S T A T E O F M I C H I G A N

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

* * * *

Application of Enbridge Energy, Limited	)	
Partnership for the Authority to Replace and	)	
Relocate the Segment of Line 5 Crossing the Straits	)	Case No. U-20763
of Mackinac into a Tunnel Beneath the Straits of	)	
Mackinac, if Approval is Required Pursuant to	)	
1929 PA 16; MCL 483.1 et seq. and Rule 447	)	
of the Michigan Public Service Commission's	)	
Rule of Practice and Procedure, R 792.10447	)	
	)	

REOPENED RECORD REBUTTAL TESTIMONY OF

DANIEL N. ADAMS

MICHIGAN PUBLIC SERVICE COMMISSION

March 10, 2023

Q. Please state your name, address and occupation.

A. My name is Daniel N. Adams and my business address is 1011 Western Ave, Suite 706, Seattle, WA. I am a Tunnel Engineer and CEO of Delve Underground (formerly McMillen Jacobs Associates).

Q. On whose behalf are you testifying?

A. I am testifying on behalf of MPSC Staff (Staff).

Q. Are you the same Daniel N. Adams who submitted direct and rebuttal testimony in the initial phase of this case?

A. Yes.

Q. Describe your qualifications.

A. My professional experience and qualifications were included in the initial direct testimony I previously submitted in this case on September 14, 2021.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of this testimony is to respond on behalf of Staff to the Direct Testimony on Remand submitted by Bay Mills Indian Community witness Brian J. O'Mara on February 3, 2023.

Q. Are you sponsoring any additional exhibits?

A. Yes, I am sponsoring one exhibit:

Exhibit S-37: Memorandum Re: Line 5 Methane Concentrations is a three-page exhibit that includes an analysis of whether naturally occurring methane could reach a concentration within the proposed tunnel required for ignition.

Q. Was this exhibit prepared by you or under your direction?

A. Yes, this exhibit was prepared under my direction by Jacob Facey and reviewed by Sam Swartz.

Q. A number of other tunnel projects are cited by Mr. O'Mara in his testimony in terms of risks to tunnel structures and the potential damage that can lead to loss of secondary containment during a large fire event. Can you please provide background on these projects as to their relevancy to the Line 5 project?

A. All projects cited in Mr. O'Mara's testimony, including the Gotthard Road Tunnel in Switzerland, the Channel Tunnel between England and France, and the Caldecott Tunnel near Oakland, California, were built before the year 2000. All three tunnels are used for transportation, with two of them being roadway tunnels and one being used for trains. All were designed, built, and are operating with the assumption that human occupancy exists within them at any time of any day. Put another way – traffic (in the road tunnels) and train travel (in the Channel Tunnel) is a 24 hour a day operation.

As a consequence of the examples cited by witness O'Mara, the tunneling industry has made significant advances in both analysis and practical design considerations for large fire events for tunnel lining design. As outlined in Exhibit BMC-65, the Line 5 Tunnel has been designed per current standard-of-practice in my opinion. The lining has been designed for the Rijkswaterstaat ("RWS") fire event, which is typical for large hydrocarbon fires in a tunnel. While limited damage may occur to the lining, it has been designed to withstand this fire event and maintain overall stability to allow for subsequent repairs. Polypropylene fibers will be incorporated into the concrete mix design for the lining, which have been proven to significantly reduce impacts from explosive spalling of the concrete. This type of failure was observed in the examples cited by witness O'Mara.

Numerous technical publications have summarized extensive research into the benefits of polypropylene fibers relative to explosive spalling, and methods of analyzing concrete tunnel linings for fire design. Some specific examples are the following: *Fire Protection of Concrete Tunnel Linings*, Shuttleworth, P., Tunnel Management International (2002); *Fire Protection in Concrete Tunnels*, Carvel, R., and Both, K., Handbook of Tunnel Fire Safety, 2nd Ed. (2011); *Design of Concrete Tunnel Linings for Fire Safety*, Maraveas, C., and Vrakas, A., Structural Engineering International (2014); and *Design of the Metro Tunnel Project Tunnel Linings for Fire Testing*, Guerrieri, M. et al., Structural Concrete (2020).

In addition, fires in transportation tunnels present significant risks to occupants of the tunnel at the time of the fire. Effects of smoke are a critical element of fire performance and must be addressed as part of overall fire life safety design. While the Replacement Project tunnel will require periodic maintenance, in general, the tunnel will not be typically occupied. Thus, risks from fire are primarily on the overall structural integrity of the tunnel post fire event. In this regard, the tunnel has been designed to the state of the practice for fire design.

Q. Mr. O'Mara's testimony highlighted risks of long-term methane seeping through the tunnel lining, and risks of concentrations exceeding the Lower Explosive Limit (LEL) in the tunnel. Can you please provide your opinion on this risk?

A. In general, allowable leakage rates through the tunnel lining are low, and when methane was detected (in project's data set), concentrations were quite low as well. Per joint specifications developed by Enbridge and the Mackinac Straits Corridor Authority's specifications technical team, specifically Section 317117, Paragraph 3.14, the tunnel lining has an allowable inflow leakage of 7000 gallons per day total over the full length of the tunnel, or 0.7 gallons per minute per 1000 feet of tunnel over shorter stretches of the tunnel. Exhibit MM-7, Page 237 of 238.) From the Geotechnical Data Report for this project (Exhibit MM-4, Page 45 of 2625), methane detected in groundwater samples were a maximum of 11 micrograms of methane per liter of water, with average values of approximately 7 micrograms per liter.

Exhibit S-37 provides estimates of the duration it would take to reach LEL in the tunnel for parameters cited above. These estimates have been made for both allowable flow rates cited above, and used the following conservative assumptions: No tunnel ventilation occurs, allowing methane concentrations to accumulate without air exchange; all inflows into the tunnel contain methane at the maximum concentration detected along the tunnel alignment; all methane in the groundwater is released into the tunnel atmosphere; and methane is assumed to concentrate in a smaller portion of the tunnel, approximately 5% of the overall tunnel length. Our duration estimates suggest it would take approximately 800 and 2,400 years for the allowed tunnel inflow rates as well as higher inflow rates for short periods and lengths of the tunnel, to reach this level of methane concentration within the air in the tunnel. These calculations are provided in Exhibit S-37. In conclusion, durations are well beyond the design life of the tunnel even for conservative assumptions throughout.

Q. Does this conclude your testimony?

A. Yes.

S T A T E O F M I C H I G A N

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

* * * *

Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rule of Practice and Procedure, R 792.10447	)	Case No. U-20763

REOPENED RECORD REBUTTAL TESTIMONY OF

DAVID CHISLEA

MICHIGAN PUBLIC SERVICE COMMISSION

March 10, 2023

Q. Please state your name, address and occupation.

A. My name is David Chislea and my business address is 7109 West Saginaw Highway, Lansing, Michigan 48917. I am employed by the Michigan Public Service Commission (MPSC or Commission) as the Director of the Gas Safety & Operations Division.

Q. Are you the same David Chislea who submitted direct and rebuttal testimony in the initial phase of this case?

A. Yes, during the initial phase of the case my title was Manager of the Gas Safety & Operations Section.

Q. Describe your qualifications.

A. My professional experience and qualifications were included in the initial direct testimony I previously submitted in this case on September 14, 2021. Despite the change in my title, my relevant experience and responsibilities are the same as when I filed my direct testimony in the initial phase of this case.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to present the Michigan Public Service Commission Staff's (Staff) response to the direct testimony on remand of the Bay Mills Indian Community (BMIC) witness Richard Kuprewicz as it relates to the Enbridge Energy, Limited Partnership (Enbridge or the Company) Application for the Line 5 Straits Replacement Project (Replacement Project).

Q. What is your response to Mr. Kuprewicz's discussion of federal integrity management regulations on page 6 of his direct testimony on remand, where he states that assigning a numeric probability to risk assessment "finds no

support in federal pipeline regulations...[and] is inconsistent with the purpose of the federal integrity management regulations?"

A. The federal integrity management regulations can be found in 49 CFR Part 195. In Rule 195.452 (e), instruction to the operator is given on how to identify risk factors for establishing a baseline and continual assessment schedule, and it includes further guidance in Appendix C of Part 195. Appendix C itself contains an example where different pipeline segments are evaluated and classified by risk values to determine an integrity management schedule. In addition, Mr. Kuprewicz does testify on page 10 of his remand direct testimony that "the federal regulations do allow an operator to use quantitative risk assessment as a tool in its Integrity Management program to manage risks." The federal regulations on pipeline integrity management require pipeline risk assessment, which can include calculating numeric probabilities, to establish baseline and continual assessment schedules.

Q. What is Staff's understanding of the purpose of the federal integrity management regulations concerning hazardous liquids pipelines that witness Kuprewicz's addresses on pages 7-11 of his direct testimony on remand?

A. The federal integrity management regulations are codified under 49 C.F.R. Part 195, which addresses, among other safety standards and reporting requirements, the integrity management of pipelines transporting hazardous liquids. Pipeline integrity management for hazardous liquid and carbon dioxide pipelines is specifically contained in Rules 195.452 and 195.454. Rule 195.452 outlines requirements for: a written integrity management program; a baseline assessment plan; determination of risk factors to develop an assessment schedule; elements of an integrity management program; information analysis; actions to address integrity issues; preventive and mitigative measures to protect high consequence areas; the continual process of pipeline integrity evaluation and assessment; and methods to measure program effectiveness. Rule 195.454 outlines requirements in addition to 195.452 that apply only to certain underwater hazardous liquids pipeline facilities. As I stated previously in my direct testimony filed on September 14, 2021, PHMSA has the responsibility to inspect and enforce safety regulations for hazardous liquids pipelines in Michigan.

Q. How does Staff consider the applicant's integrity management program and the requirements of 49 CFR Part 195 in a typical application filed under Act 16?

A. As I previously noted in my direct testimony filed on September 14, 2021, Staff consults with PHMSA to ensure that they reviewed the design, will be inspecting the construction, and will inspect ongoing operation and maintenance of the pipeline, which will include integrity management for the life of the pipeline. If necessary, based on the information obtained in the consultation with PHMSA, Staff can make recommendations to the Commission regarding the Company's application, including integrity management procedures.

Q. What is your response to the concerns raised by Mr. Kuprewicz concerning proper pre- and post-heat treatment on girth welds on pages 14-15 of his direct testimony on remand?

A. I have made previous recommendations to the Company in my rebuttal testimony submitted on December 14, 2021. Specifically, I recommended that for all mainline girth welds, Enbridge should be required to develop low-hydrogen welding procedures and qualify them per the requirements found in 49 CFR 195.214. These procedures should include pre-heat requirements prior to starting welding and inter-pass temperature requirements. In addition, the non-destructive testing of the mainline girth welds should include automatic phased array ultrasonic testing methods. Staff's position is that if these recommendations are met, post-heat treatment is not necessary. These recommendations exceed procedures required by API STD 1104.

Q. Does this conclude your testimony?

A. Yes.

S T A T E O F M I C H I G A N

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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Application of **Enbridge Energy, Limited Partnership** for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 Of the Michigan Public Service Commission's Rule of Practice and Procedure, R 792.10447	)	Case No. U-20763

EXHIBITS OF

ENERGY OPERATIONS DIVISION

MICHIGAN PUBLIC SERVICE COMMISSION

March 10, 2023

DELVE underground

Memorandum

To:	Travis Warner (MPSC Staff)	Project:	6191.0 Line 5 Advisory Services
From:	Dan Adams	Cc and Reviewed By:	Sam Swartz
Prepared by:	Jacob Facey	Job No.:	6191.0
Date:	3/2/2023		
Subject:	Line 5 Methane Concentrations		

Revision Log

Revision No.	Date	Revision Description
0	3/2/2023	First Draft

1.0 Introduction

Methane is a flammable gas thus, at high enough concentration, can be ignited by a spark. There is concern expressed regarding the presence of naturally occurring methane in the bedrock beneath the Straits of Mackinac and the potential impacts of an explosion and/or fire event.

2.0 Assumptions

The following assumptions were made when determining the potential for a methane explosion event. The maximum measured methane concentration of 11 $\frac{\mu g}{L}$ was conservatively assumed for all groundwater entering the tunnel, noting that methane was only detected in a fraction of the overall groundwater monitoring program. Groundwater inflows were assumed to be 7,000 gallons per day, based on the criteria established in Section 317119. A second, more conservative, inflow assumption of 0.7 GPM per 1,000ft was also evaluated, which is allowed over short reaches of tunnel. It is also conservatively assumed that all the methane contained within groundwater will enter the air within the tunnel. Using inflow rates and methane concentration, the time it takes for methane concentrations to exceed the LEL (5% concentration) within the tunnel can be calculated.

3.0 Entry Parameters

The following section discusses the tunnel and groundwater parameters used in this analysis. The dimensions of the tunnel and inner works are defined in Table 1 below.

Table 1 Tunnel Parameters

Parameter	Equation	Value
Tunnel Diameter D_{Tunnel}	$Constant$	$20.8\ ft$
Tunnel Area A_{Tunnel}	$\frac{D_{Tunnel}{}^2}{4}$	$339.8\ ft^2$
Pipe Diameter D_{Pipe}	$Constant$	$30\ in$
Pipe Area A_{Pipe}	$\frac{D_{Pipe}{}^2}{4}$	$4.9\ ft^2$
Area of other Items in Tunnel A_{Misc}	$0.1 * A_{Tunnel}$	$33.98\ ft^2$
Tunnel Area (Adjusted) $A_{Tunnel\ Adj}$	$A_{Tunnel} - A_{Pipe} - A_{Misc}$	$300.9\ ft^2$
Tunnel Length L_{Tunnel}	$Constant$	$20{,}850\ ft$
Tunnel Volume V_{Tunnel}	$L_{Tunnel} * A_{Tunnel\ Adj}$	$6{,}274{,}000\ ft^3$

This analysis assumes the maximum recorded methane concentrations encountered in nearby borings. The parameters involving methane are defined in Table 2 below.

Table 2 Methane Parameters

Parameter	Equation	Value
Methane Concentration $C_{Methane}$	$Constant$	$11\ \frac{\mu g}{L}$
Methane Density $\gamma_{Methane}$	$Constant$	$0.657\ \frac{g}{L}$
Methane Inflow Concentration $C_{Methane}V$	$\frac{C_{Methane}}{\gamma_{Methane}}$	$1.7 * 10^{-5}\ \frac{L_{Methane}}{L_{Water}}$
LEL Methane $LEL_{Methane}$	$Constant$	5.0%

Inflow criteria as defined in Section 317119 is shown in Table 3 below.

Table 3 Inflow Parameters

Parameter	Equation	Value
Inflow per Tunnel $Q_{TunnelA}$	$Constant$	$7000 gpd$
Inflow per Foot $\frac{Q}{ft_{Tunnel}}$	$Constant$	$0.7\ \frac{gpm}{1000 ft}$
Inflow Entire Tunnel $Q_{TunnelB}$	$L_{Tunnel} * \frac{Q}{ft_{Tunnel}}$	$14.6\ gpm$

3.1 Calculations

As a conservative estimate, it was assumed that the methane accumulates in a 1000ft section of the tunnel. Table 4 calculates the time required for the methane concentration to exceed the LEL in a 1000ft section of tunnel based on an inflow of 7000 gpd (within the entire tunnel). Table 5 calculates the time required for methane concentrations to exceed the LEL within a 1,000 ft section of tunnel based on an inflow of 0.7 gpm per 1000 ft.

Table 4 Time to reach Methane LEL (7000 gpd)

Parameter	Equation	Value
Tunnel Volume (1000ft) $V_{Tunnel1000ft}$	$1000 * A_{Tunnel\ Adj}$	$309{,}000\ ft^3$
Methane Volume to Reach LEL $V_{MethaneLEL}$	$V_{Tunnel1000ft} * LEL_{Methane}$	$15{,}094\ ft^3$
Water Volume to reach LEL $V_{WaterLEL}$	$\frac{V_{MethaneLEL}}{C_{Methane}V}$	$9.0\ x\ 10^8\ ft^3$
Time to reach Methane LEL $Time$	$\frac{V_{WaterLEL}}{Q_{TunnelA}}$	$2{,}452\ Years$

Table 5 Time to reach Methane LEL ($0.7\ \frac{gpm}{1000ft}$)

Parameter	Equation	Value
Tunnel Volume (1000ft) $V_{Tunnel1000ft}$	$1000 * A_{Tunnel\ Adj}$	$309{,}000\ ft^3$
Methane Volume to Reach LEL $V_{MethaneLEL}$	$V_{Tunnel1000ft} * LEL_{Methane}$	$15{,}094\ ft^3$
Water Volume to reach LEL $V_{WaterLEL}$	$\frac{V_{MethaneLEL}}{C_{Methane}}$	$9.0\ x\ 10^8\ ft^3$
Time to reach Methane LEL $Time$	$\frac{V_{WaterLEL}}{Q_{TunnelB}}$	$875\ Years$

4.0 Conclusions

Using the dimensions of the tunnel, surrounding methane concentrations, and allowable inflow, the potential for methane accumulation and subsequent explosion can be evaluated. Based on this data, it was estimated that it would take at least 875 years for methane to accumulate within the tunnel in exceedance of the LEL.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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Application of **Enbridge Energy, Limited Partnership** for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 Of the Michigan Public Service Commission's Rule of Practice and Procedure, R 792.10447	)	Case No. U-20763

PROOF OF SERVICE

Michelle L. Conarton, being duly sworn, deposes and says that on March 10, 2023, A.D., she emailed a copy of the attached MPSC Rebuttal Testimony and Exhibits to the persons as shown on the attached list.

Michelle L. Conarton
Digitally signed by Michelle L. Conarton
Date: 2023.03.10 09:12:05 -05'00'

Michelle L. Conarton

Subscribed and sworn to before me
This 10th day of March 2023.

Brianna L. Brown

Brianna L. Brown, Notary Public
State of Michigan, County of Gratiot
Acting in County of Eaton
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