The Honorable Rick Snyder
Office of the Governor
P.O. Box 30013
Lansing, Michigan 48909

April 30, 2015

Dept. of Attorney General
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NATURAL RESOURCES
DIVISION

Attorney General Bill Schuette
G. Mennen Williams Building, 7th Floor
525 West Ottawa Street
P.O. Box 30212
Lansing, Michigan 48909

Director Dan Wyant
Michigan Department of Environmental Quality
525 West Allegan Street
P.O. Box 30473
Lansing, Michigan 48909

Re: Based on Expert Review, Recommendation to the Michigan Petroleum Pipeline Task Force that Enbridge's Line 5 in the Straits Be Shut Down and/or Stringent Measures Be Imposed Pending a Comprehensive Review by the State under Public Trust Law to Assess Alternatives that Prevent Catastrophic Harm to Our Public Trust Waters of The Great Lakes

Dear Governor Snyder, Attorney General Schuette, and Director Wyant:

Your Administration and the citizens of Michigan share a common and grave concern involving Enbridge's 62-year-old twin oil pipelines in the Straits of Mackinac: the risk of a leak, rupture, or break in Line 5 and the resulting catastrophic oil spill into Lake Michigan and Lake Huron. The Michigan Petroleum Pipeline Task Force and all of us uniformly agree that such a globally significant calamity is unacceptable given the magnitude of harm and ramifications to our public waters, Great Lakes fisheries and ecosystem, and the public health, and economy – in short, an unacceptable risk to a *Pure Michigan* way of life.

During the last year, we at FLOW (For Love of Water) – in partnership with the Environmental Law & Policy Center, Michigan Environmental Council, Michigan Land Use Institute, Sierra Club, Tip of the Mitt Watershed Council, and many others – have submitted a number of letters and made formal and informal presentations to the Michigan Petroleum Pipeline Task Force with a clear and consistent request: for the State of Michigan to act immediately on Enbridge's Line 5 oil pipelines located in the Straits of Mackinac through a public process under the Great Lakes Submerged Lands Act (GLSLA) and its public trust authority under the 1953 easement and authorizing Act 10 of 1953.

This GLSLA process is the only way to assure that the unacceptable risk of devastating harm to the Great Lakes does not occur. Moreover, the GLSLA process is the only way to satisfy the State of Michigan's public trust duties as well as Enbridge's duties under the 1953 easement held in trust, because this public trust law sets forth clear legal principles, scope of review with alternative risk assessment and prevention, and subsequent decisions and actions required of Enbridge to ensure that there is no future risk of a release or leak from Enbridge Line 5 into the Great Lakes.

From September 2014 through February 2015, the Michigan Petroleum Pipeline Task Force conducted closed door stakeholder meetings with Enbridge, the U.S. Coast Guard, PHMSA, Great Lakes

Commission, National Wildlife Federation, FLOW and other members of the Oil & Water Don't Mix Campaign, Michigan's 12 federally recognized tribes, Marathon Petroleum Company, and Dr. James Hill and Ken Winters to consider "the status of existing pipelines, their safety, *how to mitigate risks* to the environment and natural resources, regulation, emergency planning and spill response, and providing information to the public." This method and scope of the Task Force's inquiry, however, *does not seek to prevent the risk* of such unacceptable devastating harm, and as result fails to comply with the State's fiduciary role as public trustee of the Great Lakes and their bottomlands for citizens and beneficiaries.

Before this Task Force issues its final recommendations, perhaps as early as May, FLOW is submitting this letter and accompanying composite summary report to further aid your review and decision, and to underscore and highlight the urgency for the State of Michigan to act under existing public trust law and to evaluate alternatives that place our Great Lakes at zero risk. FLOW convened a team of scientists and engineers – with extensive education and training and career-long experience in hazardous materials, environmental and process engineering, chemical and liquid processes, materials, design, construction, and security – to evaluate whether the information Enbridge provided and the scope of review undertaken by the Michigan Petroleum Pipeline Task Force follow standard principles for evaluation of risks and magnitude and probability of harm for pipelines carrying oil and related liquids, such as Enbridge's Line 5 under the Straits of Mackinac. This submission provides additional critical scientific and engineering information, and evaluation criteria regarding such review, decisions and actions. Specifically, this team evaluated:

- Whether the Task Force process and primary focus on Line 5 and its safety assures reasonable prevention and safety for the public, the Great Lakes and ecosystem, drinking water, and communities and citizens who live near the Straits of Mackinac or northern Lake Michigan and Lake Huron.
- Whether Enbridge's pipeline network logistics, strategies and alternative assessments have included abandoning Line 5 in favor of other options, including but not limited to alternative pipelines or routes, existing or feasible, that would prevent risk of devastating harm (achieve zero risk) entirely to the Straits and the Great Lakes.
- Whether Enbridge has submitted or the Task Force has sought and received sufficient information to address the prevention of risks and safety based on reliable and credible worst-case scenarios and alternatives, and overall age, end-of-life plan, anchoring structures, and integrity assessment of Line 5.
- Whether new circumstances exist that affect the pipeline's safety and reliability and that were not considered at the time of Line 5's design in 1952 and construction the following year.
- Whether the original design, welding techniques, and margin of safety are acceptable under modern practices and standards.
- Whether the risk and the impact of external corrosion on Line 5's coal tar enamel coating and external stresses of zebra and quagga mussels – which had not entered the Great Lakes when Line 5 was designed and began operating – on bare steel have been disclosed and reviewed.

It must be noted that there is a stunning lack of publicly available information about the integrity and end-of-life plans of this private aging infrastructure, even though an entire year has lapsed since the AG and DEQ made a formal request to Enbridge for critical information about operation, maintenance, and easement compliance of these Line 5 petroleum pipelines. Enbridge has controlled public access to some of this information through a password-protected portal that prevents the State to have documents in its possession as required under the state FOIA law. This situation puts the Great Lakes at an unacceptable risk

to citizen beneficiaries of this public trust. Accordingly, based on the available public information, data, and other information, the summary report developed by a team of experts convened by FLOW concludes that:

- The charge or scope of review by Enbridge and the Task Force is unduly limited to "mitigation of risks" regarding the safety of Line 5, and improperly fails to evaluate logistics, strategies, and alternatives that would avoid or prevent the risk of devastating magnitudes of harm.
- Enbridge has controlled the nature and extent of available information, which has resulted in inadequate or insufficient information and review by the Task Force or state officials.
- The evaluation and review has ignored the reality that Line 5 is old, outdated, and that a break or leak in the line is inevitable without a broader, open and public review and decision-making process that seeks to both prevent and mitigate risks and ensure safety.
- The evaluation is not based on a reasonable and credible worst-case scenario assessment of alternatives, integrity, and safety issues.
- Between the period of 1952-1953, when Line 5 was designed and constructed, and 2015, materials, standards, and circumstances have changed significantly, such as corrosion and/or invasive populations of zebra and quagga mussels.
- There are a number of additional questions that must be asked, consistent with a necessarily broader scope of review and evaluation, and that must be answered by Enbridge and independent experts.
- Substantial risk of pipeline failure related to the potential impacts of new stresses and corrosion demand Line 5 be shut down and/or stringent measures be imposed pending a comprehensive review of alternative risk assessments, safety and integrity assessments, and response information has been made under the state's legal authority provided by the GLSLA.

We thank all of you and the Task Force for considering this new information, and we urge you to take meaningful and preventative action under the GLSLA that goes beyond mere mitigation and enhanced emergency response. The State and the Task Force must not continue to delay action because, as we know, eventually every pipeline breaks, if not removed or replaced in a timely manner. Anything less than the above puts the Great Lakes and the public health, safety, and public trust at risk, as if the Task Force and State are betting the Great Lakes, citizens' safety and health, and the public trust in order to allow Enbridge to continue using Line 5 indefinitely.

Sincerely,

James Olson, Founder and President, FLOW (For Love of Water)

Liz Kirkwood, Executive Director, FLOW (For Love of Water)

cc: Chief Deputy Attorney General Carol L. Isaacs

Division Chief S. Peter Manning

DNR Director Keith Creagh

Enclosures.

**Before Governor Snyder's Michigan Petroleum Pipeline Task Force**

**Office of Attorney General William Schuette**

**Office of Director of Department of Environmental Quality Dan Wyant**

**Office of Director of Department of Natural Resources Keith Creagh**

# A COMPOSITE SUMMARY OF EXPERT COMMENT, FINDINGS, AND OPINIONS ON ENBRIDGE'S LINE 5 OIL PIPELINE IN THE STRAITS OF MACKINAC IN LAKE MICHIGAN

**Compiled by James Olson, J.D., LL.M. and Liz Kirkwood, J.D.**

***on behalf of***

**FLOW's (For Love of Water) Great Lakes Water Policy Project**

***for submission to the***

**Michigan Petroleum Pipeline Task Force**

**April 30, 2015**

## 1. OVERVIEW

This Composite Summary of several reports produced by qualified experts for FLOW (For Love of Water) – a Great Lakes water law and policy center located in Traverse City, Michigan – is intended to assist the Governor's Michigan Petroleum Pipeline Task Force and the above-named leaders and agencies charged by law with evaluating and protecting the Great Lakes, public health, and our water-dependent economy from the risk of devastating harm from the location and operation of the Enbridge Line 5 pipeline[1] in the Straits of Mackinac. The summary and underlying reports are also intended to help citizens better understand the nature of this 62-year-old pipeline, the scope of inquiry, information, and critical need for an alternative and course of action that prevents the risk of harm from an oil spill in the Straits.

Presently, federal and state officials have been focused on safety and emergency response measures, rather than considering and implementing alternatives or options that would prevent the risk of such devastating harm from an oil spill to the Great Lakes. This Composite Summary points to one inescapable overall conclusion: Even the best efforts by the Task Force and officials regarding Line 5 fail to encompass an outcome that would prevent entirely the risk of catastrophic harms to the public health and economy. Because the Task Force's review is limited to safety and mitigation, it has excluded review of alternatives or logistical options that would achieve zero risk of such unacceptable harm to the Great Lakes. The review has also been shrouded by non-disclosure and lack of complete information from Enbridge.

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[1] For purposes of this summary, the words "pipeline" and "Line 5," although singular, refer to Enbridge's two (2) 20-inch diameter pipelines that rest on the state-owned bottomlands in Lake Michigan approximately two miles west of the Mackinac Bridge in the Straits of Mackinac.

It is submitted that the failure to consider and implement logistical, strategically available alternatives or options that achieve zero risk and the lack of an open, public proceeding under "rule of law" violate the state's and officials' fiduciary duty to citizens under the Great Lakes public trust doctrine and the Great Lakes Submerged Lands Act (GLSLA).[2]

FLOW – in partnership with the Environmental Law & Policy Center, Michigan Environmental Council, Michigan Land Use Institute, Sierra Club, Tip of the Mitt Watershed Council and others – has previously submitted letters to the Michigan Petroleum Pipeline Task Force, outlining the recommended legal framework and principles for the State regarding necessary process, scope of review, decisions, and actions required of Enbridge regarding Line 5. This submission provides additional critical scientific and engineering information and evaluation regarding such review, decisions, and actions.

FLOW convened a team of scientists and engineers – with extensive education and training and career-long experience in hazardous materials, environmental and process engineering, chemical and liquid processes, materials, design, construction, and security – to evaluate whether the information Enbridge provided and the scope of review undertaken by the Michigan Petroleum Pipeline Task Force follow standard principles for evaluation of risks and magnitude and probability of harm for a pipeline carrying oil and related liquids, such as Enbridge Line 5 under the Straits of Mackinac. Specifically, this team evaluated:

- Whether the Task Force process and primary focus on Line 5 and its safety assures reasonable prevention and safety for the public, the Great Lakes and ecosystem, drinking water, and communities and citizens who live near the Straits of Mackinac or northern Lake Michigan and Lake Huron.
- Whether Enbridge's pipeline network logistics, strategies, and alternative assessments have included abandoning Line 5 in favor of other options, including but not limited to alternative pipelines or routes, existing or feasible, that would prevent risk of devastating harm (achieve zero risk) entirely to the Straits and the Great Lakes.
- Whether Enbridge has submitted and the Task Force sought and received sufficient information to address the prevention of risks and safety based on reliable and credible worst-case scenarios and alternatives, and overall age, end-of-life plan, anchoring structures, and integrity assessment of Line 5.
- Whether new circumstances exist that affect the pipeline's safety and reliability and that were not considered at the time of Line 5's design in 1952 and construction the following year.
- Whether the original design, welding techniques, and margin of safety are acceptable under by modern practices and standards.
- Whether the risk and the impact of external corrosion on Line 5's coal tar enamel coating and external stresses of zebra and quagga mussels – which had not entered the Great Lakes when Line 5 was designed and began operating – on bare steel have been disclosed and reviewed.

[2] MCL 324.32501 et seq. (here after "GLSLA").

Based on the available public information, data, and other information and the analysis and findings of the team of scientists and engineers,[3] this Summary Composite report concludes that:

- The charge or scope of review by Enbridge and the Task Force is unduly limited to "mitigation of risks" regarding the safety of Line 5, and improperly fails to evaluate logistics, strategies, and alternatives that would avoid or prevent the risk of devastating magnitudes of harm.
- Enbridge has controlled the nature and extent of available information, which has resulted in inadequate or insufficient information and review by the Task Force or state officials.
- The evaluation and review has ignored the reality that Line 5 is old, outdated, and that a break or leak in the line is inevitable without a broader, open and public review and decision-making process that seeks to both prevent and mitigate risks and ensure safety.
- The evaluation is not based on a reasonable and credible worst-case scenario assessment of alternatives, integrity, and safety issues.
- Materials, standards, and circumstances have significantly changed between the period of 1952-1953, when Line 5 was designed and constructed and 2015, such as corrosion and/or invasive populations of zebra and quagga mussels.
- There are a number of additional questions that must be asked, consistent with a necessarily broader scope of review and evaluation, and that must be answered by Enbridge and independent experts.
- Substantial risk of pipeline failure related to the potential impacts of new stresses and corrosion demand Line 5 be shut down and/or stringent measures be imposed pending a comprehensive review of alternative risk assessments, safety and integrity assessments, and response information has been made under the state's legal authority of provided by the GLSLA.

The Task Force and all stakeholders have repeatedly acknowledged that "No one wants an accident, release or leak in the Straits of Mackinac." However, Enbridge and the Task Force are, in effect, kicking the can down the road by limiting the Task Force review just to the safety issues surrounding the 62-year-old pipeline, thus avoiding other options and alternatives for Line 5.[4] It is precisely these types of strategic and alternative assessment decisions that prevent risk, not just mitigate it. By not demanding such information from Enbridge, the Task Force is literally betting the Great Lakes, public health and safety, environment, and the economy of Michigan.

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[3] On request, FLOW will make its team of experts and their analyses and findings available to the Task Force and its officials, or their technical advisors, in a meeting called to discuss these conclusions, findings, and recommendations.

[4] By contrast, Enbridge has announced its plans and filed for a Certificate of Need and Route Permit with the Minnesota Public Utilities Commission for its $7.5 billion Line 3 Replacement Project. Press Release, Enbridge, MN, EnbridgeMN@enbridge.com, April 24, 2015.

## 2. QUALIFICATIONS OF SCIENTIFIC AND ENGINEERING TEAM[5]

**Richard J. Kane, QEP, CHMM, CPP**, was formerly the Director of Security, Environment, Transportation Safety & Emergency Services for Rhodia, North America. He is past Chairman of the Chemical Sector Coordinating Council, Chairman, Security Committee, the American Chemistry Council (ACC), and former member of The Society of Chemical Manufacturers & Affiliates (SOCMA) Environmental, Safety & Security Committees. He is a Certified Protection Professional (CPP), Certified Hazardous Materials Manager (CHMM), and Qualified Environmental Professional (QEP).

**Edward E. Timm, PhD., PE**, was formerly a Senior Scientist and Consultant to Dow Chemical's Environmental Operations Business (EOB), subject matter expert on Dioxin Formation and Transport in Chemical Process Systems, and leader in the company's voluntary efforts to reduce dioxin emissions. He was also Senior Scientist for Liquid Separations Business (LSB), including Ion Exchange and Film Tec Products for water purification. As Senior Scientist in EOB, he served as technical professional in developing a process for gasification of chlorinated wastes as alternative to incineration, and as Senior Scientist for LSB, he developed reverse osmosis membranes to concentrate dissolved solids and purify water. He also served as an expert on development and evaluation of new chemical processes, invention and patents, process development, plant design and construction, and process optimization.

**Gary L. Street, PE**, was formerly Director of Engineering, Dow Environmental (Eastern Operations); Technology Director, Film Tec Corporation, subsidiary of Dow Chemical; Section Manager, Process Engineering, Dow Chemical; Board Chair and Vice President, Midland Engineering, Ltd.; and Engineering Consultant, Freshwater Future. He is currently an Engineering Consultant for FLOW. Mr. Street's 30-year career has covered an extensive range of experience in environmental engineering, chemical process design, ethanol production processes, minimization of waste materials, and project management. He is the co-author of the text, Applied Chemical Process Design.

## 3. COMPOSITE SUMMARY OF COMMENTS, FINDINGS, AND OPINIONS ON LINE 5

### a. The Available or Disclosed Information Is Inadequate and Insufficient to Comply with Standards Required for Assessing Oil Transport Strategies, Alternative Assessment, Risk Assessment, and Emergency Response Resources and Processes.

The existing available or disclosed information is inadequate for the Task Force or any agency or official to render a decision that the continued or future transport of oil or other petroleum products through Line 5 in or near the Straits of Mackinac would protect the public health and safety, private or public riparian property, the bottomlands and waters of the Straits and affected areas of Lake Michigan and Lake Huron, the ecosystem, and the public trust in or public trust uses thereof, including water for drinking, fishing and the preservation of fishing

[5] Complete Curriculum Vitae are available upon request by the Task Force. As noted above, FLOW's technical consultants or science and engineering team offers to meet with the Task Force and its officials or their technical consultants to exchange and/or review their findings and comments.

rights, boating, navigation, swimming, and other recreation. At a minimum, to be adequate for reaching such a decision, the following information and conclusions[6] would have to be made publicly available, disclosed, reviewed, and considered:

**i. Existing and Forecasted Evolution and Strategy for the Petroleum or Oil Distribution System and Role that Line 5 Serves for Both Normal Operations and in the Event of Disruptions Elsewhere in the System.**

The scope of the system for such purposes is at least the pipeline and other petroleum transportation networks from the Western United States and Canada to the East, which potentially impact or affect the Michigan pipeline network and Line 5 in particular. The information is also fragmented, and a consolidated forecast is not available. An easily understood view on the current and forecasted distribution system evolution and strategy is basic and necessary for the Task Force, officials, and/or public review. This would also include Enbridge's disclosure of its existing and future back-up or alternative plan for oil pipeline transport if Line 5 is temporarily shut down due to a rupture, accident, or power outage, and it includes plans or contingent plans for discontinuing Line 5 for oil transport, future oil transport, or abandonment of Line 5 completely.

This is normal business and industry practice, and such information should exist or be prepared and should be submitted, made publicly available, and considered to comply with industry standards and the public trust and GLSLA.

**ii. A Comprehensive Alternatives Assessment.**

The alternatives assessment would identify all feasible alternatives to the existing Line 5, ranging from simply not using Line 5 to replacement through use of other pipeline options or alternative routes, and would provide a comparison of risk and harm with respect to opportunities for other alternatives.

A decision concerning safety or prevention or minimization of risk and harm at least should include a full and comprehensive assessment of alternatives, including capacity, location, routes, contingencies, disruptions, none-use or abandonment, and their comparative risk and harm. Understanding the forecasted

[6] The conclusions that follow are based on the information available on the Michigan Department of Environmental Quality (DEQ)'s Michigan Petroleum Pipeline Task Force website: http://www.michigan.gov/deq/0,4561,7-135-3306_69266---,00.html, as well as Enbridge's website, and the websites of the U.S. DOT/PHMSA, several non-governmental organizations (NGOs), and several pipeline oil and gas trade associations.

evolution and strategy and the comparative risk and harm is the only way to remove alternatives, if an accident or release of oil occurs, with the highest magnitude of harm based on a valid and credible "worst-case" scenario.

iii. **Even if Line 5 is within the Range of Acceptable Alternatives after Review and Decisions Regarding Subparagraphs i. and ii., above, a Technical, Engineering, and Risk Analysis of Line 5 Compared to a Model, State-of-the-Art Pipeline is Essential for Evaluation.**

The technical, engineering, and integrity safety risk assessment or analysis would provide a detailed comparison between the existing Line 5 and a model, state-of-the-art pipeline, covering engineering practices, installation, operation, and mechanical integrity management criteria. Protection of safety, health, environment, and the public trust must include a comparative technical, operational reliability, and risk assessment on Line 5.

iv. **A Detailed Consequence Assessment of a Straits of Mackinac Oil Release is Necessary Based on Both a "Credible Worst-Case Scenario" and the Release Scenario that Can Be Reasonably Mitigated Given Current Emergency Response Resources and Seasonal Conditions.**

A "credible worst-case scenario" would be the largest potential oil release or harm that could occur in the Straits based on assumptions that have been agreed upon by independent experts and the Task Force or officials. A key assumption in calculating a credible worst-case scenario is that active protective measures (i.e., those requiring automated, electronic, or mechanical activation) are *not* used in determining the size of the release. Based on available information, Enbridge has failed to present an acceptable credible worst-case scenario, which has resulted in a calculated release or spill and consequences that are less than what may occur under a credible worst-case scenario.[7] Moreover, a credible worst-case scenario is essential for any alternative assessment, risk assessment, and response assessment. To date, it appears that information does not exist or is unavailable, or that the scenario that has been provided is understated.

While the information on the DEQ website is a good starting point, it is inadequate for the purpose of rendering a decision as charged

[7] For example, a proper "worst-case" scenario would include a leak or release in the winter under several feet of ice in the Straits and/or winds in the range of 75-100 mph (hurricane force). Moreover, a shut down of valves would leave a million gallons of oil in the line, another aspect of "worst-case" scenario. Think Fukushima Daiichi nuclear disaster.

to the Task Force or as required by industry, alternative, system logistics, safety, and response standards. Moreover, the Great Lakes Commission submitted excellent draft studies on the overall petroleum distribution system, incidents, and regulatory trends, which support the above conclusions. Information and statements from Enbridge primarily defended the continued use of Line 5, particularly the segment near or in the Straits, without providing or assessing a standard base of information for such a decision by the company or the Task Force. Enbridge and the Task Force have not conducted or considered a state-of-the-art or standard feasible alternative harm and risk assessment. Information and reports submitted by NGOs focused mostly on potential consequences of an accident, release or spill, or matters regarding removal or discontinuance of Line 5 in or near the Straits or other water bodies, critical population or public facilities, or sensitive environmental features or areas. The information listed above should be submitted and available as key elements of industry or business continuity, risk management, and insurance coverage planning process, and assembled and submitted to the Task Force, officials, and the public. The public health, safety, public trust, and environment have not and cannot be adequately protected without the evolution strategy, alternative assessment, or other items listed in the subparagraphs i. through iv.

**b. Basic Information Should Be Required, Obtained, or Prepared to Conduct an Adequate and Sufficient Review and Render a Decision on Alternatives, Comparative Harms and Risks, Safety and Integrity Assessment of Line 5, and Emergency Response Planning.**

To assist the Task Force, decision-makers, officials, other agencies, and the public, the Task Force should submit additional questions to Enbridge and others in making a proper determination regarding Line 5, the Straits and near-shore areas, the ecosystem, safety and health, and the public trust or protection of public and private property. A set of proposed sample questions to address missing or inadequate information has been prepared, as draft only, and attached to this composite summary.[8] These questions and the information propounded are fundamental to the Task Force and state officials' responsibility under the public trust doctrine and the GLSLA. Moreover, Enbridge should submit evidence and assurances at its cost that emergency resources and equipment are immediately and locally available.

**c. Although Available or Disclosed Public Information Is Inadequate or Imprecise, Additional Conclusions Can be Drawn Based on Expertise**

[8] See attached Exhibit 1.

**and Experience Regarding the Lack of Integrity or Safety of Line 5 in the Straits.**

The aquatic ecosystem of the Straits of Mackinac is very different from the conditions at the time of Line 5's design. The construction of the St. Lawrence Seaway, which opened to navigation in 1959, resulted in the proliferation of hundreds of new invasive species. Sea lampreys, zebra mussels, and quagga mussels are examples of populations that overwhelmed the ecosystem and human facilities. The designers of Line 5 could not, and had no reason to, have considered the impact or effects of these invasive species. While the design calculations and methods used in the early 1950s for the pipeline are not publicly available, the margin of safety must be reanalyzed and recalculated in light of the existence of invasive species and as a condition of the easement itself. The margin for safety considered to good engineering practice in 1953 necessarily needs to be reassessed for Line 5. The 1953 easement from the State of Michigan to the company demanded structural supports every 75 feet; that is, unsupported spans of the underwater pipeline must not exceed 75 feet, except where buried or approaching shore. Maximum working pressure must not exceed 600 pounds per square inch gauge (psig). Other requirements or techniques, such as structural screws, welding, and coating are outdated or deficient.

i. **Line 5 Has Been and Continues to Be Subjected to Stresses that Were Not Contemplated in its Original Design and the Margin of Safety Considered to be Good Engineering Practice by Both Its Original Designers and the State of Michigan in 1953 No Longer Exists.**

The underwater sections of Line 5 are made of low carbon, low strength, and high ductility grade steel. The two Schedule-60 20-inch pipelines that constitute Line 5 in the Straits are free of longitudinal seams and resistant to stress cracking. This material works well for welding. It appears the design for the underwater segment of Line 5 sought flexibility due to unanticipated conditions. However, the type of pipe is not dispositive. Based on the 75-foot easement limit on unsupported span for the pipeline, 211 structural supports would be required; however, according to Enbridge's records, a total of only 16 grout bags, 8 grout bags and mechanical supports, and 122 mechanical screw anchors have been installed to date. A portion of the pipeline was placed on a gravel bed, which is susceptible to erosion. Use of gravel bed in lieu of structural supports does not satisfy good engineering practice today. Enbridge has reported erosion of this gravel bed.

Further, based on calculated design stress per the easement and specifications for 75-foot spans in 1953, compared to calculated

stresses in the changing aquatic environment and use since that time for transport of natural gas (NG) liquids (unfouled), light crude (2-inch fouling), heavy oil such as dilbit[9] (4-inch fouling), it can be concluded that: the margin of safety in 1953 for NG liquid through Line 5 would have a factor of 3.9; the margin of safety for light crude would have a factor of 3.4, and heavy oil or dilbit a factor of 2.75.[10] The safety factor required for the pipeline under ASME B31.8 (2003) is 2.5. At a safety factor of 1.0, there would be certain failure.

The only public information on the design in 1953 of Line 5 is summarized in "Enbridge Energy Limited Partners, Operational Reliability Plan, Line 5 and Mackinac Straits Crossing." This is not an engineering report, but appears to be a set of talking points to justify the safety of Line 5 to the Task Force and public. The document states that stress corrosion cracking "requires both a corrosive environment and high stress." "However, neither element is present in the pipelines through the Straits, which have excellent coating at less than 25% of their design capacity." This can be interpreted to mean that when operated at 600 psig and no more than 75-foot spans, the combined stress on Line 5 is less than 25% of the yield stress of the pipeline assuming adequate weld efficiency. This equates to the listed safety factor of 3.9 for NG liquid listed above.[11]

As noted above, the easement required maximum 75-foot spans. A disclosed in recent years, the maximum length of the actual spans for the pipeline under the Straits is 90 feet, which is significantly less than the specified margin of safety – only 64 percent of the required span length in the easement. More recently, Enbridge has applied for permits to install additional supports. Permits were obtained in 2014 for installation of supports every 50 feet under the GLSLA, but the DEQ did not request information related to the overall future plans, alternatives, or logistical options regarding Line 5. This should have been done so other alternatives to the old pipeline that would prevent risk to the Straits altogether.[12]

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[9] Dilbit and heavy oil are included in the event Enbridge in the future proposes or tries to use Line 5 for Tar Sands or other heavy oils. It should be noted that synthetic, diluted heavy oils and heavy oils would have similar characteristics.

[10] See Figure 2, Ed Timm, March 14, 2015, "Safety Factor Based on Yield Strength with Weld Efficiency Factor of 1.0 as Function of Support Spacing at 600 psig Maximum Allowed Pressure at 290 Feet Underwater," attached as Exhibit 2.

[11] *Id.*

[12] Looking at the Enbridge "Operational Reliability Plan" document, above, if a 90-foot span is equal to only a 64 percent safety span distance, then the original design called for 140.6 feet, with a safety factor of only 2.0. Using this as a baseline for calculating different scenarios and circumstances and respective margins of safety, and considering reported washouts of the gravel bed, a range of unsupported

Again, ASME requires at least a 2.5 safety factor. Based on observed changes in conditions, such as the encrustation of the pipeline with invasive mussels, the following conclusions can be made for a:

Span of 75 feet, NG liquid, 2" encrustation, and safety factor 3.5.
Span of 100 feet, NG liquid, 2" encrustation, and safety factor 3.0.
Span of 150 feet, NG liquid, 2" encrustation, and safety factor 1.8.
Span of 75 feet, light crude, 2" encrustation, and safety factor 3.5.
Span 100 feet, light crude, 2" encrustation, and safety factor 2.5.
Span 150 feet, light crude, 2" encrustation, and safety factor 1.4.
Span 75 feet, dilbit, 4" encrustation, and safety factor 3.1.
Span 100 feet, dilbit, 4" encrustation, and safety factor 2.2.
Span 150 feet, dilbit, 4" encrustation, and safety factor 1.1.

The above conclusions are summarized in Table 2 to this composite summary.[13] As can be seen, there are instances both above and below the safety factor and acceptable risk of failure of Line 5. Structural supports were added in 2005, then more permitted in 2014. The safety factor has been compromised, and attempts, including fabric bags, were used to address washouts and the lack of safe support. Based on calculations and the conditions of the 1953 easement, 211 structural supports are required according to Enbridge's records submitted to the state, only 16 grout bags, 8 grout bags and mechanical supports, and 122 mechanical screw anchors have been installed to date. Enbridge has added more supports, but more are required to achieve a "margin of safety" for supports. As noted previously, the supports, age of pipeline, and conditions in the Straits require a much broader logistical and alternative analysis on the pipeline under the Straits.[14]

**ii. The Welding Techniques Used for Line 5 in 1953 Have Proven to Be Less Robust than Contemplated.**

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spans of 90 to 120 feet may not comply with ASME B31.8. Enbridge operated the pipeline in violation of the easement, under conditions that have been unsafe. The addition of some 50-foot spans demonstrates this. But the reason for these spans at 50 feet and the alternatives available to protect the Great Lakes and Straits were excluded from the GLSLA proceeding.

[13] See Table 2. Timm, 3/14/2015, p. 9, attached as Exhibit 3.

[14] The type of original support structures was designed for sandy soil. It is not clear how the new supports will perform under rocky, glacial till, subject to washouts and scouring, as evidenced from reports. Improper selection or installation of the screw anchor supports could result in failures of the supports and compromise of pipeline safety factors, as wells as greater risk of harm to the waters, bottomlands, and ecosystem, and the public trust and public uses.

Welding techniques for underwater pipelines is a complex subject, and research is ongoing. Historically, the welding techniques used at the time of design and construction of Line 5 have been found deficient. Enbridge has recognized the problem as evidenced by its "X-ray" inspections of joints.[15] Until more is known about these welded joints or their deficiency corrected, a higher frequency of failure or risk factor should be assigned to the line.

**iii. The Coating that Protects the Line 5 Pipeline Exterior from Corrosion Is an Obsolete Technology and May Have Failed Locally, Resulting in Corrosion that Has Reduced the Strength of the Assembled Pipeline.**

The paint coating that was used may be deficient as well. Paragraph (9) of the 1953 easement requires protection by "asphalt primer coat, by inner wrap and outer wrap composed of glass fiber fabric material and one inch by four inch (1" x 4") slats, prior to installation."[16] The Enbridge "Operations Reliability Report" mentions tar, but no wood slats.

**iv. Line 5, including in the Straits, Should Be De-Rated, Safely Downgraded,[17] and Stringently Controlled until a Full and Comprehensive Assessment of Forecasted Strategies, Alternative Risk Assessment, Safety and Integrity Assessments, and Response Information Has Been Made Available, Disclosed, or Prepared and Submitted to the Task Force, Officials and the Public.[18]**

Given the above-identified deficiencies, there is a substantial and serious risk of a high magnitude of harm to public health, safety, communities, environment, and the public trust in the waters and bottomlands of the Straits of Mackinac for fishing, boating, navigation, drinking water, and swimming and other recreation. Because of this serious risk of grave harm, immediate interim action is required. Interim actions should be coupled with a full and comprehensive review of the major changes in circumstances,

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[15] Note that the easement at p. 4 required at construction that "All welded joints shall be tested by X-Ray."

[16] Enbridge has encountered known failures in fossil fuel-based protective coatings, e.g., Line 2, Saskatchewan, 2009, also constructed in 1953.

[17] The word "safely" is used because reducing the volume or capacity would have to be evaluated if temperature and pressures remained the same; strict interim controls and monitoring are required. See subparagraph d, infra.

[18] Undoubtedly, Enbridge (as with any energy pipeline company) would or should have a logistical contingency plan in place for oil pipeline transport to locations served by Line 5 in Michigan in the event of Line 5 failure or outage. This plan should be disclosed if Enbridge has not done so to date, and such plan should be the starting point or baseline to determine what can be done with Line 5 or what alternatives may exist or be implemented in the future in the absence of an emergency; i.e., to achieve the goal of zero risk to the Great Lakes and its ecosystem.

including the recently started and ongoing overhaul of the pipeline related to the inadequacies of the supports and stresses on the pipeline in the Straits. Such interim action should be ordered along with an order that Enbridge immediately apply for proper authorizations, occupancy agreements, and permits under the easement and GLSLA.

**d. The Substantial Risk of Failure from Lack of Adequate Consideration of Impacts of Stresses and Corrosion on Line 5 Should Be Made Subject to Stringent Conditions Pending a Thorough Review Under Public Trust Law.**[19]

**i. Protective Coating Covering Similar to that Specified for and Applied on Line 5 Has Failed in Michigan and Elsewhere and Resulted in Major Spills or Releases of Crude Oil or Heavy Crude Oil.**[20]

Enbridge Line 5 was covered with a coating and wrapped, but without wooden slats, as described in subparagraph c.iii, above, to guard against corrosion when it was constructed in 1953. The Line 5 coating is rugged, but does not last forever. The integrity of the coating depends on whether it suffers other degradation or damage, which would weaken the coating or expose the steel surface of the pipeline.[21] The extent of damage or degradation to the protective coating on Line 5 is not fully known, because the pipeline is encrusted with invasive mussels, and the measured deflection standard for dents or gouging is not always sufficient.[22] Enbridge reported dents, each less than 2%, on Line 5 in September 2012. The outcome, including exposure of bare steel, of the investigation has not been disclosed. Bare steel corrodes. Because this can result in breaks and spills, it must be reported or assumed to be exposed steel. Dents or gouges set up stress points in the coating that can also lead to failure. One risk of stress points on the coating is the fact that Line 5 was simply laid on the bottom and not anchored in 1953, resulting in movement from erosion, washing away of the

[19] Those measures would include, at Enbridge's expense: (a) continuous monitoring at lowest possible thresholds for adverse conditions and leaks; (b) emergency and recovery response resources, including equipment and personnel, in place and/or immediately and locally available; (c) time-deadlines for (i) determination and (ii) implementation of alternatives and accompanying interim measures; (d) credible insurance liability and bonding requirements.

[20] While constructed along seams and then covered with protective coating and wrap, the Enbridge Line 6b failed in July 2010, caused by corrosion (and *not* a failure at the seam), resulting in a documented oil-spill disaster in Marshall, Michigan.

[21] From 2002 to 2010, there were 17 spills or releases involving coal tar enamel Enbridge pipelines. For reportable Enbridge spills or releases in these nine years, see attached Exhibit 4.

[22] E.g., Transportation Safety Board of Canada, Report P09H0084, Crude Oil Leak, Line 2, Mile Post 474.7335, Sept. 29, 2009 at www.tsb.gc.ca/eng/rapports-reports/pipeline/2009/p09h0084/p09h0084.asp.

gravel, and direct contact of the coating with rocks or stones. Small amounts of corrosion can reduce the Maximum Allowable Working Pressure (MAWP) of a pipeline. For example, as little 1 mm of corrosion will reduce MAWP from 1421 to 1345, or 5.4%, and 2 mm of corrosion would reduce the MAWP by 15.2%.[23] Very small stresses can have a devastating impact on MAWP.

**ii. The Presence of Invasive Mussels that Encrust Line 5 Exacerbates the Corrosion of Line 5.**

The documented presence of mussels in the Great Lakes and encrusting portions of Line 5 poses a substantial risk of corrosion or stress. Mussels exacerbate the corrosion of steel.[24] The accumulation of pseudo feces decomposes and removes large amounts of oxygen (very high BOD), and the pH becomes very acidic. Mussels encrusted on Line 5 will exacerbate corrosion of any steel surface, further stressing the line and decreasing the allowable MAWP. Moreover, unless removed, a process itself that could compromise the line, the encrusted layer of mussels makes inspection virtually impossible.

**iii. Unless Enbridge Submits a Credible Worst-Case Scenario and Its Logistical, Strategic, and Alternative and Contingent Planning Information,[25] and the Task Force and State Officials Expand Their Review and Decision to Achieve "Zero Risk" Through An Alternative Assessment, Line 5 Should Be Shut Down.**

Enbridge has not disclosed and the Task Force has not made information available to the public regarding the coating, inspection, and dents or gouges of the pipeline, or the layer of invasive mussels that completely encrust the pipelines. The 1953 easement, public trust duty under it, and the GLSA demand immediate interim action to reduce stress and risk until there has been a full and comprehensive review and properly authorized occupancy and/or permits for Line 5. The lack of "credible worst-case scenarios," logistical, strategic and alternative assessment to prevent any devastating harm to the Straits and Great Lakes requires a shut-down of Line 5. However, if Enbridge submits this information and applies as it should under the GLSLA to achieve prevention of such harm, i.e. "zero risk," then the Task Force and/or State officials should place stringent measures on Enbridge

[23] See Figure 1, attached as Exhibit 5.

[24] See e.g. http://www.lakehuron.ca/index.php?page=zebra-mussels.

[25] Contingent planning information includes Enbridge logistics and strategy for moving oil in event of disruption, rupture, or temporary shut-down of Line 5. Such information is the starting point for review and evaluation of the risks, safety, and alternatives for any decision or recommendation on Line 5.

and the pipeline use and operation pending completion of review under the GLSLA.

**iv. Pending a Submission and Review of Enbridge's Submission and Application under the GLSA and Public Trust or Other Related Standards, Enbridge's Use of Line 5 Must Be Subjected to Strict Measures and Controls.**

Strict measures imposed on Enbridge's interim or temporary use, at Enbridge's cost, would include continuous monitoring, locally available emergency response and recovery resources and personnel, time deadline for the GLSLA determination as provided by law and the actions that eliminate or achieve zero risk (i.e., prevention, with one deadline for determination and a second deadline for elimination), credible insurance and bonding requirements under the easement, and daily disclosure of petroleum products.

## 4. CONCLUSION

There is a substantial and real risk and threat posed by Enbridge's Line 5 in and near the Straits of Mackinac to the waters, bottomlands, ecosystem, and the public trust in these Great Lakes waters and ecosystem and uses protected by the public trust. Based on available information, Enbridge has not submitted future and existing logistical information regarding present and alternative or future plans and alternative routes and alternative risk assessments. As a result, the scope of the Task Force review has been limited to safety and response activities because of the risk of accident, release, or leak. This is unacceptable.

The Task Force, officials, and all stakeholders agree that a release or leak of any oil from Line 5 in the Straits is unacceptable. This means that the baseline risk of the high magnitude of harm to the Straits and public health and safety is zero – 0. In turn, this means that the evaluation and decisions by the Task Force and/or state officials must include all logistical, strategical, and alternatives assessments and plans of Enbridge for volumes, pipelines, and existing and planned routes. Failure to conduct such an evaluation and decision to achieve zero risk would violate the public trust and the Great Lakes Submerged Lands Act.

This can and should be accomplished by a thorough analysis and public review of all relevant and required information identified in this composite summary – coupled with a review under the 1953 easement, associated public trust duties in and related to the easement, and the GLSLA to protect the public health, safety of citizens and communities, and public trust in the Straits, Lake Michigan, and Lake Huron. Immediate action should be taken to shut down and/or impose stringent measures for Line 5 for oil or similar petroleum products, pending a full and complete public review, consideration, and determination to implement an alternative assessment and decision.[26] This action is compelled by the easement and the fiduciary public trust responsibility that applies to it, as well as the necessary proceedings for Line 5 under the

[26] See subparagraph d. iv, above.

GLSLA. Anything less than the above puts the Great Lakes and the public health, safety, and public trust at risk; in effect, the Task Force and State officials would be betting the Great Lakes, citizens' safety and health, and the public trust in order to allow Enbridge to continue using Line 5 indefinitely.

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## EXHIBIT 1

# Questions for Michigan Pipeline Task Force

## Introduction

This document provides questions for use by the Task Force to obtain additional information and fill critical gaps on Line 5. This is not comprehensive list but an initial "brain-storming" list. A recommended next step would be to expand and refine the list using a team approach including subject-matter-experts (SME's).

## A. Petroleum Distribution System Overview and Strategy

*Objectives:*

- *Understand the commercial, operating and regulatory environments for petroleum distribution affecting the State of Michigan and specifically Line 5.*
- *Understand the short-term plans and capabilities of the existing network and potential impact of regulations and emergency incidents.*
- *Understand the key drivers and potential strategic changes in the distribution system, including: changes in petroleum supply-side, end-user demands, regulations, alternative transportation modes and the long-range plans for the pipeline network.*

Are *systems analyses* and *strategic plans* available for the North American (NA) petroleum distribution system that include Michigan?

Do the analyses cover all modes (pipeline, rail, truck, ship/barge) and a range of potential scenarios including normal and emergency operations?

Are the facts, assumptions, design bases and scenarios available for the strategic plans?

If system strategic plans are not available, can a study team be convened to develop system scenarios and analyze them with industry support? The team would include participants from the public sector, SME's, industry, NGO's and government?

The Great Lakes Commission issued several excellent draft reports on NA petroleum distribution. Is this organization appropriate and positioned to coordinate development of systems and ***alternatives assessment*** on behalf of the PTF?

What are the primary distribution scenarios (high, most-likely, low and "emergency") for all transport modes (pipeline, rail, truck, ship/barge) and evolution planned for petroleum production from the Alberta Tar Sands and Bakken Fields?

What is the contingency plan for disruptions in the different transportation modes?

What petroleum materials are allowed by regulation to be transported in Line 5? Are there regulatory requirements that must be met before additional materials can be transported and what are they?

What petroleum materials does Enbridge believe could be transported in Line 5 under the regulations? What petroleum materials is Line 5 able to transport in Enbridge's view based on the existing technical capabilities without regard to regulatory restrictions?

Is Line 5 technically capable of handling heavy crude oil and Dilbit (diluted bitumen) based on current engineering and risk assessments? Have any tests or pilot trials been run with these materials and Line 5?

Are there contingency plans or potential scenarios where an incident elsewhere in the pipeline or rail distribution system would drive Enbridge or government action to transport greater volumes or heavier crude oil or Dilbit through Line 5? If there are no plans in place, does Enbridge believe that Line 5 is capable of carrying these materials?

How will the proposed Sandpiper Pipeline Project affect the petroleum materials mix and volumes that are planned for Line 5? Will an additional feed point to the Superior Wisconsin terminal drive changes in Line 5 operation? If there is an incident on other pipelines originating from this terminal, could the incident drive volume or mix changes in Line 5?

How will Line 5 operations be affected if or when the rail tank car shortage becomes acute (retrofitting or replacement of DOT-111 specification tank cars)?

Has a "credible worst case" scenario been developed and analyzed? What are the assumptions and results?

Has a "Black Swan" event been considered of multimode system failure and the impact on Michigan pipeline operation such as a major rail tank car shortage and pipeline incident outside of the State of Michigan and the impact on Line 5 operation?

What are Enbridge's system operations and business continuity plans in the event of leak on Line 5?

What is the impact on suppliers, customers, regional and national economy if a leak on Line 5 causes extended or permanent shutdown due to clean-up, regulatory and public pressure?

Does the PTF and Great Lakes Commission have direct access to DNV - Det Norske Veritas to obtain information on their assessments and recommendations on Line 5 risk.

**B. Alternatives Assessment**

*Objectives:*

- *Launch an Alternatives Assessment, which includes key stakeholders.*

- *Develop a range of alternatives, such as modifications to Line 5, new pipelines, different petroleum materials transported, different routing, changes in modes and destinations.*

- *In simple terms, are there alternatives that reduce or eliminate risks in the Straits? Or is a greater risk transferred to other areas and modes; and what are the implications?*

- *Are there* ***inherently safer approaches?***

Have alternatives and scenarios been developed for petroleum transportation if the Straits of Mackinac route is not an option? What are they and what are the facts, assumptions and risk assessment results?

What are the scenarios, timing and risks for a new trans-Canada pipeline above Lake Superior?

What are the alternatives, timing and risks for additional pipeline capacity through Wisconsin, Illinois, Indiana and southern Michigan and to the east?

What is the feasibility of eventually eliminating the Line 5 Straits Crossing by expanding transportation by pipelines in other areas and expansion of rail shipments?

Would a new pipeline reduce the risk for a Straits crossing by having state-of-the-art design, installation, operation and monitoring capabilities?

Is there a lower risk, more visible, above water, under-the-bridge option?

Are there viable alternatives for transporting only the lowest environmental risk materials (natural gas, NGL's) in Line 5 and no emergency provisions for higher risk materials such as heavy crude and Dilbit?

Are there feasibility studies and risk assessments for Great Lakes petroleum transportation by ship and barge? Are there plans for additional studies especially on comparative risk to other modes?

**C. Evaluate the Current Line 5 Risk Assessment**

*Objectives:*

- *Understand how risk assessments were conducted including the input facts, assumptions, technical and engineering design bases and especially the risk tolerance criteria.*

- *Understand any scenarios, assumptions in the scenarios and output consequences if assessed. Did the assessment and scenarios include events with failures triggered by common causes; multiple system failures of equipment, procedures and human elements?*

- *Was an analysis done on a "credible worst case scenario"? A credible worst-case scenario is a scenario that can technically occur and would include "common-cause" and multiple failures of layers of detection and mitigation. What are the triggering events? What were the conclusions for an "undefined triggering event", a "black swan event?" where the spill was limited to only passive protective measures that are inherently safe and reliable?*

Has a complete Line 5 segment risk assessment been conducted and routinely updated? Does one segment specifically cover the Straits Crossing? Are copies available for Task Force and public review?

Who conducted the original Straits risk assessment? What methodology, assumptions and scenarios were used?

In 1953 when Line 5 pipelines were laid by "pulling" it across the Lake, when it the edge of the gorge, did it sink to the Lake bottom and follow the gorge topography or did it totally, or at least partially, "bridge" the gorge?

If pipe did not sink completely to the Lake bottom, how is it supported? How is the additional strain on the lines managed due to currents, corrosion, storms, ship traffic, seches and etc.?

If the pipe did reach the Lake bottom and is supported, did it undergo significant "bending" to conform to the Lake bottom?

Did the bends set up strain on the outside of the curvature, and compression on the inside?

Did the pipelines undergo "thinning" as it was stretched to conform to the contours? Does this thinning reduce the MAWP?

Does the stress/strain on the pipeline enhance corrosion as well as lead to failure of the coating?

During operation when separation or gaps in the material being transported occur have changes in line buoyancy been analyzed to determine if "pipeline flexing" could occur causing metal and coating fatigue leading to failure?

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What would the economic and energy supply impact be for an extended Line 5 outage (any point, any cause) for Michigan residents, regionally and nationally?

Are there gaps in environmental impact studies? What areas and scenarios need additional study and what are the confidence levels? When was the last study completed and what was the scope of coverage?

Was a "credible worst-case scenario" scenario developed including assumptions on common-cause, multi-mode, human and management system failures? What resources are in-place and tested to respond to and mitigate this incident?

Did regulatory authorities evaluate a "credible worst-case scenario"? Independent experts?

What "design basis events" were considered in the original Line 5 design and assessment?

Does the assessment include "common-cause" and "multiple system failures" that could lead to a serious incident?

What recommendations were made from risk assessments? Were all recommendations implemented? What recommendations were modified? Are still open? Discarded and reasons for not implementing?

Have the consequences from a "black swan" event been determined and reviewed? This would be an "unconstrained release" with only inherently safety measures credited for risk reduction.

Has a risk assessment been conducted on start-up, shutdown and maintenance (SSM) operations covering differences between normal operating conditions and SSM transition periods? Are potential excursions investigated during testing and transitions?

Has a 3rd party review been conducted on Line 5 such as the study conducted by Dr. T. Gunton and S. Broadbent at Simon Frasier University titled, "A Spill Risk Assessment of the Enbridge Northern Gateway Project?"

Were risk and design assessments conducted on the design and placement criteria for the new underwater supports being installed to fill voids defined in the original design? Why is a new design being used? Why are additional supports being installed? Is the installation of new supports being driven in part by engineering modeling (line movement and vibration suppression) and / or actual incidents and fatigue measurements? Provide a detailed explanation.

Does the new support installation project initiate the regulatory requirement to conduct a new environmental impact assessment?

Provide a list of risk reduction assumptions and engineering measures for the existing line. What recommendations were developed and implemented or not implemented because or low cost-benefit such as incidents involving underwater land shifts, earthquakes, anchor drops and drags, potential installation issues from underwater slopes and bends and vibration causing pipeline fatigue that factor into risk assessments after 50+ years of operation?

What are Enbridge's "risk tolerance" or "acceptable risk criteria" used in the risk assessment modeling? What are the bases for current risk transfer scenarios justifying the purchase of catastrophic incident insurance coverage?

What metrics are used for evaluating acceptable risk (spills / leaks per mile per year, size and cost of spill cleanup, reputation damage, environmental impact damage, public sector economic impact)?

Was an environmental impact assessment (ERA) required by and submitted to the EPA for the new support installation project?

Has DNV assessed Line 5 risk? References indicate that DNV was involved in modeling Line 5? What aspects were modeled and what were the results and recommendations? Can the assessments be made available for PTF review?

Are there plans and assessments to address a scenario where a large spill may generate enough public concern and pressure resulting in an extended or permanent shutdown of the Straits Crossing?

Crude oil transported in the pipeline is a complex mixture with some of the components being polyaromatic hydrocarbons (PAHs) which are listed CMR (carcinogenic, mutagenic , reprotoxic) materials. Has the human health and environmental impacts been assessed on the potential release of these materials into the Straits and Great Lakes?

Are toxicology reports available on risk to municipal and private water systems and human health impacts? Are there estimates on the time required to return to safe water consumption?

**D. Comparative Design – a 1953 Vintage Pipeline Compared to State-of-the-Art 2015**

*Objective:*

- *Conduct a comparison of risk for the existing Line 5 and a "2015 model" using state-of-the-art design, fabrication and installation and operation criteria.*

Have studies, preliminary designs and cost estimates for a new Straits Crossing pipeline been developed?

Has an assessment been conducted on "inherently safer design" (ISD) approaches that could be used on the existing or a new line and the benefits obtained?

Has comparative and/or gap analysis been conducted on the design and installation of the current line versus a new design?

What are the differences, advantages and disadvantages the Line 5 design compared to today's standards and normal industry practices? Enbridge - " The Straits pipelines are well designed and constructed to design standards that far exceed normal industry practice". What are the details behind "normal industry practice", especially for normal terrains versus environmentally sensitive, high consequence geography?

What are the state-of-the-art design and installation practices for pipelines crossing major waterways?

What are the differences between the Line 5 quality control and commissioning activities and todays best practices? Has a gap analysis been conducted? Enbridge - "Quality control and commissioning activities were robust to ensure safety and reliability"

Are there differences between pipelines crossing inland rivers and lakes compared to deep-water maritime environments? Are there practices used for maritime pipelines that would reduce risk for Line 5 or a new pipeline?

Have modeling studies been conducted to determine the possible effects of water currents land shifts and vibration on Line 5? Is there evidence of issues or concerns about pipeline vibration, stress and fatigue? What would be done differently for a new line design?

What were the design and installation consideration specifically for the deep lakebed channel, through the Straits connecting Lakes Michigan and Lake Huron? The channel has steep walls and can reach 300 ft deep in some areas. The pipeline suspends over this channel about quarter-mile-wide? The tension on that section of the line is likely to be severe?

Why were 2 - 20" lines installed instead of 1 - 30" line across the Straits, reliability, fabrication considerations, design limitations, maintenance, back-up in case one branch fails?

Are there scenarios where Line 5 could be impacted by ice packs? Does actual ice flow data exist or only assumptions? Discussions were conducted on possibly installing a new line underground through the Straits? Enbridge, "the lines are buried at depths that protect it from moving ice packs."

What is the risk for ship anchor drops and drags in the area? The area is marked and managed for routine shipping but what about emergency scenarios (human error, mechanical or navigation failures, accidents, severe weather, common-cause, multiple system failures)? Enbridge Line 5 - Location is not conducive to anchoring - deep water, strong currents, shipping corridor." How does this relate to the discussions on a buried pipeline that may be safer from anchor damage but more difficult to inspect?

How do the planned Keystone practices compare to the current Line 5 installation such as inspections, non-destructive testing (NDT), coatings, welding technology and testing cathodic and other protection? What best practices would be used for a new line compared to Line 5. Has a gap analysis been conducted?

**E. Evaluate Current Approaches for Line 5 Integrity and Leak Detection**

*Objectives:*

- *Obtain an understanding of the limitations in the Line 5 integrity management process. What potential line failure issues could be underestimated or not detected due to limitations in the technology and/or management system? What are the gaps that Enbridge reference studies are trying to address, timing and action plan related to improved pipeline integrity measurement and management? What is the "layered protection approach" being used to cover gaps?*

- *Obtain and understanding on reliability accuracy and precision for detecting leaks and the limitations of the detection process relative to leak size, quantity, leak rate and identification of location.*

- *Has an assessment been done on the management system and could it meet standards an OSHA PSM / NEP level audit? Are the gaps and areas for improvement, especially related to external communications?*

Have there been any underwater repairs made to Line 5 since installation? What were the reason for repairs and findings?

Technical studies have concluded that zebra mussel excrement has a corrosive impact on exposed steel. Has an assessment been made on the likelihood that at least some of the original coal tar sealant has deteriorated or been scraped off and the steel exposed to corrosion induced by zebra mussels?

As relative small levels or corrosion can result in a significant deterioration in MAWP has the impact of zebra mussels or other acidic materials been assessed on potential line failure?

Have zebra mussels impacted the ability to conduct pipeline exterior and surface inspections for integrity issues?

Has PHMSA or other regulatory agencies conducted detailed compliance audits on the pipeline system and management practices? Have regulatory agency audits similar to the OSHA / EPA National Emphasis Program (NEP) conducted on oil refineries and chemical operations been conducted? Any specific audits conducted as a result of lessons learned from the Marshal MI spill?

Specific regulatory compliance audits conducted - agencies, focus of audits, dates and deficiencies found. Open deficiencies under review and remaining to be completed?

Explain in detail - Enbridge has started to lay the groundwork to expand Line 5 by 50,000 barrels of oil per day— or 1.8 million gallons. As part of that effort, Enbridge has conducted hydro testing to evaluate the condition of the pipeline, which has turned up recent failures on the line near Bay City, Michigan

Enbridge personnel have stated that block valves on both sides of the Straits would shut immediately if a leak is detected. During activation for testing or in the event of an actual leak can severe pipeline damage occur and/or potential failure due to the "water hammer effect?" Are controls and surge dampeners in place to reduce hammer?

Has a 3rd party evaluation been conducted on pipeline integrity inspections and the minimum detection thresholds for issues such as defective welds, dents, cracks, areas of fatigue, stress, corrosion, stress corrosion cracking and wear both internal and external?

Have assessments or forecasts been conducted on pipeline end-of-life? Have cost estimates and/or preliminary designs been developed for line replacement in the event of it being taken out of service for any reason? Enbridge - " Prioritized repair timing, re-inspection interval setting, additional assessments in top consequence areas" - Are these areas in the Straits sections?

Has a comparison of the 1953 enamel coating reliability been made to state-of-the-art technology that would be used today? Would the 1953 coating be used today, if not why not? Does the original coating age and what are the "end-of-life" issues and criteria for replacement? How is the underwater coating inspected and repaired?

Is there a different coating used on Line 5 outside of the Straits area and what is the reliability and end-of-life issues with this coating?

Can the entire Line 5, especially sensitive areas be effectively checked by "high-technology pigs?" Are there areas of concern or gaps where pigs may not be reliable? The 1953 pipeline was not originally designed for pig inspections?

Where is cathodic protection used? How effective is the cathodic protection in corrosion protection? What areas are not effectively covered and how these areas inspected?

Integrity of records - a pipeline seam failure occurred on another pipeline where records incorrectly listed the segment as seamless. Have all Line 5 records been verified with what is actually in place?

Has the Task Force interviewed the Enbridge 3rd party service providers for findings, recommendations and pending safety and integrity issues yet to be addressed? Enbridge - "3rd party damage management."

Did the insurance company covering Line 5 make recommendations? What recommendations are open action items and are there recommendations that were rejected from resolution?

Provide information on: process safety studies conducted and findings, layer of protection assessments (LOPA), instrumentation reliability, calibration and testing programs? What is the history of instrument reliability in different seasons, weather conditions, electrical power and communication system disruptions?

How effective are the back flow check valves? Are they considered to be a credited protection layer? Is there an additional double block and bleed system that act as the primary isolation?

Explain inline inspections for cracks and metal loss - the "features" that were found, were they individual isolated features or were some concentrated in an area that could result in a large or catastrophic failure?

Explain comments by Enbridge that Line 5 corrosion rates are lower than typical? What is the "typical" comparison used? What are the differences between overland and underwater corrosion rates?

Pressure cycling and fatigue crack growth, how accurate and precise are inspections at detecting fatigue cracks? What are the crack initiation times and growth rates to possible failure compared to detection capabilities and inspection intervals? How good is the "best available crack inspection technology?

For geotechnical hazard management, have there been any incidents of line shifting? Steep slope changes, landslides, support of pipeline movement in the Straits? Are the new supports being installed to improve the stability in response to concerns about actual incidents or near misses? Has the ROV inspections detected any areas of actual movement and risk?

Explain - "no pipeline repairs have been required at the Straits" - how would underwater repairs be performed? What is the decision process, approvals required and how long would a repair take? Are there current defect areas where risk assessments list these as below the threshold criteria that would require repair?

What incidents could have happened during original installation or since installation that have reduced line integrity and are not adequately detected today, such as stress, bends and shifts?

What technical and scenario assumptions on line integrity have or are being challenged by any party and their views?

What studies have been conducted, conclusions and recommendations on additional leak detection? How reliable and sensitive is the technology, i.e. the lower level leak detection limits? Enbridge - "commissioning an engineering assessment to explore the feasibility of applying additional external leak detection and real-time damage-detection technology on the Straits crossing."

What is the limit of detection for leaks using the Enbridge "material balance system?" For example, typical flow meters read +/- 0.5%, a leak of this magnitude could spill nearly 80,000 gallons of oil within 3 hours (for each line) and still be below the limit of detection.

ROV inspections, what are the real capabilities and observation limits for issues? What are the objectives for ROV inspections (leaks, line damage, line shifts, other)?

What is the possibility of long-term small leaks underwater not large enough to be detected by any of the existing measures? Have performance tests been conducted on the systems and what are the results?

Provide more details on new leak detection technologies understudy. Are any 3rd party studies being conducted and have advances in offshore systems been studied? (fiber-optic cable, rarefaction wave leak detection, acoustic strike detectors, etc)

Explain the approach, accuracy and precision of Enbridge's "computational pipeline monitoring" and "scheduled line-balance calculations". How large could a continuous leak or small intermittent leak be and miss detection by this system?

**F. Emergency Response**

*Objectives:*

- *Understand the baseline assumptions and scenarios (materials, leak size, weather conditions, time of day and length of time and etc.) that the emergency response plan is designed to address. What gaps or potential scenarios would the plan not be able to address or have short-comings?*
- *Given given a large scale incident, what additional resources and timing could be called on outside of the plan in a reasonable amount of time, such as other federal, states or communities?*
- *What are the assumptions on recovery and remediation issues and actions required for the baseline response scenario? Who takes responsibility, manages and pays?*
- *For emergency response, what resources are firmly committed (contracted) such as responders (government and 3rd party), equipment and funding? Extent of contractual agreements including retainers to insure that response personnel and equipment are guaranteed to be available.*
- *What agreements are in place with Canadian government for support and the type available?*

What scenarios have been developed and analyzed for emergency response?

What are the details for the base case scenario that the emergency response plans are represented as able to address?

What is the credible worst-case scenario? What are the response and mitigation capabilities for this worst-case scenario?

Has the Enbridge worst-case scenario been reviewed by SME's? Published articles state that according to the Enbridge emergency response plan, it takes the company a minimum of eight minutes to shut down a ruptured pipeline and isolate the flow of oil from the leaking pipe. Enbridge has estimated that a "worst-case" discharge for line 5, with the eight-minute shut off, would be up to 1.5 million gallons of oil released. This scenario does not appear to cover common-cause, cascading and multiple system failures.

What is the size of a release for a line failure at the worst point underwater with no "active" emergency shutdown communications and isolation systems in operation? In other words, only passive and inherently safe layers of protection would be credited for stopping the spill.

Are any actions being taken to prepare for possible new communications and response capabilities to address Executive Order 13650?

Has the University of Michigan release analysis been incorporated into emergency response planning?

Have experimental data and spill spreading scenarios been developed for the different petroleum materials transported in Line 5? For example, are the actual paths taken by light crude versus NGL's actually known and accounted for in planning? How does material evaporate or sink or move during different seasons and weather conditions?

How will a spill be located and tracked during each season especially under ice cover?

Is there any history or examples of a large oil spill in the Great Lakes? What were issues in cleanup and ecological recovery times (biodegradability compared to maritime, e.g. Gulf Coast spills)

Has an "all threat" integrated contingency analysis been conducted based on DHS protocols or NFPA 1600?

Do contingency plans have detailed procedures for working with the USCG, LEPC, EPA, SERC and Fusion Center? Do the plans cover mitigation, planning, response and recovery operations?

For the past three winters, the U.S. Coast Guard Sector Sault Ste. Marie has been running "oil and ice" exercises in the Straits of Mackinac. What spill scenarios and mitigations capabilities were used? What were the conclusions, gaps and recommendations?

For a response to worst-case scenario - what were the assumptions for the scenario and who participated in the exercises with the USCG? LEPC?

Has an independent group of SME's review the Integrated Contingency Plan (not available to the public) and findings from the peer review? Who were the peers that reviewed the report? ref 8

What are the estimated times for emergency response crew to arrive? Set-up and commence spill stoppage? What is the time required to start cleanup operations and what would the equipment and scale of cleanup in the 1st day, 1st week? Enbridge's emergency response plans show it would take company crews around three hours to respond to a spill in the Straits of Mackinac. Note this appears to be arrival time not set-up and cleanup and assumes required equipment is available where?

Describe the equipment and capabilities at the Straits or that will be sent to the Straits for cleanup that are on-site, will be brought in and timing. Are there guarantees that the equipment will be available on retainer or "expected to be available?"

Do villages and cities in the potential spill impact zone have contingency and communications plans in place to monitor and respond to a release that may impact there water intake systems and other critical infrastructure?

What organizations are directly involved in emergency response planning and recovery? Where is the incident command center and who are the designated incident commanders?

Have "after-action" and "hot-wash" analyses been conducted on line incidents, near-miss, false alarms and drills and exercises? What conclusions and recommendations were developed and are there any open actions?

In practical terms, how effective would a 2-man submarine from a Detroit company be in vacuuming oil from bottom of the lake?

Has the USCG Captain of the Port responsible for ship traffic in the Straits met with the PTF and explained actions that may be taken to shutdown ship traffic to reduce spill dispersion, potential outage

times and conditions that allow reopening. Potential economic impact on Lake Huron and Lake Michigan sides of shipping lanes.

What is the status of studies on equipment that can be used to remove oil during ice cover?

Are there plans to use dispersants and surfactants on oil spills? What materials are in place, available for for use? Have the materials been assessed for human health and environmental impact?

The USCG objective is to prevent oil from a spill reaching the shoreline and environmentally sensitive areas. What equipment is readily available to meet this objective (skimmers, booms, boats, workers, designated areas and plans, and etc.)?

What are the economic and environmental costs calculated for the: 1) Enbridge worst case scenario release, 2) credible worst case scenario release and 3) a "black swan" release maximum release with only passive layers of protection credited?

What new regulations need to be addressed covering onshore oil pipeline facility response plans (FRPs) by PHMSA and coordinated with U.S. Coast Guard (USCG) oil spill response regulations?

What specific petroleum materials does the current emergency response plans cover? If there is a transportation shutdown elsewhere in the network and there are actions to transport materials in Line 5 that are not currently transported, what are the communication and response procedures to address this possible change?

What are possible events that could impact the system that would drive implementation of emergency plans or orders to change this position? In what areas can the federal government through interstate commerce authority override state law?

**EXHIBIT 2**

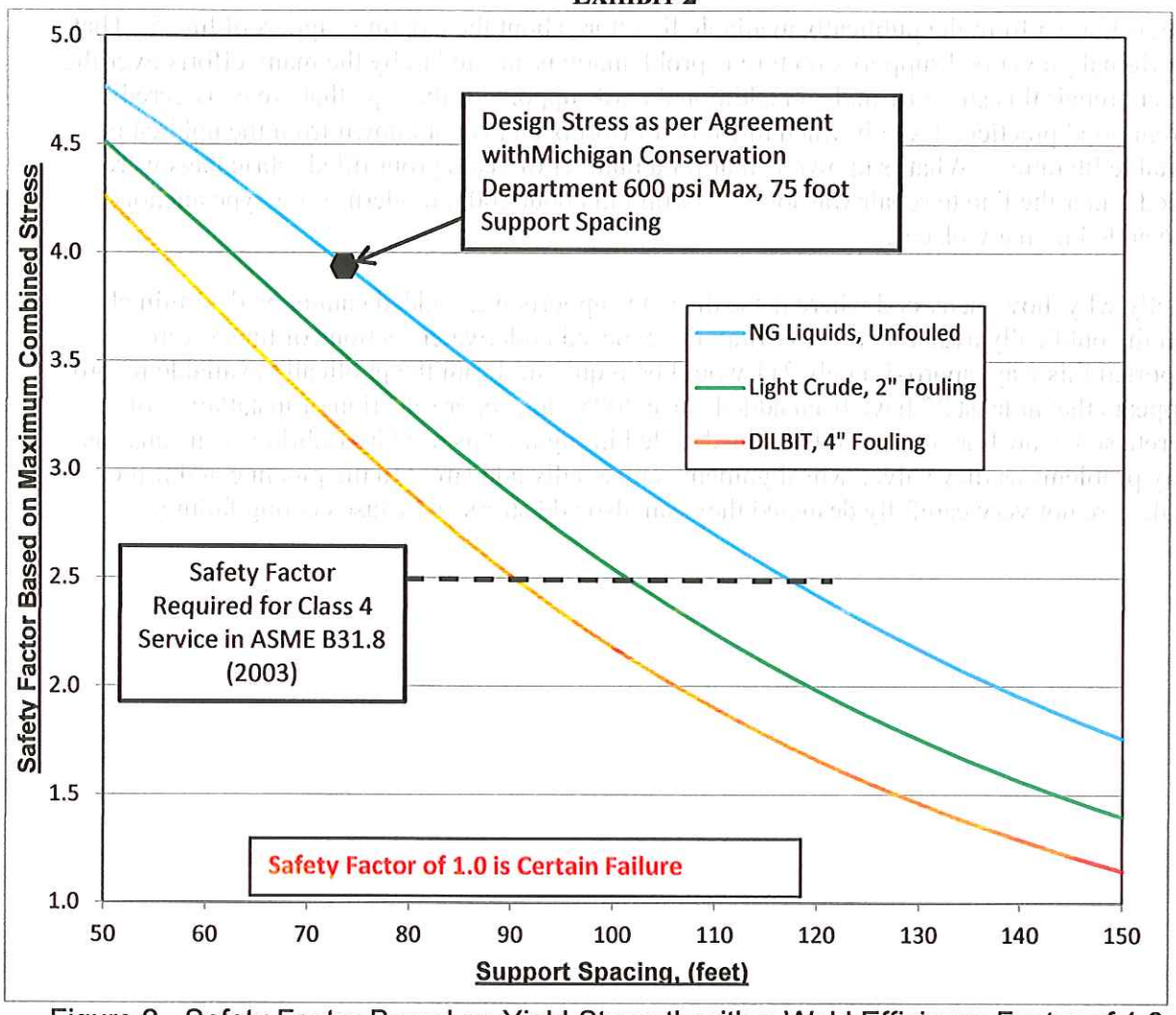



Figure 2. Safety Factor Based on Yield Strength with a Weld Efficiency Factor of 1.0 as a Function of Support Spacing at 600 psig Maximum Allowed Pressure at 290 Feet Underwater.

**EXHIBIT 3**

Table 2. Pipeline 5 Safety Factor Based on Yield Strength with a Weld Efficiency Factor of 1.0 as a Function of Support Spacing at 600 psig Maximum Allowed Pressure at 290 Feet Underwater.

| Unsupported Span in Feet | Natural Gas Liquids, No Encrustation | Light Crude, 2" Encrustation | DILBIT, 4" Encrustation |
|---|---|---|---|
| 75 | 3.9 | 3.5 | 3.1 |
| 100 | 3.0 | 2.5 | 2.2 |
| 150 | 1.8 | 1.4 | 1.1 |

Little is known from the publically available literature about the existing support of line 5. That the original gravel bed support structure is problematic is attested to by the many efforts over the years to repair this structure and add additional hard supports of the type that are considered current good practice. Exactly when this repair effort began is not known from the publically available literature. What is known is that for a number of years grout filled fabric bags were placed under the line to repair washouts. Starting in about 2005, modern screw type anchors were added in many places.

Exactly why, how many and where these discrete supports were added cannot be determined from the publically available record. If all the exposed underwater sections of line 5 were supported this way, approximately 211 would be required. From the publically available record it appears that at least 27 have been added since 2005. Improper selection or installation of discrete screw anchor support of the type detailed in Figure 3 as used by Enbridge can cause as many problems as they solve. Misalignment can actually add stress to the pipeline and if the saddles are not very carefully designed they can also add stress and cause coating failure.

| 1 | Year | Month | State/Province | Location | Estimated Amount Spilled ($m^3$) | Cause | Caused by Corrosion? | Construction Date | Pipeline Material - Pipe | Pipeline Material Coating | Pipeline Material - Long Seam Weld | Material Transported | Amount recovered[1] ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2010 | April | Minnesota | Pipeline | 0.79 | Corrosion | Yes | 1957 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.63 |
| 3 | 2010 | January | North Dakota | Pipeline | 477.0 | Weld Failure | No | 1956 | Steel | Coal Tar Enamel | FW | Crude Oil | 246.04 |
| | 2009 | September | Saskatchewan | Pipeline | 175.0 | Excavation or physical damage to facility or pipeline by operator or operator's contractor | No | 1953 | Steel | Coal Tar Enamel | FW | Crude Oil | 175.0 |
| 5 | 2009 | July | Manitoba | Pipeline | 0.02 | Weld Failure | No | 1953 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.02 |
| 6 | 2009 | June | Minnesota | Pipeline | 0.79 | Weld Failure | No | 1954 | Steel | Coal Tar Enamel | FW | Crude Oil | 0 |
| 7 | 2008 | April | Minnesota | Facility | 0.95 | Pump - Seal or Packing Failure | No | 1950 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.65 |
| 8 | 2007 | July | Alberta | Pipeline | 0.48 | Corrosion | Yes | 1954 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.48 |
| 9 | 2007 | March | Minnesota | Facility | 0.79 | Equipment Failure, stripped | No | 1954 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.79 |
| 10 | 2006 | August | Alberta | Pipeline | 30.0 | Weld Failure | No | 1954 | Steel | Coal Tar Enamel | FW | Crude Oil | 30.0 |
| 11 | 2006 | May | Michigan | Facility | 3.18 | Pump - Seal or Packing Failure | No | 1953 | Steel | Coal Tar Enamel | SAW | Crude Oil & NGL | 3.18 |
| 12 | 2005 | August | Illinois | Pipeline | 17.01 | Hydrotest failure | No | 1952 | Steel | Coal Tar Enamel | DSAW/Flash Welded | Crude Oil | 11.29 |
| 13 | 2005 | April | Illinois | Pipeline | 0.79 | Dent | No | 1968 | Steel | Coal Tar Enamel | FW | Crude Oil | 0.79 |
| 14 | 2004 | December | Michigan | Facility | 0.16 | Equipment failure, cracked threads | No | 1953 | Steel | Coal Tar Enamel | SAW | Crude Oil & NGL | 0.16 |
| 15 | 2004 | February | Minnesota | Pipeline | 1.59 | Dent with cracking | No | 1957 | Steel | Coal Tar Enamel | FW | Crude Oil | 1.43 |
| 16 | 2002 | July | Saskatchewan | Pipeline | 3.00 | Natural Forces - Lightning | No | 1954 | Steel | Coal Tar Enamel | SAW | Crude Oil | 3 |
| 17 | 2002 | May | Manitoba | Facility | 60.00 | Weld Failure | No | 1950 | Steel | Coal Tar Enamel | ERW | Crude Oil | 10 |

**EXHIBIT 4 – Reportable Enbridge Liquids Pipeline Spills for Past 9 Years (see next page)**

## EXHIBIT 5

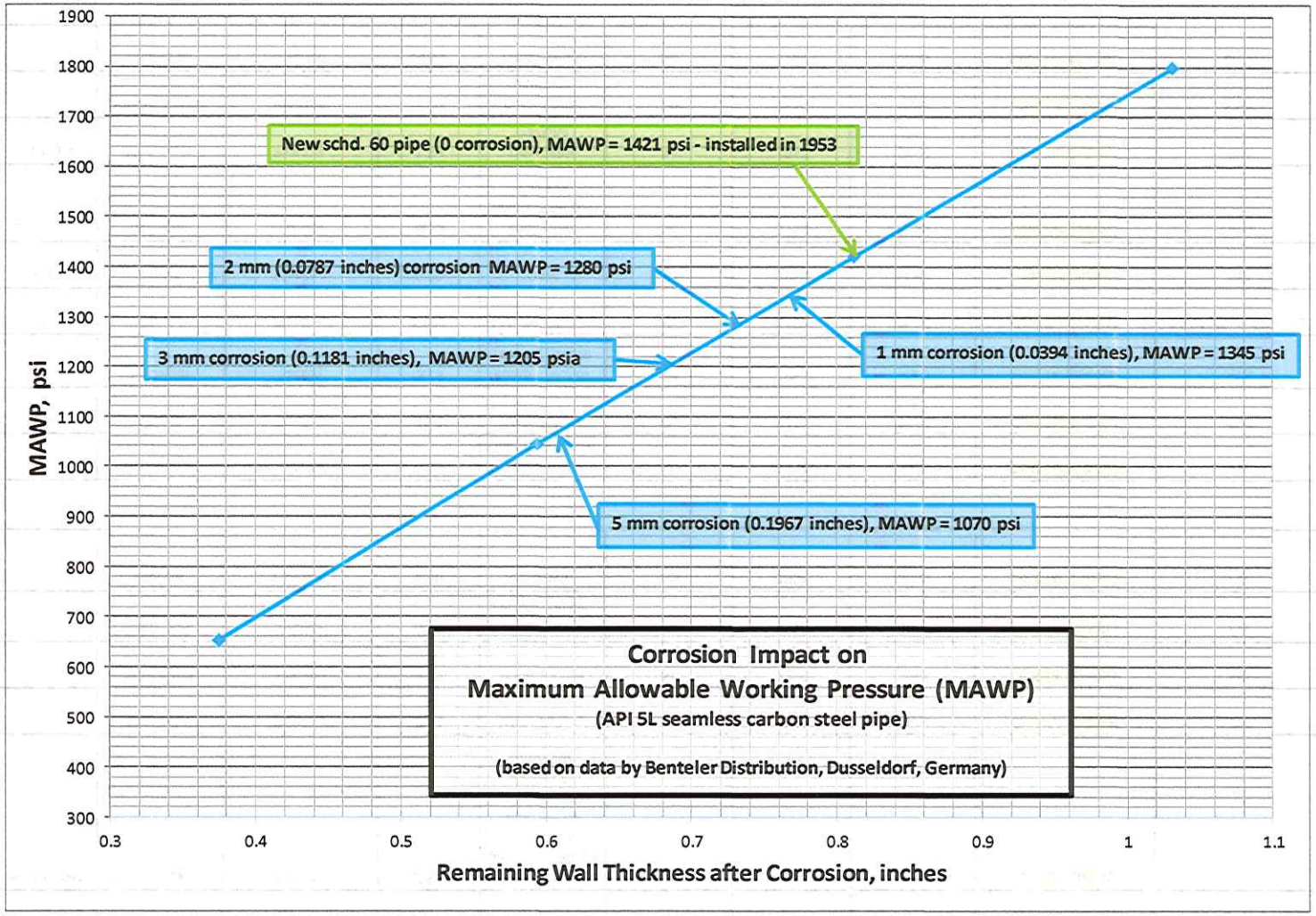

New schd. 60 pipe (0 corrosion), MAWP = 1421 psi - installed in 1953
2 mm (0.0787 inches) corrosion MAWP = 1280 psi
3 mm corrosion (0.1181 inches), MAWP = 1205 psia
1 mm corrosion (0.0394 inches), MAWP = 1345 psi
5 mm corrosion (0.1967 inches), MAWP = 1070 psi
Corrosion Impact on
Maximum Allowable Working Pressure (MAWP)
(API 5L seamless carbon steel pipe)
(based on data by Benteler Distribution, Dusseldorf, Germany)
MAWP, psi
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
Remaining Wall Thickness after Corrosion, inches

EXHIBIT 6

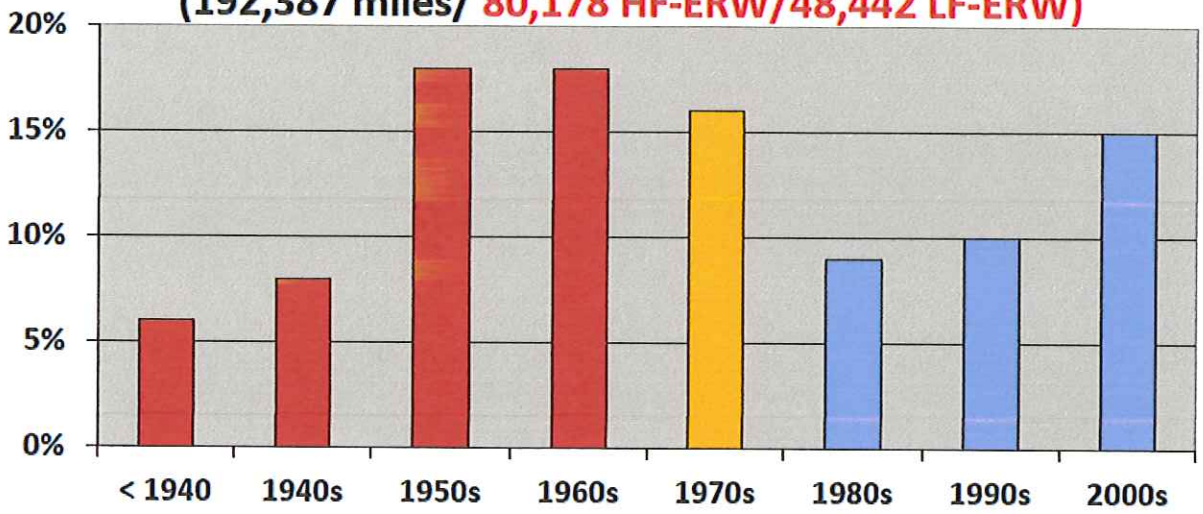
Pipeline and Hazardous
Materials Safety Administration

# U.S. Pipeline Infrastructure

## Hazardous Liquid Pipeline Vintage

50% installed prior to 1970

(192,387 miles/ 80,178 HF-ERW/48,442 LF-ERW)




PHMSA Pipeline Annual Report Data – October 31, 2014

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