3.0 PROJECT NEED Minn. R. 7853.0240

Need Summary

Each application shall contain a section that summarizes the major factors that justify the need for the proposed facility. The summary shall not exceed, without the approval of the commission, 15 pages in length, including text, tables, schedules, graphs, and figures.

The Replacement Project will enable Enbridge to better meet the petroleum supply needs of PADD II, including Minnesota, as well as Eastern Canada and the Gulf Coast by allowing Enbridge to more reliably and more efficiently transport an economic and secure supply of crude petroleum.

The Project will replace the existing Line 3 in its entirety within Minnesota, from the North Dakota border to the Wisconsin border. The Project accomplishes three goals:

- First, the Project will address the existing Line 3's integrity risks by replacing a pipeline with a large number of integrity anomalies with a new pipeline constructed with the latest technology and materials. The Project will avoid the large number of integrity digs currently forecasted to be required on Line 3 over the next 15 years, as well as the related impacts to landowners and the environment.
- Second, the Project will reduce on-going and forecasted apportionment[1] to the refining industry in PADD II, Eastern Canada, and the Gulf Coast, including Flint Hills and Northern Tier Energy in Minnesota.
- Third, the restored operational flexibility will allow Enbridge to more efficiently operate the Enbridge Mainline System, optimize its pipeline system and reduce power utilization on a per barrel basis.

Enbridge believes that these benefits will help to ensure the future adequacy, reliability, and efficiency of energy supply to Enbridge's customers, and, as a result, to the people of Minnesota and neighboring states. If the Project is not approved, Enbridge will continue to operate Line 3 in a safe and reliable manner, however ongoing maintenance will not restore the operating capabilities of Line 3, leaving Enbridge's customers without adequate, reliable, and efficient transportation capacity to reduce apportionment. Further, the increasing number of integrity digs that are required would not only inconvenience landowners and impact the environment, but would be economically inefficient and likely drive refiners to either seek alternate sources of supply or alternative modes of transportation.

[1] Apportionment occurs when the total nominations of a specific crude type exceed the capacity to transport that crude type and all shippers nominations are reduced pro-rata, i.e., by the same percentage.

3.1 Replacing Line 3 is the Optimal Maintenance Alternative to Ensure Safe Operation

3.1.1 Replacement is the Optimal Maintenance Alternative to Continuing to Undertake an Extensive Dig and Repair Program to Ensure the Continued Safe Operation of Line 3.

Enbridge has a comprehensive pipeline and facility maintenance regime, which is referred to as the integrity management program. Pipeline maintenance refers to those actions that have the objective of restoring pipeline operation to a state in which it can perform its intended function. In the case of Line 3, the maintenance program recommended by Enbridge is the full replacement of the line, as that is the only maintenance alternative that will eliminate the pressure restrictions imposed on the pipeline and enable it to return to its historical operating capabilities. While Line 3 can be safely operated under a dig and repair maintenance regime, the extensive number of digs and repairs along the entire pipeline would still not remove the pressure restrictions.

Enbridge's integrity management program requires the collection of pipeline integrity data through the use of highly sensitive tools that travel through and scan the internal and external conditions of the pipeline. The data is analyzed to identify integrity threats to the pipeline such as deformations, corrosion, other metal loss, or cracking. The analysis is then reviewed to develop a plan for safely maintaining the pipeline with the objective of restoring the pipeline's ability to perform its intended function. Of all the pipelines that Enbridge operates, Line 3 has the most integrity anomalies, specifically corrosion and long seam cracking anomalies. As a result of these integrity anomalies, their concentration, and their sheer numbers, Line 3 requires a high level of integrity monitoring and an extensive on-going integrity dig and repair program to safely operate the line.

As part of its integrity management program for Line 3, Enbridge has also voluntarily reduced the MOP. As a result of the reduced MOP, Line 3's capacity is limited to 390 kbpd, and as a result it cannot meet the needs of its shippers who require restoration of the Line's higher capacity to alleviate apportionment on the Mainline System.

The sections that follow provide:

- An overview of how Enbridge maintains its pipelines, including the applicable federal regulations and specifics regarding Enbridge's integrity management program; and
- A discussion of why replacing Enbridge's existing Line 3 with new modern pipe is the optimal solution to meet shipper needs for transportation of crude oil to Minnesota, PADD II, Eastern Canada and the Gulf Coast.

3.2 Overview of Pipeline Maintenance

Safe and reliable operations are the foundation of Enbridge's business, and maintaining pipeline integrity is one of the essential means to accomplish this objective. Maintaining pipeline integrity requires a comprehensive set of activities to ensure the safe and reliable operation of a pipeline system. This includes monitoring the pipelines to understand the risk to each pipeline's ability to function at its intended capability.

The general purpose of monitoring through inspections is to reduce uncertainty about the pipeline. Without adequate information, the operational risk of the pipeline is higher. Acquiring data through monitoring and inspection is therefore critical to the safe operation of a pipeline. Enbridge strives to gather actionable intelligence on its pipelines, which is then thoroughly analyzed prior to implementing a maintenance plan.

Once the information is collected, Enbridge then develops a plan to maintain the pipeline. The plan is in essence a documented program that specifies the practices used by Enbridge to ensure the safe, environmentally responsible and reliable operation of its pipeline system.

3.3 Federal Requirements for Integrity Management Programs

In accordance with the federal regulations established by the U.S. Department of Transportation (U.S. DOT) in 2001 (revised in 2007),[2] Enbridge has formalized its integrity management plan (IMP). Although these regulations are not prescriptive, they are very comprehensive and require pipeline operators to develop and maintain an IMP consistent with 49 C.F.R. § 195.452. The IMP and all documents the IMP generates must be maintained for inspection and audit oversight by PHMSA.

The U.S. DOT regulations contain specific requirements for pipeline integrity assessment, evaluation, validation and repair focused on a comprehensive analysis of pipeline segments that could impact high consequence areas (HCAs).[3] Per the regulations, pipeline operators are required to develop a written IMP identifying all pipeline segments that could affect an HCA, conduct a baseline integrity assessment of those segments to ensure their integrity, and establish an on-going integrity assessment process tailored to individual pipeline needs. More specifically, an IMP must contain:

- A process for determining which pipeline segments could affect an HCA;
- A baseline assessment plan;

[2] See 49 C.F.R. §§ 195.450 and 452.
[3] See 49 C.F.R. §§ 195.450 and 452. HCAs are discussed further on pages 26 of the Safety Report, provided in Appendix B.

- A process for continual integrity assessment and evaluation;
- An analytical process that integrates all available information about pipeline integrity and the consequences of a failure;
- Repair criteria to address issues identified by the integrity assessment method and data analysis;
- A process to identify and evaluate preventative and mitigative measures to protect HCAs;
- Methods to measure the IMP's effectiveness; and
- A process for review of integrity assessment results and data analysis by a qualified individual.[4]

The federal regulations also require operators to conduct integrity assessments, utilizing in-line inspection (ILI) tools, external corrosion direct assessment, or other acceptable methods, at least once every five years. Further, the regulations require operators to develop individualized inspection schedules based on each pipeline segment's specific integrity needs, which may require more frequent inspections. If certain defects are identified through integrity inspections along pipeline segments that could affect an HCA, operators must repair the defect.

As discussed below, Enbridge's IMP meets or exceeds the goals of these regulations.

3.4 Overview of Enbridge's Integrity Management Program

From its beginnings in 1949, Enbridge and its predecessor companies have invested heavily in system integrity management and maintenance while working to achieve their goal of zero releases. Enbridge has a Pipeline Integrity Department, which supports the goal of maintaining a safe and reliable pipeline system with a focus on preventing leaks and ruptures caused by duty-related deterioration such as corrosion, defects and mechanical damage. Integrity management, including the inspection, repair and maintenance of its pipelines, is one of several programs Enbridge has implemented to ensure the safety and integrity of its pipeline system. For a discussion of other programs, see Enbridge's Safety Report (Appendix B).

Enbridge's integrity management program meets or exceeds the requirements of the federal regulations. For example, although the federal regulations require pipeline operators to develop an IMP which applies to pipeline segments that could affect an HCA, Enbridge applies its IMP system-wide. Thus, in the U.S., while only 32 percent, or 103 miles, of the existing Line

[4] 49 C.F.R. § 195.452.

3 is considered to be located in or able to affect an HCA, Enbridge's heightened standards apply the IMP to the entire 324 miles of Line 3 in the U.S.

Enbridge also invests significant financial capital and resources in integrity initiatives that maintain its pipelines and facilities. For example, from 2009 to 2014, Enbridge conducted 884 total system tool runs and, through 12,133 integrity digs conducted on nearly 16,000 miles of pipeline, Enbridge has validated the in-line inspection (ILI) tool results to affirm the reliability of the data. Significantly, in 2012 and 2013, Enbridge invested approximately $1 billion and $1.5. billion respectively in programs and initiatives to maintain and further enhance its pipelines and facilities across all of its pipelines.

Enbridge's goal is to operate its pipelines to preserve the integrity and the longevity of the assets through robust, well-resourced and financed programs. Such programs create three layers of protection that prevent threats to pipeline safety, monitor the condition of the pipeline and the environment around the pipeline, and remediate threats to maintain or restore each pipeline's capability.

Enbridge's Pipeline Integrity management focuses on the following goals:

- **Prevent** threats (see Section 3.4.1 of the Application);
- **Monitor** condition (see Section 3.4.2 of the Application); and
- **Mitigate** to maintain fitness (see Sections 3.4.3 and 3.4.4 of the Application).

These goals are more fully described in the sections below.

3.4.1 Preventing Integrity Threats

Preventing integrity threats begins with Enbridge collecting data and assessing the pipeline system and its environment. Enbridge then applies the data to known conditions that cause pipeline failures across the industry. Finally, Enbridge employs various methods to mitigate the risk of the threats. On all of its pipelines, Enbridge monitors and implements prevention measures, as necessary, for the five main integrity threats, shown in Table 3.4.1-1.

Table 3.4.1-1
Integrity Threats and Potential Prevention Measures

Integrity Threat		Potential Prevention Measures
Metal Loss	External Corrosion	• Application of Protective Coatings • Cathodic Protection
	Internal Corrosion	• Product Quality Tariffs and Controls • Cleaning and Corrosion Inhibitors
Cracking	Stress Corrosion Cracking (SCC)	• Application of Protective Coatings • Cathodic Protection • Pressure Cycle Management
	Fatigue	• Quality Control of Pipe and Fitting Manufacture • Pressure Cycle Management
Deformation & Strain	Bending Dents Third-party damage	• Careful Route Selection • Quality Control of Pipeline Installation • Engineered Wall Thickness Selection • One-Call/Click System • Public Awareness • Comprehensive Excavation Procedures
Facilities-related threats	Mechanical Equipment	• Stringent Facility Design Standards • Prudent Equipment Selection • Quality Control of Equipment Manufacture and Installation

Some examples of potential measures Enbridge employs to prevent these integrity threats are described in more detail below:

- Enbridge combats external corrosion and stress corrosion cracking through the use of effective coatings and by applying cathodic protection, which consists of running low electrical currents through the pipe to protect the steel.
- Enbridge works to reduce pressure cycling to preserve the integrity and longevity of the asset and prevent crack growth. “Pressure cycling” is a repeated change in the operating pressure of a pipeline. The most extreme example would be turning a pipeline on and off repeatedly. In more technical terms, pressure cycling refers to the range of

pressure variation that occurs in the pipeline and the frequency of the cycle. Pressure cycling is analogous to fatigue and has the potential to create and accelerate the growth of cracking features in the pipe wall.

- Enbridge requires its vendors to meet stringent standards for the quality of the pipe and equipment. A comprehensive inspection system helps Enbridge to achieve this quality, step-by-step and with precision. The inspectors examine the formed pipe for possible defects. They monitor ultrasonic and x-ray tests that examine the integrity of each weld and, using calipers and micrometers, they assess each section for exact tolerances on diameter, roundness and straightness.
- Enbridge addresses the threat that third parties pose to the integrity of its system in a variety of ways. Enbridge has been an active leader and advocate of the nation-wide one-call system. Enbridge also has a comprehensive public awareness program in place to engage landowners, community members and first responders to ensure that they are aware of Enbridge’s pipelines and related facilities. Each year Enbridge sends out approximately one million pipeline safety brochures to residents, businesses, school officials, emergency responders, public officials, farmers, and excavators near our pipelines. Finally, active monitoring of the right-of-way (ROW) is also used to prevent third party damage. Enbridge patrols its ROW at least 26 times a year, or every two weeks to monitor the conditions on and around the ROW including monitoring any unauthorized excavation practices. These programs reduce the threat of third-party damage to the pipeline.
- Pipeline design is also a critical step to minimize integrity risks. It is a comprehensive process and includes selection of appropriate pipe wall thickness given site-specific conditions and running an intelligent valve placement model to determine the optimum placement of valves.
- During construction, quality control is essential. Enbridge’s quality control program for welds exceeds federal requirements. For example, Enbridge exceeds the federal weld testing requirements by x-raying 100 percent of its welds, even though federal regulations require testing of only 10 percent of the welds.

3.4.2 Monitoring of Integrity Threats.

Enbridge invests heavily every year in advanced leak detection, damage prevention and pipeline integrity management technologies. For example, since 2011 Enbridge has invested approximately $4.5 billion dollars in its integrity management program. Enbridge verifies the integrity of its system using multiple comprehensive diagnostic capabilities, including:

- The most sensitive ILI tools available for all mainlines and certain facility piping;
- Hydro-testing during pipe manufacture, pipeline commissioning, and ILI verification studies;
- On-line sensors, which read pressures/cycling, pipe movement, external and internal corrosion, and vibration;
- Surveys to measure pipe depth, geotechnical conditions, corrosion control, and third-party activity near the rights-of-way;
- Non-destructive testing at targeted investigation sites; and
- Regularly scheduled equipment maintenance and monitoring.

ILI is the primary integrity method used to assess the current (i.e. at time of inspection) condition of a pipeline. Enbridge works collaboratively with pipeline inspection vendors by challenging the limits of their technology and by supporting and funding research, development, and testing of new tools that advance our monitoring capabilities.

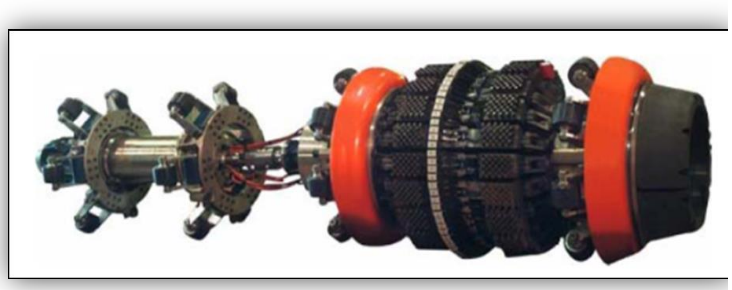


Figure 3.4.2-1 – In-Line Inspection: Baker Hughes Vectra Tool

The ILI technologies identify cracks, corrosion, and deformations (dents) that may exist in a pipeline. In the detection of corrosion there are two types of sensory technologies: magnetic flux leakage and ultrasonic transducers. Figure 3.4.2-1 shows a Baker Hughes Vectra tool, which uses magnetic flux leakage to detect corrosion.

Figure 3.4.2-2 depicts an ultrasonic crack detection ILI tool, the General Electric Phased Array Tool. The tool provides the highest resolution detection and characterization to identify cracking in welds and the pipe body.

Figure 3.4.2-2 – In-Line Inspection: General Electric Phased Array Tool

Figure 3.4.2-3 – In-Line Inspection: Deformation & Strain Detection ILI Tool

Figure 3.4.2-3 depicts a tool that is used to detect and characterize pipeline deformations.

These tools are commonly used throughout the industry with a great deal of success in identifying integrity anomalies. Together, these extremely sensitive tool sensors work to inspect the pipeline, using calipers (to measure geometry), gyroscopes (to gauge pipe movement), GPS (for precise pipe position), and ultrasonic or magnetic flux (to measure associated gouge, corrosion, and cracking). The ILI tools Enbridge uses to inspect its pipelines are extremely sensitive and measure the size, frequency and location of minute changes on both the inside and the outside of pipe walls, providing a level of detail similar to that provided by an MRI, ultrasound, or x-ray screening in the medical industry.

Once gathered, the data from each ILI run is analyzed by internal Enbridge and external engineering and integrity experts to align current and prior ILI data, such as anomaly density and severity, with pipe characteristics, relative location of anomalies, environmental conditions, coating materials, and operating history.

Data analysis requires the significant expertise of engineers and integrity specialists to review the millions of pieces of data collected through the tool runs. Once the data is collected and analyzed, Enbridge then reviews the analysis to develop an integrity management plan to address the anomalies that have been identified. This maintenance plan addresses both the work required to be undertaken and predicts the amount and type of work required in the future.

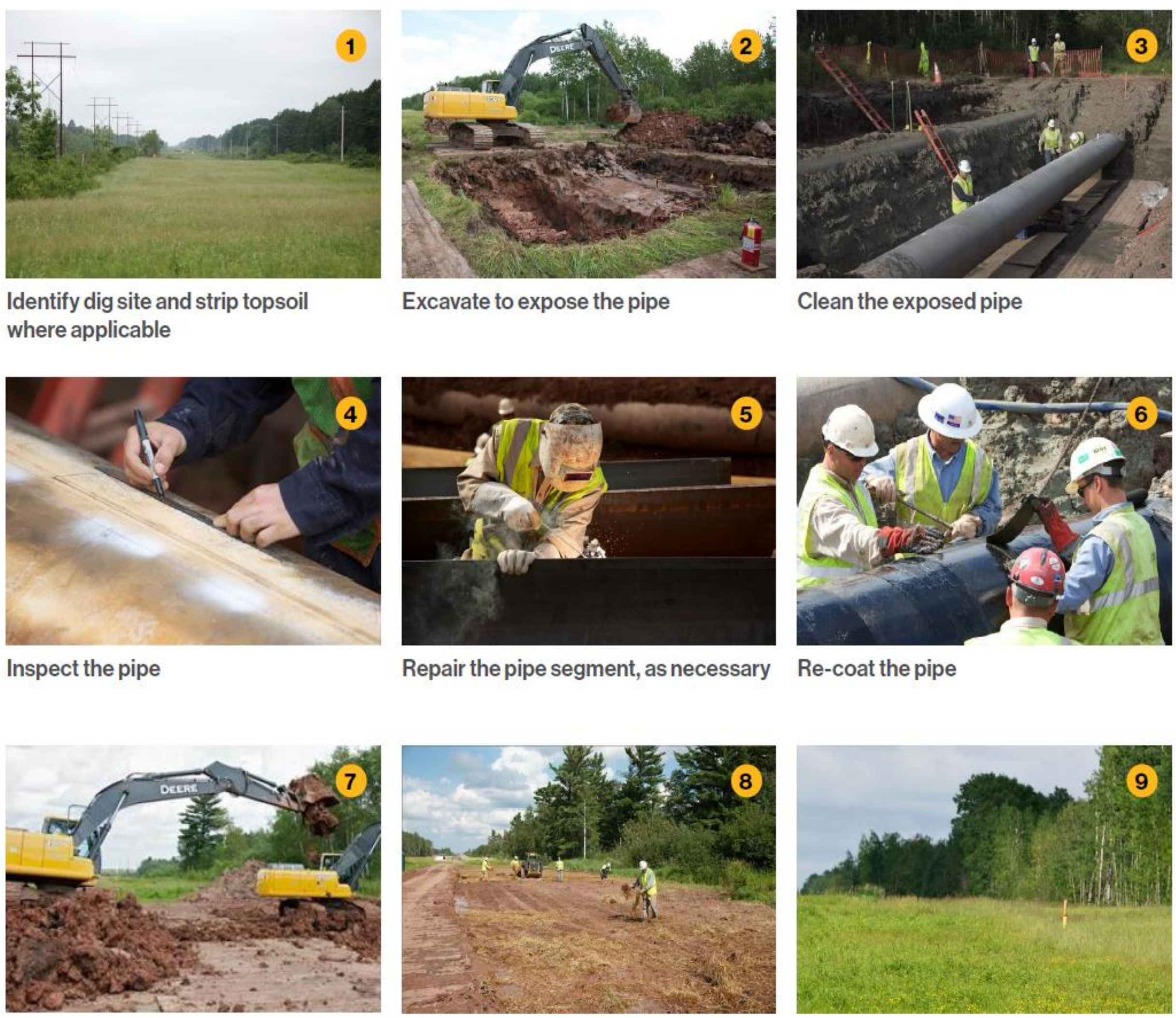
3.4.3 Integrity Threat Mitigation – Dig and Repair.

Integrity threat mitigation refers to those activities undertaken by a pipeline operator to manage the risk exposure of a particular pipeline system or its individual components. Mitigation activities are broad ranging and are specific to the context (i.e., the type of equipment, its current state, the environment in which it is located, operating conditions, and other factors). Enbridge employs a broad range of mitigation measures or activities including, but not limited to, integrity monitoring activities, operating a state of the art control center with highly qualified and trained personnel to respond in the event of a trigger alerting them that there has been a change in volume or operations of a line; reducing operating pressure; undertaking a dig and repair; or replacing the line. For further discussion of the mitigation measures employed, see Enbridge's Safety Report (Appendix B).

Enbridge's monitoring and inspection program alerts it to pipeline anomalies that may require a visual inspection to determine if a repair or other action is required, which is referred to as a dig and repair program. As demonstrated in Figure 3.4.3-1 below, the following steps are undertaken during a dig and repair. An on-site inspection typically involves excavating a section of buried pipe so that it can be cleaned and examined; then repaired as needed. Repair methods include recoating the pipe with modern epoxy coating, or sleeving the pipe (i.e., welding two fitted pieces of pipe together around an existing segment of pipeline) and then recoating with epoxy coating over the sleeve. In some cases, a section of pipe may be cut out to remove a feature and a new piece of pipe is welded in its place.

Integrity Dig Steps

Figure 3.4.3-1



1. Identify dig site and strip topsoil where applicable
2. Excavate to expose the pipe
3. Clean the exposed pipe
4. Inspect the pipe
5. Repair the pipe segment, as necessary
6. Re-coat the pipe
7. Backfill excavation and cleanup
8. Restoration
9. Restored right-of-way

The following Figures 3.4.3-2 through 3.4.3-4 below depict a typical integrity excavation (dig) where a sleeve has been placed on a section of the pipe.

Figures 3.4.3-2: Placing a pipe sleeve on pipeline

Figure 3.4.3-2

Figure 3.4.3-3: A welder prepares this half section of sleeve. This photo was taken in July 2011 near Superior, Wisconsin.

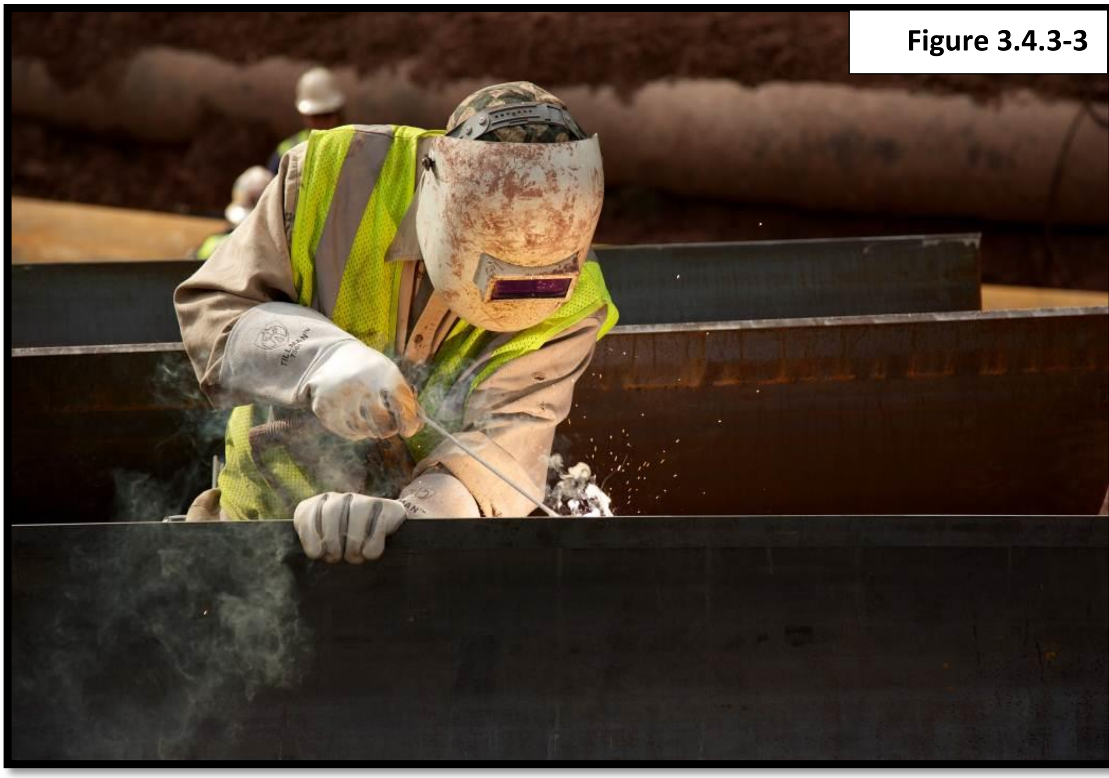


Figure 3.4.3-3

Figure 3.4.3-4: Upper and lower sections of steel sleeves are compressed over the identified section of pipe and then welded together. The ends of the completed sleeve are welded to the existing pipe for a full repair. This photo was taken in July 2011 near Superior, Wisconsin.

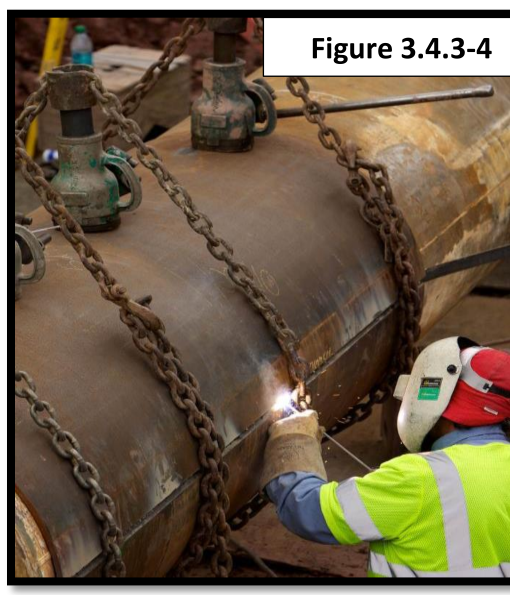


Figure 3.4.3-4

Figure 3.4.3-5 shows an integrity dig site within a wetland. A temporary containment berm was installed around the site to ensure that the wetland was protected during the integrity dig. In this instance, Enbridge used barges that were floated into position, then filled with water to create a road and coffer dam. Water was then pumped out of the interior to allow for repair of the pipeline.

Figure 3.4.3-5: Integrity Dig in a Wetland

As the above pictures illustrate, integrity digs typically involve significant disturbance of the land and create a nuisance for the population in the vicinity. However, they are necessary to maintain the safety of the pipeline.

3.4.4 Integrity Threat Mitigation – Pressure Restriction and Replacement

A strong dig and repair program is Enbridge's most successful maintenance tool to ensure the safe and reliable operation of its system. Where it is required, other mitigation actions are employed, such as restricting operating pressures or pipe replacement.

Short term pressure restrictions are implemented as temporary measures to ensure safe operation until a dig and repair program can be completed. Longer term pressure restrictions are considered when the dig and repair program becomes impractical. However, pressure restrictions can cause significant operational challenges and typically limit capacity making them less than optimal.

Replacement is considered if the number of digs projected is, among other things, overly burdensome to the landowners, economically infeasible, or impracticable. Pipe replacement is neither an easy decision nor a last resort. Instead, it is a calculated decision that takes into consideration the costs and benefits to both landowners and customers given the circumstances of the specific pipeline. For example, Enbridge chose to replace Line 6B in Michigan and Indiana due to the number and proximity of dig and repairs that would have to be conducted over many years. This was successfully accomplished in 2014.

The advantages of pipeline replacement as a maintenance tool include the following:

- Existing (and future) integrity features requiring repair are eliminated as a result of pipe replacement, greatly reducing the number of integrity digs that will be required. This reduction in integrity digs benefits landowners by decreasing the year-after-year disruptions to landowners along the right-of-way and shifts the costs paid by customers for maintaining an aging pipeline to the cost of constructing and operating a new pipeline at its intended capabilities.
- Pipe replacement benefits customers by enabling the line to operate at its intended capability.
- Pipe replacement allows Enbridge to leverage up-to-date pipeline design knowledge, pipeline manufacturing and coating processes and quality assurance and quality control methodologies to ensure that the new pipe is appropriately manufactured and designed for the specific operating and environmental conditions that it will be subject to.

As discussed above, Enbridge gathers and analyzes integrity data to identify appropriate mitigation measures, which, ultimately, may involve pipe replacement.

3.4.5 Line 3 Integrity History and Replacement Analysis

Line 3 Integrity History

Over the years Enbridge's integrity management program for Line 3 has become increasingly complex as a result of integrity threats relating to corrosion growth and material defects. Corrosion on Line 3 is primarily attributed to the particular environment in which the pipeline resides and the fact that over time, the coating has started to separate from the pipe causing corrosion growth on the surface of the pipe where it is no longer protected.

Long seam cracking on Line 3 is attributable to manufacturing defects and the impact of operational pressure cycling on the longitudinal weld. As discussed previously, "pressure cycling" is a repeated change in the operating pressure of a pipeline.

Through 50 years of operation, Line 3 has experienced a number of failures. Since 1990, seven failures have occurred in Minnesota that PHMSA classifies as "significant"[5] or where more than 50 barrels of crude oil were released from the pipeline.[6] These failures are primarily a result of integrity anomalies, such as long seam cracking, with the largest occurring in 1991 by Grand Rapids where 40,500 barrels were released.

Line 3's prior failures have resulted in on-going regulatory scrutiny by PHMSA (in the U.S.), the NEB (in Canada) and scrutiny by Enbridge itself. In order to prevent future releases, Enbridge has made significant investments in its maintenance of Line 3, including implementing an aggressive in-line inspection schedule, undertaking extensive dig and repair programs, and voluntarily imposing permanent pressure restrictions that limit operational capacity and flexibility.

For example, between 2000 and 2014, Enbridge completed 108 ILI tool runs on Line 3,. In addition, to ensure safe and reliable operation of Line 3, in 2008, Enbridge implemented a voluntary long-term pressure reduction on the discharge of all pump stations along Line 3. In 2010, Enbridge extended the pressure restriction across all of Line 3 to further increase the line's operating safety margin. Finally, in 2012, Enbridge voluntarily derated Line 3's MOP to align with the pressure restriction.

These efforts have prevented a failure from occurring on Line 3 since 2007. However, they have also resulted in the pipeline operating at a level far below its historical capability and the implementation of an extensive dig and repair maintenance program. Given that this dig and repair program cannot restore the historical capability of the line and that it requires an

[5] http://www.phmsa.dot.gov/pipeline/library/datastatistics/pipelineincidenttrends; last visited on April 4, 2015.
[6] This number excludes releases inside Enbridge owned facilities.

increasing number of integrity digs into the future, it may someday become economically infeasible and/or impractical to continue operating the line.

Line 3 Pipeline Replacement Analysis

As discussed above, one of the maintenance activities that Enbridge can employ is replacement of a pipeline. Determining the long term plan of a pipeline such as Line 3 requires a complex analysis of replacement versus repair. Where such an analysis has been required, Enbridge has analyzed whether the technical or integrity risks could be mitigated at an acceptable cost and whether continuing with other maintenance activities was feasible.

The objectives of Enbridge's replacement analysis were to:

- Maintain pipeline safety as the top priority;
- Address capacity, operability and integrity needs; and
- Ensure optimized economics from a repair versus a replace perspective.

The following criteria were evaluated as part of Enbridge's replacement analysis:

- anticipated repairs from integrity anomalies;
- the location of HCAs;
- year-over-year impact to landowners;
- future capacity requirements;
- cost of repair versus replacement;
- cost recovery from shippers; and
- pipeline system operability.

All of the above criteria were considered in reaching the decision to utilize replacement as a pipeline remediation strategy rather than continuing with the extensive dig and repair program on Line 3.

3.4.6 Line 3 Replacement Is the Optimal Long-Term Integrity and System Capacity Solution

Although addressing Line 3's integrity through a dig and repair program would enable the company to safely operate Line 3, it would be at the cost of on-going year-after-year impacts to the environment and landowners without lifting the self-imposed pressure restrictions. Accordingly, Enbridge is proposing to replace Line 3 because it is the best long-term means of addressing Line 3's integrity needs, while simultaneously lifting the pressure restrictions and restoring the historical capabilities of Line 3.

Key factors weighing in favor of replacing Line 3 include:

- To fully address external corrosion issues it would be necessary to remove and replace the degraded coating.
- The extent of existing corrosion is significant, requiring thousands of integrity digs across the entire line over the following decades.
- On average, 10-15 digs are forecasted per mile.
- Line 3 has the largest corrosion feature density in the Enbridge system.
- More frequent in-line inspection tool runs would be required, with some associated maintenance outages.
- The MOP of Line 3 has been reduced, significantly limiting its operational flexibility and its ability to meet customer needs.
- On-going integrity digs would not enable Enbridge to restore Line 3's historical operating capabilities and the on-going maintenance activities would result in more temporary service interruptions, further impacting the capacity available on Line 3.

In consideration of all the factors above, Enbridge concluded that the full replacement of Line 3 is the optimal, long term, maintenance solution.

3.5 Replacing Line 3 Allows Enbridge to Reduce Impacts of Apportionment to Refineries in Minnesota

3.5.1 The Enbridge Mainline System Provides Minnesota and Neighboring States with Vital Supplies of Crude oil.

Enbridge's Mainline System serves refineries in Minnesota, Wisconsin, Illinois, Indiana, Ohio, and many other states. A map of the Enbridge pipeline network and the refineries it serves is included as Figure 8.3.E-1 and Table 8.3.E-2 in Section 8.

Crude oil production regions are not typically located near refineries or demand centers. No one nation, province, region, or state stands on its own; all depend on crude oil pipelines to supply refineries and refined product pipelines to supply consumers. Minnesota, in particular, has significant demand for refined petroleum products, but no indigenous crude oil production. Minnesota accordingly must transport all crude oil or refined products needed within the state from production areas or refineries.

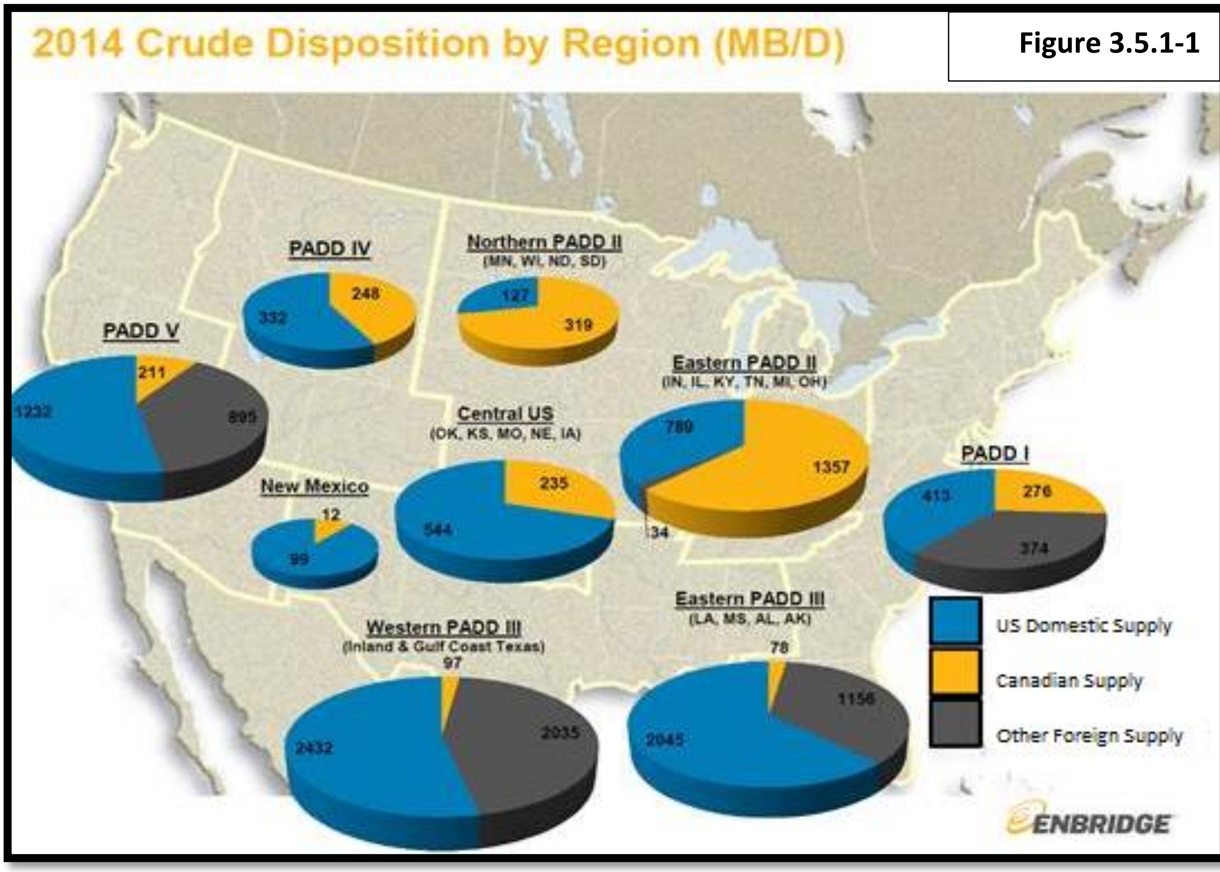
Three methods to transport crude oil are available to Minnesota: truck, rail, and pipelines. Of the three, pipelines, like those that make up the Enbridge Mainline System, are the most efficient and safest method to move petroleum over long distances, as discussed in the attached Safety Report (See Appendix B).

Minnesota relies on the extensive Enbridge Mainline System pipeline network to provide crude oil to its two large refineries located in and around Minneapolis and St. Paul. The Enbridge Mainline System plays a key role in providing crude oil feedstock to these refineries in Minnesota, but also to those in Wisconsin, the remainder of PADD II, Eastern Canada and the Gulf Coast. Enbridge has been a major crude oil transporter for PADD II and Eastern Canada since 1949, and has recently put in service two pipelines to serve the Gulf Coast refineries.[7]

During this time, PADD II has moved toward relying solely on North American crude sources, in part because of the availability of safe, efficient, and reliable pipeline transportation provided by Enbridge. As depicted below in Figure 3.5.1-1, the refineries in PADD II now primarily rely on North American sourced crude oil, with Northern PADD II, including Minnesota, 100 percent reliant on access to Western Canadian and U.S. domestic crude oil supplies for its refineries. The Enbridge Mainline System, which includes Line 3, is therefore critical to sustaining Western Canadian crude oil supply to these markets.

[7] A list of all refineries that are directly or indirectly connected to the Enbridge Mainline system is provided in Table 8.3.E-2 in Section 8 of this Application.

Figure 3.5.1-1: Crude Sources in Mainline System Markets[8]



To determine the demand and the adequacy of supply for the Project, Enbridge commissioned Muse Stancil & Co. to prepare a market analysis for the Project (the Muse Report). The Muse Report examines the petroleum product supply and demand situation for Minnesota and neighboring states, estimates the utilization of the Enbridge Mainline System at the U.S./Canada border, and provides a comparison of Western Canadian crude supply forecast data between the publically available independent sources. A copy of the Muse Report, including the forecast analysis prepared for Enbridge pursuant to Minn. Rule 7853.0520, is attached as Appendix C. Mr. Neil Earnest, the President of Muse Stancil, concludes that there is significant supply available to meet the demand for Canadian light and heavy crude oil today, and that there will be adequate supply to meet this demand for the foreseeable future in each of the refinery markets directly or indirectly connected to the Enbridge Mainline system.

[8] MB/D as used in Figure 3.5.1-1, is defined as "million barrels per day."

The Muse Report demonstrates that demand for reliable and efficient pipeline capacity into and through Minnesota will continue, and any decrease in capacity or increase in demand downstream will negatively affect the reliability and efficiency of supply to Minnesota and neighboring states.

3.5.2 The Demand for Western Canadian Crude Oil exceeds the Current Enbridge Mainline Capacity

Refiners relying on the Enbridge Mainline system for crude oil feedstock are currently unable to receive all the crude oil they require by pipeline, their preferred means. A viable, reliable pipeline network must exist to satisfy the refiner's demand for Western Canadian supply. Currently, the Enbridge Mainline System reaches refinery markets with a total capacity of 13,247 kbpd, which far exceeds the Enbridge capacity. The following Table 3.5.2-1 provides the total daily refinery run rates in the markets that can be served by the Enbridge Mainline System.

Table 3.5.2-1

Regional Submarkets (aggregate of 150+ individual North American refineries)	Total Refinery Run Rate (kbpd)[9]	Percentage of Canadian Crude, 2014[10]
Upper Midwest (includes Minnesota's two refineries)	1,709.6	76.97%
Lower Midwest	1,270.1	24.95%
Ontario/Quebec	905.5	Not Available[11]
Mid-Continent	1,257.3	11.45%
Gulf Coast	8,104.9	1.28%
TOTAL	13,247	

Minnesota and its neighboring states in PADD II rely on Canadian crude oil, as shown in Figure 3.5.2-1 above, and discussed in the Muse Report. U.S. demand for Canadian crude oil transported on the Enbridge Mainline System has increased significantly in recent decades. As a result, demand for capacity to ship crude oil on the Enbridge Mainline System continues to exceed available pipeline capacity, even after Enbridge's recent projects have improved efficiency and added capacity to transport additional oil.

[9] Data from the EIA *Refinery Capacity Report*, June 25, 2014, available at http://www.eia.gov/petroleum/refinerycapacity/.
[10] *Id.*
[11] Although there is no EIA data for refinery runs in Ontario and Quebec, the Enbridge Mainline System is expected to transport the majority of crude used as feedstock in these refineries.

The current total annual average capacity of the Enbridge Mainline System in Minnesota is 2,621 kbpd and the current effective system capacity is 2,333 kbpd. After the Project is in-service, the anticipated annual average capacity of the Enbridge Mainline System in Minnesota will be 3,221 kbpd, and the effective system capacity will be 2,867 kbpd. The effective capacity of the Enbridge Mainline System is 89 percent of the annual capacity, based on 2014 operations data. The effective capacity is less than the annual average capacity because of various maintenance operations, pressure restrictions, and other issues resulting in an overall lower annual system capacity.

In 2014, Enbridge's pipelines transported over 53 percent of Canadian crude oil production to the U.S., which accounts for 15 percent of total imported crude oil to the U.S. Moreover, in 2014 Enbridge transported over 74 percent of the Canadian crude oil imported from Canada and consumed in PADD II.[12] This is still not sufficient to meet refinery demand. Refineries in Minnesota and the neighboring states in PADD II cannot currently obtain all of the Canadian crude oil they require by pipeline, because pipeline capacity is limited.

While it is not expected that the Enbridge Mainline System will increase its capacity to 13,247 kbpd to satisfy all refinery demand, any increase in capacity will benefit the refineries in PADD II, including Minnesota. As a common carrier, Enbridge is obligated to treat all similarly situated customers the same on the Mainline System. Thus, when demand for pipeline capacity to move crude oil to these refineries exceeds the actual capacity of the pipelines, Enbridge declares apportionment, as discussed below, and all refineries receive less capacity for transportation of their crude oil nominations.

[12] United States Securities and Exchange Commission Form 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934, Enbridge Energy Partners, L.P., February 12, 2015, p. 10.

Apportionment is calculated in accordance with Enbridge's Rules and Regulations on file and in effect at the Federal Energy Regulatory Commission (FERC).[13] Shippers request transportation capacity on the Enbridge Mainline System by nominating a shipment to Enbridge. Nominations are submitted to Enbridge on a prescribed date each month, generally the 20th of the preceding month. Upon receipt of all nominations, Enbridge verifies the nomination with upstream suppliers and downstream delivery points designated by the shipper. Once verified and accepted, the nominations are allocated between the various lines, in accordance with the line's designated use (light, heavy or mixed service). If barrels nominated for a specific crude type exceed the capacity of the pipelines that transport that crude type, apportionment is declared, and the available pipeline capacity is allocated amongst the shippers on a pro rata basis, calculated using the following equation:

$$\boxed{Percent\ Apportionment = \frac{(Nominations - Available\ Capacity)}{Nominations}}$$

Apportionment is currently occurring on the Enbridge Mainline System; the Enbridge Mainline System has been apportioned frequently since 2011. Table 3.5.2-2 presents Enbridge's apportionment percentages since 2010.[14]

[13] Enbridge's "Lakehead" FERC Tariff is currently available at http://www.enbridge.com/~/media/www/Site%20Documents/Informational%20Postings/Tariffs/Lakehead/FERC-41-10-0.pdf?la=en. Generally, Enbridge tariffs are available at http://www.enbridge.com/DeliveringEnergy/Shippers/Tariffs/Enbridge-Energy-Limited-Partnership-Lakehead-Tariffs.aspx.

[14] Apportionment is declared by crude type; as a result pipelines that move the same type of crude oil typically have the same apportionment percentage. For example, Lines 4 and 67 both transport heavy crude oil. As a result, when the Enbridge Mainline System has insufficient heavy crude capacity, as it did in March of this year, Lines 4 and 67 were both apportioned by an equal amount – 33 percent.

Table 3.5.2-2: Enbridge Historical Mainline Apportionment within Minnesota

	Apportionment Percentage by Month (2015)											
Line	Jan	Feb	Mar	Apr								
2	5.00	6.00	-	-	-	-	-	-	-	-	-	-
3	5.00	6.00	-	-	-	-	-	-	-	-	-	-
4	30.00	36.00	33.00	42.00	-	-	-	-	-	-	-	-
67	30.00	36.00	33.00	42.00	-	-	-	-	-	-	-	-
	Apportionment Percentage by Month (2014)											
Line	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2	-	-	-	-	-	-	-	-	-	-	-	12.00
3	-	-	-	-	-	-	-	-	-	-	-	12.00
4	3.00	-	-	-	-	16.00	34.00	30.00	25.00	25.00	13.00	22.00
67	3.00	-	-	-	-	16.00	34.00	30.00	25.00	25.00	13.00	22.00
	Apportionment Percentage by Month (2013)											
Line	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2	-	-	-	-	-	-	-	-	-	12.00	15.00	6.00
3	-	-	-	-	-	-	-	-	-	12.00	15.00	6.00
4	-	7.00	-	-	-	-	-	-	-	-	-	-
67	-	7.00	-	-	-	-	-	-	-	-	-	-
	Apportionment Percentage by Month (2012)											
Line	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
4	-	-	-	-	-	-	-	-	-	8.00	-	13.00
67	-	-	-	-	-	-	-	-	-	8.00	-	13.00
	Apportionment Percentage by Month (2010)											
Line	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	-	-	-	-	-	-	4.00	-	-	-	-	-
2A	-	-	-	-	-	-	4.00	-	-	-	-	-
3	-	-	-	-	-	-	4.00	-	-	-	-	-
4	-	-	-	-	-	-	4.00	-	-	-	-	-
65	-	-	-	-	-	-	4.00	-	-	-	-	-

While projects such as Line 67 and its subsequent upgrades have benefitted Minnesota and the neighboring states in PADD II by reducing apportionment to refineries that serve the region, they have not eliminated the problem and apportionment continues to increase. The MPUC itself recognized that the Line 67 Phase 2 upgrade would be insufficient to eliminate the risk of apportionment.[15]

Table 3.5.2-3, below, demonstrates that apportionment will continue without the Project. This Table uses throughput forecast data from the Muse Report, and applies an 89 percent effective system capacity factor.[16] For purposes of this chart, Enbridge has assumed that refinery demand in Minnesota remains stable. If refinery demand increases in Minnesota, apportionment may occur at even higher levels. Of note, this table assumes that the Line 67, Phase 2 upgrade is complete and that Line 3 continues to operate at 390 kbpd, which is its current restricted capacity.

[15] *See* In re Application of Enbridge Energy, Limited Partnership for a Certificate of Need for the Line 67 (Alberta Clipper) Station Upgrade Project - Phase 2 - in Marshall, Clearwater, Itasca, Kittson, Red Lake, Cass, and St. Louis Counties (the "Line 67 Phase 2 Order), Docket No. PL-9/CN-13-153, November 7, 2014, p.21 (eDockets Doc. 201411-104527-01) (recognizing that the Line 67, Phase 2 upgrade would be insufficient to eliminate the risk of apportionment).

[16] While the Muse Report uses an effective capacity of 95 percent, Enbridge relied on an effective capacity of 89 percent after examination of the actual throughput in 2014. For purposes of Mr. Earnest's external analysis, Enbridge believes that 95 percent effective capacity is adequate.

Table 3.5.2-3: Apportionment without Line 3 Replacement

Apportionment Forecast Without L3R (kbpd)																
Without Line 3R (Hvy/Light)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Heavy Throughput	1869	2021	1763	2069	2172	2086	2140	2167	2102	2152	2190	2190	2196	2203	2204	2193
Light/Medium Throughput	988	670	455	509	554	641	525	561	688	670	678	692	696	689	688	699
NGL and Refined	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Adjusted Light/Medium Throughput	1108	790	575	629	674	761	645	681	808	790	798	812	816	809	808	819
Total Throughput	2977	2811	2338	2698	2846	2847	2785	2848	2910	2942	2988	3002	3011	3011	3011	3011
Effective Heavy Capacity ex Western Canada	1420	1420	1420	1420.4	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420
Excess Heavy Capacity ex Western Canada	-449	-600	-342	-649	-752	-665	-720	-747	-682	-732	-769	-769	-775	-782	-783	-772
Heavy System Utilization	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Apportionment ex Western Canada	**24%**	**30%**	**19%**	**31%**	**35%**	**32%**	**34%**	**34%**	**32%**	**34%**	**35%**	**35%**	**35%**	**36%**	**36%**	**35%**
Effective Light Capacity ex Western Canada	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117	1117
Excess Light Capacity ex Western Canada	9	327	542	488	443	356	472	436	309	327	319	305	301	308	309	298
Light System Utilization	99%	71%	51%	56%	60%	68%	58%	61%	72%	71%	71%	73%	73%	72%	72%	73%
Light Apportionment ex Western Canada	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

The Minnesota refiners, Flint Hills and Northern Tier St. Paul, currently receive 276 kbpd[17] of Western Canadian crude oil per day. Canadian light crude deliveries to Minnesota refineries were apportioned on average by 5.5 percent in the first two months of 2015. Canadian heavy crude deliveries to Minnesota refineries were apportioned on average by 35 percent in the first four months.

As demand for Canadian crude increases, apportionment will continue to adversely affect Enbridge's customers, including the Flint Hills Refinery and the Northern Tier St. Paul refinery.

Apportionment has serious consequences for Minnesota. The Commission has recognized that avoiding apportionment is important because apportionment forces refiners to either reduce production of refined products or obtain crude oil by other transportation means, such as rail or truck, with greater environmental and socioeconomic impacts.[18] This also increases direct costs to the Minnesota refineries, as shipping crude oil by rail is significantly more expensive than by pipeline. Based on Enbridge's analysis, the lowest price per barrel to transport heavy Canadian crude oil from Hardisty, Alberta, Canada to St. Paul by rail includes $12.06 in freight charges, a 7 percent fuel surcharge, a $0.75/barrel ownership and maintenance charge for the rail tank car, and $3.00/barrel to load and unload the tank car which is substantially higher than the rates charged for deliveries on Enbridge's Mainline System to Clearbrook.

Replacing Line 3 and restoring its capacity in mixed service is expected to effectively reduce predicted apportionment to Minnesota refineries to below 5 percent through 2030. Table 3.5.2-4, below, presents Enbridge's predicted apportionment of light and heavy crude oil following completion of the Project and the Line 67, Phase 2 upgrade. This chart uses throughput forecast data from the Muse Report, and applies an 89 percent effective system capacity factor.[19] For purposes of this chart, Enbridge has assumed that refinery demand in Minnesota remains stable. If refinery demand increases in Minnesota, apportionment may occur at higher levels.

[17] EIA data, averaging 2013 and 2014 data.
[18] *See* Line 67 Order, p. 21. The environmental impacts of alternatives to pipeline transportation are discussed in Sections 6.2 and 6.3 of this application.
[19] See footnote 15.

Table 3.5.2-4: Apportionment with L3R in Mixed Service

Apportionment Forecast With L3R (kbpd)																
With Line 3 Replacement (Mixed)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Heavy Throughput	1869	2021	1763	2069	2172	2086	2140	2167	2102	2152	2190	2190	2196	2203	2204	2193
Light/Medium Throughput	988	670	455	509	554	641	525	561	688	670	678	692	696	689	688	699
NGL and Refined Product	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Total Throughput	2977	2811	2338	2698	2846	2847	2785	2848	2910	2942	2988	3002	3011	3011	3011	3011
Effective Capacity ex Western Canada	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867	2867
Excess Capacity (Mixed)	(110)	56	529	169	21	20	82	19	(44)	(75)	(121)	(135)	(145)	(145)	(145)	(145)
Utilization of Additional Line 3 Capacity	100%	83%	0%	49%	94%	94%	75%	94%	100%	100%	100%	100%	100%	100%	100%	100%
System Utilization	100%	98%	82%	94%	99%	99%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%
Apportionment	**4%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**	**3%**	**4%**	**4%**	**5%**	**5%**	**5%**	**5%**

The Project will provide direct benefits to Minnesota by dramatically reducing apportionment of deliveries to Minnesota's two refineries and refineries throughout PADD II, Eastern Canada and the Gulf Coast.

3.6 Enbridge's Customers Need and Support the Project

Enbridge's customers, which are the shippers that use Enbridge's pipelines, support the Project because it will reduce apportionment and provide them with needed pipeline reliability and operational flexibility. Enbridge's shippers have demonstrated their support by agreeing to fund the Project through payment of an agreed upon per barrel charge on Enbridge Mainline shipments.

The Project, like all Enbridge projects, is privately funded through agreement between Enbridge and its shippers. This is very different from how capital projects are developed by local electric or gas distribution companies, where the costs of infrastructure projects are recovered through rates paid for by residential, commercial and industrial customers. Instead, Enbridge must seek out and obtain support from its shippers before proceeding with large capital projects.

In order to recover its costs, Enbridge receives revenues from its customers for each barrel they ship through the Enbridge Mainline System. Enbridge operates Line 3 as a component of the common-carrier Enbridge Mainline System that provides shipping services on a nondiscriminatory, non-contract basis, and develops new projects through discussions with its customers. The process for recovering the costs of new projects is detailed in Enbridge's agreement with its customers where Enbridge offered rate stability through a Competitive Toll Settlement (CTS).[20] Since entering into the CTS in 2011, Enbridge has developed several projects to increase its mainline capacity and provide increasing access to highly desirable markets throughout PADD II, the Gulf Coast and Canada with the support of its shippers.

A critical feature of the CTS was the establishment of the Representative Shipper Group (RSG), which is comprised of a group of shippers that regularly ship approximately 80 percent of the crude oil on the Enbridge Mainline System. The CTS only allows for rate adjustments under limited circumstances, and precludes Enbridge from recovering the cost of capital projects over $250 million without agreement from the RSG. Accordingly, Enbridge and the RSG must agree to any change in the rate charged for transportation service as a result of a new capital projects over $250 million in both Canada and the U.S. Enbridge cannot unilaterally build the Project and then increase rates to recover its investment.

[20] *See http://www.enbridge.com/DeliveringEnergy/Shippers/Competitive-Tolling-Settlement.aspx.*

Need for the Project is demonstrated by the RSG's agreement to increase the rates to recover the costs of replacing Line 3. The terms were memorialized in the Issues Resolution Sheet (IRS) included as Appendix D. Specifically, the RSG agreed to a 15 year rate increase of between US$0.75 to US$0.80 per barrel.

Enbridge also received the support of the Canadian Association of Petroleum Producers (CAPP), which represents a number of the largest shippers on the Enbridge Mainline System, as well as support from regional refineries served by Line 3.

Finally, Enbridge has also received several letters demonstrating that shippers support replacing Line 3 in order to restore the capacity of the pipeline, which will relieve apportionment on the Enbridge mainline. Letters from BP Products North America, Inc. (BP), Marathon Petroleum Company LP (Marathon), Suncor Energy, Canadian Natural Resources Limited (CNRL), and Cenovus Energy Inc. (Cenovus) are included as Appendix E. These shippers represent a broad group of refineries and producers that supply PADD II, including Minnesota, with petroleum products. All five letters cite ongoing problems in obtaining crude oil supplies due to apportionment, and the shippers' expectation that the Project will increase the reliability of crude oil supplies to refiners that serve PADD II with petroleum products. Three of the shippers, BP, CNRL, and Cenovus, participated in negotiations for funding the Project and voted in favor of the Project.

These shippers are large, sophisticated parties. For example, Marathon is the largest refiner in PADD II (and the fourth largest refiner in the U.S.), the largest retailer of petroleum products in the Midwest, and employs approximately 45,340 people. As Marathon notes in its letter of support, the Enbridge Mainline System delivers virtually all of the Canadian crude oil Marathon purchases. Marathon expects the Project to reduce apportionment on the Enbridge Mainline System, thereby reducing the need to rely on rail or purchase crude at a higher price or from a different source, such as Venezuela, Brazil or Mexico instead of Canada.

Similarly, CNRL is Canada's largest producer of crude oil, natural gas, and natural gas liquids. CNRL provides crude petroleum to PADDs II, III, and IV, and views PADD II as one of its key markets. Continued apportionment on the Enbridge Mainline System and projected increases in Canadian crude production led CNRL to vote in favor of the Project.

Cenovus is also an oil producer in Canada. Cenovus has extensive in situ oil sands and oil production in Alberta and Saskatchewan, as well as 50 percent ownership in two U.S. refineries, located in Roxana, Illinois and Borger, Texas. Cenovus uses the Enbridge Mainline System, which includes Line 3, to ship its crude oil to customers in the Midwest and the Gulf Coast. Cenovus notes that it, and other common-carrier shippers, cannot obtain all of the capacity they need on the Enbridge Mainline System due to apportionment. Cenovus states that the Project will mitigate apportionment, and unless the Project is built, Cenovus will suffer reduced adequacy, reliability, and efficiency in supplying crude oil to its customers. Cenovus is a member of the RSG and voted in favor of the Project.

BP operates the 410,000+ bpd refinery in Whiting, Indiana and the 160 kbpd refinery near Toledo, Ohio. The Whiting refinery provides consumers in the Midwest and other parts of the U.S. with approximately 9.6 million gallons per day of gasoline, 3.8 million gallons per day of diesel, and 1.6 million gallons per day of jet fuel. Minnesota is directly supplied by this refinery, as BP operates a refined products pipeline that can deliver up to 1 million gallons of fuel to Minnesota per day. BP voted in favor of the Project because apportionment exposes BP's operations to increased supply and transportation risks and costs.

These five refiners or producers are extremely important to the consumers of refined petroleum products in Minnesota and neighboring states. These entities are all large, sophisticated parties that need the Project. Their financial support of the Project demonstrates how important the Project is to both interstate and international commerce.

3.7 THE PROJECT WILL ALLOW ENBRIDGE TO MORE EFFICIENTLY OPERATE ITS PIPELINE SYSTEM

The number of integrity threats present on Line 3 caused Enbridge to reduce the MOP of the pipeline, and as a result, its maximum annual average capacity today is reduced to 390 kbpd. Replacing Line 3 in its entirety from Alberta, Canada to Superior, Wisconsin will increase the MOP, restoring the historical operating capabilities of the pipeline and enhancing the reliability of the Enbridge Mainline system.

The Project is designed to be in mixed service, transporting both light and heavy crude oil, which will allow Enbridge the flexibility to continually re-balance the light and heavy crude allocations to the various Enbridge Mainline System pipelines to ensure available system capacity is utilized in the most efficient manner. The ability to continually balance the system to operate in the most efficient manner results in the following five important benefits to shippers, refiners and Enbridge.

1. Enables Enbridge to better respond to variable refinery needs.
2. Reduces power requirements on the Enbridge Mainline System.
3. Minimizes the impact of planned maintenance on the Enbridge Mainline System to shippers and refiners.

4. Allows Enbridge to better respond to unplanned disturbances to the North American crude oil network.

5. Allows Enbridge to better respond to potential future variations in volume and crude oil demand.

3.7.1 Replacing Line 3 Enables Enbridge to Better Respond to Refinery Needs

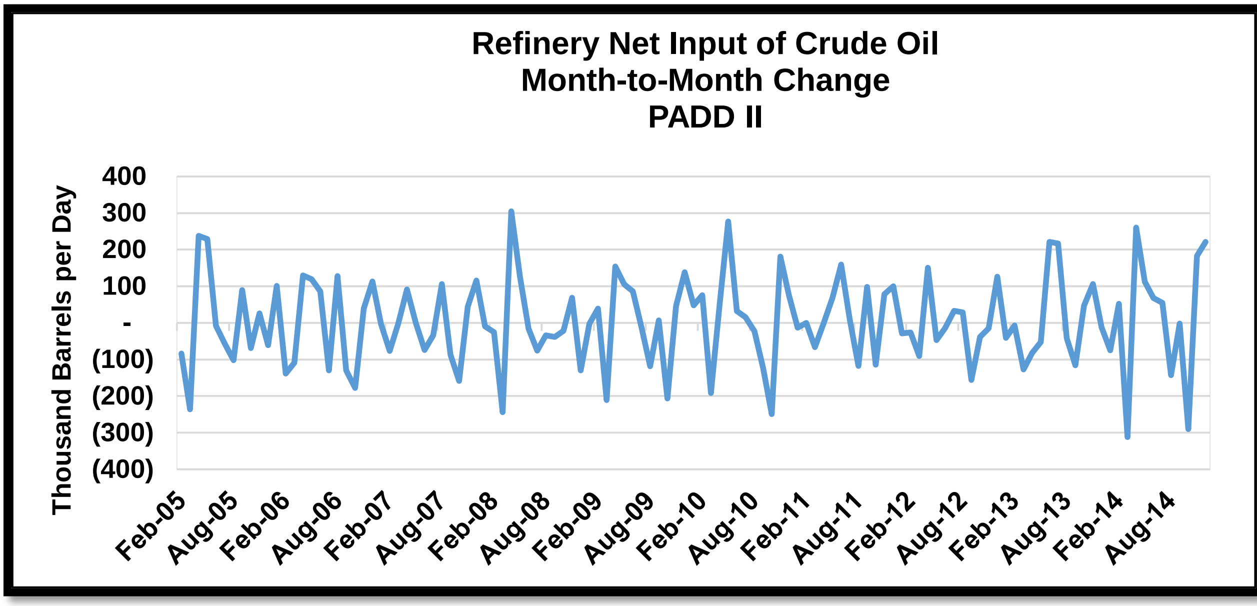
The first benefit described above is the ability to adapt to changes in refinery demand patterns. Enbridge optimizes crude movements among its pipelines to provide the most efficient movement of a specific type of crude oil to the desired destination. Enbridge allocates capacity on its pipelines based on two factors: the crude oil type and the receipt and delivery points on the Enbridge Mainline System. Some of its existing pipelines are designed to move light crude oils, while others are designed for heavy crude oil service only. To allocate heavy crude to a pipeline that has been designed for light crude would significantly reduce the capacity of that pipeline. This Project, however, is being designed with mixed service in mind to create flexibility in allocating specific crude types amongst the various pipelines.

Designing the Project to restore Line 3's historical ability to operate in mixed service benefits shippers, Enbridge, and Minnesota. Refineries typically utilize a blend of crude oils to create the desired refined product. However, in determining what type of crude feedstock components to utilize, the refiners are influenced by such things as the variability in the price paid for each component. This typically results in a change in the refiner's feedstock requirement. The relative product yield of the crude oil streams in the market also plays a significant factor in a refiner's decision as to what crude feedstocks to purchase each month. Accordingly, refiners seek different crude oil types to meet their refined product demands on a monthly basis. Having a pipeline designed to move both light and heavy crudes enables Enbridge to react to these changes in nominations, thereby reducing apportionment on its light and heavy crude oil pipelines.

In addition, the volume of crude oil required by refiners from the Enbridge system on a month-to-month basis varies considerably for a variety of reasons. The more important reasons include the need to periodically shut down much, or all, of the refinery for major maintenance, scheduled or unscheduled outages on non-Enbridge crude oil pipelines, and seasonality in refined product demand.

The variability of PADD II crude oil demand, which includes Minnesota, is shown below in Figure 3.7.1-1.

Figure 3.7.1-1: Monthly Changes in PADD II Refinery Demand[21]



As can be observed, the refinery crude oil demand can increase or decrease by as much as 300 kbpd month-to-month. Replacing Line 3 and thereby restoring its capacity in mixed service is helpful to PADD II refiners, including those in Minnesota, for managing their fluctuations in crude oil demand, and therefore helpful in ensuring that there is a reliable supply of refined product for Minnesota and the Midwest.

3.7.2 Reduces Power Requirements on the Enbridge Mainline System

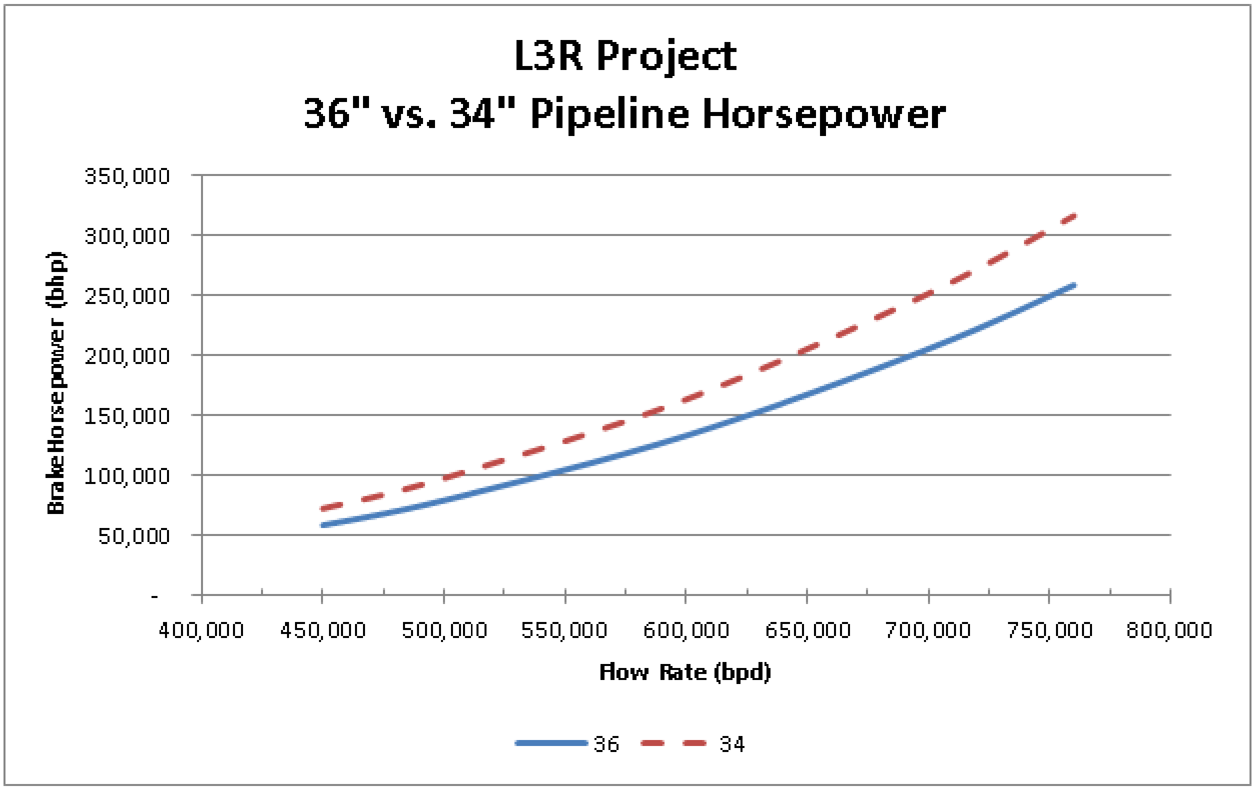
The second benefit described in this section is an overall reduction in electric power requirements due to the Project increasing Enbridge's ability to optimize crude allocations between the various pipelines on the Enbridge Mainline System. Enbridge relies on electricity to power the pumps that apply the pressure required to move crude oil through its pipelines. As might be expected, power costs are Enbridge's largest operating expense. Assuming equal throughput on the Enbridge Mainline System of 2.537 Mbpd pre- and post-Project, the Project will result in an estimated reduction in annual power requirements of approximately 81 GWh, which equals over 56,000 metric tons of CO_2 for Minnesota operations.

Also, replacing Line 3 with 36 inch diameter pipe will offer power savings at all flow rates as compared to replacing Line 3 with a 34 inch pipeline. At 760 kbpd the Project will save 108

[21] U.S. Energy Information Administration Data: "Refinery Net Input of Crude Oil" statistics.

gigawatt hours (GWh) of energy as compared to the power required to move the same volume on a 34 inch pipeline. Saving 108 GWh equates to an annual reduction of over 74,000 metric tons of CO_2 emissions within Minnesota. Figure 3.7.2-1 below shows the approximate power consumption for a 36 inch and a 34 inch pipeline at varying throughputs. A 36 inch pipeline is more efficient than a 34 inch pipeline at the same flow rate because the greater internal area of the 36 inch pipeline means that the fluid moves slower than in the 34 inch pipeline. For the same type of fluid, a fluid moving more slowly will experience less friction and so will require less pressure to pump and therefore less power.

<u>Figure 3.7.2-1</u>: Power Consumption of 36-inch vs. 34-inch Pipeline



3.7.3 Replacing Line 3 Minimizes the Impact of Planned Maintenance on the Enbridge System to Shippers and Refiners

Additionally, the Project provides benefits by allowing Enbridge to minimize the effect of necessary maintenance on the Mainline System on crude oil throughput and quality. Pipeline maintenance occasionally requires taking a pipeline out of service. As discussed previously, Line 3 will require almost 4,000 integrity digs over the next 15 years, which will result in repairs that could take Line 3 temporarily out of service during the maintenance activities. Replacing Line 3 will reduce the number of future maintenance events requiring such outages.

Moreover, as an operationally integrated crude oil system, the Enbridge Mainline can transport different crude oils on different pipelines to the same destination. As a result, the Project will provide additional optionality and flexibility for transporting crude oil to various delivery points if other lines are shut-down or have reduced capacity due to maintenance, pressure restrictions, or other reasons. The Project helps avoid reduced system capacity and, in turn, apportionment (discussed above), if nominations exceed available capacity of the Mainline System during maintenance. As the Commission has recognized, maintenance is not a discretionary activity.[22] Thus, the need for flexibility in the Enbridge Mainline System to ensure the ability to perform maintenance activities, while still providing refiners with needed crude oil volumes, is essential.

3.7.4 Replacing Line 3 Allows Enbridge to Better Respond to Unplanned Events with the North American Crude Oil Network

The fourth benefit of the Project to Enbridge's system, shippers, and refiners is the increased ability to respond to sudden unplanned events with the North American crude oil network. Examples of events with the North American crude oil network include supply disruptions on the Enbridge Mainline System itself, supply disruptions on other crude oil rail or pipeline systems, demand spikes by refineries, or refinery turndowns. The system currently has insufficient "sprint" capacity, which is the ability to transport the required barrels of crude oil to refineries when needed to satisfy a sudden increase in demand, to make up for pipeline outages, to satisfy peak demand when multiple refineries seek large volumes at the same time, or transport excess crude supply to other markets when refineries have unexpected turndowns.

Supply disruptions caused by system outages or a lack of adequate pipeline capacity can have serious implications for local economies. Replacing Line 3 will also help provide access to the

[22] *See* In re Application of Enbridge Energy, Limited Partnership for a Certificate of Need for the Line 67 (Alberta Clipper) Station Upgrade Project - Phase 2 - in Marshall, Clearwater, Itasca, Kittson, Red Lake, Cass, and St. Louis Counties (the "Line 67 Phase 2 Order), Docket No. PL-9/CN-13-153, November 7, 2014, p.21 (eDockets Doc. 201411-104527-01).

supply of crude oil needed to meet demand when other sources are not available. Refineries cannot produce refined products without feedstock. Accordingly, lack of feedstock is equivalent to other refinery outages, which can have serious impacts on the price and availability of refined products. For example, in the summer of 2013 a series of regional refinery outages and system constraints caused record high gasoline prices in Minnesota and much of the Upper Midwest. Similar results could occur if unexpected capacity constraints result in reduced supply to refineries. Restoring Line 3's capacity will help minimize similar adverse impacts.

3.7.4 Allows Enbridge to better respond to potential future variations in volume and crude demand

The fifth benefit of the Project is that it allows Enbridge to better respond to a potential variations in future increased volume and crude demand. This project is being designed with mixed service in mind to create flexibility in allocating specific crude types amongst the various pipelines. This will allow Enbridge to respond to future needs in either light or heavy crude without requiring significant infrastructure changes. In contrast if the Project were to be designed for either light or heavy crude only, significant infrastructure changes or even additional pipelines may be required if future needs were to vary from the forecasted crude type.