012, Enbridge launched an online, state-of-the-art Emergency Responder Education Program to provide emergency responders with training on how to safety and effectively respond to an incident on the Enbridge or Vector Pipeline systems. The program is provided free of charge to emergency responders and provides an overview of pipeline operations, the Incident Command System and how Enbridge will work within that system, and real-life scenarios to allow for practical application of skills discussed in the program. **In Michigan, 270 emergency responders, employees, and others have registered for**

the program; 148 have completed the program. We also provide grants to emergency response organizations along our pipeline rights-of-way to help cover costs related to equipment and training that may be needed in the event of a pipeline emergency. In 2013, we provided more than $70,000 to emergency response departments throughout Upper Michigan.

Safety, the protection of people and the environment, rapid response, and thorough containment and cleanup to minimize the impacts are the highest priorities. **The products transported in Line 5 include NGLs and light crudes, non-heavy conventional products. These are conventional products and not heavy.**

As evidenced by the 60yrs of incident-free operation, a release of oil into the Straits is extremely unlikely. Furthermore, with the application of modern integrity practices and the increased efforts to safeguard the integrity of these lines, the likelihood of a leak event has been further reduced. Never the less, Enbridge has modeled leak event scenarios that show how Line 5 products (NGL and Light products) would react in order to inform our emergency response planning.

- **How non-heavy conventional products react in the unlikely event of a spill depend on many factors, such as ambient temperature and wind. Suspended sediment can also influence the behavior of crude oil released into a freshwater environment. These factors are discussed below.**
- **Temperature: Aside from NGLs, which will dissipate as a gas, other Line 5 products consisting of a variety of light oils would typically be expected to evaporate up to 30 percent of initial volume in the first few days following a release. In a constant environment, the remaining oil would remain buoyant for collection and recovery from the surface using oil recovery technologies.**
- **Weathering: The weathering process will change the crude oil's physical and chemical characteristics. A weathered light crude oil is expected to remain buoyant, but may emulsify based on wind and current patterns. The weathered oil is also likely to form multiple oil slicks in rough water conditions or windrows in high winds. In rough cold water, a light crude oil will also have a tendency to temporarily submerge from the surface but will resurface as the surface water calms.**
- **Suspended Sediment: As a weathered crude oil enters an area of higher suspended sediment such as near shore or near a river mouth, the likelihood of sediment entrainment and loss of buoyancy increases. As with any crude oil release, the tactics used to collect the product need to predict and evolve as the product weathers and environmental conditions change.**

In summary, the modeling indicates that for Line 5 products, much of the released product would evaporate, and the rest would remain buoyant for many days, allowing for removal through Enbridge and Coast Guard emergency response efforts. Recent simulations conducted by external parties that purport to show how oil will move in the event of a release are not based on an oil spill model, but simply show how particles released in the water will move with the currents. No oil weathering, such as evaporation, that affect how long the oil stays in the environment were accounted for. Further, no consideration was given for emergency response timing and effectiveness. Enbridge has modeled how quantities of crude oil might spread before spill containment measures could be implemented; the response plans have been developed such that they address all areas where oil may flow following a release on the Straits ensuring they can effectively accommodate all contingencies.

6.1 Integrated Contingency Plan

In the event of an incident, Enbridge will work closely with the appropriate authorities in an incident command system, including state and federal regulators on a timely, effective response. The goal is always to restore the area as closely as possible to its pre-spill condition. In an incident command system, the environmental management component is part of the planning section and is responsible for all environment matters related to the response. That includes strategic assessment, modeling, surveillance, sensitive area identification, wildlife management, environmental monitoring and permitting, waste management, historic and cultural sites, and remedial expertise.

An Integrated Contingency Plan (ICP) was drafted in 2013 and underwent an extensive, first-ever PHMSA coordinated peer review. That process included the United States Coast Guard (USCG); U.S. Environmental Protection Agency (EPA); independent third-party industry expert, Det Norske Veritas (DNV); the Canadian National Energy Board (NEB) with PHMSA facilitating the final approval. Comments were collected by PHMSA, changes made and final approval was issued in July 2013.

A redacted version is located on PHMSA's site as a "model plan" for other companies to refer to. As well, Enbridge has an ERAP, which is a condensed version of the ICP. The ERAP removed sensitive information and it is intended to be used for initial response and sharing with external first responders, and emergency management in the communities along the pipeline system.

6.2 Tactical Plans

Enbridge has a Tactical Response Plan for the Straits of Mackinac that identifies more than 60 potential response sites. The Tactical Response Plan is a controlled document and has been provided to the Local Emergency Planning Committee (LEPC) to assist them with updating the Area Contingency Plan for the Straits of Mackinac.

PHMSA has copies of the Straits of Mackinac Tactical Response Plan and the Superior Region ICP that covers the Straits of Mackinac. PHMSA has posted on its website a version of Enbridge's Chicago Region ICP which would be similar to the Superior Region ICP.

Enbridge has our own initial response equipment for oil releases until additional responses arrive from contracted response agencies. Our Spill Management Teams (SMT) are located throughout the regions that would respond to the Straits pipelines (upwards of 200 responders in Superior region and 150 responders in Chicago region). We have GPS mapped average response times for company and contracted personnel based on speed limits and no inclement weather conditions. In addition, our SMTs have a comprehensive training syllabus that they adhere to. That training includes operations of skimmers, boom deployment, and a range of other tactical courses for emergency response.

Company field personnel would be immediately dispatched to an incident from the closest positions and then progressively further away depending on the scope of the incident and person-power needed.

6.3 Emergency Response Exercises

First responders are critical to ensuring safety of the community and protection of the environment. For that reason, Enbridge participates with emergency responders and public agencies and communities in drills and simulations to test readiness and continually improve preparedness procedures.

Enbridge held a major emergency response exercise at the Straits of Mackinac in January, 2012. This exercise involved USCG, OSRO and Enbridge Incident Command System staff and field responders. The information gained helped inform the Straits of Mackinac Tactical Plan.

Enbridge has also voluntarily accepted the National Preparedness Response Exercise Program (PREP) as the guide for emergency response exercises. The PREP guidelines are the minimum and Enbridge strives to exceed the minimum number of exercises each year.

Plans are underway to conduct a full-scale PREP exercise that includes USCG, U.S. EPA, local county emergency managers, and Michigan Department of Environmental Quality (MDEQ) and many other stakeholders at Indian River with a focus on containment strategies and common operating picture. Both PHMSA and the NEB will be invited to attend.

An Emergency Response exercise conducted on the Straits of Mackinac crossing in January 2012.

6.4 Advancements in Emergency Response

Enbridge recently enhanced the training provided to emergency responders along its U.S.-Canada pipeline system by introducing a new program that includes an interactive online course and in-person sessions. That program is seen as a significant advancement that enables reaching a large number of emergency response agencies with consistent, comprehensive information about the products transported and the most effective tactics for responding to a pipeline emergency.

AUV tool developed in partnership with Michigan Tech University's Great Lakes Research Center.

6.5 Research and Innovation

Enbridge has invested millions of dollars in advanced monitoring and inspection practices and continues to make progress toward achieving our goal of zero incidents. **As a proactive measure, and to support the reliable operation of the pipelines across the Straits, Enbridge is undertaking a number of additional measures to enhance safety and reliability:**

- **Michigan Tech University Partnership: Enbridge's Research, Development and Innovation Department has partnered with Michigan Tech's Great Lakes Research Center to acquire a state-of-the-art autonomous underwater vehicle (AUV) to conduct repeated bottom mapping of the pipeline water crossing. The objective is to develop an advanced underwater sensing technology that can more effectively and efficiently capture pipeline integrity information. The project also includes improvements to the AUV guidance system to allow it to more accurately track the underwater pipeline crossing during inspections.**
- Participation/leadership of many industry research and development projects: Enbridge is currently involved in dozens of industry research projects annually that look to advance knowledge of pipeline integrity management.
- Water Modeling Study: A water current modeling study to examine the effect of currents on the lines is in development.
- Feasibility Study: With respect to the Straits, Enbridge has commissioned a feasibility assessment to determine the benefits of deploying additional commercially available external leak detection and damage detection technology on the Straits crossing or at the valve sites that are situated upstream and downstream of the crossing.
- **Straits of Mackinac Leak and Damage Detection: For specific application at the Straits crossing, Enbridge is currently assessing the applicability of an acoustic sensing fiber optic system, which would deploy fiber optic cables directly onto the pipeline crossing at the Straits. That system would "listen" for acoustic signatures caused by non-operational activities such as a pipeline leak or something striking the pipeline. That would provide real-time confirmation of an event to the operator. An alternative technology for this purpose is also being explored that utilizes an acoustic pressure wave system to measure pressure waves created when a leak occurs.**

The Enbridge ELDER apparatus, which identifies the best external leak detection technologies on the market, will help to improve pipeline safety across the industry.

In addition, Enbridge has completed design and construction of an External Leak Detection Experimental Research (ELDER) test apparatus. The ELDER apparatus is the first tool of its kind in the world of this scale, and was purpose-built to evaluate external leak detection technologies. The apparatus is being used to identify the best external leak detection technologies on the market, and that information will ultimately improve pipeline safety across the industry. A joint industry partnership has been established and testing is underway to determine the effectiveness of these technologies under a variety of conditions and leak rates.

7.0 Moving Forward

The people who live and work near our pipelines have the right to expect we will operate all our pipelines, including Line 5, to the highest standard possible. To meet or exceed their expectation, Enbridge manages the integrity of its pipelines, applying advanced technologies, meeting regulatory requirements, and leading positive change. We invest heavily every year in the most advanced leak detection, damage prevention, and pipeline integrity management technologies.

We maintain an ongoing commitment to the continued integrity of Line 5, especially through the Straits of Mackinac where the pipeline has been incident-free for more than 60 years.

This commitment is backed up by action.

On Line 5 through the Straits of Mackinac, Enbridge is going beyond what is required in multiple ways. Our immediate and future plans to ensure the continued integrity of Line 5 and the Straits of Mackinac Crossing are summarized below:

- In-line inspections for cracks and corrosion on the On-Shore segments on Line 5 were completed in January, February, March and April 2014.
- External inspections using ROVs are scheduled for the summer of 2014 and every two years thereafter.
- GEOPIG and two forms of circumferential crack inspections (internal) are also scheduled for the summer of 2014 and again in the summer of 2018.
- Installation of screw anchor supports to prevent pipe movement will be completed in 2014. This will reduce unsupported spans to less than 75 feet, from 140 feet.
- An AUV, which will complement existing ROVs and accommodate increased inspections is in development.
- A water current modeling study is in development to examine the effect of currents on the lines.
- In 2014, Enbridge is performing a preliminary engineering assessment to determine the feedback of applying acoustic sensing fiber optic cable technology to the Straits.
- A full-scale Preparedness Response Emergency Program (PREP) exercise is planned for fall 2014.

Through the Straits of Mackinac, Enbridge is going beyond what's required in multiple ways. Our immediate and future plans to ensure its continued integrity are summarized as follows.

Enbridge recognizes the importance of the Great Lakes as a vital resource to Michiganders. We understand those water resources are integral to the health, quality of life, and economy of the people of Michigan, providing hundreds of thousands of jobs and supporting a $12.8-billion travel industry; a $21-million charter boat industry; $4-billion commercial and sport fisheries; water for an agricultural and food industry; and a source of water to Michigan manufacturing that currently produces 60 percent of the continent's steel and automobiles made in North America.

The energy delivered by Enbridge is also critical to Michiganders and their quality of life — providing energy to heat homes; fuel cars; run hospitals, schools, businesses, and power those industries that drive the economy. Michiganders depend on that energy and our continued success after 65 years in operation depends on delivering it safely. Delivering energy — and delivering it safely — is our core business and prime responsibility.

We are committed to putting safety and environmental protection ahead of everything else. We do that by investing in our business, including maintenance and integrity programs and technological advancements in leak detection and prevention. As an industry leader, we share those innovations to help advance pipeline safety globally.

Enbridge paid special attention to the Straits when the lines were laid in 1953 and this waterway remains an important focus of Enbridge's safety efforts today. We set our sights on not just meeting regulations but exceeding them through the Straits — then and now.

Enbridge is also committed to building trust and engaging with our stakeholders because we don't just operate in these communities — our people are part of them. We do that through demonstrated performance, transparency, investment and exceeding regulations — all detailed in this Line 5 Pipeline Reliability Plan. This report demonstrates that Enbridge's commitments are backed by action and the results of our efforts show Line 5 and especially the Straits remain safe for continued operation.

Ensuring safety and reliability in all our operations, including Line 5 and especially the Straits, will always be a priority for Enbridge because without it, nothing else matters.

Table 1: Line 5 Pipeline Construction Specifications

Pipe Properties	PE-IR	IR-Straits	East Straits	West Straits	MA-BC	BC-RW
Outside Diameter / Wall Thickness / Grade	762mm (30") / 7.14mm, 7.92mm, 8.74mm, 9.53mm (0.281", 0.312", 0.344", 0.375") / 318MPa, 359MPa (X46, X52)	762mm (30") / 7.14mm, 7.92mm, 8.74mm, 9.53mm (0.281", 0.312", 0.344", 0.375" / Grd. B, 318MPa, 359MPa (X46, X52)*	508mm (20") / 20.62mm (0.813") / Grd. B, 241MPa (X35)**	508mm (20") / 20.62mm (0.813") / Grd. B, 241MPa (X35)**	762mm (30") / 7.14mm, 7.92mm, 8.74mm, 17.45mm (0.281", 0.312", 0.344", 0.687") / Grd. B, 318MPa, 359MPa (X46, X52)	762mm (30") / 7.14mm, 7.92mm, 9.53mm, 12.70mm (0.281", 0.312", 0.375", 0.500") / Grd. B, 318MPa, 359MPa (X46, X52)
Coating	Coal Tar Enamel	Coal Tar Enamel	Coal Tar Enamel**	Coal Tar Enamel**	Coal Tar Enamel	Coal Tar Enamel
Long Seam Weld Type	SAW	SAW	SMLS**	SMLS**	SAW	SAW, DSAW***
Vintage	1953	1953	1953	1953	1953	1953
Section Length Km (Miles)	279.631 (173.75)	327.968 (203.79)	6.585 (4.09)	6.585 (4.09)	252.616 (156.97)	170.260 (105.79)
Manufacturer	National Tube (NT), Consolidated Western (CWNT)	National Tube, Consolidated Western, Wickwire Spencer (WS)****	National Tube	National Tube	National Tube, Consolidated Western	National Tube, Consolidated Western

Table 2: Line 5 In-Line Inspection History

	ILI Tool Type		
Inspection Segment	Geometry	Metal Loss	Crack
PE-IR	1976 TDW Caliper (SN-IR) 1978 TDW Caliper (PE-IR) 1988 TDW Caliper (SN-GO) 1996 TDW Caliper 2000 BJ Inertial Geometry 2003 Donsa Ctool 2005 GE Energy CaliPPer 2006 Donsa Ctool 2006 BJ Vectra MFL 2011 GE CalScan XR	1972 LR MFL 1986 LR MFL 1991 LR MFL 1996 Vetco MFL 2003 GE MFL 2008 NDT MFL 2013 MFL	2005 GE USCD 2011 GE USCD 2014 GE USCD
IR-MA	1978 TDW Caliper 1988 TDW Caliper (IR-AR) 1988 TDW Caliper (MQ-GC) 1996 TDW Caliper 2000 BJ Inertial Geometry 2003 Donsa Ctool 2004 Positive Projects CaliPPer 2006 Donsa Ctool 2006 BJ Vectra MFL 2011 GE CaliPPer	1971 LR MFL 1981 LR MFL (IR-GC) 1986 LR MFL 1991 LR MFL 1996 Vetco MFL 2003 GE MFL 2008 NDT MFL *2008 Rosen MFL 2013 MFL	2004 GE USCD 2011 GE USCD 2014 GE USCD
West Straits	1987 TDW Caliper 1998 Enduro Caliper 2003 BJ Geometry 2004 Donsa Ctool 2005 BJ Geometry 2008 Positive Projects CaliPPer	1991 LR MFL 1998 PII MFL 2003 PII MFL 2008 GE MFL 2013 MFL	2014 NDT UCC 2014 GW Tethered
East Straits	1987 TDW Caliper 1998 Enduro Caliper 2003 BJ Geometry 2004 Donsa Ctool 2005 BJ Geometry 2008 Positive Projects CaliPPer	1991 LR MFL 1998 PII MFL 2003 PII MFL 2008 GE MFL 2013 MFL	2014 NDT UCC 2014 GW Tethered
MA-BC	1978 TDW Caliper 1996 TDW Caliper 2002 Donsa Ctool 2005 GE Calipper 2006 Donsa Ctool 2010 GE CalScan XR 2011 GE CalScan XR	1972 LR MFL 1986 LR MFL 1991 LR MFL 1996 Vetco MFL 2002 PII MFL 2007 GE MFL 2012 MFL	2005 GE USCD 2007 GE USCD 2011 GE USCD 2014 GE USCD
BC-RW	1978 TDW Caliper 1988 TDW (BC-NB) 1996 TDW Caliper 2002 TDW Caliper 2002 Donsa Ctool 2005 GE CaliPPer 2007 Donsa Ctool 2010 CalScan XR 2011 CalScan XR	1971 LR MFL 1986 LR MFL 1991 LR MFL 1996 Vetco MFL 2002 PII MFL 2007 GE MFL 2012 MFL	2005 GE USCD 2011 GE USCD 2014 GE USCD

Table 3: In-Line Inspection Program – On-Shore Segment of Line 5

Start location	End Location	Tool	Purpose	Launch Date	Run Status
PE	IR	CD+	Axial Crack	13-Jan-14	First Run Success
PE	IR	AFD	Axial Metal Loss	18-Mar-14	First Run Success
BC	RW	CD+2	Axial Crack	9-Apr-14	First Run Success
MA	BC	AFD	Axial Metal Loss	25-Jun-14	
PR	IR	CXR	Geometry	1-Aug-14	
BC	RW	AFD	Axial Metal Loss	26-Aug-14	
PE	IR	EMAT	Crack in Dent	1-Sep-14	
PE	IR	UCc	Circ. Crack	9-Sep-14	
MA	BC	TBD	Proving	2015	
MA	BC	EMAT	Crack in Dent	2015	
BC	RW	EMAT	Crack in Dent	2015	