UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

September 14, 2017

REPLY TO THE ATTENTION OF

VIA EMAIL AND UPS

Lisa D. Wilson
Associate General Counsel
Enbridge
26 East Superior Street, Suite 309
Duluth, MN 55802

Re: Enbridge Line 5 Coating Repairs Work Plan (Version 2.0)

Dear Ms. Wilson:

On September 13, 2017, the U.S. Environmental Protection Agency ("EPA") received Version 3 of Enbridge's Line 5 Coating Repairs Work Plan ("Work Plan"). Enbridge submitted the Work Plan after identifying gaps in the exterior coating of the Dual Pipelines of Line 5 that cross the Straits of Mackinac. Enbridge identified the coating gaps during implementation of the Biota Investigation Work Plan, as required pursuant to Paragraph 69 of the Consent Decree for *U.S. v. Enbridge Energy, Limited Partnership, et al.*, (Civil Action No: 1:16-cv-914) ("Consent Decree"). The Independent Third Party, retained by Enbridge pursuant to the Consent Decree, has reviewed the Work Plan and provided comments to EPA and Enbridge.

EPA approves this Work Plan with the following conditions:

1. EPA is not approving the use of Method 2 (described in the Work Plan) at this time because Enbridge has not yet demonstrated the effectiveness of that Method. Enbridge may not use Method 2 unless EPA provides prior written approval; and

2. within 30 days of Enbridge's completion of the activities required by the Work Plan, Enbridge shall submit to EPA a Final Report, summarizing its activities and identifying and justifying any deviations from the procedures in the Work Plan; and

3. Enbridge shall implement the Work Plan in accordance with all federal, state, and local regulations and laws, including any permitting requirements.

Enbridge shall implement this Work Plan immediately upon receipt of this approval.

Approval of this Work Plan does not release Enbridge from its obligation to fully comply with Paragraph 69(c) of the Consent Decree. Paragraph 69(c) requires that, no later than 60 days after

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the completion of the biota investigation, Enbridge shall submit a final report to EPA, describing the findings of the investigation. In the event that the investigation finds that biota have impaired, or threaten to impair, the Dual Pipelines, Enbridge shall supplement its final report with a proposed work plan and schedule to address such impairments.

Approval of the Work Plan also does not indicate that EPA accepts Enbridge's confidentiality claims attached to the Work Plan. As described in Paragraph 155 of the Consent Decree, EPA will evaluate any claims of confidentiality pursuant to 40 C.F.R. Part 2.

Sincerely,

Jason H. El-Zein, Chief
Emergency Response Branch 1

cc: Matthew Thompson, Enbridge
Joanne Coprez, Enbridge
Carrie Mymko, Enbridge
William Hassler, Steptoe
Jay Eickholt, MDEQ
Jerry Popiel, USCG
Allan Beshore, PHMSA
Margaret Guerriero, EPA
J. Matthew Moore, EPA
Karen Peaceman, EPA
Ellen Riley, EPA
Matthew Mankowski, EPA

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Coating Repairs Work Plan
Line 5 Dual Pipelines

United States v. Enbridge Energy et al Case 1:16 –cv-914

Consent Decree	VII. Injunctive Measures, E. Measures To Prevent Spills In The Straits Of Mackinac, Paragraph 69c., Biota Investigation		
Version	3.0	Version date	September 13, 2017

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Introduction

Paragraph 69 of the Consent Decree entered in Case 1:16-cv-00914 (ECF No. 14, 05/23/17) requires the Enbridge defendants (collectively referred to as "Enbridge") to create and complete a Biota Investigation Work Plan ("BI Work Plan") on the Dual Pipelines that cross the Straits of Mackinac. On or about August 14, 2017, Enbridge initiated the field activities of the BI Work Plan at the Straits and as of September 13, 2017 the BI Work Plan field work has been completed.

Through the BI Work Plan activities there have been several locations identified as areas with bare or potentially bare metal.

Per Paragraph 69c. Enbridge is required to submit a final report to the EPA within 60 days of completion of the BI Work Plan investigation. In particular, in the event that evidence is developed that zebra mussels and other biota have impaired, or threaten to impair, the Dual Pipelines Enbridge shall supplement the final report with a proposed work plan to address such impairments. Enbridge however, is currently unaware of any evidence linking zebra mussels or other biota to the coating repairs identified above.

Enbridge is submitting this Coating Repairs Work Plan ("CR Work Plan") in advance of the final BI Work Plan Report with the intent of receiving EPA approval for implementing coating repairs in time to allow Enbridge to complete the work in 2017.

Objective

The objective of the CR Work Plan is to ensure that all repairs are completed safely and in accordance with the Enbridge's coating procedure and in compliance with federal regulations.

Background

On June 13, 2017 the EPA approved Enbridge's BI Work Plan. This plan included detailed steps to complete biota sampling at various locations along the Dual Pipelines. The BI Work Plan also highlighted 18 areas of interest that would be investigated by divers as per the BI Work Plan definition (partial) included below:

Area(s) of Interest: An Area of Interest is a part of the pipeline where, based on visual inspection, (i) the normal (local) Biota is unexpectedly absent or (ii) there is evidence of possible coating damage (e.g., Dislodged Coating and/or potential Holiday).

In addition to the 18 Areas of Interest, three (3) Additional Sites were identified by the Enbridge marine contractor as being appropriate to investigate further. These Additional Sites were identified on Figures 2 and 3 of the BI Work Plan.

Coating Repair Scope Of Work And Schedule

The following locations have been identified as areas with bare or potentially bare metal:

• Additional Site #1 (EAS-1): One area proposed for coating repair (bare metal). • Additional Site #2 (EAS-2): One area proposed for coating repair (potential bare metal). • Additional Site #3 (WAS-1): Four areas proposed for coating repair (bare metal).	Known at the time for inclusion in CR Work Plan - Version 1.0
• East Additional Sites (August Supplement): Three areas proposed for coating repair (bare metal) (North and South). Please refer to coating inspection reports titled EAS-3 and EAS-4.	Known at the time for inclusion in CR Work Plan - Version 2.0
• Area of Interest #1 (EAOI-1): Three areas proposed for coating repair (potential	Known at the time for inclusion

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Method 1 is more likely to be chosen when the repair is located on the side of the pipe and the repair area is larger and runs axially along the pipe. Method 2 is more likely to be chosen in situations where dive time is limited, the repair area is smaller, and the repair is located on top of the pipe.

Enbridge is currently working with the coating manufacturer to investigate the suitability of using Method 2 with a pre-cast sleeve in place of the Stricture Bandings ("Modified Method 2"). Enbridge will approach the EPA for approval of Modified Method 2 if the investigation shows the approach is effective. The table below shows the coating repair locations and the currently proposed coating repair method.

Location	Identification	Coating Repair Method
Additional Site #1	EAS-1	Method 1
Additional Site #2	EAS-2	Method 1
Additional Site #3	WAS-1	Method 1
East Additional Site (August Supplement)	EAS-3	Method 1
	EAS-4	Method 1 or Modified Method 2 - if deemed acceptable through testing and subsequently approved by the EPA
Area of Interest #1	EAOI-1	Method 1
Area of Interest #5	EAOI-5	Method 1
Area of Interest #7	EAOI-7	Method 1

It is anticipated that permit(s) for lake floor excavation will be required for EAS-4 unless Modified Method 2 is acceptable and approved. Enbridge will provide the state of Michigan with the plan detailing the materials, methods, and procedures it will use to repair the coating areas.

The product data sheets for the BIO-DUR 563 epoxy filler and the X-100 UW epoxy are included in Appendix C. In addition, Appendix D includes a letter from the Manufacturer confirming that the materials comply with 49CFR195.559 and highlighting underwater installations that have been performed using their products since 1989.

Based on the full scale application and testing at SES, Enbridge has also developed a procedure for the application of the coating repair to the Dual Pipelines. The Enbridge procedure "Application Of Underwater Repair Coatings For Line 5 Straits" – Version 2.0 is found in Appendix E. The procedure was developed in consultation with PRTI.

The cure time for the coating system will be verified using a field trial to confirm the SES testing results that are incorporated into the coating procedure. A pipe sample will be prepared and coated concurrently with the coating repairs at WAS-1. This site represents the deepest water depth (201 feet) and therefore the location with the most challenging environment for successful coating repair. The sample will be allowed to cure at depth and retrieved to the barge after 7 days of cure. While on the barge, Shore D measurements will be completed to confirm a value of 60 or greater. Should the field trial not confirm a Shore D measurement of 60 or greater Enbridge will inform the EPA and the Independent Third Party to discuss next steps relative to the CR Work Plan.

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Reporting

Per Paragraph 69c. Enbridge is required to submit a final report to the EPA within 60 days of completion of the BI Work Plan investigation. In particular, in the event that evidence is developed that zebra mussels and other biota have impaired, or threaten to impair, the Dual Pipelines Enbridge shall supplement the final report with a proposed work plan to address such impairments. Enbridge however, is currently unaware of any evidence linking zebra mussels or other biota to the coating repairs identified above.

In addition to the above mentioned report, Enbridge will submit a report to the EPA within 30 days of completion of the CR Work Plan. This report will include a summary of the work completed, any CR Work Plan deviations with justification, and other pertinent information.

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External Pipeline Inspection Form for L5 Straits of Mackinac

General Information			
Date:	08/15/2017	**Contractor:**	Ballard Marine Co
AFE / W.O.#:	20008990	**Company Rep / Inspector:**	REDACTED
Segment:	EAS-1	**Water Depth (ft):**	R
Longitude:	REDACTED	**Latitude:**	REDACTED

External Pipe Coating Inspection Results			
General Area	☒ Disturbed Area ☐Dislodged Coating ☐Holiday	**Size of anomaly (ft^2):**	48.84 (46'x 1.74')
Holiday 1	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	**Size of anomaly (ft^2):**	0.01 (3.0"x0.5")
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	**Size of anomaly (ft^2):**	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	**Size of anomaly (ft^2):**	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	**Size of anomaly (ft^2):**	
Corrosion present:	☐YES ☒NO	**Biota present:**	☒YES ☐ NO
Dislodged coating observed on the lake floor: ☐YES ☒NO		**Lake floor location wrt pipe:**	N/A (pipe is suspended)

Comments/Issues/Discussion

EAS-1 within span of E-72. Total span is 46' long, within the areas of 10:00 and 2:00.
South End Lat: REDACTED long REDACTED
North End Lat: REDACTED long REDACTED
Center Line listed in general information above.

One (1) feature with DFT measurements below the minimum resolvable thickness of gauge was found. The Polatrak CP gun was used to confirm the existence of bare metal:

Holiday 1 presented average CP reading of -1680mV CSE (holiday confirmed). Holiday found in coating at coordinates Lat: REDACTED Long: REDACTED

No external corrosion was detected by dive team.

	REDACTED
Contractor Signature	**Enbridge Representative/ Inspector Signature**

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Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 1							
CP Reading #1 (mV)	-1676 -1683	CP Reading #2 (mV)	-1674 -1681	CP Reading #3 (mV)		-1690 -1674	
Temperature (°F)	NR	DFT at Holiday (mil)	≤ 25	DFT Adjacent to Holiday (mil)		96, 94, 95	
For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.							



Date:	8/15/17	Frame(HH:MM:SS)	13:02:03



Date:	8/15/17	Frame(HH:MM:SS)	13:05:42

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External Pipeline Inspection Form for L5 Straits of Mackinac

Visual Inspection (General Coating Condition)

For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.





Date:	8/24/17	Frame(HH:MM:SS)	14:11:12	Date:	8/24/17	Frame(HH:MM:SS)	14:38:33

Coating Gauge Information

Manufacturer:	Elcometer Inspection Equip	**Product:**	211 Coating Thickness Gauge
Last Calibrated:	08/09/2017	**Next Calibration Due:**	08/09/2018
Gauge verified prior to use:	☒YES ☐ NO		

Coating Thickness Inspection Data

Thickness Measure (mil)	Area of Interest	Undisturbed Area (< 2 in.)	Undisturbed Area (> 5 ft.)
North End #1	135	130	115
#2	140	130	115
#3	110	140	120
South End #4	117	119	125
#5	130	94	130
#6	70	150	135
Average Thickness	117	127	121

Additional Coating Thickness Inspection Data (A/R)

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External Pipeline Inspection Form for L5 Straits of Mackinac

General Information			
Date:	08/29/2017	Contractor:	Ballard Marine Co
AFE / W.O.#:	20008990	Company Rep / Inspector:	REDACTED
Segment:	EAS-3	Water Depth (ft):	RE
Longitude:	REDACTED	Latitude:	REDACTED

External Pipe Coating Inspection Results			
Coating Condition	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	Size of anomaly (ft^2):	0.93 (8"x1.4')
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	Size of anomaly (ft^2):	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	Size of anomaly (ft^2):	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	Size of anomaly (ft^2):	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday	Size of anomaly (ft^2):	
Corrosion present:	☐YES ☒NO	Biota present:	☒YES ☐ NO
Dislodged coating observed on the lake floor: ☐YES ☒NO		Lake floor location wrt pipe:	Pipe suspended

Comments/Issues/Discussion

East Additional Site #3 (South of E-22).

DFT measurements at the feature are below the minimum resolvable thickness of gauge.
The Polatrak CP gun was used to confirm the existence of bare metal:

Holiday 1 presented average CP reading of -848mV CSE (holiday confirmed).

No external corrosion was detected by dive team.

Contractor Signature	REDACTED Enbridge Representative/ Inspector Signature

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External Pipeline Inspection Form for L5 Straits of Mackinac

Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 1							
CP Reading #1 (mV)	-852 -886	CP Reading #2 (mV)	-804 -842	CP Reading #3 (mV)	-834 -875		
Temperature (°F)	44	DFT at Holiday (mil)	≤ 25	DFT Adjacent to Holiday (mil)	80, 80, 125		

For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.



Date:	8/29/17	Frame(HH:MM:SS)	10:35:09



Date:	8/29/17	Frame(HH:MM:SS)	10:35:44

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External Pipeline Inspection Form for L5 Straits of Mackinac

Visual Inspection (General Coating Condition, Holidays 1 and 2)

For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video sdurveillance.





Date:	8/30/17	Frame(HH:MM:SS)	09:17:44	Date:	8/30/17	Frame(HH:MM:SS)	08:55:25

Coating Gauge Information

Manufacturer:	Elcometer Inspection Equip	**Product:**	211 Coating Thickness Gauge
Last Calibrated:	08/09/2017	**Next Calibration Due:**	08/09/2018
Gauge verified prior to use:	☒YES ☐ NO		

Coating Thickness Inspection Data

Thickness Measure (mil)	Area of Interest	Undisturbed Area (< 2 in.)	Undisturbed Area (> 5 ft.)
North End #1	≤25	N/R (see note, below)	N/R
#2	≤25	N/R	N/R
#3	≤25	N/R	N/R
South End #4	≤25	N/R	N/R
#5	≤25	N/R	N/R
#6	≤25	N/R	N/R
Average Thickness			

Additional Coating Thickness Inspection Data (A/R)

Note: coating thickness in undisturbed areas around the cable rub could not be obtained due to the presence of silt and soil (lake bed). The pipe is below the level of the lake bed. See Holiday 1 and Holiday 2 *'DFT thicknesses adjacent to the Holidays'* for representative coating thickness in the area.

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External Pipeline Inspection Form for L5 Straits of Mackinac

General Information

Date:	08/25/2017	**Contractor:**	Ballard Marine Co
AFE / W.O.#:	20008990	**Company Rep / Inspector:**	REDACTED
Segment:	WAS-1	**Water Depth (ft):**	RE
Longitude:	REDACTED	**Latitude:**	REDACTED

External Pipe Coating Inspection Results

General Area	☐ Disturbed Area ☒Dislodged Coating ☐Holiday	**Size of anomaly (ft^2):**	20.8 (13' x 1.6')
Holiday 1	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	**Size of anomaly (ft^2):**	0.06 (9" x 1")
Holiday 2	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	**Size of anomaly (ft^2):**	0.24 (1'2" x 2.5")
Holiday 3	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	**Size of anomaly (ft^2):**	0.07 (1'7" x ½")
Holiday 4	☐ Disturbed Area ☐Dislodged Coating ☒Holiday	**Size of anomaly (ft^2):**	0.01 (1'3" x 1/8")
Corrosion present:	☐YES ☒NO	**Biota present:**	☒YES ☐ NO
Dislodged coating observed on the lake floor: ☐YES ☒NO		**Lake floor location wrt pipe:**	N/A (pipe is suspended)

Comments/Issues/Discussion

WAS-1 within span of W-68A. Four (4) features with DFT measurements below the minimum resolvable thickness of gauge were found. The Polatrak CP gun was used to confirm the existence of bare metal at the following features:

Holiday 1 presented average CP reading of -1312mV CSE (holiday confirmed).
Holiday 2 presented average CP reading of -1312mV CSE (holiday confirmed).
Holiday 3 presented average CP reading of -1365mV CSE (holiday confirmed).
Holiday 4 presented average CP reading of -1408mV CSE (holiday confirmed).

No external corrosion was detected by dive team. A white deposit was found at the holiday area.

	REDACTED
Contractor Signature	ture

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ENBRIDGE	External Pipeline Inspection Form for L5 Straits of Mackinac

Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 1							
CP Reading #1 (mV)	-1300 -1362	CP Reading #2 (mV)	-1277 -1336	CP Reading #3 (mV)		-1277 -1322	
Temperature (°F)	43	DFT at Holiday (mil)	≤ 25	DFT Adjacent to Holiday (mil)		90, 93, 110	
For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.							





Date:	8/25/17	Frame(HH:MM:SS)	09:15:30	Date:	8/25/17	Frame(HH:MM:SS)	10:14:42

Cathodic Protection and Coating Measurements (if Holiday is found) - Holiday 2							
CP Reading #1 (mV)	-1274 -1328	CP Reading #2 (mV)	-1283 -1237	CP Reading #3 (mV)		-1375 -1372	
Temperature (°F)	43	DFT at Holiday (mil)	≤ 25	DFT Adjacent to Holiday (mil)		79, 94, 100	
For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.							





Date:	8/25/17	Frame(HH:MM:SS)	13:29:51	Date:	8/25/17	Frame(HH:MM:SS)	13:30:30

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External Pipeline Inspection Form for L5 Straits of Mackinac

General Information			
Date:	09/08/17	**Contractor:**	Ballard Marine Co
AFE / W.O.#:	20008990	**Company Rep / Inspector:**	REDACTED
Segment:	EAOI-1	**Water Depth (ft):**	194
Longitude:	REDACTED	**Latitude:**	REDACTED

External Pipe Coating Inspection Results				
Coating Condition	☒ Disturbed Area ☐Holiday	☐Dislodged Coating ☐Other	**Size of anomaly (ft^2):**	9.17 (3'4" X 2'9")
Feature 1	☐ Disturbed Area ☐Holiday	☐Dislodged Coating ☒Other	**Size of anomaly (ft^2):**	0.01 (1" X1")
Feature 2	☐ Disturbed Area ☐Holiday	☐Dislodged Coating ☒Other	**Size of anomaly (ft^2):**	0.01 (1" X1.5")
Feature 3	☐ Disturbed Area ☐Holiday	☐Dislodged Coating ☒Other	**Size of anomaly (ft^2):**	0.01 (1" X1")
	☐ Disturbed Area ☐Holiday	☐Dislodged Coating ☐Other	**Size of anomaly (ft^2):**	
Corrosion present:	☐YES	☒NO	**Biota present:**	☒YES ☐ NO
Dislodged coating observed on the lake floor: ☐YES ☒NO			**Lake floor location wrt pipe:**	6 o'clock (pipe resting on lake bed)

Comments/Issues/Discussion

EAOI-1 E-01B-B is an area of disturbed biota and contains three areas of white deposit within a 6" X 1.5" area on the top of the pipe (12 o'clock).

DFT measurements indicate normal coating thickness through the entire area inspected.

CP measurements taken with the Polatrak CP gun through the white deposit areas deviated slightly from reference 'open water' measurements, but they were not sufficiently electronegative to indicate contact with Line 5 pipe metal.

	REDACTED
Contractor Signature	**Enbridge Representative/ Inspector Signature**

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External Pipeline Inspection Form for L5 Straits of Mackinac

Cathodic Protection and Coating Measurements (if Holiday is found) (note: holiday could not be confirmed)							
CP Reading #1 (mV) (feature 1)	-234 -281	CP Reading #2 (mV) (feature 2)	-440 -316	CP Reading #3 (mV) (feature 3)	-320 -260		
Temperature (°F)	45	DFT at Feature (mil)	N/R	DFT Adjacent to Features (mil) (features 1, 2, and 3 respectively)	130, 145, 140		

For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.



Date:	09/08/17	Frame(HH:MM:SS)	12:07:06	Date:		Frame(HH:MM:SS)	

Note: CP readings at this feature were recorded with the probe of Polatrak CP gun pressed firmly into the white substance coating the pipe. These readings were more electronegative than the 'open water' CP readings (-198mV / -170mV), but are not consistent with Line 5 pipe metal contact – indicating that the presence of a resistive coating on the pipe surface.

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External Pipeline Inspection Form for L5 Straits of Mackinac

Visual Inspection (General Coating Condition)

For all sections of dislodged coating or holidays, provide pictures below. Included the date and time stamps associated with video surveillance.





Date:	09/06/17	Frame(HH:MM:SS)	14:45:12	Date:	09/06/17	Frame(HH:MM:SS)	14:47:47

Coating Gauge Information

Manufacturer:	Elcometer Inspection Equip	**Product:**	211 Coating Thickness Gauge
Last Calibrated:	08/09/2017	**Next Calibration Due:**	08/09/2018
Gauge verified prior to use:	☒YES ☐ NO		

Coating Thickness Inspection Data

Thickness Measure (mil)	Area of Interest	Undisturbed Area (< 2 in.)	Undisturbed Area (> 5 ft.)
North End #1	145	72	130
#2	94	115	130
#3	105	100	110
South End #4	130	130	135
#5	110	120	105
#6	105	100	105
Average Thickness	119	106	119

Additional Coating Thickness Inspection Data (A/R)* (see note below)

	16" from South End	34" from South End	52" from South End
West	135	145	145
Top	105	105	120
East	105	125	105

Note: An area of dislodged outer wrap was identified 2.5' from the south end of the AOI. Coating thickness in this area was 100 mil.

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External Pipeline Inspection Form for L5 Straits of Mackinac

General Information

Date:	09/05/17	**Contractor:**	Ballard Marine Co
AFE / W.O.#:	20008990	**Company Rep / Inspector:**	REDACTED
Segment:	EAOI-7	**Water Depth (ft):**	81
Longitude:	REDACTED	**Latitude:**	REDACTED

External Pipe Coating Inspection Results

Coating Condition	☒ Disturbed Area ☐Dislodged Coating ☐Holiday ☐Other	**Size of anomaly (ft^2):**	7.08 (2'5" X 2'10")
Feature 1	☐ Disturbed Area ☐Dislodged Coating ☐Holiday ☒Other	**Size of anomaly (ft^2):**	0.04 (3" X2")
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday ☐Other	**Size of anomaly (ft^2):**	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday ☐Other	**Size of anomaly (ft^2):**	
	☐ Disturbed Area ☐Dislodged Coating ☐Holiday ☐Other	**Size of anomaly (ft^2):**	
Corrosion present:	☐YES ☒NO	**Biota present:**	☒YES ☐ NO
Dislodged coating observed on the lake floor: ☐YES ☒NO		**Lake floor location wrt pipe:**	N/A (pipe is suspended)

Comments/Issues/Discussion

EAOI-7 is located in Span E-35. This area of disturbed biota contains one area of white deposit.

DFT measurements indicate normal coating thickness through the entire area inspected, with slightly thinner coating adjacent to the white deposit.

The Polatrak CP gun was used to test for coating holiday through the white deposit, but valid CP measurements could not be obtained. This indicates the presence of a resistive or isolating coating on the pipe surface.

	REDACTED
Contractor Signature	**Enbridge Representative/ Inspector Signature**

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Appendix B:
Report from Stress Engineering Services

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Limitations of This Report

This report is prepared for the sole benefit of the Client, and the scope is limited to matters expressly covered within the text. In preparing this report, SES has relied on information provided by the Client and, if requested by the Client, third parties. SES may not have made an independent investigation as to the accuracy or completeness of such information unless specifically requested by the Client or otherwise required. Any inaccuracy, omission, or change in the information or circumstances on which this report is based may affect the recommendations, findings, and conclusions expressed in this report. SES has prepared this report in accordance with the standard of care appropriate for competent professionals in the relevant discipline and the generally applicable industry standards. However, SES is not able to direct or control operation or maintenance of the Client's equipment or processes.

ENBDNR0001519

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ENBDNR0001520

Figure 17: (a) Photograph of 20" pipe sample after removal from water bath; (b) photograph showing stricture still applied to Areas "A" and "B/D/E." Area "C" (patch repair with no stricture) is on right end. Numbered scale divisions are 0.1 feet. 18

Figure 18: Full circumferential repair (Areas "B/D/E") is shown in upper photograph after stricture was removed. Patch repair Area "A" is shown in lower photograph after stricture was removed. 19

Figure 19: Photographs showing patch repair at Area "C" where no stricture was applied. 20

Figure 20: Photographs of rough cut cross-section through repair Area "A" (a patch repair with stricture banding) 21

Figure 21: Metallographic cross-sections through repair Area "A." Section in upper photograph was removed through center of repair where original coating was completely removed down to bare metal. Lower photograph shows edge of repair where fiber wrap covers original coating 22

Figure 22: Photograph of cross-sectional ring cut from center of 20" pipe sample containing repair Areas "B/D/E." 23

Figure 23: Metallographic cross-section of repair Area "B" located at top of pipe. A full 360° wrap and stricture was used in this repair 24

Figure 24: Metallographic cross-section of repair Area "D" located on south side (90°) of pipe. A full 360° wrap and stricture was used in this repair. 25

Figure 25: Metallographic cross-section of repair Area "E" located on north side (270°) of pipe. A full 360° wrap and stricture was used in this repair. (Reduction in thickness of filler material at left side of section is due to this section's being taken near edge of repair.) 26

Figure 26: Rough cut cross-section through repair Area "C," a patch repair where no stricture banding was used. While center of repair was well adhered to pipe wall, perimeter of patch was disbonded from pipe. 27

Figure 27: Metallographic cross-section through repair Area "C," a patch repair where no stricture banding was used 28



Figure 1: Photograph showing as-received 20" diameter pipe sample used for full-scale repair testing.

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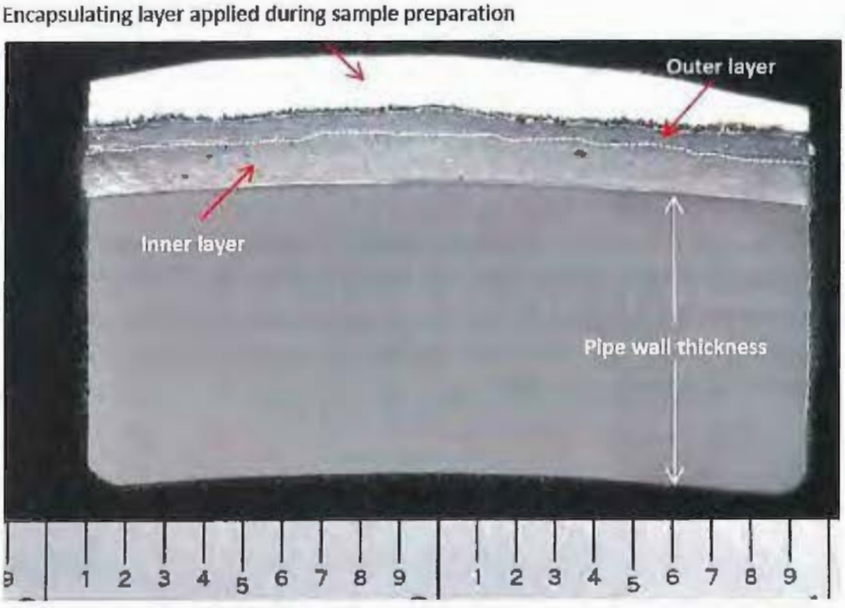


Figure 3: Metallographic cross-section through original coating. Dashed line indicates approximate boundary between inner and outer layers of coating. Numbered scale divisions are 0.1".

3. Laboratory Tests of Repair Coating System

Prior to conducting any repairs on the 20" diameter pipe section, SES performed small-scale tests on scrap pieces of carbon steel pipe. The outer surfaces of two 3-ft lengths of 6" diameter pipe were prepared to a NACE 2[2] finish.

The cure rate of an epoxy (and possibly its ability to cure) is largely a function of temperature. In general, the lower the temperature, the longer it will take for an epoxy to cure. An internet survey of Great Lakes water temperatures, including dive company websites, indicated that the temperature at the bottom of the Straits can be near 40°F, even in summer months. It is also known that 40°F is a standard test temperature for offshore oil & gas applications in the Gulf of Mexico. Thus, 40°F was selected as the coating application temperature for this test program.

Two modified chest freezers were filled with prepared water and chilled to 40°F using a combination of the freezer's compressor and dry ice (Figure 4). The water bath was maintained at 40°F throughout testing.

The repair coating system under evaluation (Figure 5) is a two-part epoxy system. First, the epoxy base (X100 – UW Epoxy Base – Blue) was mixed with curing agent (Bio-Seal X-100 Curing Agent – Clear) and applied to the surface of the pipe as a preparation layer (Figure 6(a)). The mixed epoxy was then saturated into a 12" wide, E-glass fabric that was wrapped around the pipe in at least four layers (Figure

[2] Near-white metal abrasive blast cleaning.

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Figure 6: Photographs showing application of laboratory epoxy repair wrap: (a) epoxy applied to bare steel; (b) and (c) fabric impregnated with two-part epoxy; (d) fiber mesh repair wrapped around pipe in four layers; and (e) stricture banding applied over repair.

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debris already present in the sample pipe[3]. Prior to affixing the end plates, SES attached two thermocouples to the inside surface of the pipe to monitor metal temperature during the test (Figure 9(a)).

A 2,700 gallon, insulated tank (see Figure 8 background) was filled with water obtained by reverse osmosis. Chemicals were added to simulate the Straits' water composition. The water was pumped continuously through a 10 ton water chiller and circulation pump with a 50 micron sediment filter until a temperature of 40°F was obtained. The water temperature was monitored via two temperature probes submerged in the tank, in addition to the thermocouples attached to the pipe. The temperature at the four probes was continuously recorded throughout the test procedure (Figure 9(b)).

Five separate areas on the 20" diameter pipe were prepared for repair. The schematic in Figure 10 shows the locations and variables of the different repairs. This information is also summarized below and in Table 1. Compass directions refer to the relative orientation of the pipe sample in the laboratory during testing. Clock/circumferential positions are viewed from the west end of the sample, with top dead center at 0°.

- A 16" square section of the (original) outer coating was removed from each end of the pipe along the top surface using a hand grinder and wire wheel. In the center of these squares, a 2" x 4" section of the inner coating was also removed, exposing bare steel. These areas were labeled "A" and "C" and designated as patch repairs.
- A 16" wide area of the outer coating was removed around the circumference of the pipe near the center of the sample length to provide space to apply a full 360° repair.
    - A 4" x 4" area of the inner coating was removed at the top of the pipe from this 16" wide area, exposing bare steel. This location was designated as Area "B."
    - Two 4" x 4" patches of the inner coating were removed at the north (Area "D") and south (Area "E") sides of the sample aligned with Area "B."

Figure 11 shows these prepared areas of the pipe prior to repair.

[3] The interior of the pipe was allowed to fill with water, however, to avoid excessive buoyancy during the test.

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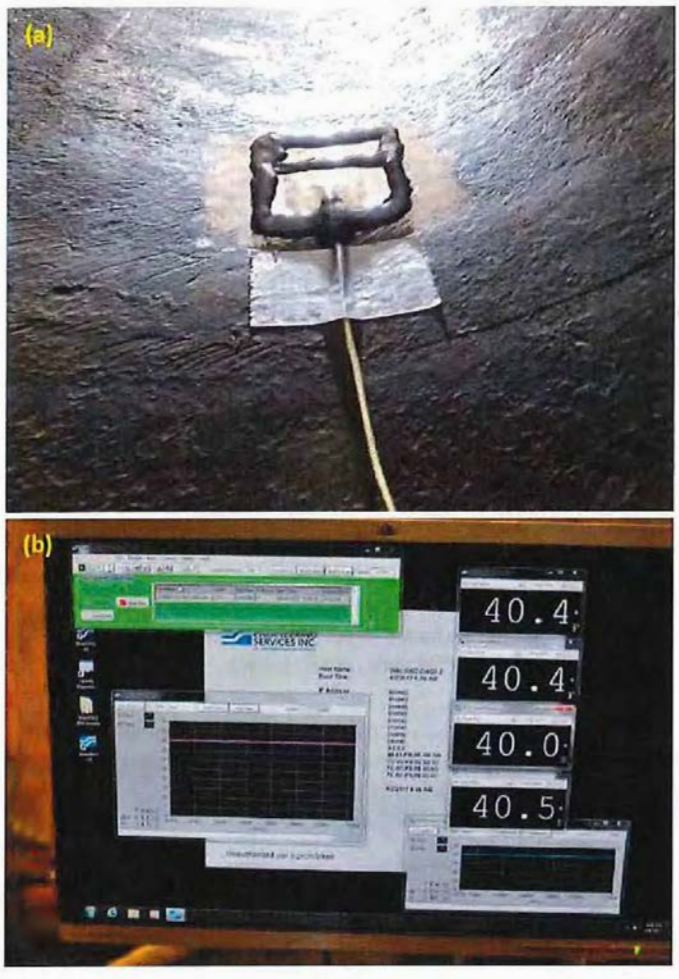


Figure 9: Photograph showing (a) thermocouple attached to inside surface of pipe and (b) temperature readout for water tank and pipe.

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Figure 11: Photograph showing 20" pipe in 40°F water prior to application of epoxy repairs. Repair areas are labeled per Table 1 and Figure 10. Flash rust on exposed areas was removed prior to repair.

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Figure 13: Application of full circumferential repair at Areas "B," "D," and "E." Photographs (a) and (b) show application of impregnated fabric around the circumference of pipe; (c) shows application of stricture.

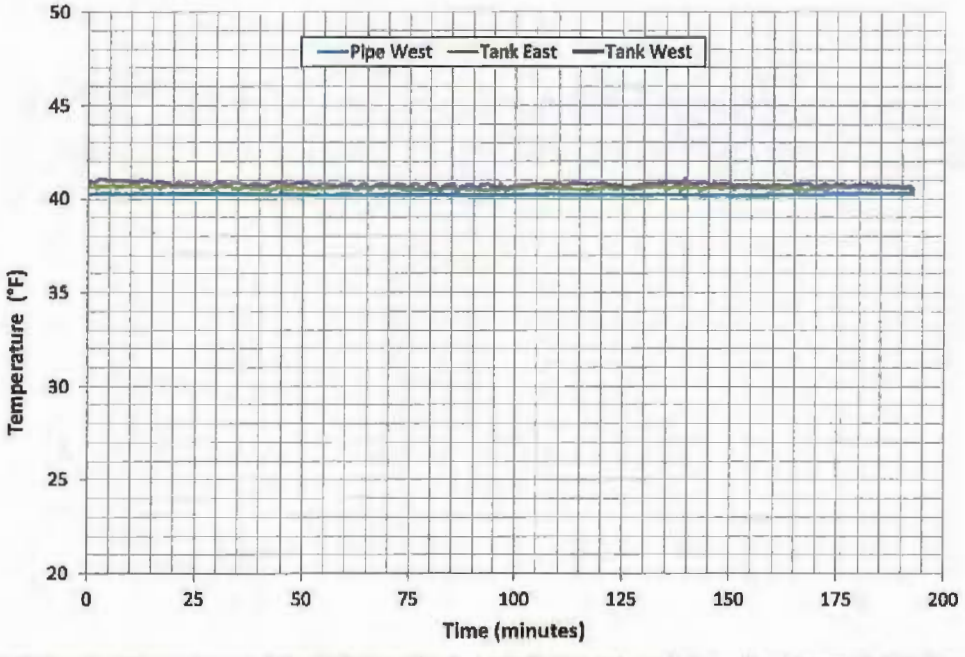


Figure 14: Graph of temperature data during application of full circumferential repair at Areas "B," "D," and "E" (see Figure 13). Water temperature remained near 40°F during installation of all repairs.

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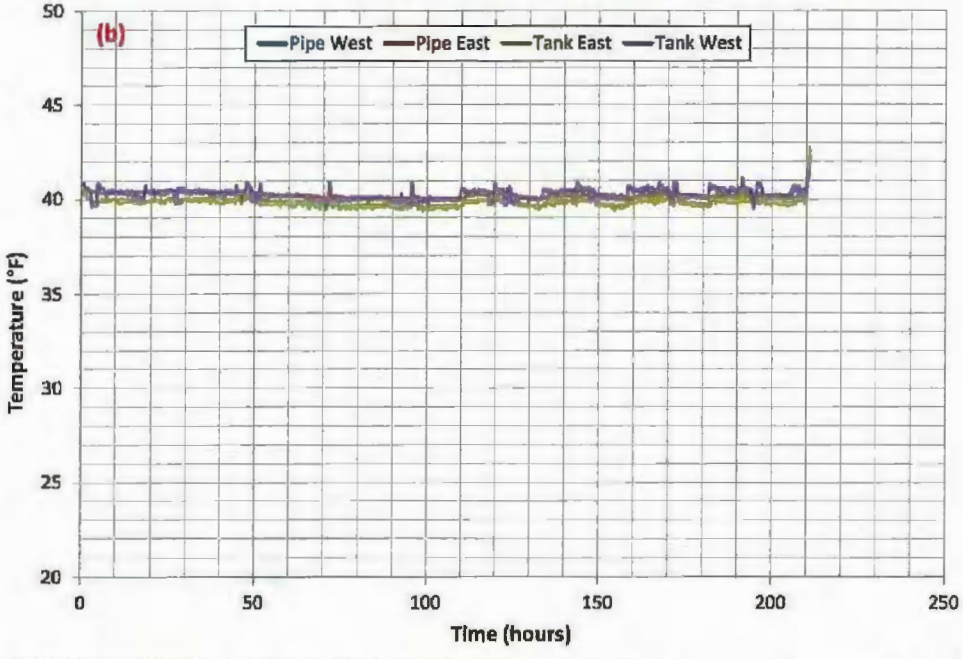


Figure 15: (a) Photograph showing water tank and (b) graph of water-bath temperature during curing period of full-scale repairs.

and "E" are obscured by the stricture banding. Patch repair area "C" exhibits only the repair fiber wrap since no stricture was used in this area.

The full circumferential repair at the center of the pipe is shown in Figure 18(a) after the stricture was removed. The patch repair at Area "A" is shown in Figure 18(b). Both repairs appear to be well attached to the pipe, including along the perimeter of the repair patch and the edges of the circumferential wrap.

The patch repair at Area "C" is shown in Figure 19. While the majority of Area "C" appears well attached to the pipe sample, the edges of the fiber wrap layers were not completely bonded to the pipe, creating a crevice along the perimeter of the patch.



Figure 17: (a) Photograph of 20" pipe sample after removal from water bath; (b) photograph showing stricture still applied to Areas "A" and "B/D/E." Area "C" (patch repair with no stricture) is on right end. Numbered scale divisions are 0.1 feet.

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Figure 19: Photographs showing patch repair at Area "C" where no stricture was applied.

5.2 Cross-Sections of Full-Scale Repairs

SES removed transverse sections through each of the repair areas to document the overall configuration of the repair. Additionally, smaller sections were removed from these cross-sections, mounted, and prepared using standard metallographic techniques. In order to maintain the integrity of the coatings during sample preparation, a large diameter diamond wafer saw was used to cut through the pipe wall thickness, original coating, and repair materials. It was found to not be necessary to encapsulate the samples prior to metallography; the coating layers remained intact using normal mounting and preparation techniques.

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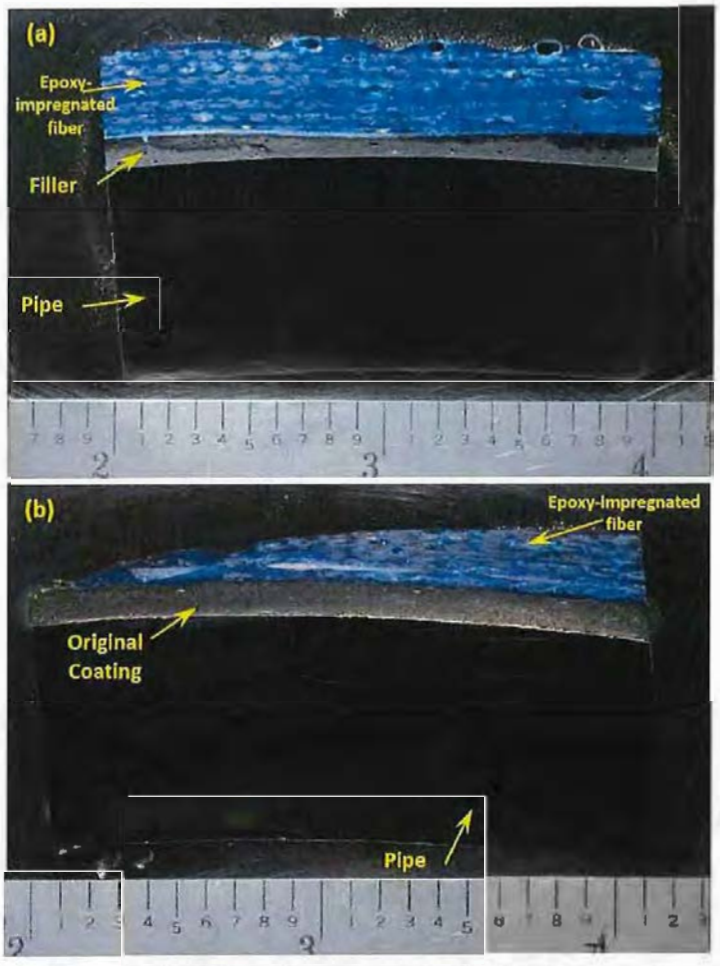


Figure 21: Metallographic cross-sections through repair Area "A." Section in upper photograph was removed through center of repair where original coating was completely removed down to bare metal. Lower photograph shows edge of repair where fiber wrap covers original coating.

5.2.2 Circumferential Repair Areas "B," "D," and "E"

A cross-section through the three areas repaired with a full 360° wrap is shown in Figure 22. Closer views of each area are shown in Figure 23 to Figure 25. As with the patch repair in Area A, the full repairs appeared to be well bonded to the pipe, including at the outer edges of the wrap. Metallographic cross-sections through each area are shown in the lower photographs in Figure 23 to Figure 25, respectively. Again, the repairs were found to be relatively uniform and appeared to have good adhesion to the pipe wall, though areas of porosity were evident in the cross sections. The porosity is not extensive and does not appear to compromise the integrity of the repair.

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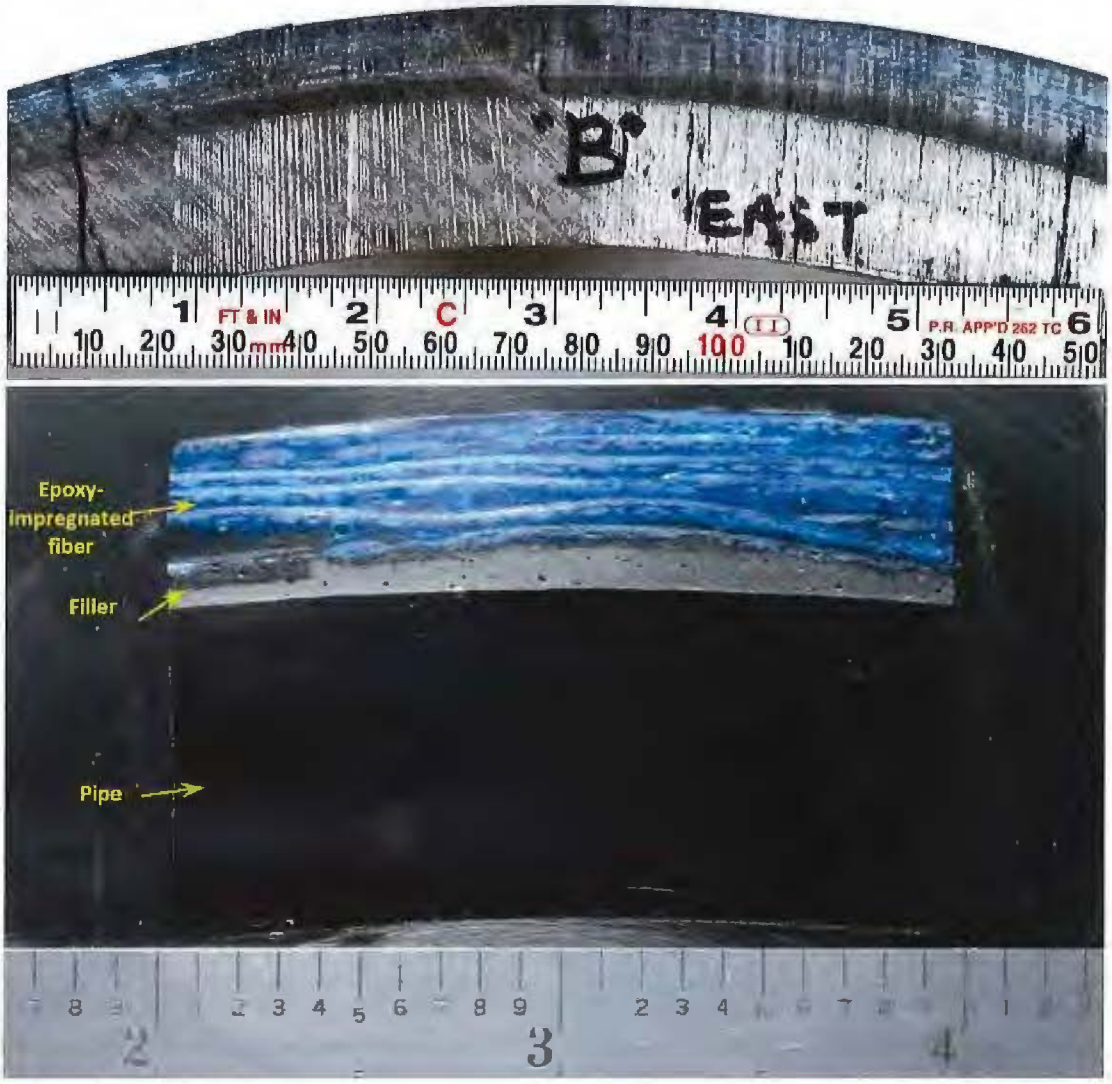


Figure 23: Metallographic cross-section of repair Area "B" located at top of pipe. A full 360° wrap and stricture was used in this repair.

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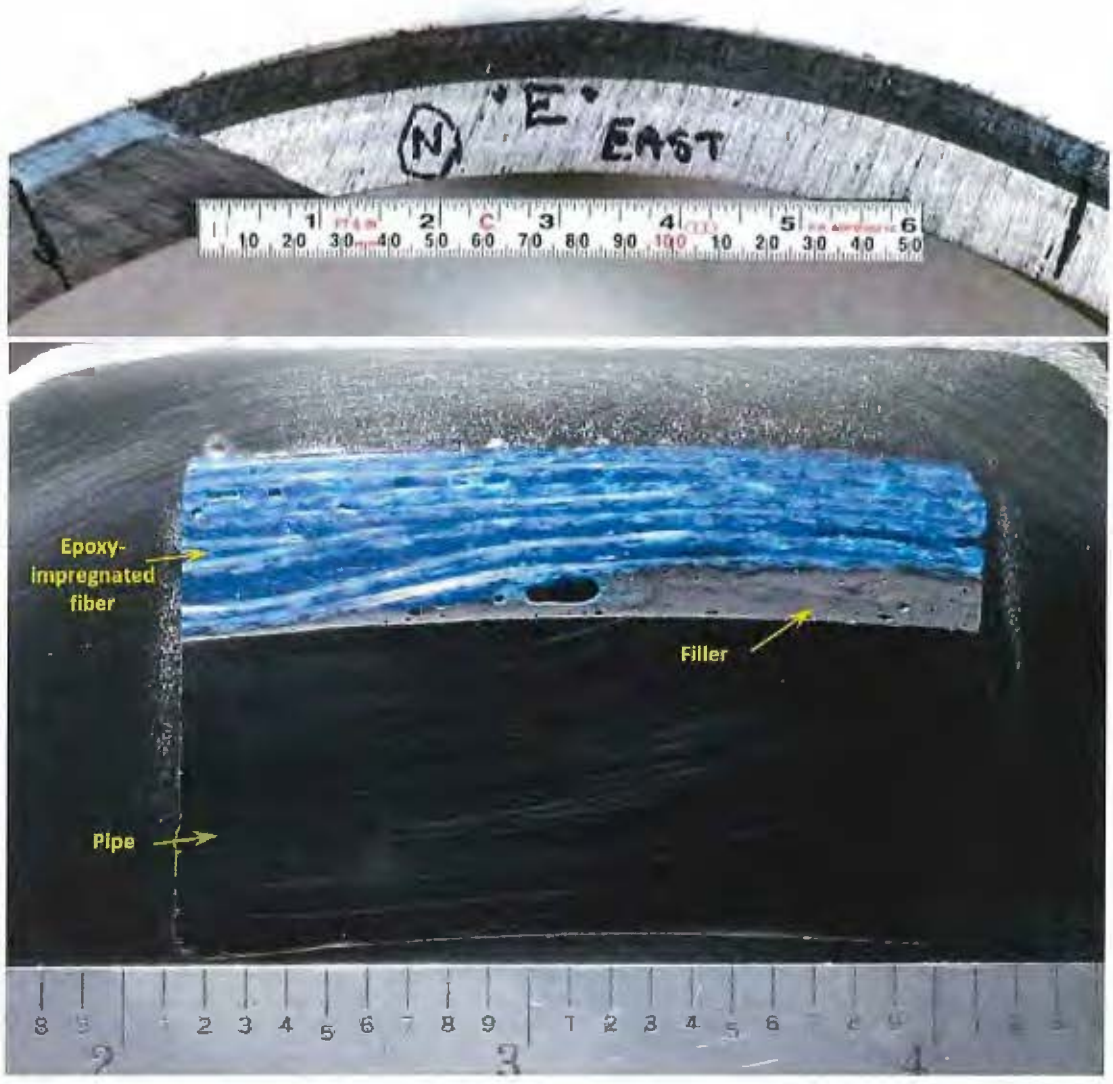


Figure 25: Metallographic cross-section of repair Area "E" located on north side (270°) of pipe. A full 360° wrap and stricture was used in this repair. (Reduction in thickness of filler material at left side of section is due to this section's being taken near edge of repair.)

5.2.3 Patch Repair Area "C"

A cross-section taken through Area "C" is shown in Figure 26 along with closer views at the perimeter of the repair. A stricture wrap was not applied to this repair site. The center of the repair (where the repair was applied over bare steel) was relatively uniform and appeared to have good adhesion to the pipe wall. At the perimeter of repair, however, the wrap layers were found to be cured, but not adhered to the pipe wall. An approximately 1" length of the wrap was not bonded to the surface, which created a small crevice around the perimeter.

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Figure 27: Metallographic cross-section through repair Area "C," a patch repair where no stricture banding was used.

6. ASTM D4541 Coating Adhesion Tests

Following the laboratory and full-scale repair tests, coating adhesion testing per ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," was conducted in both the original and repaired areas of the coating to determine their relative adhesion after full curing. The results of these tests are summarized in Table 3. Because minimal repair area was available for testing after the cross-sections were removed from the pipe, only three tests could be conducted at each repair location. Additionally, no minimum specified adhesion strength was provided for comparison for the repair material or original coating.

The data show that the fiber-wrap repairs were, in general, more highly adhered than the original coal-tar coating on the sample pipe and that the full 360° repair areas exhibited a higher adhesion than the patch repairs. However, it should be noted that the 20" sample pipe was not exposed to the same operational environment as Pipeline #5. This fact, along with the limited number of data points that could be obtained at each repair location, indicates that these results should be used for general comparison only.

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Appendix C:
Product Data Sheets

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APPLICATION NOTES

SURFACE PREPARATION: Remove marine biological settlement and corrosion by >5,000 psi water jetting with or without abrasive. Conventional air/abrasive blasting works well at shallow depths however efficiency falls off sharply below 10 feet. Hand held power tools such as needle guns or grinders can give good results if applied conscientiously in small areas but will be inadequate in large areas. Plan to apply the BIO-DUR®563 SW within 45 minutes maximum after surface preparation to minimize rerusting or initial settlement of fouling slime, which interferes with initial adhesion.

Application above water requires similar high-pressure water blasting or dry abrasive blasting to yield a firm, granular surface free of loose contamination.

MIXING PROCEDURE: BIO-DUR® 563 SW is supplied in 2 gallon kits of 2 x 1 gallon containers each of epoxy base and curing agent. These components are formulated in contrasting colors to facilitate complete mixing. Visible streaks of either component seen during the course of mixing indicate "hotspots" of unmixed components. It is imperative to properly mix the components since unmixed "hotspots" of either base or curing agent will never cure.

Remove equal quantities of base and curing agent from their cans and place them in a clean plastic or steel container. Mixing is accomplished by stirring with a "Jiffy" type mixer in a geared down, (high torque), 1/2" electric drill. Once mixing begins, there will be about 20 minutes of working time available at 77°F. This time may be extended by keeping the components and mixture cool, rather than leaving it in a hot area.

APPLICATION:

1) Using a stiff brush or roller apply mixed components from a tray aiming for a coverage rate of about 50 sq.ft. per gallon.
2) Apply by heated plural component airless spray using the following equipment setup:

Spray Unit:	Graco "King" or similar with heated hoses.
Mix ratio:	1/1 by volume
Fluid pressure:	2,500 psi
Fluid temp:	140°F
Filters:	Remove all filters
Tip size:	.031" -.039" orifice

CURING BEFORE SERVICE: BIO-DUR® 563 SW may be immersed in fresh or salt water immediately after application. It will cure to a hard film within about 3 hours and is suitable for traffic after this time. Allow at least 24 hours at 77°F before subjecting to aggressive chemical service from industrial solvents and similar materials.

TYPICAL PHYSICAL PROPERTIES OF THE CURED FILM:

Compressive strength:	7,380 psi (50.9 N/mm2)
Tensile strength:	6,000 psi (est.)
Flexural strength:	4,550 psi (31.4 M/mm2)
Abrasion resistance:	34.0 mg/1,000 cycles (CS17 wheels with 1,000 gram weights)
Tensile adhesion:	>2,000 psi ("Near White" SA2.5 abrasive blasted dry steel)
Tensile adhesion:	>1,000 psi (>5,000 psi water jetted steel applied/cured underwater)
Tensile adhesion:	>1,000 psi (power tool cleaned then >2,500 psi water jetted dry steel)

PRT Piping Repair Technologies
HEMPSTEAD, TEXAS USA
979-826-0075
mail to: info@pipingrepairtechnologies.com
www.pipingrepairtechnologies.com

X-100 UW RESIN SYSTEM:

The X-100 UW resin is based on pure liquid epoxy polymers and proprietary polyamine curing agents. The X-100 UW resin system is designed for use on wet surfaces or underwater applications. It is a two-component, ambient temperature epoxy matrix, and is suitable for use with a variety of reinforcement fabrics. The X-100 UW resin wets out easily and is relatively fast setting, approximately 30 minutes at 77°F (25°C). No VOC and is a 100% solids epoxy resin.

SURFACE PREPARATION:

Remove marine biological settlement and corrosion by >5,000 psi water jetting with or without abrasive. Conventional air/abrasive blasting works well at shallow depths however efficiency falls off sharply below 10 feet. Hand held power tools such as needle guns or grinders can give good results if applied conscientiously in small areas but will be inadequate in large areas. Plan to apply the X-100 UW within 45 minutes maximum after surface preparation to minimize re-rusting or initial settlement of fouling slime, which interferes with initial adhesion.

Application above water requires similar high-pressure water blasting or dry abrasive blasting to yield a firm, granular surface free of loose contamination.

MIXING PROCEDURE:

X-100 UW is supplied in size specific, factory pre-measured kits with corresponding reinforcement fabric lengths depending upon application. Kits are comprised of a Part A epoxy base in a partially filled container and a Part B curing agent to be poured into Part A container to assure proper mix ratio. After pouring the curing agent into the base, mix thoroughly for approximately 2 minutes taking care to stir in all base material from the edges and base of the container; *unmixed material will never properly cure.* No induction or "sweat-in" time is required and the mixed material may be used immediately. Pot life and reaction time is heavily dependent on temperature, as a general guide figure that each 18°F, (10°C), variation in temperature above or below 77°F, (25°C), will respectively halve or double the pot life and cure times.

APPLICATION:

When saturating the reinforcement fabric, a roller or flexible spreader should be used to evenly distribute the X-100 UW material throughout the fabric. The material will thicken in cold weather and will be noticeably thicker at temperatures of 50°F and below.

CURING BEFORE SERVICE at 77°F (25°C):

Dry time, dust free, 8 hours; light service, 12 hours; heavy service. Low temperature curing at approximately 40°F (5°C) will require approximately 7 days. Post cured Shore D scale hardness 70+.

- **CAN BE APPLIED AT FULL PRESSURE**
- **FACTORY PRE-MEASURED FOR FAST INSTALLATON**
- **EGLASS AND CARBON FIBER FABRICS AVAILABLE**
- **CAN BE USED ON STRAIGHT RUN PIPING, ELBOWS, TEES AND FLAT SURFACES**
- **ISO 9001:2008 CERTIFIED MANUFACTURER**

Industries Served

- Refining
- Power Generation
- Chemical Plants
- Mining
- Industrial
- Pulp and Paper
- Liquid and Gas Transportation
- Production Facilities
- Water and Wastewater Treatment

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Appendix D:
Letter from Manufacturer

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Please do not hesitate to contact us if we may supply any additional information to support the statements above.

With thanks for your interest in our products,

Sincerely,

Jesse R. Sanders
President and Technical Director
Piping Repair Technologies, Inc.

40164 FM 2979 Hempstead, Texas 77445 / office (979) 826-0075 / Cell (713 906-8650

Email: jsanders@pipingrepairtechnologies.com

Website: www.pipingrepairtechnologies.com

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APPLICATION OF UNDERWATER REPAIR COATINGS FOR LINE 5 STRAITS

Version #: 2.0

Version Date: 09/08/2017

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include, but are not limited to, the onsite Company Inspector, the Diver, and the coating Manufacturer. If the deviation is accepted, the requested deviation, key stakeholder inputs and risk assessment associated with the deviation will be uploaded into the Company's Business Information Management (BIM) system.

Note: No deviations will be accepted if they are not supported by the coating Manufacturer.

3.0 Surface Preparation

3.1 Pre-Preparation

The steel surface shall be cleaned using scarpers, hydroblasting cleaning, wet abrasive blasting, or pneumatic power wire wheel brush. The repair area shall be abraded using either wet abrasive blasting or pneumatic power wire wheel brush. The method shall be capable of providing a surface profile of 2.5 – 5 mils.

3.2 Parent Coating

3.2.1

Feathering shall remove the sharp edge at the transition from the parent coating.

3.2.2

The parent coating shall be roughened (abraded) using a cup disk brush to remove the loosely adherent biota, coating and provide a surface for overcoating.

3.2.3

For full circumferential composite wrap repairs (Method 1), the roughening shall extend at least 6 inches from the upstream and downstream edge of the repair area and around the entire circumference of the pipe.

For composite patch repairs (Method 2), the roughening shall extend onto the parent coating at least 6 inches from the edge of the repair area.

4.0 Coating Application

4.1 Surface Condition for Coating

Immediately prior to coating application, the Diver shall remove any flash rust and/or accumulated debris (silt, clay, etc.) using a wire brush or other method approved by the Manufacturer.

Note: The surface of the pipe shall meet all preparation requirements listed in Section 3.0 before the coating application.

Note: alternative protective wraps or encasements are allowed if approved by the coating Manufacturer.

4.3.6

The Stricture Bandings® shall extend at least 4 inches upstream and downstream of the repair.

Note: the Stricture Banding is applied in the same direction of the composite wrap and shall have tension in order to secure the composite wrap.

4.4 Preparation and Application of Composite Repairs (Method 2)

4.4.1

The X-100 epoxy shall be prepared by thoroughly mixing the X100 – UW Epoxy Base – Blue and the BIO-SEAL ™ X-100 Curing Agent – Clear.

4.4.2

The E-glass fabric shall be cut into approximately 12 inch x 12 inch patches and impregnated with the X-100 epoxy to form the composite patches.

4.4.3

Composite patch repairs shall consist of a minimum of 4 layers of the patch applied directly over the epoxy filler and abraded adjacent parent coating. The patches shall be applied in 4 layer patches until the entire repair area (filler and abraded adjacent parent coating) is coated.

4.4.4

Blue Stricture Banding® will be tightly applied 360 degrees around the pipe over the composite patch repairs to a minimum of three (3) layers to assure the radial compression and retention of the repair in place during cure.

Note: alternative protective wraps or encasements are allowed if approved by the coating Manufacturer.

4.4.5

The Stricture Bandings® shall extend at least 4 inches upstream and downstream of the edge of the coating repairs.

4.5 Cure Time

4.5.1

After application, the coating system will be allowed to cure in place for a minimum of 7 days at 40 °F.

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Appendix F:
OQ Checklist

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API #	Covered Task Name	CHECK PERSON RESPONSIBLE (Put X in box if person needs to be qualified on the covered task) Contractor	Evaluation	Evaluation	Enbridge Employee	Enbridge OQ Covered Task Name
5	**Inspect Buried Pipe When Exposed**	**Group Heading Only**				
5.1	Examine for mechanical damage on buried or submerged pipe	x	1:1	1:2 1:1		#15: External defect investigation #21: Inspect/examine buried pipe when exposed
5.2	Examine for external corrosion on buried or submerged pipe	x	1:1	1:1		#21: Inspect/examine buried pipe when exposed
5.3	Inspect the condition of external coating on buried or submerged pipe	x	1:1	1:2 1:1		#19: Pipe and valve coating #21: Inspect/examine buried pipe when exposed
7	**Application and Repair of External Coatings**	**Group Heading Only**				
7.1	Visual inspection of atmospheric coatings	x	1:1	1:1		#18: Atmospheric corrosion inspection
7.2	Prepare surface for atmospheric coating using hand and power tools	x	1:2	1:2		#20: Corrosion prevention methods
7.3	Prepare surface for coating by abrasive water blasting	x	1:2	1:2		#20: Corrosion prevention methods
7.4	Prepare surface for coating by abrasive blasting methods other than water	x	1:2	1:2		#20: Corrosion prevention methods
7.5	Apply coating using hand application methods	x	1:2	1:2		#20: Corrosion prevention methods
7.6	Apply coating using spray applications		1:2	1:2		#20: Corrosion prevention methods
7.7	Perform coating inspection	x	1:2	1:2		#20: Corrosion prevention methods
8	**Measure Wall Thickness of Pipe**	**Group Heading Only**				
8.1	Measure pit depth with pit gauge	x	1:1	1:1		#22: Measure wall thickness of pipe
8.2	Measure wall thickness with ultrasonic meter	x	1:1	1:1		#22: Measure wall thickness of pipe
8.3	Measure corroded area	x	1:1	1:1		#22: Measure wall thickness of pipe
9	**Cathodic Protection Remediation**	**Group Heading Only**				
9.1	Install bonds		1:1	1:1		#10.1: Install bonds
9.2	Install galvanic anodes		1:1	1:1		#10.1: Install bonds
9.3	Install rectifiers		1:1	1:1		#8: Rectifier installation
9.4	Install impressed current groundbeds		1:1	1:1		#10: Groundbed installation and repair
9.5	Repair shorted casings	x	1:3	1:3		#11: Shorted casing inspection #12: Shorted casing clearing/repair
9.6	Install electrical insulating device		1:1	1:1		Under Development
10	**Monitoring for Internal Corrosion**	**Group Heading Only**				
10.1	Insert and remove coupons		1:1	1:1		#13: Insert and remove coupons
10.2	Monitor probes (on-line)		1:1	1:1		#14: Hydrogen foil inspection
11	**Internal Corrosion Remediation**	**Group Heading Only**				
11.0	Monitoring and controlling the injection rate of the corrosion inhibitor		1:2	1:2		#17: Corrosion inhibitor injection
12	**Inspect Internal Pipe Surfaces**	**Group Heading Only**				
12.0	Visually inspect internal pipe surface		1:2	1:2		#18: Defect investigation- internal corrosion

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API #	Covered Task Name	CHECK PERSON RESPONSIBLE (Put X in box if person needs to be qualified on the covered task) Contractor	[redacted]	[redacted]	Enbridge Employee	Enbridge OQ Covered Task Name
22	Inspect, Maintain and Calibrate Relief Valves	Group Heading Only				
22.1	Inspect tank pressure/vacuum breakers		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices #91: Pressure relief valve test
22.2	Inspect, test and calibrate HVL tank pressure relief valves		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices #91: Pressure relief valve test #CC5: Control Center; Monitor tank levels
23	Maintain/Repair Relief Valves	Group Heading Only				
23.1	Maintain/repair relief valves		1:2	1:2		#88: In-service valve repair
23.2	Inspect, test and calibrate relief valves		1:2	1:2		#91: Pressure relief valve test
24	Inspect, test and calibrate pressure limiting devices	Group Heading Only				
24.1	Maintain/repair pressure limiting devices		1:1	1:1		#91: Pressure relief valve test
24.2	Inspect, test and calibrate pressure limiting devices		1:1	1:1		#89: Pressure control Valve (PCV) maintenance
25	Inspect, test and calibrate pressure limiting devices	Group Heading Only				
25.1	Inspect, test and calibrate pressure switches		1:1	1:1		#92: Pressure switch calibration
25.2	Inspect, test and calibrate pressure transmitters		1:1	1:1		#93: Inspect and test pressure transmitter
26	Verify or Set Protection Parameters for Programmable Controllers and/or Instrumentation Control Loops	Group Heading Only				
26.0	Verify or set protection parameters for programmable controllers and/or other instrumentation control loops		1:1	1:1		#90: Pressure allowable set points
27	Inspect and Repair Breakout Tanks	Group Heading Only				
27.1	Routine inspection of breakout tanks (API 653 monthly or DOT Annual)		1:0	1:1		#52: Tank inspection
[redacted]						
[redacted]						
29	Protect Breakout Tanks from Static Electricity, Lightning, and Stray Electrical Currents	Group Heading Only				
29.1	Launching in-line inspection devices		1:2	1:2		#54: Launching tool (pig) in scraper trap
29.2	Receiving in-line inspection devices		1:2	1:2		#55: Receiving tool (pig) in scraper trap
30	Test Overfill Protective Devices	Group Heading Only				
30.0	Test overfill protective devices		1:1	1:1		#83: Inspect, test and calibrate overfill protection devices
31	Inspect and Calibrate Overfill Protective Devices	Group Heading Only				

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API #	Covered Task Name	CHECK PERSON RESPONSIBLE (Put X in box if person needs to be qualified on the covered task)				Enbridge OQ Covered Task Name
		Contractor	[redacted]	[redacted]	Enbridge Employee	
32	Monitoring Excavation Activities	Group Heading Only				
32.0	Observation of excavation activities		1:1	1:1		#58: Damage prevention during excavation activities
33	Moving In-Service Pipe	Group Heading Only				
33.1	Determine allowable line pressure in section to be moved		1:2	1:2		#58: Line lowering
33.2	Preparation for movement activities		1:2	1:2		#58: Line lowering
33.3	Moving in-service pipeline		1:2	1:2		#58: Line lowering
34	Inspect Existing Pipe Following Movement	Group Heading Only				
34.0	Inspect existing pipe following movement	x	1:2	1:2		#49: Right-of-way inspections
35	Abandoning, Safe Disconnect, Purging, and Sealing of Pipeline Facilities	Group Heading Only				
35.1	Safe disconnect of pipeline facilities		1:2	1:2		#59: Line deactivation
35.2	Purging of pipeline facilities		1:2	1:2		#59: Line deactivation
35.3	Sealing a disconnected portion of pipeline		1:2	1:2		#59: Line deactivation
37	Installation or Repair of Support Structures on Existing Aboveground Components	x				
37.0	Install or repair support structures on existing above ground components		1:2	1:2		#82: Install or repair support structures on existing or above ground components
38	Inspection Activities for Tie-Ins, Pipe Replacement, or Other Components Connecting to an Existing Pipeline	Group Heading Only				
38.1	Visually inspect pipe and pipe components prior to installation		1:2	1:2		#15: External defect investigation
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
39	Backfilling a Trench Following Maintenance	Group Heading Only				
39.0	Backfilling a trench following maintenance		1:1	1:1		#57: Backfilling activities

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API #	Covered Task Name	CHECK PERSON RESPONSIBLE (Put X in box if person needs to be qualified on the covered task) Contractor	[redacted]	[redacted]	[redacted]	Enbridge OQ Covered Task Name
44	CPM Leak Detection	Group Heading Only				
44.3	Inspect, test and maintain flow computer for hazardous liquid leak detection			1:1		#CC4: Control Center: Monitor leak detection - Computational Pipeline Monitoring (CPM) (**Liquid Pipelines only) #CC5: Control Center: Monitor tank levels
44.4	Inspection, testing, corrective and preventative maintenance of tank gauging for hazardous liquid leak detection		1:1			Under Development
44.5	Prove flow meters for hazardous liquid leak detection			1:1		#CC8: Control Center: Prove Flow Meters for Hazardous Liquid Leak Detection
44.6	Maintain flow meters for hazardous liquid leak detection		1:1			Under Development
44.7	Inspect, test and maintain gravitometers/densitometers for hazardous liquid leak detection		1:1			Under Development
44.8	Inspect, test and maintain temperature transmitters for hazardous liquid leak detection		1:1			Under Development
52	Leakage Survey (retained from previous version)	Group Heading Only				
52.1	Conduct vegetation survey		1:1	1:1		#84 Gas leakage survey
52.2	Conduct a leak survey with a CGD		1:1	1:1		#84 Gas leakage survey
52.3	Conduct a leak survey with a flame ionization unit		1:1	1:1		#84 Gas leakage survey
55	Fixed Gas Detection (retained from previous version)	Group Heading Only				
55.0	Maintain fixed gas detection equipment		1:1	1:1		#94: Station gas detection calibration
63	Operation of a Pipeline System	Group Heading Only				
63.1	Start-up of a liquid pipeline (field)		1:1	1:1		#95: Local operation of pumps (start up/shut down of a pump)
63.2	Shutdown of a liquid pipeline (field)		1:1	1:1		#95: Local operation of pumps (start up/shut down of a pump)
63.3	Monitor pressure, flows, communications and line integrity and maintain them within allowable limits on a liquid pipeline system (field)		1:1	1:1		#89: Pressure Control Valve (PCV) maintenance #96: Pressures, flows and communications monitoring - field ops
63.4	Locally operate valves on a liquid pipeline system		1:1	1:1		#50: Local operation of valves #86: Remote communicated valve check

Enbridge LP Representative (Print Name):

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