IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

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| UNITED STATES OF AMERICA,<br><br>Plaintiff,<br><br>v.<br><br>ENBRIDGE ENERGY, LIMITED PARTNERSHIP,<br>ENBRIDGE PIPELINES (LAKEHEAD) L.L.C.,<br>ENBRIDGE ENERGY PARTNERS, L.P.,<br>ENBRIDGE ENERGY MANAGEMENT, L.L.C.,<br>ENBRIDGE ENERGY COMPANY, INC. ,<br>ENBRIDGE EMPLOYEE SERVICES, INC.,<br>ENBRIDGE OPERATIONAL SERVICES, INC.,<br>ENBRIDGE PIPELINES INC., and<br>ENBRIDGE EMPLOYEE SERVICES CANADA INC.,<br><br>Defendants. | Civil Action No. 1:16-cv-914<br><br>Judge Robert J. Jonker |

EIGHTH MODIFICATION OF CONSENT DECREE

WHEREAS, the United States of America ("United States"), on behalf of the United States Environmental Protection Agency ("EPA") and the United States Coast Guard, filed a complaint in this matter on July 20, 2016, asserting claims against Enbridge Energy, Limited Partnership and several affiliated entities (hereinafter collectively referred to as "Enbridge") under the Clean Water Act, 33 U.S.C. § 1251 *et seq.*, and the Oil Pollution Act, 33 U.S.C. § 2701 *et seq.*, arising from two 2010 oil transmission pipeline failures that resulted in discharges of oil into waters of the United States.

WHEREAS, on May 23, 2017, this Court approved and entered a Consent Decree ("Original Consent Decree") resolving claims that the United States asserted against Enbridge in this action.

WHEREAS, the Original Consent Decree, as later modified by the United States and Enbridge (collectively, the "Parties") and/or by the Court, ("Consent Decree") establishes numerous requirements applicable to fourteen separate oil transmission pipelines in the United States owned and operated by Enbridge known as the "Lakehead System."

WHEREAS, on December 20, 2021, the Court signed and approved the Sixth Modification of Consent Decree, which, among other things, revised the definition of "Established Maximum Operating Pressure" or "Established MOP" – a term that is used below in this Eighth Modification of Consent Decree.

WHEREAS, on July 28, 2023, the Parties filed with the Court a Joint Stipulation partially terminating the Consent Decree in accordance with Paragraph 204.d.(1) of the Consent Decree as modified by the Seventh Modification of Consent Decree, which was entered by this Court on June 12, 2023 (ECF No. 40, PageID.2447).

WHEREAS, under Paragraph 204.a.(7) of the Consent Decree as modified by the Seventh Modification of Consent Decree, the Parties agreed that partial termination of the Consent Decree would not apply to any obligations under the Consent Decree with respect to Circumferential Crack features (*i.e.*, cracks that are primarily oriented in the direction of the pipeline's circumference as opposed to the pipeline's axis), except for the obligation set forth in Subparagraph 70.a of the Consent Decree (which Enbridge completed in 2017).

WHEREAS, it is the position of the United States that Circumferential Crack features are subject to the obligations set forth in Section VII.D ("In-Line Inspection Based Spill Prevention Program") of the Consent Decree.

WHEREAS, the agreed-upon In-line Inspection ("ILI") Based Spill Prevention Program is intended to prevent oil spills by requiring Enbridge to deploy ILI tools to detect, characterize, and size features that are present or anticipated on the particular pipeline being inspected and might present integrity threats to the Lakehead System.

WHEREAS, on May 1, 2023, Enbridge submitted a Notice of Dispute under Paragraph 180 of the Consent Decree disputing the United States' interpretation of the Consent Decree with respect to Circumferential Crack features.

WHEREAS, in its Notice of Dispute, Enbridge argued that the ILI-Based Spill Prevention Program in Section VII.D of the Consent Decree does not apply to Circumferential Crack features, noting, among other things, that the Consent Decree requires Enbridge to assess Crack features using a commercially-available product designed to assess Axially-Aligned Crack features (*i.e.*, cracks that are primarily oriented in the direction of the pipeline's axis as opposed to the pipeline's circumference), not Circumferential Crack features.

WHEREAS, in its Notice of Dispute, Enbridge also argued that (1) it has a robust integrity management program, independent of the Consent Decree requirements, that evaluates and manages all threats on its pipeline system, including Circumferential Crack features, (2) the ILI tool that Enbridge used to assess Circumferential Crack features in Line 6A in 2019 often mischaracterized features on girth welds as Circumferential Crack features of indeterminable depth, and (3) no ILI tool currently exists with the ability to assess Circumferential Crack features in Line 4, which is a pipeline with a varying diameter of 36 to 48 inches.

WHEREAS, in accordance with Section XIII (Dispute Resolution) of the Consent Decree, the Parties have engaged in a period of informal negotiations in an effort to resolve their differences with respect to Circumferential Crack features in the Lakehead System.

WHEREAS, in an effort to resolve such differences, the Parties have discussed changes to the Consent Decree with respect to (1) the schedule and method for investigating Circumferential Crack features in Lakehead System Pipelines, (2) the method for assessing the fitness-for-service of Circumferential Crack features, (3) the criteria and schedule for excavating and repairing or mitigating Circumferential Crack features, (4) the criteria and schedule for establishing interim pressure restrictions for Circumferential Crack features, and (5) the procedures for final termination of the Consent Decree under Section XX (Termination).

NOW THEREFORE, before taking any further testimony, without further adjudication of any issue of fact or law, and upon the consent and agreement of the Parties, it is hereby ORDERED, ADJUDGED, and DECREED as follows:

1. Paragraph 10 of the Consent Decree is modified to read as follows:

10. * * *

a-supp 1. "80/60 Interim Pressure Restriction" shall mean a pressure restriction that limits operating pressure at the location of a feature to 80% of the highest actual operating pressure at that location during the last 60 Days.

* * *

c. "Axially-Aligned Crack" shall mean any Crack feature that is predominantly oriented in the direction of the pipeline's axis as opposed to the pipeline's circumference.

* * *

e-supp 1. "Circumferential Crack" shall mean any Crack feature that is predominantly oriented in the direction of the pipeline's circumference as opposed to the pipeline's axis.

e-supp 2. "Circumferential Crack Look-back Assessment Program" shall mean the actions required under Paragraph 37.f of the Consent Decree relating to Lines 5, 6A, and 10 and the audit of such actions by a Third-Party Consultant under Paragraph 37.g of the Consent Decree.

* * *

l. "Crack feature" or "Crack" shall mean any feature on a pipeline detected by any tool, field measurement device, or other field observation that detects any crack or crack-like feature on the pipeline, irrespective of the orientation of the feature or whether the feature type is classified as crack-like, crack field, notch-like, surface-breaking lamination, linear indication, seam-weld manufacturing anomaly, hook cracks, Axially-Aligned Cracks, Circumferential Cracks, or any other label denoting a crack or cluster of cracks. In addition, for purposes of this Consent Decree, Crack features shall be deemed to include Axial Slotting features, Axial Grooving features, selective seam Corrosion features and features identified in ILI reports as Seam Weld Anomaly A/B.

* * *

u. "Field Burst Pressure" shall mean, with respect to each Axially-Aligned Crack feature and each Corrosion feature located on any section of a Lakehead System Pipeline that is excavated, whether for repair or mitigation of features, investigation of features or otherwise, the Predicted Burst Pressure of such feature calculated in accordance with Paragraph C of Appendix B.

u-supp 1. "Field Tensile Strain Capacity" shall mean, with respect to each Circumferential Crack feature located on any section of a Lakehead System Pipeline that is excavated, whether for repair or mitigation of features, investigation of features or otherwise, the Tensile Strain Capacity of such feature calculated in accordance with Paragraph C of Appendix B.

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x-supp 1. "High-Resolution Circumferential Crack Detection ILI Tool" or "HRCCD ILI Tool" shall include any ultrasonic Circumferential Crack-detection ILI tool where the design specification intends for the tool to be capable of detecting, at least 90% of the time, any (1) Circumferential Crack in a pipe weld when such a Crack feature has a minimum depth of 2 millimeters ("mm") and a minimum length of 25 mm, and (2) Circumferential Crack in the base metal of a pipe Joint, or in the heat-affected zone adjoining a pipe weld, when such a Crack feature has a minimum depth of 1 mm and a minimum length of 25 mm.

y. "ILI Burst Pressure" shall mean, with respect to each Axially-Aligned Crack feature and each Corrosion feature, the Predicted Burst Pressure of such feature calculated based on ILI measurements of feature length and depth.

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ll-supp 1. "Non-Priority Saturated Signal" shall have the definition provided in Paragraph 2 of Appendix A under the heading of "Circumferential Cracks with Saturated Signals Detected by HRCCD ILI Tool."

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zz-supp 1. "Priority Saturated Signal" shall have the definition provided in Paragraph 1 of Appendix A under the heading of "Circumferential Cracks with Saturated Signals Detected by HRCCD ILI Tool."

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aaa. "Remaining Life" shall mean the estimated period of time remaining before an Axially-Aligned Crack feature or Corrosion feature is predicted to grow to the point where its Predicted Burst Pressure is less than or equal to the Established MOP at the location of the feature. For Circumferential Crack features, it shall mean the estimated period of time remaining before Tensile Strain Demand is predicted to equal or exceed Tensile Strain Capacity at the location of the feature.

aaa-supp 1. "Remaining Life at 180 Days" shall mean the Remaining Life of a feature as of the date that marks the end of the 180-Day period for repair or mitigation of such feature as initially prescribed under Paragraph 48 (Table 1) or Paragraph 58 (Table 5).

* * *

ddd. "Rupture Pressure Ratio" or "RPR" shall mean, with respect to any Axially-Aligned Crack or Corrosion feature, the Predicted Burst Pressure of such feature divided by the pressure at 100 percent Specified Minimum Yield Strength.

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kkk-supp 1. "Tensile Strain Capacity" shall mean the lowest predicted axial strain (*i.e.*, strain along the axis of the pipeline) at which the Circumferential Crack is predicted to fail, either by leaking or rupturing.

kkk-supp 2. "Tensile Strain Demand" shall have the meaning stated in Paragraph 43 as modified by the Eighth Modification of Consent Decree.

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nnn-supp 1. "Unrepaired Circumferential Crack Features" shall mean Circumferential Crack features that Enbridge has detected by means of an ILI tool but that Enbridge has not excavated and repaired or mitigated.

2. Paragraph 19 of the Consent Decree (as modified by Paragraph 3 of the Fifth Modification of Consent Decree) is modified to read as follows:

19. Enbridge shall fund and perform all injunctive measures set forth in Section VII as detailed in Subsections VII.A-J below and in Appendices A to K, which are incorporated by reference.

3. Paragraph 29 of the Consent Decree is modified to read as follows:

29. * * *

a. By no later than July 1, 2025, Enbridge shall investigate the segment of Line 1 from Clearbrook, Minnesota to Superior, Wisconsin ("CR-PW") and the entirety of Lines 2 and 62 using an ultrasonic ILI tool designed to detect, characterize, and size Circumferential Crack features.

b. With respect to 48-inch diameter "dual seam" Joints in Line 4, Enbridge shall not be required to conduct an inspection using an ultrasonic ILI tool designed to detect, characterize, and size Circumferential Cracks, provided that Enbridge undertakes and completes the direct assessment program set forth in Appendix J (Direct Assessment Program of Circumferential Cracks in Dual-Seam Joints in Line 4 *hereinafter* "Line 4 Direct Assessment Program") and, by no later than April 30, 2025, demonstrates the safety case required under that

program. If Enbridge is unable to meet either requirement, the parties shall proceed in accordance with Paragraph E of Appendix J.

c. By no later than 60 Days after the Court's approval of this Eighth Modification of Consent Decree, Enbridge shall add the procedures set forth in the Line 4 Direct Assessment Program and Appendix K (Work Instruction: ILI-based Circumferential Crack Integrity Management Program) into the manual of written procedures that Enbridge must prepare and follow in accordance with 49 C.F.R. § 195.402 for operating and maintaining the Lakehead System.

4. Paragraph 36 of the Consent Decree is modified to read as follows:

36. For the purposes of this Consent Decree, the term "Feature Requiring Excavation" shall mean any Crack feature, Corrosion feature, or Geometric feature that meets one or more of the dig selection criteria in Subsection VII.D.(V), below. With respect to Axially-Aligned Crack features and Corrosion features, Enbridge shall apply three methods to identify a Feature Requiring Excavation. First, Enbridge shall determine a feature's fitness-for-service using the procedures set forth in Subsection VII.D.(IV), below. Second, Enbridge shall estimate the amount of time remaining until the feature is predicted to rupture or leak ("Remaining Life") using the procedures set forth in Subsection VII.D.(VI), below. Third, Enbridge shall consider other unique characteristics of the feature using the criteria set forth in Subsection VII.D.(V). With respect to Circumferential Crack features, Enbridge shall apply only the first and third methods in identifying a Feature Requiring Excavation, and, with respect to Geometric features, Enbridge shall apply only the third method in identifying a Feature Requiring Excavation.

5. Paragraph 37 of the Consent Decree (as modified by Paragraph 6 of the Fifth Modification of Consent Decree and Paragraph 3 of the Sixth Modification of Consent Decree) is modified to read as follows:

37. * * *

| METHOD OF IDENTIFYING FEATURES REQUIRING EXCAVATION | APPLICABLE DEADLINES FOR INDENTIFYING FEATURES REQUIRING EXCAVATION AND PLACING SUCH FEATURES ON THE DIG LIST |
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| Features that are identified as Features Requiring Excavation based upon an analysis of their fitness-for-service | Enbridge shall complete identification of all such Features Requiring Excavation and add such features to the Dig List within five Days of calculating their fitness-for-service in accordance with Subsection VII.D.(IV), below. |
| Features that are identified as Features Requiring Excavation based upon their Remaining Life | Enbridge shall complete identification of all such Features Requiring Excavation and add such features to the Dig List within five Days of calculating the Remaining Life of the features in accordance with Subsection VII.D.(VI) below. |
| Features, excluding dent features subject to Table 5, that are identified as Features Requiring Excavation based upon reasons other than their fitness-for-service or their Remaining Life | Enbridge shall complete identification of all such Features Requiring Excavation and add such features to the Dig List within 5 Days of completing the preliminary review of the Initial ILI Report, provided that such a review does not identify any data quality concerns relating to the feature. For those features with data quality concerns, Enbridge shall complete identification of all Features Requiring Excavation and add such features to the Dig List within 5 Days after resolving those data quality concerns. |
| Dent features subject to Table 5 | Enbridge shall complete the identification of all such Features Requiring Excavation and add such features to the Dig List in accordance with the requirements of Paragraph 58. |

a. *Re-evaluation of Certain Features (other than Circumferential Crack features) Based on Revised Pipe Wall Thickness Information Documented During the MOP Verification Project.* As provided below in this Paragraph 37, Enbridge shall assure that revised pipe wall thickness information documented during the MOP Verification Project is used to identify any additional features (other than Circumferential Crack features) that meet dig selection criteria under Section VII.D of the Consent Decree, as well as to establish or revise certain pressure restrictions in accordance with requirements set forth in Section VII.D of the Consent Decree.

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f. *Circumferential Crack Look-back Assessment*: By no later than April 30, 2025, Enbridge shall complete the Circumferential Crack Look-back Assessment, which shall include (1) the re-assessment of all Circumferential Crack features in Lines 5, 6A, and 10 that Enbridge has discovered through past ILIs but that Enbridge has not excavated and repaired ("Unrepaired Circumferential Crack Features"), and (2) completion of the excavation and repair of all Circumferential Crack features on Joint 100360 of the Superior to Adams segment of Line 6A. With respect to the re-assessment of Unrepaired Circumferential Crack Features on Lines 5, 6A, and 10, Enbridge shall determine whether such features are Features Requiring Excavation based upon the dig selection criteria set forth in Paragraph 48 (Table 1) and Paragraph 58 (Table 5), as modified by this Eighth Modification of Consent Decree. If a Circumferential Crack feature has been evaluated by more than one ultrasonic Circumferential Crack-detection ILI tool in the past, Enbridge shall conduct the re-assessment based upon the data collected about the feature from the most recent ILI using such a tool. Within 5 Days of completion of this re-assessment, Enbridge shall add to the Dig List all Unrepaired Circumferential Crack Features on

Lines 5, 6A, and 10 that are Features Requiring Excavation. Enbridge shall then excavate and repair or mitigate all such features in accordance with the requirements and deadlines set forth in the Consent Decree as modified by this Eighth Modification of Consent Decree. Notwithstanding the previous sentence, the Circumferential Crack Look-back Assessment shall not be subject to deadlines based upon (1) the date of completion of the data quality review or (2) the date that the ILI tool was removed from the pipeline.

g. *Circumferential Crack Look-back Assessment Audit*: Enbridge shall implement an audit of the Circumferential Crack Look-back Assessment in accordance with Subparagraphs 37.g.(1) to 37.g.(6), below, to ensure compliance with the Consent Decree as modified by this Eighth Modification of Consent Decree.

(1) Circumferential Crack Look-back Assessment Dig List: Within 30 Days of adding Unrepaired Circumferential Crack Features to the Dig List in accordance with Subparagraph 37.f, above, Enbridge shall prepare a written report listing, by each pipeline, each Circumferential Crack feature added to the Dig List as a result of the Circumferential Crack Look-back Assessment ("Look-back Assessment Dig List Report"). For each such feature, the Look-back Assessment Dig List Report shall include:

(a) Information considered by Enbridge in re-assessing the feature, including but not limited to (i) information reported by the ILI vendor about the feature (*e.g.*, depth of feature, length of feature, type of feature, and location of feature on the Joint), (ii) information relating to any portion of the feature with a saturated signal (*e.g.*, number of saturated sensors, equivalent ellipse analysis), (iii) information relating to the Joint in which the feature is located (*e.g.*, wall thickness, notch toughness, steel grade, manufacturer, year of installation), (iv) information relating to the strain state and loading conditions imposed on the

feature such as proximity to pipe bends, (v) information relating to the inputs and assumptions used to assess the fitness-for-service of the feature (*e.g.*, conversion of Charpy V-notch energy value to equivalent value using J-integral or crack tip opening displacement, elastic modulus), and (vi) information relating to any other features that may intersect with or interact with the feature;

(b) A description of all of the inputs and methods used to assess the fitness-for-service of the feature and the results of each such assessment (*e.g.*, the Tensile Strain Capacity of the feature and Tensile Strain Demand at the location of the feature);

(c) A description of the analysis conducted to determine whether the feature is subject to fatigue crack growth and, if it is subject to such growth, a description of the analysis to determine the Remaining Life of the feature;

(d) Identification of all dig selection criteria set forth in Paragraph 48 (Table 1) and Paragraph 58 (Table 5) that apply to the feature;

(e) The date when the feature was added to the Dig List, the date by which it must be excavated based upon the deadlines set forth in Paragraph 48 (Table 1) and/or Paragraph 58 (Table 5), and the date by which Enbridge excavated and repaired (or plans to excavate and repair) the feature; and

(f) A statement as to whether the feature is subject to an interim pressure restriction and, if so, the date on which the restriction was established and a description of the analysis used to establish the pressure restriction.

(2) Retention of Third-Party Consultant: No later than 90 Days after the Court approval of this Eighth Modification, Enbridge shall enter into a written agreement with a third-party consultant ("TPC") to audit the Circumferential Crack Look-back Assessment

by performing the tasks set forth in Subparagraph 37.g.(4), below ("TPC Retention Agreement"). The TPC Retention Agreement, which shall be signed by Enbridge and the TPC, shall require the TPC to undertake and complete such tasks as expeditiously as practicable but in no event later than 90 Days after Enbridge completes the Circumferential Crack Look-back Assessment. The TPC Retention Agreement shall require Enbridge to provide the TPC with timely and complete access to all information necessary to perform the tasks required under Subparagraph 37.g.(4), below.

(3) TPC Qualifications: The individual retained as the TPC shall have both a Bachelor of Science degree and a master's degree (or their equivalent) in mechanical engineering or a related field and shall have a minimum of 15 years of work experience in material science as applied to the fabrication, maintenance, or repair of welded carbon steel parts or equipment, including at least ten years of work experience in pipeline integrity management. In addition, such individual shall have academic training, work-related experience, and/or publications that demonstrate his or her knowledge of each of the following topics:

(a) Advanced fracture mechanics and strain-based failure models, including API 579;

(b) Ultrasonic crack detection ILI tools, including the interpretation of primary and secondary signals to determine the depth of Crack features;

(c) Analysis and processing of ILI data to determine the fitness-for-service of Crack features, including Crack features that interact with Corrosion or Geometric features;

(d) Analysis of the growth and Remaining Life of Crack features using crack-growth life-prediction tools, such as the AFGROW computer program originally developed by the Air Force Research Laboratory;

(e) Circumferential Crack propagation and management; and

(f) Pipe/soil interaction mechanism for pressurized pipe.

(4) TPC Tasks: The TPC shall undertake and complete the following tasks as expeditiously as practicable but in no event later than 90 Days after Enbridge completed the Circumferential Crack Look-back Assessment:

(a) Task 1 – Confirmation of Dig List: The TPC shall complete an audit to determine whether Enbridge complied with the requirements set forth in this Eighth Modification of Consent Decree for assessing Unrepaired Circumferential Crack Features detected in Lines 5, 6A, and 10 and for determining whether such features are Features Requiring Excavation based upon the dig selection criteria. The TPC shall confirm whether or not Enbridge added to the Dig List (and reported in the Look-back Assessment Dig List Report) all Unrepaired Circumferential Crack Features that qualify as Features Requiring Excavation based upon the dig selection criteria set forth in the Consent Decree as modified by this Eighth Modification of Consent Decree.

(b) Task 2 – Confirmation of Dig Schedule: With respect to each Circumferential Crack feature identified in the Look-back Assessment Dig List Report, the TPC shall verify whether or not the schedule set by Enbridge for excavation and repair or mitigation of the Circumferential Crack feature complies with the requirements set forth in Paragraph 48 (Table 1) and Paragraph 58 (Table 5). To the extent that Enbridge has elected to extend the schedule for repair of such features pursuant to Paragraph 49, the TPC shall verify

whether or not the date selected by Enbridge for excavation and repair of such features complies with the requirements set forth in Paragraph 49. In the event that the TPC identifies in Task 1 any Unrepaired Circumferential Crack Feature to be added to the Dig List, the TPC shall set forth its findings and recommendations as to the schedule for excavation and repair of each such feature under Paragraph 48 (Table 1) and Paragraph 58 (Table 5).

(c) Task 3 – Confirmation of Interim Pressure Restrictions: With respect to each Circumferential Crack feature identified in the Look-back Assessment Dig List Report (and with respect to each Circumferential Crack identified in Task 1 that should be added to the Dig List, if any), the TPC shall evaluate whether the feature is subject to fatigue crack growth based upon the procedures set forth in Appendix I. To the extent that a Circumferential Crack feature is subject to fatigue crack growth, the TPC shall verify the Remaining Life of the feature in accordance with Appendix I and confirm whether or not the Remaining Life requires Enbridge to take action by accelerating the schedule for excavation and repair of the feature and/or establishing an interim pressure restriction in accordance with Paragraph 48 (Table 1), Paragraph 58 (Table 5), and Paragraph 59. The TPC shall then confirm whether Enbridge has taken such action(s) and done so in accordance with the requirements and deadlines set forth in the Consent Decree, as modified by this Eighth Modification of Consent Decree.

(d) Task 4 – Written Report: The TPC shall prepare and provide to Enbridge a written report documenting the information that the TPC has reviewed and setting forth the TPC's findings and recommendations with respect to each of the tasks set forth in Subparagraphs 37.g.(4)(a) to (c), above ("TPC Audit Report"). In addition, the TPC Audit Report shall include findings with respect to Enbridge's compliance with provisions of the

Consent Decree regarding (i) the assessment of Circumferential Crack features with saturated signals, (ii) the assessment of the fitness-for-service of Circumferential Crack features based upon, among other things, the strain state and loading conditions placed on such features, and (iii) the assessment of Circumferential Crack features that interact or intersect with Corrosion or Geometric features.

(5) Enbridge Response to the TPC Audit Report: No later than 30 Days after receipt of the TPC Audit Report, Enbridge shall prepare a written report responding to the TPC's findings and recommendations and setting forth the actions, if any, that Enbridge will take to address those findings and recommendations and the schedule for doing so ("Response to TPC Audit Report"). Such actions shall be taken as expeditiously as practicable but with the goal of completing each action no later than 90 Days after receipt of the TPC Audit Report. In the event that Enbridge should disagree with any of the TPC's findings and recommendations, Enbridge shall include in its Response to the TPC Audit Report an explanation of is position with respect to each such finding and recommendation and identify all information upon which Enbridge relies in support of its position.

(6) Submittals to EPA and Maintenance of Reports: Enbridge shall submit to EPA a copy of (a) the non-destructive examination ("NDE") report relating to the excavation and repair of all features on Joint 100360 of the Superior to Adams segment of Line 6A, (b) the Look-back Assessment Dig List Report, (c) the TPC Retention Agreement, (d) the TPC Audit Report, and (e) Enbridge's Response to the TPC Audit Report. Enbridge shall submit each such report to EPA within 15 Days of the date that the final report was generated or received by Enbridge or, if completed prior to Court approval of the Eighth Modification, within 15 Days of Court approval of the Eighth Modification. Enbridge shall also maintain all of these

reports in its files and, upon request, provide a copy to PHMSA. Enbridge shall, upon request, provide or make available to EPA all information necessary to understand and evaluate such submittals.

6. Paragraph 38 of the Consent Decree is modified to read as follows:

38. For each Feature Requiring Excavation placed on the Dig List, including any Feature Requiring Excavation placed on the Dig List pursuant to Subparagraphs 40.a or 40.b, below, Enbridge shall take the following actions:

* * *

7. Paragraph 39 of the Consent Decree is modified to read as follows:

39. * * *

a. In cases where an excavated section of pipe contains a high volume of unreported features, Enbridge need not collect and record field measurements of all features observed in the field, provided that (1) Enbridge obtains and records field measurements of all features that were identified by the ILI, as well as the five worst features not identified by the ILI; (2) Enbridge records the total number of unreported features that are detectible within ILI tool specifications and includes that information in its next Semi-Annual Report; and (3) Enbridge repairs or mitigates the features on such section of pipe by sleeving or replacing such section of pipe, or by grinding or blasting and recoating features on such section of pipe. In the case of unreported Axially-Aligned Crack features and unreported Corrosion features, features with the lowest Predicted Burst Pressures shall be deemed to be the worst features. In the case of unreported Circumferential Crack features, features with the lowest Field Tensile Strain Capacity shall be deemed to be the worst features.

* * *

8. Paragraph 40 of the Consent Decree is modified to read as follows:

40. Within 30 Days after completing excavation of all Features Requiring Excavation identified on a pipeline based on any Initial ILI Report, Enbridge shall complete an analysis of field data obtained during all excavations conducted on such pipeline subsequent to the ILI, including investigative digs pursuant to Paragraph 34.e, above, for the purpose of making two determinations. First, Enbridge must determine whether field data indicate that the ILI tool tended to understate the actual severity of features on the excavated sections of the pipeline ("ILI Tool Depth Bias Study"). Second, if the ILI tool was a High-Resolution Circumferential Crack Detection ILI Tool, and if ten or more of the excavated Circumferential Cracks had a depth that could not be measured by the ILI tool based solely upon the tool's primary ultrasonic signal, and if one of the excavated Circumferential Cracks was found to have a depth greater than 5 mm based upon measurements of the Circumferential Crack taken in the field after the Circumferential Crack was excavated, Enbridge must evaluate the field data from such excavations ("Saturated Data Set") to determine whether it should increase the Assumed Depth used in Appendix A to determine whether Circumferential Cracks with saturated signals should be placed on the Dig List ("Saturated Depth Study"). Enbridge shall conduct the ILI Tool Depth Bias Study in accordance with Subparagraph 40.a, below, and it shall conduct the Saturated Depth Study, if required, in accordance with Subparagraph 40.b, below.

a. *ILI Tool Depth Bias Study:* In performing the analysis, Enbridge shall consider all field data that has sufficient precision and reliability to assess the accuracy of the ILI-reported data. With respect to ILI tools used to detect Axially-Aligned Cracks or Corrosion

features, this determination shall be based on a statistical analysis, described in Paragraphs 40.a.(1) and (2) below, indicating either that (i) field measurements of feature depths on excavated sections of the pipeline exceed ILI-reported feature depths on excavated sections of the pipeline by more than one tool tolerance, or that (ii) burst pressures of Axially-Aligned Cracks or Corrosion features on excavated pipe segments calculated using field measurement values of feature lengths and depths ("Field Burst Pressure") are lower than burst pressures for the same features calculated using the ILI-reported feature length and depth ("ILI Burst Pressure"). Both Field Burst Pressure and ILI Burst Pressure values shall be calculated in accordance with Subsection VII.D.(IV), below, and Appendix B, except that the Field Burst Pressure value for each feature may be calculated using all recorded depth measurements for the feature, rather than using the maximum reported feature depth value and a flaw profile approximation, such as parabolic or rectangular. With respect to ILI tools used to detect Circumferential Crack features, Enbridge shall undertake the statistical analysis described in Paragraph 40.a.(3), below.

(1) If Enbridge uses a statistical analysis of Field Burst Pressure values and ILI Burst Pressure values for Axially-Aligned Crack features or Corrosion features on excavated sections of any pipeline for the determination required in this Paragraph 40.a, and that analysis indicates that Field Burst Pressure values are greater than or equal to ILI Burst Pressure values, ILI-reported values concerning the length and depth of Axially-Aligned Crack features and Corrosion features shall be considered acceptable for purposes of this Paragraph 40.a, and Enbridge shall not be required to adjust any Predicted Burst Pressure values previously calculated in accordance with Subsection VII.D.(IV), below, or any Remaining Life estimates calculated under Subsection VII.D.(VI), below, and Enbridge will not be required to add any

new Axially-Aligned or Corrosion features to the Dig List. Conversely, if the analysis indicates that Field Burst Pressure values are lower than ILI Burst Pressure calculations on such excavated pipeline sections, Enbridge shall (i) revise the calculated burst pressure values previously calculated in accordance with Subsection VII.D.(IV) below, for all remaining unrepaired Axially-Aligned Crack features or Corrosion features on such pipeline, to appropriately account for the reduction in burst pressure values established on the basis of field measurements, and (ii) revise Remaining Life estimates previously calculated in accordance with Subsection VII.D.(VI), below, for all unrepaired Axially-Aligned Crack or Corrosion features on such pipeline to appropriately account for additional information regarding feature depth obtained during excavations. To the extent that the revised burst pressure or Remaining Life calculations indicate that any Axially-Aligned Crack feature or Corrosion features remaining on such pipeline are Features Requiring Excavation, such features shall be added to the Dig List within 5 Days after completing the relevant calculations.

(2) If Enbridge does not undertake a statistical analysis comparing Field Burst Pressure values and ILI Burst pressure values of Axially-Aligned Crack features or Corrosion features on excavated sections of a pipeline pursuant to this Paragraph 40.a, Enbridge must complete a statistical analysis that compares field measurements of feature depth and ILI-reported feature depth on such excavated pipeline sections for the determination that is required by this Paragraph 40.a. Except as provided in Subparagraph 40.a.(1), above, if field measurements of feature depth exceed ILI-reported feature depth values by more than one tool tolerance, Enbridge shall quantify the magnitude of any ILI tool depth bias. Not more than five (5) Days after determining the magnitude of any ILI tool depth bias, Enbridge shall add the ILI tool bias to the ILI-reported depth of all unrepaired features, and complete revised Predicted

Burst Pressure calculations and Remaining Life calculations in accordance with Subsections VII.D.(IV) and VII.D.(VI), below, and determine whether any additional features qualify as Features Requiring Excavation when the revised feature depth values are taken into account. Upon determining that any feature is a Feature Requiring Excavation, Enbridge shall add such feature to the Dig List immediately, but in no event longer than 5 Days after the determination required by this Paragraph 40.a.

(3) Enbridge must complete a statistical analysis that compares field measurements of the depth of Circumferential Crack features with the ILI-reported depths for such features. If such analysis reveals that field measurements of feature depth exceed ILI-reported feature depth values by more than one tool tolerance, Enbridge shall quantify the magnitude of any ILI tool depth bias. Not more than five (5) Days after determining the magnitude of any ILI tool depth bias, Enbridge shall add the ILI tool bias to the ILI-reported depth of all Unrepaired Circumferential Crack Features, and complete revised Tensile Strain Capacity calculations in accordance with Subsection VII.D.(IV), below, and determine whether any additional features qualify as Features Requiring Excavation when the revised feature depth is taken into account. Upon determining that any feature is a Feature Requiring Excavation, Enbridge shall add such feature to the Dig List immediately, but in no event longer than five (5) Days after the determination required by this Paragraph 40.a.(3).

b. *Saturated Depth Study:* Enbridge shall evaluate, using either a t-test or an analysis of variance (ANOVA), whether the Circumferential Crack features in the Saturated Data Set are statistically similar to the statistical distribution of the field data for Circumferential Crack features with saturated signals that were excavated and repaired in Line 6A between 2019

and 2020. If the two populations are statistically different, Enbridge shall undertake the following evaluations:

(1) Based upon Circumferential Crack features in the Saturated Data Set, Enbridge shall compute the distribution curve showing the range of probable depths of all Circumferential Crack features with saturated signals on the newly investigated pipeline or pipeline segment ("Post-Excavation Distribution Curve"). If the depth at the 95th percentile on this curve ("95th Percentile Depth) is greater than 5 mm, Enbridge shall consider whether to increase the Assumed Saturated Depth used in Appendix A to determine whether a Circumferential Crack feature has a Priority Saturated Signal. If Enbridge determines that no increase in the Assumed Saturated Depth is warranted, Enbridge shall document its determination in a report that it shall maintain on file for later review by PHMSA. Conversely, if Enbridge determines that an increase to the Assumed Saturated Depth is appropriate, Enbridge shall select an Assumed Saturated Depth greater than 5 mm ("Updated Assumed Saturated Depth") based upon the Post-Excavation Distribution Curve and other relevant information collected by Enbridge from its operation and maintenance of pipelines in the Lakehead System. In accordance with Paragraph 1.b.v of Appendix A, Enbridge shall apply the Updated Assumed Saturated Depth for the purpose of conducting the Equivalent-Ellipse Analysis required under Paragraph 1.b of Appendix A. Enbridge shall apply this analysis to each Unrepaired Circumferential Crack Feature with a Non-Priority Saturated Signal. Upon determination that any such feature, when evaluated using the Updated Assumed Saturated Depth, now qualifies as a Circumferential Crack feature with a Priority Saturated Signal, Enbridge shall immediately add the feature to the Dig List, but in no event longer than 5 Days after such a determination is made.

(2) If the evaluation in the preceding Subparagraph 40.b.(1) shows that one or more Unrepaired Circumferential Crack Features continue to have a Non-Priority Saturated Signal, Enbridge shall re-calculate the Tensile Strain Capacity and Tensile Strain Demand of all such features in accordance with Paragraph 3.a. of Appendix A. As required under Paragraph 3.a.ii of Appendix A, Enbridge shall conduct this re-calculation using the Updated Assumed Saturated Depth in lieu of the 5 mm depth that Enbridge initially used in calculating Tensile Strain Capacity. If the revised Tensile Strain Capacity of an Unrepaired Circumferential Crack Feature results in the feature meeting the dig selection criteria in Subsection VII.D.(V), below, Enbridge shall immediately place the feature on the Dig List, but in no event longer than 5 Days after such a determination is made.

9. The Heading of Section VII.D.(IV) is modified to read as follows: **Fitness-for-Service**

10. Paragraph 42 of the Consent Decree is modified to read as follows:

42. Except as provided below in this Paragraph 42, Enbridge shall determine the fitness-for-service of all Crack features and Corrosion features identified by ILI tools, in accordance with the requirements of this Subsection VII.D.(IV). Enbridge shall not be required to determine the fitness-for-service of the following features:

* * *

c. any Crack feature with a Saturated Signal or Circumferential Crack feature with a Priority Saturated Signal; provided, however, that all such Crack features shall be excavated and repaired or mitigated in accordance with the dig selection criteria for such features in Subsection VII.D.(V), or

* * *

11. Paragraph 43 of the Consent Decree is modified to read as follows:

43. To determine the fitness-for-service of Axially-Aligned Cracks and Corrosion features, Enbridge shall calculate each feature's Predicted Burst Pressure, which is the lowest pressure in the pipeline at the location of the feature that would be predicted to result in failure of the feature either by leaking or rupturing. To determine the fitness-for-service of Circumferential Crack features, Enbridge shall calculate each feature's Tensile Strain Capacity, which is the lowest predicted axial strain (*i.e.*, strain along the axis of the pipeline) at which the Circumferential Crack is predicted to fail, either by leaking or rupturing. After determining the Tensile Strain Capacity of the Circumferential Crack, Enbridge shall also calculate the Tensile Strain Demand at the location of the Circumferential Crack. The Tensile Strain Demand shall mean the axial strain in the pipeline, resolved to the location of each Circumferential Crack, due to the strain state and loading conditions imposed on the pipeline by internal pressurization and other forces. The procedures for calculating Predicted Burst Pressure, Tensile Strain Capacity, and Tensile Strain Demand are set forth in Appendix B, except that the procedures for calculating the Tensile Strain Capacity and Tensile Strain Demand for Circumferential Crack features with Non-Priority Saturated Signals are set forth in Paragraph 3 of Appendix A.

12. Paragraph 44 of the Consent Decree is modified to read as follows:

44. Following each ILI to assess any pipeline for Crack features or Corrosion features, Enbridge shall complete initial fitness-for-service calculations and initial Remaining Life calculations for all Crack or Corrosion features, as applicable (except as provided in

Paragraph 42) as expeditiously as practicable after completing data quality review of the feature and/or pipeline section where the feature is located, in accordance with Subsection VII.D.(II), above, but in no event later than:

* * *

13. Paragraph 45 of the Consent Decree is modified to read as follows:

Notwithstanding any corporate record retention policy, Enbridge shall maintain electronic records documenting all fitness-for-service calculations, and all Remaining Life calculations, including inputs and the dates on which such calculations were completed with respect to particular features, until five years after Phase 2 Final Termination pursuant to Paragraph 205.(b) of the Consent Decree. Enbridge shall make such records available to the United States upon request.

14. Paragraph 47 of the Consent Decree is modified to read as follows:

47. Dig Selection Criteria and Pressure Restriction Requirements for Crack Features: Enbridge shall excavate and repair or mitigate each Crack feature that meets one (or more) of the dig selection criteria set forth in Table 1, in accordance with the timeframes specified in column 2 of Table 1. Enbridge shall also establish pressure restrictions for such Crack features consistent with applicable requirements and timeframes specified in column 3 of Table 1. The requirements set forth in Table 1 are applicable to Crack features in all sections of pipelines, regardless of whether the feature is located in a High Consequence Area or not. Enbridge shall also excavate and repair or mitigate Crack features that intersect or interact with Corrosion features or Geometric features, and establish appropriate pressure restrictions for such interacting

features, as provided in Table 5 and Paragraphs 58 and 59, below. With respect to a Circumferential Crack that meets the dig selection criteria in Table 1 based upon its fitness-for-service, Enbridge shall follow the procedures set forth in Appendix I to determine whether such a Circumferential Crack is subject to growth and, if so, to determine the Remaining Life of the Circumferential Crack. Enbridge shall make such determination on the same Day that it places such a feature on the Dig List.

15. Paragraph 48 (Table 1) of the Consent Decree is modified to read as follows:

48. * * *

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| Any Crack with a Saturated Signal (other than a Circumferential Crack with a Saturated Signal detected by a High-Resolution Circumferential Crack Detection ILI Tool) | As expeditiously as practicable but not to exceed 30 Days | No later than 2 Days after determination that the feature meets the dig selection criteria, Enbridge shall establish and maintain a pressure restriction that limits operating pressure at the location of the feature to 80% of the highest actual operating pressure at that location during the last 60 Days ("80/60 Interim Pressure Restriction"). |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| Circumferential Crack feature with a Priority Saturated Signal based upon Criteria One in Appendix A | As expeditiously as practicable but not to exceed 90 Days | No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature. |
| Circumferential Crack feature with a Priority Saturated Signal based upon Criteria Two in Appendix A | As expeditiously as practicable but not to exceed 90 Days | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than 270 Days, in which event Enbridge shall establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after its determination that the feature meets dig selection criteria. |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| Axially-Aligned Crack feature with a Predicted Burst Pressure that is less than the Established Maximum Operating pressure ("MOP") | As expeditiously as practicable, but not to exceed 30 Days | No later than 2 Days after determination that the feature meets dig selection criteria, operating pressure at the location of the feature shall be limited to the Predicted Burst Pressure ÷ 1.25 or the highest actual operating pressure at that location over the last 60 Days, whichever is lower. |
| Any Circumferential Crack feature (including those with a Non-Priority Saturated Signal) with a Tensile Strain Capacity less than or equal to 1.05 times the Tensile Strain Demand | Not to exceed 180 Days in all circumstances (*i.e.*, no extension of deadline under Paragraph 49 below). If the feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and the Remaining Life of the Circumferential Crack is less than or equal to 540 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater than 180 Days and establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 540 Days, in which event Enbridge shall establish and maintain an interim pressure restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is placed on the Dig List until date that feature is repaired/mitigated"). Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination that the feature meets dig |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | determination that the feature meets dig selection criteria. Deadline for repair cannot be extended under Paragraph 49, below.<br><br>Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 3. No pressure restriction is required and deadline for repair cannot be extended under Paragraph 49, below.<br><br>Action 3: No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain at the location of the feature an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the feature | selection criteria. |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | within a time period less than the Remaining Life divided by 3. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Paragraph 49, below. | |
| Any Axially-Aligned Crack feature with a depth greater than 70% of the wall thickness **and** Predicted Burst Pressure that is less than the Established MOP | As expeditiously as practicable, but not to exceed 30 Days | No later than 2 Days after determination that the feature meets dig selection criteria, operating pressure at the location of the feature shall be limited to the Predicted Burst Pressure ÷ 1.25 or the highest actual operating pressure at that location over the last 60 Days, whichever is lower. |
| Any Circumferential Crack feature with a depth greater than 70% of the wall thickness | Not to exceed 180 Days, except as provided below in Paragraph 49, for any feature that is stable or has a Remaining Life greater than 360 Days. If the feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions: | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 360 Days, in which event Enbridge shall establish and maintain an interim pressure restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is |

| Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater than 180 Days and establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after determination that the feature meets dig selection criteria. Deadline for repair can be extended under Paragraph 49, below.<br><br>Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Paragraph 49, below.<br><br>Action 3: No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain at the location of the feature an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than | placed on the Dig List until date that feature is repaired/mitigated"). Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination that the feature meets dig selection criteria. |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the feature within a time period less than the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Paragraph 49, below. | |
| Any Axially-Aligned Crack feature with a Predicted Burst Pressure that is less than 1.25 x the Established MOP | Not to exceed 180 Days except as provided below in Paragraph 49, below. | No later than 2 Days after determination that the feature meets dig selection criteria, operating pressure at the location of the feature shall be limited to the Predicted Burst Pressure ÷ 1.25. |
| Any Circumferential Crack feature (including those with a Non-Priority Saturated Signal) with a Tensile Strain Capacity that is less than 1.25 x the Tensile Strain Demand (but greater than 1.05 x the Tensile Strain Demand) | Not to exceed 365 Days for any feature that is stable or has a Remaining Life greater than 730 Days. If the feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 730 Days, Enbridge shall take one of the following actions: | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 730 Days, in which event Enbridge shall establish and maintain an interim pressure |

| Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater than 365 Days and establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after determination that the feature meets dig selection criteria.<br><br>Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 2. No pressure restriction is required.<br><br>Action 3: No later than 2 Days after the determination that the feature meets dig selection criteria, Enbridge shall establish and maintain an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining | restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is placed on the Dig List until date that feature is repaired/mitigated"). Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination that the feature meets dig selection criteria. |

| **Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Life based on the interim pressure restriction and excavate and repair the feature within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 365 Days. | |
| Any Axially-Aligned Crack feature with a Remaining Life (determined in accordance with Subsection VII.D.(VI), below) that is less than 5 years (*i.e.*, a feature that is predicted to grow, within five years (or less), to a point where its Predicted Burst Pressure will be less than the Established MOP) | 365 Days, except that if the Remaining Life of the feature is ≤ 365 Days from the time the feature was added to the Dig List, then repair/mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days | N/A |
| Any Axially-Aligned Crack feature with a Remaining Life that is less than 2x the planned re-inspection interval | 365 Days, except that if the Remaining Life of the feature is ≤ 365 Days from the time the feature was added to the Dig List, then repair/ mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days | N/A |

16. Paragraph 49 of the Consent Decree is modified to read as follows:

49. * * *

c. If it is not practicable, as described in this Paragraph, to meet an applicable 180 Day deadline in Tables 1 through 5 for excavating and repairing or mitigating any Feature Requiring Excavation, Enbridge shall, prior to expiration of the 180-Day period, complete the procedures in Subparagraph 49.c.(1), below, for all such features that are not Circumferential Crack features and complete the procedures in Subparagraph 49.c.(2), below, for all such features that are Circumferential Crack features.

(1) *Procedures for Features Other Than Circumferential Crack Features*: For features other than Circumferential Crack features, Enbridge shall establish and/or maintain appropriate pressure restrictions limiting the maximum operating pressure at the location of each such feature, as provided in this Subparagraph 49.c.(1). The maximum operating pressure at the location of each such feature shall not exceed the following:

(a) In the case of any feature for which a pressure restriction was previously required pursuant to this Subsection VII.D.(V), Enbridge shall limit the maximum allowable operating pressure at the location of the feature as follows:

(i) In the case of Geometric Features listed in Table 4 or 5, Enbridge shall reduce the maximum allowable operating pressure at the location of the feature by an additional 5% below the previously established operating pressure restriction.

(ii) In the case of Axially-Aligned Crack features, Enbridge shall recalculate the Predicted Burst Pressure of each feature, taking into consideration the predicted growth of the feature (in terms of both length and depth) between the time of the ILI and the end of the prescribed 180-Day period for repair or mitigation of such feature, and if

the recalculated Predicted Burst Pressure of any feature is less than 1.25 x the Established MOP at the location of the feature, Enbridge shall limit the maximum allowable operating pressure at the location of the feature to the recalculated Predicted Burst Pressure divided by 1.25.

(iii) In the case of Corrosion features, Enbridge shall recalculate the Predicted Burst Pressure of each feature, taking into consideration the predicted growth of the feature (in terms of both length and depth) between the time of the ILI and the end of the prescribed 180-Day period for repair or mitigation of such feature, and if the recalculated Predicted Burst Pressure of any feature is less than 1.39 x the Established MOP at the location of the feature, Enbridge shall limit the maximum allowable operating pressure at the location of the feature to the recalculated Predicted Burst Pressure divided by 1.39.

(b) In the case of any Axially-Aligned Crack feature or Corrosion feature for which a pressure restriction was not required under this Subsection VII.D.(V), Enbridge shall limit the operating pressure at the location of the feature to the Predicted Burst Pressure of the feature divided by 1.39.

(2) *Procedures for Circumferential Crack Features*: For features that are Circumferential Crack features, Enbridge shall determine the revised schedule for repair or mitigation, as well as establish and/or maintain appropriate pressure restrictions (if required), as provided in this Subparagraph 49.c.(2). Enbridge shall complete the excavation and repair of such Circumferential Crack features as expeditiously as practicable after the applicable 180-Day time period, but in no event shall Enbridge exceed the deadlines applicable to the feature, as set forth in the Subparagraphs 49.c.(2)(a) through (c) below.

(a) If a Circumferential Crack feature is not subject to a pressure restriction because the feature was determined to be stable (*i.e.*, it is not subject to

fatigue crack growth under Paragraph 1 of Appendix I) at the time it was placed on the Dig List, Enbridge may extend the schedule for repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List. No interim pressure restriction is required.

(b) If a Circumferential Crack feature is not subject to a pressure restriction because its Remaining Life was determined to be greater than 360 Days at the time the feature was placed on the Dig List, Enbridge shall recalculate the Remaining Life in accordance with Paragraph 1 of Appendix I to determine the Remaining Life as of the date that marks the end of the initially prescribed 180-Day period for repair or mitigation ("Remaining Life at 180 Days"). If the Remaining Life at 180 Days is greater than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge does not need to establish a pressure restriction for the feature and may extend the schedule for excavation and repair or mitigation to a date within 365 Days from the date the feature was initially placed on the Dig List. If the Remaining Life at 180 days is less than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair and mitigation, Enbridge shall select one of the following actions in Subparagraphs 49.c.(2)(b) (i), (ii), or (iii), below:

(i) First, Enbridge shall establish an 80/60 Interim Pressure Restriction at the location of the feature no later than the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, and, second, Enbridge shall extend the schedule for excavation and repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List.

(ii) From the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall extend the schedule for

excavation and repair or mitigation by no more than the number of days equal to the Remaining Life at 180 Days divided by 2. No pressure restriction is required.

(iii) First, Enbridge shall establish a pressure restriction that is less stringent than an 80/60 Interim Pressure Restriction and do so at the location of the feature no later than the date that marks the end of the initially prescribed 180-Day period for repair or mitigation; second, taking into account the effect of this pressure restriction, Enbridge shall recalculate the Remaining Life at 180 Days following the procedures at Paragraph 1 of Appendix I, and, third, from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall extend the schedule for excavation and repair or mitigation by no more than the number of days equal to the revised Remaining Life at 180 Days divided by 2.

(c) If the feature is already subject to a pressure restriction, Enbridge shall calculate the Remaining Life at 180 Days taking into account the effect of this pressure restriction. If the Remaining Life at 180 Days is greater than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge may extend the schedule for repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List, provided that Enbridge continues to maintain the pressure restriction. If the Remaining Life at 180 Days is less than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall continue to maintain the pressure restriction and may extend the schedule for excavation and repair or mitigation to a date that is no later than the date that marks the end of the initially prescribed 180-Day period for repair or mitigation plus the number of days equal to the Remaining Life at 180 Days divided by 2.

* * *

17. Paragraph 58 of the Consent Decree (as modified by Paragraph 9 of the Fifth Modification of Consent Decree) is modified as follows:

58. * * *

| **Table 5 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types** | | | |
|---|---|---|---|
| **Criterion No.** | **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | | **High Consequence Area ("HCA")** | **Non-HCA** |
| 1 | Any dent located in the top of the pipeline (above the 4 and 8 o'clock positions) that has any indication of metal loss, cracking, or a stress riser. | As expeditiously as practicable, but not to exceed 30 Days | As expeditiously as practicable, but not to exceed 60 Days, for each dent deeper than 2% of the outer diameter of the pipeline; otherwise, excavate and repair within 365 Days |
| 2 | Any dent located at the top of the pipeline (above the 4 and 8 o'clock positions) that has any indication of corrosion and has a strain safety factor less than 2.0, determined in accordance with Appendix G, unless Enbridge demonstrates that the feature satisfies all of the criteria in Paragraph 58.c.(3)(B) of the Consent Decree, above. | As expeditiously as practicable, but not to exceed 30 Days | As expeditiously as practicable but not to exceed 60 Days |
| 3 | Any dent located in the bottom of the pipeline (below the 4 and 8 o'clock positions) that has any indication of metal loss, cracking, or a stress riser. | Not to exceed 60 Days | 180 Days for a dent deeper than 2% of the outer diameter of the pipeline; otherwise, excavate and repair within 365 Days |
| 4 | Any dent located on the bottom of | Not to exceed 60 | Not to exceed 180 |

| Table 5 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | | |
|---|---|---|---|
| **Criterion No.** | **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | | **High Consequence Area ("HCA")** | **Non-HCA** |
| | the pipeline (below the 4 and 8 o'clock positions) that has any indication of corrosion and has a strain safety factor less than 2.0, determined in accordance with Appendix G, unless Enbridge demonstrates that the feature satisfies all of the criteria in Paragraph 58.c.(3)(B) of the Consent Decree, above. | Days | Days |
| 5 | Any case in which an Axially-Aligned Crack feature intersects or interacts with a Corrosion feature and the Predicted Burst Pressure of such interacting or intersecting features determined using the CorLAS™ model (assessed as a Crack-like feature) is less than 1.25 x the established maximum operating pressure. | Not to exceed 180 Days, except as provided in Paragraph 49 of the Consent Decree | Not to exceed 180 Days except as provided in Paragraph 49 of the Consent Decree |
| 6 | Any intersecting or interacting Axially-Aligned Crack/Corrosion feature with a Remaining Life (determined in accordance with Subsection VII.D.(VI), below) that is less than 5 years (*i.e.*, a feature that is predicted to grow, within five years or less, to a point where its Predicted Burst Pressure will be less than the Established MOP). | 365 Days, except that if the Remaining Life of the feature is $\leq$ 365 Days from the time the feature was added to the Dig List, then repair/mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days | 365 Days, except that if the Remaining Life of the feature is $\leq$ 365 Days from the time the feature was added to the Dig List, then repair/mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days |
| 7 | Any intersecting or interacting Axially-Aligned Crack/Corrosion feature with a Remaining Life that is less than 2 x the planned re- | 365 Days, except that if the Remaining Life of the feature is $\leq$ 365 Days from the time | 365 Days, except that if the Remaining Life of the feature is $\leq$ 365 Days from the time |

| Table 5 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | | |
|---|---|---|---|
| **Criterion No.** | **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | | **High Consequence Area ("HCA")** | **Non-HCA** |
| | inspection interval. | the feature was added to the Dig List, then repair/mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days | the feature was added to the Dig List, then repair/mitigation shall be as expeditiously as practicable, and in no event longer than 30 Days |
| 8 | Any case in which a Circumferential Crack feature (including those with a Non-Priority Saturated Signal) intersects or interacts with a Corrosion feature and the Tensile Strain Capacity of such interacting or intersecting features is less than 1.25 x the Tensile Strain Demand of the features. | Not to exceed 180 Days, except as provided in Paragraph 49 of the Consent Decree, for any interacting or intersecting features where the Circumferential Crack is stable or has a Remaining Life greater than 360 Days. If the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the features within a period no greater than 180 Days | Not to exceed 180 Days, except as provided in Paragraph 49 of the Consent Decree, for any interacting or intersecting features where the Circumferential Crack is stable or has a Remaining Life greater than 360 Days. If the Circumferential Crack feature is subject to fatigue crack growth (as determined in Appendix I at Paragraph 1) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the features within a period no greater than 180 Days |

| Table 5 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | | |
|---|---|---|---|
| **Criterion No.** | **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | | **High Consequence Area ("HCA")** | **Non-HCA** |
| | | and establish an 80/60 Interim Pressure Restriction at the location of the intersecting or interacting features no later than 2 Days after the determination that such features meet dig selection criteria. Deadline for repair can be extended under Paragraph 49.<br><br>Action 2: Enbridge shall excavate and repair the features within a time period less than the Remaining Life of the Circumferential Crack feature divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Paragraph 49.<br><br>Action 3: No later than 2 Days after the determination that the features meet dig selection criteria, Enbridge shall establish an interim pressure restriction at the location of such | and establish an 80/60 Interim Pressure Restriction at the location of the intersecting or interacting features no later than 2 Days after the determination that such features meet dig selection criteria. Deadline for repair can be extended under Paragraph 49.<br><br>Action 2: Enbridge shall excavate and repair the features within a time period less than the Remaining Life of the Circumferential Crack feature divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Paragraph 49.<br><br>Action 3: No later than 2 Days after the determination that the features meet dig selection criteria, Enbridge shall establish an interim pressure restriction at the location of such |

| Table 5 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | | |
|---|---|---|---|
| **Criterion No.** | **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | | **High Consequence Area ("HCA")** | **Non-HCA** |
| | | features that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the features within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Paragraph 49. | features that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the features within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Paragraph 49. |

18. Paragraph 59 of the Consent Decree (as modified by Paragraph 10 of the Fifth Modification of Consent Decree) is modified to read as follows:

59. * * *

a. Within 2 Days after determining that any unmitigated intersecting or interacting Axially-Aligned Crack/Corrosion feature has a Predicted Burst Pressure that is less than 1.25 times the Established MOP, Enbridge shall limit operating pressure at the location of the feature

to not more than 80% of the Predicted Burst Pressure. Within 2 Days after determining that any Circumferential Crack feature (including those with a Non-Priority Saturated Signal) intersects or interacts with a Corrosion feature and the Tensile Strain Capacity of such interacting or intersecting features is less than 1.25 x the Tensile Strain Demand of the features, Enbridge shall limit operating pressure at the location of the feature in accordance with Row 8 of Table 5, above.

* * *

19. Paragraph 60 of the Consent Decree is modified to read as follows:

60. Following each ILI to evaluate Axially-Aligned Crack features and each ILI Tool Run to evaluate Corrosion features on any pipeline, Enbridge shall determine the Remaining Life of each detected Axially-Aligned Crack feature and Corrosion feature that does not meet any of the dig selection criteria in Subsection VII.D.(V) (other than dig selection criteria based on Remaining Life of the feature), except as provided below in Paragraph 61. For purposes of this Consent Decree, the Remaining Life of any Axially-Aligned Crack feature or Corrosion feature refers to the time period required for the feature to grow to the point where the Predicted Burst Pressure of the feature is less than or equal to the Established MOP, as determined in accordance with this Subsection.

20. Paragraph 61 of the Consent Decree (as modified by Paragraph 11 of the Fifth Modification of Consent Decree) is modified to read as follows:

61. With respect to Axially-Aligned Crack features and Corrosion features, Enbridge shall not be required to calculate the Remaining Life of:

a. any feature described in Subparagraphs 42.a - d of the Consent Decree; provided, however, that in any case where Enbridge is not required to repair or permanently mitigate any intersecting dent-and-Corrosion feature based on an evaluation conducted pursuant to Appendix G or Appendix H, Enbridge shall calculate the Remaining Life of such Corrosion feature in accordance with this Section VII.D.(VI) of the Consent Decree;

b. any feature that is placed on the Dig List, provided that Enbridge completes excavation and repair or mitigation of the feature in accordance with the timeframes specified in this Subsection VII.D.(V), or

c. any feature that is stable (*i.e.*, has not grown since the last ILI), provided that the frequency and magnitude of pressure cycles in the pipeline segment where the feature is located are not significantly different than the frequency and magnitude of pressure cycles in such pipeline segment at the time of the prior ILI.

21. Paragraph 62 of the Consent Decree is modified to read as follows:

62. Enbridge shall determine the Remaining Life of each Axially-Aligned Crack feature, using representative values of actual operating parameters of the pipeline or pipeline segment, as applicable, including the number and magnitude of pressure cycles.

* * *

b. If Enbridge increases the operating pressure limit in any segment of a Lakehead System Pipeline after determining the Remaining Life of Axially-Aligned Crack features in accordance with this Paragraph, Enbridge shall recalculate the Remaining Life of the unrepaired Axially-Aligned Crack features remaining in such line segment.

22. Paragraph 63 of the Consent Decree is modified to read as follows:

63. Enbridge shall calculate the Remaining Life of each Axially-Aligned Crack feature using either a fatigue crack growth model or an SCC crack growth model, whichever yields the fastest projected growth rate and the shortest Remaining Life.

23. Paragraph 65 of the Consent Decree is modified to read as follows:

65. For each pipeline, the maximum interval between successive ILIs to assess Axially-Aligned Cracks shall not exceed one-half of the shortest Remaining Life of any unrepaired Axially-Aligned Crack feature in the pipeline, calculated as provided above. For each pipeline, the maximum interval between successive ILIs to assess Corrosion features shall not exceed one-half of the shortest Remaining Life of any unrepaired Corrosion feature in the pipeline, calculated as provided above in this Subsection VII.D.(VI).

24. Paragraph 66 of the Consent Decree is modified to read as follows:

66. Notwithstanding any other provisions in the Consent Decree, the maximum interval between successive ILIs for Axially-Aligned Crack, Corrosion, or Geometric features on each pipeline in the Lakehead System shall not exceed 5 years, except as provided below in this Paragraph 66. Until Original Line 3 is taken out of service and depressurized as provided in Paragraph 22.a, Enbridge shall complete ILIs for each feature type on an annual basis except that Enbridge need not conduct ILIs during the final 12 months that Original Line 3 is in operation.

25. Paragraph 125 of the Consent Decree is modified as follows:

125. Enbridge will retain, at its expense, an Independent Third Party to conduct a comprehensive verification of Enbridge's compliance with the requirements set forth in this Section VII (Injunctive Measures) of the Consent Decree, except the Independent Third Party shall not be responsible for assessing (a) Enbridge's compliance with requirements in Subsection VII.H (Spill Response and Preparedness), or (b) Enbridge's compliance with Circumferential Crack requirements exempted from Phase 1 Final Termination pursuant to Paragraph 205.(a).(1) and subject to Phase 2 Final Termination pursuant to Paragraph 205.(b). In addition, the Independent Third Party shall, at Enbridge's expense, perform the tasks set forth in this Section VII.J.

26. Paragraph 203 of the Consent Decree (as modified by Paragraph 8 of the Seventh Modification of Consent Decree) is modified as follows:

203. No sooner than four years after the Effective Date of the Consent Decree, Enbridge may serve upon the United States a written request for either Partial Termination or Final Termination of Defendant's obligations under the Consent Decree, provided that any such request meets all applicable requirements set forth below in Section XX ("Termination") of the Consent Decree. As set forth in Paragraph 205, below, Final Termination shall proceed in two phases. In Phase 1, Enbridge may seek termination of the Consent Decree except for (a) obligations set forth in Paragraph 29.b and Appendix J relating to the Line 4 Direct Assessment Program and (b) obligations set forth in Paragraphs 37.f and 37.g relating to Circumferential Crack features in Lines 5, 6A, and 10 ("Circumferential Crack Look-back Assessment Program"). In Phase 2, Enbridge may seek termination of the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program.

27. Paragraph 205 of the Consent Decree is modified to read as follows:

205. Final Termination. Subject to Paragraph 203, Enbridge may submit a request for Final Termination of the Consent Decree in two phases in accordance with Subparagraphs 205.a (Phase 1) and 205.b (Phase 2), below.

a. *Phase 1 – Final termination of obligations other than those relating to the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program*: Enbridge may seek termination of all obligations under the Consent Decree, other than obligations relating to the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program, once it has (a) implemented certain requirements relating to Circumferential Crack features set forth in Subparagraph 205.a.(1), below, (b) fully implemented all other requirements of the Consent Decree that do not relate to Circumferential Crack features ("Non-CC Requirements"), and (c) maintained substantial compliance for at least the last 12 continuous months with respect to all Non-CC Requirements that have not previously terminated under Paragraph 204 (Partial Termination). For purposes of the preceding sentence, Enbridge shall be deemed to have fully implemented any continuing obligations with respect to Non-CC Requirements under Subpart VII.D of the Consent Decree if, as of the date of the request for Phase 1 Final Termination, Enbridge is current and up to date with respect to all such obligations. Any request for Phase 1 Final Termination shall include a Phase 1 Final Termination Report that includes all of the information described below in Subparagraph 205.a.(2) of this Consent Decree.

(1). *Certain Obligations that Enbridge Must Perform with respect to Circumferential Crack Features before Requesting Phase 1 Final Termination*: Before it can

request Phase 1 Final Termination, Enbridge shall implement some (but not all) of the requirements set forth in Section VII.D ("ILI-Based Spill Prevention Program") relating to Circumferential Crack features. Specifically, those obligations that Enbridge shall have completed in advance of requesting Phase 1 Final Terminations are as follows:

(a). *Modification of Manual of Written Procedures*: Enbridge shall have modified its manual of written procedures in accordance with Paragraph 29.c, above, to incorporate those requirements of the ILI-Based Spill Prevention Program that relate to the investigation, assessment, and (if required) repair and mitigation of Circumferential Crack features in certain Lakehead System Pipelines.

(b). *Actions Relating to Circumferential Crack Look-back Assessment Program*: Enbridge shall have undertaken and completed some (but not all) of the requirements set forth in Paragraphs 37.f and g with respect to the re-assessment of Circumferential Crack features in Lines 5, 6A, and 10. Specifically, Enbridge shall have (i) retained an individual who meets the qualifications set forth in Paragraph 37.g.(3) (TPC Qualifications) for conducting an audit of the Circumferential Crack Look-back Assessment that Enbridge shall perform under Paragraph 37.f, and (ii) prepared and executed a written agreement that meets the requirements in Paragraph 37.g.(2) (Retention of Third-Party Consultant) with respect to the TPC Retention Agreement.

(2) *Phase 1 Final Termination Report*. The Phase 1 Final Termination Report shall include the following information:

(a) documentation that Enbridge has paid all civil penalties required under Section V of this Consent Decree, together with any interest due thereon, unless Enbridge previously provided such documentation in a Partial Termination Report;

(b) documentation that Enbridge has paid all stipulated penalties demanded by the United States pursuant to Paragraph 167 of the Consent Decree with respect to obligations that have not previously been terminated in accordance with Paragraph 204, together with any interest due thereon, except to the extent that such penalties have been successfully contested by Enbridge;

(c) documentation that Enbridge has paid all recoverable removal costs and damages (other than natural resource damages) that the United States has incurred and paid with respect to the Line 6B Discharges, unless Enbridge previously provided such documentation in a Partial Termination Report;

(d) documentation, which may incorporate by reference prior Semi-Annual Reports, that Enbridge has implemented all Non-CC Requirements that have not previously been terminated in accordance with Paragraph 204 of this Consent Decree and maintained substantial compliance with such obligations for at least the last 12 continuous months. With regard to implementation of obligations that relate to ongoing Non-CC Requirements, the Phase 1 Final Termination Report must document that Enbridge's implementation of all such obligations is current and up-to-date as of the date of submission of the request for Phase 1 Final Termination, and the Phase 1 Final Termination Report must include a certification that such obligations will continue to be implemented in compliance with the Consent Decree until Phase 1 Final Termination is effective;

(e) a summary of all instances during the 12-month period prior to submission of the request for Phase 1 Final Termination and Phase 1 Final Termination Report (including instances that occurred subsequent to the last Semi-Annual Report submitted pursuant to Paragraph 143 of the Consent Decree) in which Enbridge did not fully comply with

any Non-CC Requirement (including any schedules set forth pursuant to or established pursuant to this Consent Decree) not previously terminated in accordance with Paragraph 204 of the Consent Decree, and a description of any resolution of each such non-compliance, including any payment of stipulated penalties;

(f) documentation that Enbridge has fully and timely implemented the requirements relating to Circumferential Crack features that Enbridge must implement under Paragraph 205.a.(1) before it can request Phase 1 Final Termination; and

(g) a certification that there are no unresolved assertions of Force Majeure under Section XII or Dispute Resolution proceedings under Section XIII, relating to any obligations that are subject to Phase 1 Final Termination.

(3) Following submission of a request for Phase 1 Final Termination and Phase 1 Final Termination Report, Enbridge remains responsible for implementation of all obligations set forth in the Consent Decree until the Phase 1 Final Termination is approved in accordance with Subparagraph 205.a.(4), below. If Enbridge becomes aware of any instance following submission of the Phase 1 Termination Report in which Enbridge did not implement or fully comply with one or more obligations subject to Phase 1 Final Termination, Enbridge shall notify the United States in writing within 7 Days and provide a written description of the circumstances. Until the United States reaches a decision under Subparagraph 205.c, below, with respect to the request for Phase 1 Final Termination, Enbridge shall submit Supplemental Phase 1 Final Termination Reports every 90 Days that update the information described in Subparagraphs 205.a.(2)(d) through (f) with respect to the period following submission of the Phase 1 Final Termination Report. Notwithstanding any other provisions of Subsection VII.J of this Consent Decree, the Independent Third Party's evaluation of the request for Phase 1 Final

Termination and Phase 1 Final Termination Report shall be based upon, and limited to, evaluation of Enbridge's implementation of, and compliance with, relevant provisions of the Consent Decree during the period prior to the date of submission of the Phase 1 Final Termination Report; provided, however, that in the event Enbridge is required to submit a Supplemental Phase 1 Final Termination Report in accordance with Subparagraph 205.a.(2), the Independent Third Party's evaluation of the request for Phase 1 Final Termination shall also include consideration of Enbridge's implementation of, and compliance with, relevant provisions of the Consent Decree during the period prior to the date of submission of the Supplemental Phase 1 Final Termination Report. Nothing in this Subparagraph 205.a.(3) shall be construed to limit the temporal scope of the Independent Third Party's Task 3 compliance evaluations in the event that a request for Phase 1 Final Termination is denied.

(4) Following receipt by the United States of Defendants' request for Phase 1 Final Termination and Phase 1 Final Termination Report, the Parties shall confer informally concerning such request and any disagreement that the Parties may have as to whether Defendants have satisfactorily complied with the requirements for termination of obligations under this Consent Decree.

(a) If the United States agrees that Defendants' obligations (other than those obligations relating to the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program) may be terminated, the Parties shall file a joint stipulation terminating all remaining obligations under the Consent Decree, except as provided in Paragraph 206 of the Consent Decree and except for the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program. The Parties agree, and the Court hereby orders, that the Phase 1 Final Termination shall take effect upon the filing of

the joint stipulation, without the need for further action by the Court.

(b) If the United States does not agree that Defendants' remaining obligations under the Decree (other than those obligations relating to the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program) may be terminated, Enbridge may invoke Dispute Resolution under Section XIII of the Consent Decree. However, Enbridge shall not seek Dispute Resolution of any dispute regarding termination until: (i) 120 Days after service of its request for Phase 1 Final Termination; or (ii) 30 Days after the United States informs Enbridge that the United States will not approve the Phase 1 Final Termination (whichever date is earlier).

b. *Phase 2 – Final Termination of the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program*: Enbridge may seek, in writing, Phase 2 Final Termination of the Consent Decree after it has implemented the Line 4 Direct Assessment Program and the Circumferential Crack Look-back Assessment Program. Specifically, with respect to the Line 4 Direct Assessment Program, Enbridge's written request shall document that Enbridge has (1) implemented Paragraph 29.b of the Consent Decree, which requires Enbridge to undertake and complete the direct assessment program set forth in Appendix J (Direct Assessment Program of Circumferential Cracks in Dual-Seam Joints in Line 4) and, by no later than April 30, 2025, demonstrated the safety case required under that program, and (2) submitted to the United States the report required under Subparagraph C.2 of Appendix J. Likewise, with respect to the Circumferential Crack Look-Back Assessment Program, Enbridge's written request shall document that Enbridge has (1) implemented the requirements of Paragraphs 37.f and g of the Consent Decree and (2) submitted, or caused to be submitted, to EPA all of the reports set forth in Paragraph 37.g, relating to the audit of the

Circumferential Crack Look-back Assessment conducted by the TPC and the excavation of Joint 100360 on the Superior to Adams segment of Line 6A. Following receipt by the United States of Enbridge's request for Phase 2 Final Termination, the Parties shall confer informally concerning such request and any disagreement that the Parties may have as to whether Defendants have satisfactorily complied with the requirements for termination of obligations under this Consent Decree.

(1) If the United States agrees that Defendants have complied with the requirements in Paragraph 29.b. and Appendix J relating to the Line 4 Direct Assessment Program as well as complied with the requirements in Paragraphs 37.f and g relating the Circumferential Crack Look-back Assessment Program, the United States shall file a notice of this determination with the Court. The Parties agree, and the Court hereby orders, that the termination of the Line 4 Direct Assessment Program and the termination of the Circumferential Crack Look-back Assessment Program shall take effect upon the filing of the notice, without the need for further action by the Court. Such termination as provided herein shall constitute the Phase 2 Final Termination of the Consent Decree but it shall do so only after Phase 1 Termination has been completed.

(2) If the United States does not agree that Defendants have met the safety case in Appendix J, the Parties may proceed as follows:

(a) The United States may exercise its rights under Paragraph E.2 of Appendix J to move for the Court to enforce (i) the requirement in Paragraph 28 of the Consent Decree to complete a valid ILI of the unexcavated portions of the Dual-Seam Joints on Line 4 using a tool that is the most appropriate for accurately detecting, characterizing, and sizing Circumferential Crack features, and (ii) other requirements in Section VII.D of the

Consent Decree, as amended, to repair and mitigate all Circumferential Cracks in the Dual-Seam Joints in Line 4 that meet the dig selection criteria in Tables 1 and 5. In such an event, Enbridge reserves all arguments to oppose the United States' motion, including but not limited to, the contention that the original Consent Decree, approved by the Court in May of 2017, did not require Enbridge to deploy ILI tools to investigate Circumferential Crack features in the Lakehead System. Notwithstanding the previous sentence, Enbridge may not oppose the United States' motion on the grounds that the Phase 1 Final Termination had the effect of precluding the United States from seeking enforcement of the requirements in Section VII.D of the Consent Decree, as amended, with respect to Circumferential Crack features in Line 4.

(b) Enbridge may invoke Dispute Resolution under Section XIII of the Consent Decree with respect to the Line 4 Direct Assessment Program. However, Enbridge shall not seek Dispute Resolution of any dispute regarding such program until: (i) 90 Days after service of its report under Subparagraph C.2 of Appendix J; or (ii) 30 Days after the United States informs Enbridge that the United States will not file a notice stating that the Defendants have met the safety case in Appendix J (whichever date is earlier). In such an event, Enbridge reserves all arguments, including but not limited to, the contention that the original Consent Decree, approved by the Court in May of 2017, did not require Enbridge to deploy ILI tools to investigate Circumferential Crack features in the Lakehead System.

(3) If the United States does not agree that Defendants have complied with the requirements in Paragraphs 37.f and g relating to the Circumferential Crack Look-back Assessment Program, Enbridge may invoke Dispute Resolution under Section XIII of the Consent Decree. However, Enbridge shall not seek Dispute Resolution of any dispute regarding termination of the Circumferential Crack Look-back Assessment Program until: (i) 120 Days

after service of their request for Phase 2 Final Termination; or (ii) 30 Days after the United States informs Enbridge that the United States will not approve Phase 2 Final Termination with respect to the Circumferential Crack Look-back Assessment Program (whichever date is earlier).

28. In addition to modifying the Consent Decree to include three the new appendices (i.e., Appendices I, J, and K) that are attached to this Eighth Modification of the Consent Decree, Paragraph 212 of the Consent Decree is modified to add the following text at the end of the existing language:

"Appendix I" sets forth the procedures for determining the Remaining Life of Circumferential Cracks added to the Dig List;

"Appendix J" sets forth the Direct Assessment Program of Circumferential Cracks in Dual-Seam Joints in Line 4 criteria; and

"Appendix K" set forth the integrity management plan for Circumferential Crack features, which Enbridge shall include in the manual of written procedures for the Lakehead System that Enbridge is required to prepare and maintain under 49 C.F.R. §195.402.

29. Appendix A (as modified by Fifth Modifications of the Consent Decree) is modified and replaced by the version of Appendix A attached to this Eighth Modification of the Consent Decree.

30. Appendix B of the Consent Decree is modified and replaced by the version of Appendix B attached to this Eighth Modification of the Consent Decree.

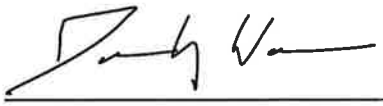
31. Public Comment. This Eighth Modification of Consent Decree will be lodged with the Court for a period of not less than 30 days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw from or withhold its consent if the comments regarding this Eighth Modification of Consent Decree disclose facts or considerations indicating that the Eighth Modification of Consent Decree is inappropriate, improper, or inadequate. Enbridge consents to the entry of this Eighth Modification of Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Eighth Modification of Consent Decree by the Court or challenge any provision of the Eighth Modification of Consent Decree, unless the United States has notified Enbridge in writing that it no longer supports entry of the Eighth Modification of Consent Decree.

32. Effective date. The effective date of this Eighth Modification of Consent Decree shall be the date upon which the Eighth Modification of Consent Decree is entered by the Court following notice and comment in accordance with Paragraph 26 of this Eighth Modification of Consent Decree or a motion to enter the Eighth Modification of Consent Decree is granted, whichever occurs first, as recorded in the Court's docket.

THE UNDERSIGNED PARTY enters into this Eighth Modification of Consent Decree in *United States v. Enbridge Energy, Limited Partnership, et al.*, Civil Action No. 1:16-cv-914 (W.D. MI).

FOR PLAINTIFF UNITED STATES OF AMERICA:

TODD KIM
Assistant Attorney General
Environment and Natural Resources Division



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THE UNDERSIGNED PARTY enters into this Eighth Modification of Consent Decree in *United States v. Enbridge Energy, Limited Partnership, et al.*, Civil Action No. 1:16-cv-914 (W.D. MI).

FOR PLAINTIFF UNITED STATES OF AMERICA (CONTINUED):

ROBERT KAPLAN

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ROBERT A. KAPLAN
Regional Counsel
U.S. Environmental Protection Agency, Region 5
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Russo, Matthew

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CATHERINE CERVI
MATTHEW RUSSO
Associate Regional Counsel
U.S. Environmental Protection Agency, Region 5
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THE UNDERSIGNED PARTY enters into this Eighth Modification of Consent Decree in *United States v. Enbridge Energy, Limited Partnership, et al.*, Civil Action No. 1:16-cv-914 (W.D. MI).

FOR PLAINTIFF UNITED STATES OF AMERICA (CONTINUED):

CATHLEEN TIERNEY

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CATHLEEN G. TIERNEY
Acting Director
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency

THE UNDERSIGNED PARTY enters into and agrees to be bound by this Eighth Modification of Consent Decree in *United States v. Enbridge Energy, Limited Partnership, et al.,* Civil Action No. 1:16-cv-914 (W.D. MI).

FOR DEFENDANTS:

ENBRIDGE ENERGY, LIMITED PARTNERSHIP,
ENBRIDGE PIPELINES (LAKEHEAD) L.L.C.,
ENBRIDGE ENERGY PARTNERS, L.P.,
ENBRIDGE ENERGY MANAGEMENT, L.L.C.,
ENBRIDGE ENERGY COMPANY, INC., and
ENBRIDGE EMPLOYEE SERVICES, INC.

Kevin Ruffatto

KEVIN RUFFATTO, Vice President U.S. Operations, Liquids Pipelines

THE UNDERSIGNED PARTY enters into and agrees to be bound by this Eighth Modification of Consent Decree in *United States v. Enbridge Energy, Limited Partnership, et al.,* Civil Action No. 1:16-cv-914 (W.D. MI).

FOR DEFENDANTS:

ENBRIDGE OPERATIONAL SERVICES, INC.,
ENBRIDGE PIPELINES INC., and
ENBRIDGE EMPLOYEE SERVICES CANADA INC.

COLIN GRUENDING, Executive Vice President and President, Liquids Pipelines

THIS EIGHTH MODIFICATION OF CONSENT DECREE IS HEREBY APPROVED AND ENTERED this _____ day of _____, 2024.

_____
ROBERT J. JONKER
UNITED STATES DISTRICT JUDGE

# APPENDIX A

## Appendix A

| Technology | Priority Feature Notification Criteria |
|---|---|
| Line Proving & Geometry | 1. Ovalities ≥ 10 % OD.<br>2. Dents and Geometric features (other than ovalities) ≥ 5% OD.<br>3. Priority notification criteria specifically identified in the project work order; provided that such criteria are not less stringent than the criteria listed above. |
| Corrosion Ultrasonics & Magnetic Flux Leakage | 1. Metal loss features with peak depths ≥ 75% of Nominal Wall Thickness ("NWT").<br>2. Metal loss feature with an effective area RPR ≤ 0.85.<br>3. Metal loss features forecasted to reach maximum depth ≥ 75%. NWT or actual wall thickness within 365 calendar days.<br>4. Unmatched metal loss features with a depth ≥ 50% NWT.<br>5. Unmatched metal loss features with a depth ≥50% actual wall thickness.<br>6. Priority notification criteria specifically identified in the project work order; provided that such criteria are not less stringent than the criteria listed above. |
| Crack Ultrasonics | 1. Crack features that meet or exceed the saturation limit of the crack detection tool ("Crack with Saturated Signal"), unless the Crack feature is a Circumferential Crack that exceeds the saturation limit of a High-Resolution Circumferential Crack Detection ILI Tool ("HRCCD ILI Tool"), in which event the Circumferential Crack shall qualify as a Priority Feature only if it has a "Priority Saturated Signal," as defined below in this Appendix A.<br>2. Crack features ≥ 2.5 mm (0.098 inch) and have been detected on the internal and external pipe surface at the same location.<br>3. Priority notification criteria specifically identified in the project work order. |

**Circumferential Cracks with Saturated Signals Detected by HRCCD ILI Tool**

If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI tool, Enbridge shall, if possible, determine the depth of the Circumferential Crack relying upon secondary signals reflected by the Circumferential Crack. If Enbridge determines the depth of the Circumferential Crack from its secondary signals, Enbridge shall determine the Tensile Strain Capacity and Tensile Strain Demand of the Circumferential Crack in accordance with Paragraph B of Appendix B. Otherwise, if Enbridge is unable to determine the depth of the Circumferential Crack, Enbridge shall determine whether the primary saturated signal is either a "Priority Saturated Signal" or a "Non-Priority Saturated Signal," as defined in Paragraphs 1 and 2, below. If the primary saturated signal is a "Priority" Saturated Signal, Enbridge shall add the

Circumferential Crack to the Dig List in accordance with Paragraph 48 (Table 1) of the Consent Decree. If the primary saturated signal is a "Non-Priority" Saturated Signal, Enbridge shall determine the Tensile Strain Capacity and Tensile Strain Demand of Circumferential Crack in accordance with Paragraph 3, below, and, if required, add the Circumferential Crack to the Dig List in accordance with Paragraph 48 (Table 1) of the Consent Decree.

1. Priority Saturated Signal: If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI Tool, such signal shall be a Priority Saturated Signal when either of the following criteria are met:

    a. *Criteria One*: Ten or more adjacent sensors are saturated by the ultrasonic signal reflected from the Circumferential Crack.

    b. *Criteria Two*. (1) Two or more adjacent sensors are saturated by the primary ultrasonic signal reflected from the Circumferential Crack, and (2) the estimated depth of the Circumferential Crack is greater than 70% of the wall thickness of the pipe Joint containing the feature. For the purpose of applying this criteria, the following definitions shall apply:

        i. *Wall Thickness of the Pipe Joint*: The phrase "wall thickness of the pipe Joint containing the feature" shall mean the wall thickness of the Joint as determined in accordance with the "General Rule" for determining the wall thickness set forth at Paragraph A.4.a of Appendix B.

        ii. *Estimated Depth of the Crack:* The phrase "estimated depth of the Circumferential Crack" shall be equal to the maximum depth of the equivalent ellipse selected from the two equivalent ellipses computed in accordance with Subparagraph 1.b.iii, below.

        iii. *Equivalent-Ellipse Analysis:* Enbridge shall compute two semi-ellipses – each with a Tensile Strain Capacity equivalent to the Tensile Strain Capacity of the Circumferential Crack based upon its Crack Profile and its Assumed Saturated Depth, as defined below. One equivalent ellipse shall reflect the lowest achievable Tensile Strain Capacity yielded by an analysis that assumes the failure mode of the Circumferential Crack is brittle fracture. The other equivalent ellipse shall reflect the lowest achievable Tensile Strain Capacity yielded by an analysis that assumes the failure mode of the Circumferential Crack is net-section collapse. Enbridge shall compute each equivalent ellipse in accordance with the procedures described by JA Beavers in *Integrity and Remaining Life of Pipe with Stress Corrosion Cracking*, PR-188-9709 (PRCI, 2001) and SJ Polasik in *Review of Engineering Fracture Mechanics Model for Pipeline Applications*, IPC2016-64605 (Calgary 2016). Upon computing the two equivalent ellipses, Enbridge shall select the deepest of the two equivalent

ellipses and use the maximum depth of this ellipse as the "estimated depth of the Circumferential Crack" for the purpose of Subparagraph 1.b.

iv. *Crack Profile*: The term "Crack Profile" shall mean the shape of the Circumferential Crack in depth and length as measured by the HRCCD ILI Tool.

v. *Assumed Saturated Depth:* The term "Assumed Saturated Depth" shall mean the estimated depth for the portion of Circumferential Crack profile that generates a saturated signal. For the purpose of determining whether the Circumferential Crack should be placed on the Dig List within the time frames specified in the table at Paragraph 37 of the Consent Decree, Enbridge shall use an Assumed Saturated Depth of 5 mm. Later, if Enbridge should determine that an increase in the Assumed Saturated Depth is warranted under Paragraph 40.b.(1) of the Consent Decree, Enbridge shall use the Updated Assumed Saturated Depth (as defined in Paragraph 40.b.(1) of the Consent Decree) to evaluate whether any unexcavated Circumferential Cracks should be added to the Dig List.

2. Non-Priority Saturated Signal: If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI Tool, such signal shall be a Non-Priority Saturated Signal when it meets neither the criteria in Subparagraph 1.a, above, nor the criteria in Subparagraph 1.b, above.

3. Tensile Strain Capacity and Tensile Strain Demand of Circumferential Crack with a Non-Priority Saturated Signal: For each Circumferential Crack with a Non-Priority Saturated Signal, Enbridge shall determine the feature's Tensile Strain Capacity and Tensile Strain Demand in accordance Subparagraphs 3.a and 3.b, below.

a. *Tensile Strain Capacity*: Enbridge shall determine the Circumferential Crack's Tensile Strain Capacity through a three-step process. First, Enbridge shall compute two semi-ellipses following the same Equivalent-Ellipse Analysis set forth, above, in Subparagraph 1.b.iii, except, in computing the ellipses, Enbridge shall use the modified Crack Profile described below in Subparagraph 3.a.i and use the modified Assumed Saturated Depth described below in Subparagraph 3.a.ii. Second, upon computing the two semi-ellipses, Enbridge shall calculate the Tensile Strain Capacity of each semi-ellipse using the procedures set forth in Paragraph B.1.b of Appendix B, except that the length and depth input for each calculation should be equal to the length and depth of the applicable equivalent ellipse. Third, after calculating the two Tensile Strain Capacity values, Enbridge shall select the lowest value as the Tensile Strain Capacity of the Circumferential Crack with the Non-Priority Saturated Signal.

i. *Modified Crack Profile*: Enbridge shall determine tool tolerance of the HRCCD ILI Tool and add this tool tolerance to the portions of the Crack Profile where the HRCCD ILI Tool was able to measure the depth of the Circumferential Crack.

ii. *Modified Assumed Saturated Depth*: For the purposes of determining whether the Circumferential Crack should be placed on the Dig List within the time periods required in the table at Paragraph 37 of the Consent Decree, Enbridge shall initially use an Assumed Saturated Depth of 5 mm, plus the tool tolerance of the HRCCD ILI Tool. Later, if Enbridge should determine that an increase in the Assumed Saturated Depth is warranted under Paragraph 40.b.(1) of the Consent Decree, Enbridge shall use the Updated Assumed Saturated Depth (as defined in Paragraph 40.b.(1) of the Consent Decree), plus a tool tolerance of the HRCCD ILI Tool, to evaluate whether any unexcavated Circumferential Cracks should be added to the Dig List.

b. *Tensile Strain Demand:* Enbridge shall calculate the Tensile Strain Demand of the Circumferential Crack using the procedures set forth in Paragraph B.1.c of Appendix B.

# APPENDIX B

## Appendix B

## Fitness-for-Service Calculations

**A. Calculation of ILI Predicted Burst Pressure for Axially-Aligned Cracks and Corrosion features**

1. Axially-Aligned Cracks: Enbridge shall calculate the Predicted Burst Pressure of all Axially-Aligned Crack features detected by an ILI tool using the CorLAS™ Model.

2. Corrosion: Enbridge shall calculate the Predicted Burst Pressure of all Corrosion features using the following models:

a. Enbridge shall calculate Predicted Burst Pressure using the modified B31G method (*i.e.*, 0.85 x depth of feature x length of feature) when the corrosion feature is detected by a magnetic flux leakage ("MFL") tool, and

b. Enbridge shall calculate Predicted Burst Pressure using the effective area method ("RSTRENG") or the modified B31G when the Corrosion feature is detected by an ultrasonic wall measurement ("USWM") tool.

3. Irrespective of the method used to determine the Predicted Burst Pressure of an Axially-Aligned Crack feature or Corrosion feature, Enbridge shall calculate the Predicted Burst Pressure using the data inputs specified in Paragraphs 4 to 7 below. For those inputs that are not specified below, Enbridge shall use all applicable and appropriate data inputs for achieving accurate and reasonable estimates of the Predicted Burst Pressure of a feature detected by an ILI tool. Such inputs shall include, among other things, all information regarding the Joint where the feature is located, including (but not limited to) pipe grade, pipe diameter, SMYS, ultimate tensile strength, fracture toughness, and flow stress.

4. "Wall thickness" Input: In selecting an input value for the wall thickness of the Joint with an Axially-Aligned Crack or Corrosion feature, Enbridge shall apply the following rules:

a. *General Rule*: Enbridge shall select a value for wall thickness equal to the wall thickness of the Joint as measured by a USWM tool. If no USWM data exists, Enbridge shall apply the wall thickness of the Joint as determined by the best available ILI tool for measuring wall thickness.

b. *Exception to General Rule*: The general rule in the preceding Subparagraph shall not apply if it yields a wall-thickness value for the Joint that is greater than the specified nominal wall thickness of the Joint. In that circumstance, Enbridge shall select a value for wall thickness equal to the specified nominal wall thickness of the Joint.

c. *Exception to Exception*: If the specified nominal wall thickness of the Joint is more than 15% thinner than the wall thickness as determined in accordance with Subparagraph A.4.a, Enbridge is not required to use the specified nominal wall thickness of the

Joint for the purpose of calculating the Predicted Burst Pressure of the feature, provided that Enbridge documents, in writing, that the specified nominal wall thickness is incorrect and does not reflect the actual wall thickness of the Joint as determined through historical dig information, as-built drawings, or other comparable records relating to the Joint. After making such a written determination, Enbridge may input a value for wall thickness that is equal to either of the following values, whichever yields the thinnest possible wall for the Joint: (i) the wall thickness as determined by historical records or (ii) the wall thickness as determined in accordance with Subparagraph A.4.a.

5. "Depth of feature" Input: In selecting an input value for the depth of an Axially-Aligned Crack or Corrosion feature detected by an ILI tool, Enbridge shall select a value equal to (a) the depth of the feature as reported by the ILI tool plus (b) an appropriate value representative of the tool tolerance of the ILI tool. If the ILI tool did not report a specific depth for an Axially-Aligned Crack feature but reported instead a minimum and maximum depth for the feature, Enbridge shall determine the depth of the feature using the following three-step process:

a. Step One: Enbridge shall input a value for the depth of the Axially-Aligned Crack feature equal to the maximum depth for the feature reported by the ILI tool.

b. Step Two: Enbridge shall calculate the Predicted Burst Pressure of the Axially-Aligned Crack feature and then compare the value yielded by this calculation to the safe operating pressure determined by 1.25 x MOP. If Predicted Burst Pressure is less than the safe operating pressure for the Joint, Enbridge shall proceed to step 3 below.

c. Step Three: For the purpose of assessing the potential severity of the Axially-Aligned Crack feature, Enbridge shall recalculate the Predicted Burst Pressure of the Axially-Aligned Crack feature after inputting a new value for the depth of the Axially-Aligned Crack feature. The new value for the depth of the Axially-Aligned Crack feature shall be equal to (a) the maximum depth of the feature as reported by the ILI tool plus (b) an appropriate value representative of the maximum variance due to tool tolerance.

6. "Length of Feature" Input: In selecting an input value for the length of an Axially-Aligned Crack feature or Corrosion feature detected by an ILI tool, Enbridge shall select a value equal to the length of the feature reported by the ILI tool, unless the feature is classified as a "crack field." With respect to crack fields, Enbridge shall select a value representative of the total interacting length of cracks in the field as reported by the ILI tool vendor.

7. "Notch Toughness" Input: In selecting an input value for the "notch toughness" of an Axially-Aligned Crack feature, Enbridge shall select a value equal to a Charpy V-notch energy of 5 foot-pounds (or an equivalent J integral value) for Axially-Aligned Crack features located in the long seams of low-frequency electric-resistance welded ("LF-ERW") pipe or flash welded ("FW") pipe. With respect to all other Axially-Aligned Crack features, Enbridge shall select an input value equal to a Charpy V-notch energy value that is no greater than 15 foot-pounds (or an equivalent J integral value).

**B. Calculation of ILI Tensile Strain Capacity and Tensile Strain Demand for Circumferential Cracks**

1. Except as provided in Paragraph 3 of Appendix A with respect to Circumferential Cracks with a Non-Priority Saturated Signal, Enbridge shall estimate the fitness-for-service of Circumferential Cracks based on a three-step method. In step one, Enbridge shall select a fitness-for-service method in accordance with Subparagraph B.1.a, below. If Enbridge elects to assess a Circumferential Crack feature using the API-579 method, and if such assessment demonstrates that the feature does not pose a leak or rupture threat, the Crack feature shall not qualify as a Feature Requiring Excavation based upon its fitness-for-service under Subsection VII.D.(IV) of the Consent Decree. Otherwise, if Enbridge does not elect to use API-579, or if an analysis using API-579 fails to demonstrate that the Circumferential Crack is fit-for-service, Enbridge shall proceed to step two and determine the Tensile Strain Capacity of the Circumferential Crack feature in accordance with Subparagraph B.1.b, below, and then proceed to step three and determine the Tensile Strain Demand at the location of the Circumferential Crack in accordance with Subparagraph B.1.c.

a. *Step One: Selection of Fitness-for-Service Model*

i. Enbridge shall assess each Circumferential Crack feature using one or more methods suitable for assessing the feature's fitness-for-service based upon its strain state and loading conditions. Such loading conditions shall include not only the stresses imposed on the Circumferential Crack feature from pumping operations, but also stresses caused by the welding of the pipe, installation of the pipe, ground movement, and proximity to pipe bends. Stresses caused by other external forces (e.g., stream crossings, road crossings, train rail crossings, temperature differentials between the pipe and ground, etc.) do not need to be included in the initial assessment of a feature's fitness-for-service, provided that such stresses shall be considered with respect to Circumferential Cracks that meet the criteria set forth in Subparagraph B.1.d, below. All stresses determined in accordance with this Appendix B shall be reasonably estimated using valid engineering methods based upon all available information, including but not limited to data derived from ILI tools (e.g., inertial measurement unit ILI tools) and field investigations.

ii. Irrespective of the method selected by Enbridge to assess a Circumferential Crack feature's fitness-for-service, Enbridge shall comply with all written specifications and requirements applicable to the method. Such written specification and requirements ("FFS Specifications") shall include (but are not limited to) any restrictions that preclude use of the method based upon a Circumferential Crack feature's length, depth, location, or orientation.

iii. Notwithstanding the duty to comply with all FFS Specifications, Enbridge may depart from any FFS Specification to reflect operating experience, conclusions drawn from the results of past integrity assessments, and other maintenance and surveillance data, and evaluation of the consequences of a leak or rupture from a pipeline due the failure of a

Circumferential Crack. The decision to depart from any FFS Specification shall be documented in a written report ("FFS Specification Modification Report") that (a) identifies the FFS Specification at issue, (b) explains the rationale, if known, for the FFS Specification, (c) identifies all actions or inactions that Enbridge has taken (or, if not yet taken, that Enbridge proposes to take) that do not comply with the FFS Specification, (d) explains each rationale for not complying with the FFS Specification, and (e) describes all documentation, reports, analyses, or other material upon which Enbridge relies as support for its view that non-compliance with the FFS Specification is reasonable and complies with PHMSA's regulations. Each FFS Specification Modification Report shall be maintained for review by PHMSA during an inspection in accordance with 49 C.F.R. § 195.452(l).

b. *Step Two: Calculate Tensile Strain Capacity*

i. Enbridge shall determine the Tensile Strain Capacity of each Circumferential Crack feature based upon the results of any fitness-for-service method that complies with the criteria set forth in Subparagraphs B.1.a.i through B.1.a.iii, above. The Tensile Strain Capacity for a Circumferential Crack shall reflect the lowest predicted axial strain (i.e., strain along the axis of the pipeline) at which the Circumferential Crack is predicted to fail, either by leaking or rupturing. In calculating the lowest predicted Tensile Strain Capacity of a Circumferential Crack feature, Enbridge shall assume that the feature will fail, either by leaking or rupturing, if it is placed under an axial strain greater than 2% – i.e., ([gage length at outer diameter of pipe when loaded] – [initial gage length with no loading at outer diameter of pipe]) / [initial gage length with no loading at outer diameter of pipe] > .02. For each Circumferential Crack feature, Enbridge shall apply the data inputs specified in Paragraph 2, below, in calculating the feature's Tensile Strain Capacity.

ii. If Enbridge cannot calculate the Tensile Strain Capacity of a Circumferential Crack feature because it cannot identify any fitness-for-service method that complies with the criteria set forth in Subparagraphs B.1.a.i through B.1.a.iii, above, Enbridge shall place the Circumferential Crack feature on the Dig List within the same time period specified in Paragraph 44 of the Consent Decree (as modified by the Eighth Modification of the Consent Decree) for completing the fitness-for-service calculations and, in such event, shall excavate and repair or mitigate the circumferential Crack feature within 180 Days of being placed on the Dig List if the feature is located in an HCA or within 365 Days if the feature is located in a non-HCA.

c. *Step Three: Calculate the Tensile Strain Demand:* Enbridge shall calculate the axial strain, resolved to the location of the Circumferential Crack, due to the strain state and loading conditions imposed on the pipeline by internal pressurization and other forces. The strain state and loading condition applicable to the pipeline shall be identical to those used to assess the Circumferential Crack's fitness-for-service under Paragraph B.1.a.i.

d. *Evaluation of Stresses Caused by Stream Crossings, Rail Crossing, and Other External Forces Not Considered in Initial Assessment of Tensile Strain Capacity and Tensile Strain Demand:* After completing the steps above, Enbridge shall divide the Tensile

Strain Capacity of a Circumferential Crack by its Tensile Strain Demand. If the resulting quotient is less than or equal to 1.5, Enbridge shall determine whether the Circumferential Crack is subject to any strains caused by stream crossings, roads crossings, rail crossings or other strains not considered when initially calculating the Tensile Strain Capacity in accordance with Subparagraph B.1.a.i, above. If the Circumferential Crack is subject to such strains, Enbridge shall determine these stresses and recalculate the Tensile Strain Capacity and Tensile Strain Demand, taking these strains into account.

2. Irrespective of the method used to determine the Tensile Strain Capacity of a Circumferential Crack feature, Enbridge shall calculate the Tensile Strain Capacity using the same data input for "length of feature" specified in Paragraph A.6, above, with respect to Axially-Aligned Cracks, but Enbridge shall use the inputs for "notch toughness," "depth of feature," and "wall thickness" set forth in Subparagraphs 2.a through 2.c, below. For those inputs that are not specified in this Appendix B, Enbridge shall use all applicable and appropriate data inputs for achieving accurate and reasonable estimates of the Tensile Strain Capacity of a Circumferential Crack detected by an ILI tool. Such inputs shall include, among other things, all information regarding the Joint where the feature is located, including (but not limited to) pipe grade, pipe diameter, SMYS, ultimate tensile strength, fracture toughness, and flow stress.

a. "Wall Thickness" Input for Circumferential Cracks: Enbridge shall select an input value for wall thickness based solely upon the "General Rule" for determining wall thickness set forth in Paragraph A.4.a, above.

b. "Depth of Feature" Input for Circumferential Cracks: In selecting an input value for the depth of a Circumferential Crack feature detected by an ILI tool, Enbridge shall select a value equal to the depth of the feature as reported by the ILI tool plus an appropriate value representative of the tool tolerance of the ILI tool. If the ILI tool did not report a specific depth for a Circumferential Crack feature but reported instead a minimum and maximum depth for the feature, Enbridge shall input a value for the depth of the Circumferential Crack feature equal to either of the following, whichever is greater: (1) the maximum depth of the feature as reported by the ILI tool or (2) the minimum depth of the feature as reported by the ILI tool plus an appropriate value representative of the tool tolerance of the ILI tool.

c. "Notch Toughness" Input for Circumferential Cracks: Enbridge shall select an input value equal to a Charpy V-notch energy value (or an equivalent J integral value or a crack tip opening displacement (CTOD) value) that is no greater than 15 foot-pounds, unless an alternative value is permissible under the FFS Specifications applicable to the fitness-for-service method used by Enbridge to assess the Crack feature and the alternative value selected is less than 25 foot-pounds. In no event shall Enbridge select an input value that falls outside the range of permissible values set forth in the FFS Specifications, unless and until Enbridge has prepared and finalized an FFS Specification Modification Report in accordance with Subparagraph B.1.a.iii, above, documenting its decision to depart from the FFS Specifications.

**C. Calculation of Fitness-for-Service During Non-Destructive Examination (NDE) of Features in the Field**

1. For purposes of fitness-for-service calculations performed after completing excavation and repair or mitigation of all Features Requiring Excavation identified in any initial Dig List, Enbridge shall apply the same procedures set forth above with respect to ILI Burst Pressure Calculations and Tensile Strain Capacity calculations, except Enbridge shall use the inputs in Paragraph 2 and 3 below in lieu of those in Paragraphs A.5, A.6, and B.2 above:

2. "Depth of feature" Input: In selecting an input value for the depth of a Crack feature or Corrosion feature analyzed in the field, Enbridge shall not select a single value for depth for the feature, but rather should input a number of values equal to the depth measurements collected by field personnel as they measured the feature's varying depth over its entire length. In the event that the feature is a Crack feature that is located within a Corrosion feature, Enbridge shall ensure that the depth reported by field personnel reflects the combined depth of the features.

3. "Length of feature" Input: In selecting an input or the length of a Crack feature or Corrosion feature analyzed in the field, Enbridge shall select a value equal to the length reported by field personnel using NDE methodologies to measure the feature's length.

# APPENDIX I

# APPENDIX I

## REMAINING LIFE OF CIRCUMFERENTIAL CRACKS ADDED TO THE DIG LIST

1. Determination of Fatigue Growth for Circumferential Cracks added to the Dig List: As required under Paragraphs 47, 48 (Table 1) and 58 (Table 5) of the Consent Decree, Enbridge shall determine whether a Circumferential Crack feature that is added to the Dig List ("Circumferential Crack FRE") is subject to fatigue crack growth through steps one to four, below, except no such analysis is required with respect to a Circumferential Crack feature with a Priority Saturated Signal based upon Criteria One in Appendix A.

    a. *Step One:* Enbridge shall determine the mean stress and stress amplitude at the location of the Circumferential Crack FRE based upon external load conditions and pressure cycling ("Stress Cycle Range"). Pressure cycling shall take into account the worst cycling quarter in the five years prior to the ILI Tool Run that identified the Circumferential Crack FRE. For the purposes of this subparagraph, the worst cycling quarter shall reflect the quarter with the worst combination of cycling frequency and cycling magnitude for the applicable line or line segment.

    *b.* *Step Two:* Enbridge shall determine the length and depth of the Circumferential Crack FRE, as well as any other variables that may affect growth of the feature ("Crack Geometry"). In determining Crack Geometry, Enbridge shall use the same length and depth inputs that it used to determine whether the Circumferential Crack FRE should be added to the Dig List based upon the criteria set forth in Section VII.D.(V) of the Consent Decree.

    *c.* *Step Three*: Based upon the Stress Cycle Range (determined in Step One) and the Crack Geometry (determined in Step Two), Enbridge shall determine the stress intensity factor range that occurs at the tip of the Circumferential Crack FRE (i.e., the point at which the Circumferential Crack propagates). In making this determination, Enbridge shall choose the fracture mechanics model that is most appropriate to the Crack Geometry and the loading condition (e.g., tension, bending, or a combination of the two) applicable to the Circumferential Crack. If the Crack Geometry is outside the scope of the specifications applicable to the fracture mechanics model (e.g., the length of the major axis of the equivalent ellipse relative to its minor axis exceeds the aspect ratio of the fracture mechanics model), Enbridge shall either (1) use the fracture mechanics model and prepare a written report documenting this decision for later review by PHMSA or (2) use the fracture mechanics model of a circumferential edge crack in a pipe with uniform depth. In the event that Enbridge chooses the first option, the written report shall identify the relevant specifications of the fracture mechanics model, describe the impact of departing from this specification, and all facts or data that

Enbridge relies upon to support its decision to use the fracture mechanics model notwithstanding this variance.

*d.* *Step four*: Enbridge shall compare the stress intensity factor (determined in Step Three) with no-growth threshold values for sharp cracks in air. If the stress intensity factor range is greater than the threshold value, the Circumferential Crack FRE is subject to fatigue crack growth. For the purposes of making this determination, the term "no-growth threshold values for sharp cracks in air" shall mean threshold stress intensity factors for sharp cracks that yield a threshold value ("$K_{th}$") of 4 MPa $m^{1/2}$ for a Stress Cycle Range with a stress ratio ("R") of 0.6 and assumes that $K_{th}$ will decrease as R increases. R is the ratio of the minimal stress to the maximal stress of the Stress Cycle Range.

2. Determination of Remaining Life for Circumferential Crack FREs: If a Circumferential Crack FRE is subject to fatigue crack growth (as determined in accordance with Paragraph 1, above), Enbridge shall determine the number of pressure cycles that remain until the Circumferential Crack FRE grows to the point where the Tensile Strain Demand at the location of the feature is predicted to equal or exceed feature's Tensile Strain Capacity. Based upon the number of remaining pressure cycles, Enbridge shall estimate the Remaining Life of the Circumferential Crack FRE, which is defined as the estimated period of time remaining before Tensile Strain Demand is predicted to equal or exceed Tensile Strain Capacity at the location of the feature.

# APPENDIX J

# APPENDIX J

## DIRECT ASSESSMENT PROGRAM OF

## CIRCUMFERENTIAL CRACKS IN DUAL-SEAM JOINTS IN LINE 4

This appendix sets forth a program that relies upon direct assessment to investigate Circumferential Cracks in portions of Line 4 constructed with dual seam 48-inch diameter Joints ("Dual-Seam Joints"). The program requires Enbridge to undertake excavations to assess and, if necessary, repair Circumferential Cracks and other features in ten Joints, as set forth in Subparagraph A, below. In addition, Enbridge may undertake one or more rounds of follow-up excavations in accordance with Subparagraph B, below.

Enbridge will have successfully completed the direct assessment program when, and if, it proves the safety case in Subparagraph C, below. If Enbridge fails to prove the safety case, it may, at its discretion, propose to modify the direct assessment program by following the procedure in Subparagraph D, below. In the event that Enbridge does not prove the safety case by the deadline set forth in Paragraph 29.b of the Consent Decree, or if either party determines that Enbridge is unlikely to prove the safety case by such deadline, the parties shall follow the procedures in Subparagraph E, below, to determine the next steps for addressing Circumferential Crack features in the unexcavated portions of the Dual-Seam Joints.

A. Initial Direct Assessment:

1) Enbridge shall excavate the ten target Joints, listed below, which are identified by their upstream girth-weld number and segment.

a. GW 29230 – Cass Lake ("CS") to Deer River ("DR")
b. GW 29340 – CS to DR
c. GW 30430 – CS to DR
d. GW 30460 – CS to DR
e. GW 30830 – Floodwood ("FW") to Wrenshall ("WR")
f. GW 30960 – CS to DR
g. GW 31270 – CS to DR
h. GW 45100 – CS to DR
i. GW 45790 – CD to DR
j. GW 50000 – DR to FW

2) At its discretion, Enbridge may expand an excavation to include Joints that are adjacent to, or in the vicinity of, the target Joint. In such an event, the term "excavated portion of the pipeline" for purposes of Subparagraphs A.3 and A.4, below, shall include the target Joint and any additional Joints that Enbridge may choose to excavate in conjunction with the target Joint.

3) For each excavated portion of the pipeline, Enbridge shall: (a) inspect all Circumferential Crack features on the excavated portion of the pipeline and any other features

that may intersect or interact with one or more Circumferential Crack features, (b) collect and record all field measurements necessary to determine the fitness-for-service of all such features using the procedures in Appendix B of the Consent Decree, and (c) repair all such features that satisfy one or more of the dig selection criteria set forth in Section VII.D.(V) of the Consent Decree.

4) For each excavated portion of the pipeline, Enbridge shall document and maintain (and make available to PHMSA upon request) a report that includes all information collected by Enbridge with respect to each Circumferential Crack feature and any other features that may intersect or interact with a Circumferential Crack feature. The report shall include a photographic log of the excavation, including a photograph of each Circumferential Crack feature on the excavated portion of the pipeline. In the event that Enbridge discovers any stress corrosion cracking, the report shall include all information required by Table 2 of NACE SP0204-2008, *Stress Corrosion Cracking Direct Assessment Methodology*.

5) If none of the ten excavations result in the discovery of a Circumferential Crack feature with a Field Tensile Strain Capacity less than 1.25 times Tensile Strain Demand at the location of the feature (as determined in accordance with Appendix B), Enbridge shall follow the procedures in Subparagraph C to determine whether the direct assessment program has demonstrated the safety of the Dual-Seam Joints with respect to threats posed by Circumferential Crack features. Otherwise, if one or more of the target Joints included a Circumferential Crack feature with a Field Tensile Strain Capacity less than 1.25 times Tensile Stain Demand at the location of the feature, Enbridge shall follow the procedures in Subparagraph B ("Follow-up Assessment"), below, unless Enbridge informs the United States in accordance with Subparagraph E.1 that it cannot meet the safety case and that further excavations in accordance with Subparagraph B will prove pointless in terms of proving the safety case.

B. Follow-Up Assessment

1) From the population of Dual-Seam Joints that remain unexcavated, Enbridge shall identify those Joints with a Tensile Strain Demand of at least 0.15% at the location of one of the long seams and, from this sub-group, select six Joints for excavation that are the most likely to contain Circumferential Crack features that meet the dig criteria based on an evaluation of their Tensile Strain Capacity and Tensile Strain Demand. In selecting these six Joints ("Follow-up Target Joints"), Enbridge shall assess and consider the following factors:

a. Net strain from internal and external forces resolved to the circumferential position of the long seam,
b. Proximity to field bend or fabricated bend,
c. Soil conditions and terrain conducive to near-neutral pH SCC,
d. Depth of cover,
e. Evidence of disbonding of tape coating,
f. Density and severity of corrosion features on the pipeline,
g. Density and severity of axial crack feature on the pipeline, including stress-corrosion cracking, and

h. Other information gained from prior excavations.

2) Notwithstanding Subparagraph B.1, above, Enbridge may elect not to include a joint on the list of Follow-up Target Joints where excavation of the Joint would result in an unacceptable risk to workers, the environment, and/or the general public and where an adequate replacement Joint is added to the list of Follow-up Target Joints.

3) Enbridge shall document and maintain (and make available to PHMSA upon request) a record of its selection of the six Follow-up Target Joints, including a record of each Joint with a Tensile Strain Demand of at least 0.15% at the location of the long seam and, for each such feature, a record of Enbridge's assessment of the selection criteria set forth in Subparagraph B.1.a to B.1.h, above. In the event that Enbridge decides not to include a Joint on the list of Follow-up Target Joints pursuant to Subparagraph B.2, above, Enbridge shall explain the basis for this decision and identify the Joint that it selected as a replacement for the Joint omitted from the list of Follow-up Target Joints.

4) Enbridge shall excavate, inspect, and repair the six Follow-up Target Joints following the same requirements set forth in Subparagraphs A.2 and A.3, above. Upon completing such excavations, Enbridge shall document and maintain (and make available to PHMSA upon request) all information that it was required to document and maintain under Subparagraph A.4.

5) If none of the six Follow-up Target Joints contain a Circumferential Crack feature with a Field Tensile Strain Capacity less than 1.25 times the Tensile Strain Demand, Enbridge shall follow the procedures in Subparagraph C ("Demonstration of Safety Case"). Otherwise, unless Enbridge informs the United States in accordance with Subparagraph E.1 that further excavations will prove pointless in terms of proving the safety case, Enbridge shall continue the Follow-up Assessment by repeating all the actions described above in Subparagraphs B.1 to B.4, above, beginning with the selection of six new Follow-up Target Joints. Enbridge shall continue to repeat the Follow-up Assessment under this Subparagraph B until it either (i) excavates a group of six Follow-up Targets Joints that contain no Circumferential Crack features with a Field Tensile Strain Capacity less than 1.25 times the Tensile Strain Demand at the location of such features or (ii) informs the United States in accordance with Subparagraph E.1 that it cannot meet the safety case and that further excavations in accordance with this Subparagraph B will prove pointless in terms of proving the safety case.

C. Demonstration of Safety Case

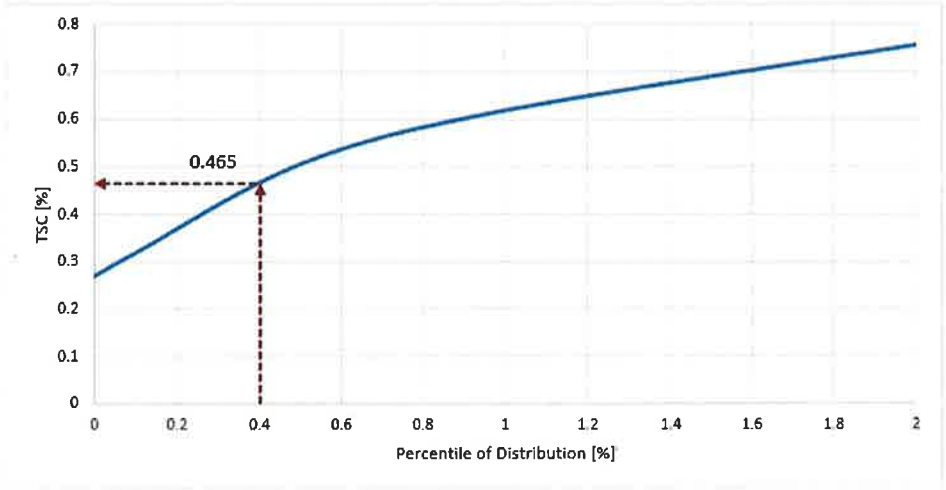
1) To demonstrate the safety of the Dual-Seam Joints with respect to threats posed by Circumferential Crack features, Enbridge must show that it is highly improbable that any unexcavated Circumferential Crack features in the Dual-Seam Joints would require excavation and repair if they were discovered through deployment of an ILI tool designed to investigate Circumferential Crack features. To make this safety case, Enbridge must calculate a safety ratio of 1.25 with respect to the "worst case" Circumferential Crack feature that could potentially remain in the unexcavated portion of the Dual-Seam Joints. Enbridge shall calculate the safety

ratio of this hypothetical feature by following the three-step procedure set forth in Subparagraphs C.1.a to C.1.c, below.

a. Step one: Enbridge shall estimate the Tensile Strain Capacity of the "worst case" Circumferential Crack feature that could potentially remain in the unexcavated portions of the Dual-Seam Joints. Enbridge may choose either of the values in Subparagraph C.1.a.i or C.1.a.ii as the Tensile Strain Capacity of this hypothetical feature.

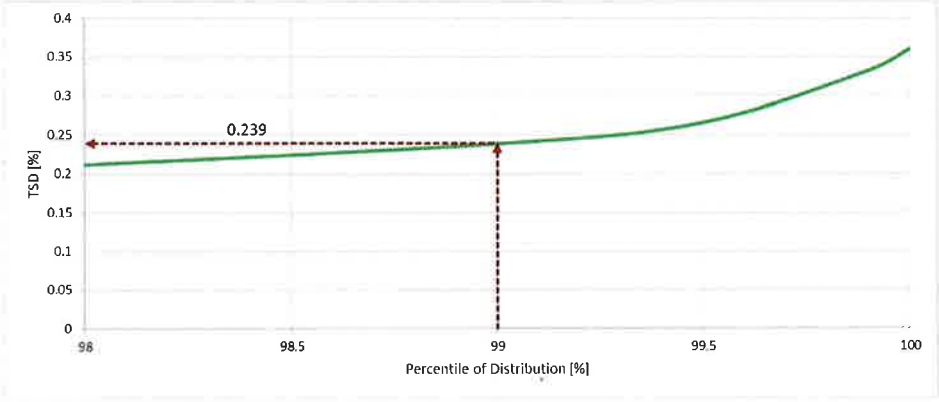
i. Enbridge may select a value equal to the lowest Tensile Strain Capacity for all Circumferential Crack features discovered on the Dual-Seam Joints. For the purposes of selecting this value, Enbridge shall consider not only the Field Tensile Strain Capacity of all Circumferential Cracks discovered pursuant to the direct assessment program mandated by this Appendix J, but also the Field Tensile Strain Capacity of all Circumferential Crack discovered at any time in the past on the Dual-Seam Joints (collectively "TSC-Data Set").

ii. Enbridge may select a value equal to the Tensile Strain Capacity that marks the bottom 0.4 percentile of the range of potential values for Tensile Strain Capacity of all Circumferential Cracks in the Dual-Seam Joints. To determine this value, Enbridge shall calculate the statistical distribution curve that best fits the TSC-Data Set. Enbridge shall then select the value that marks the bottom 0.4 percentile on this distribution curve. For example, assuming the hypothetical distribution curve in the chart below (included for demonstrative purposes only), Enbridge would select 0.465% as the Tensile Strain Capacity of the worst-case Circumferential Crack feature.




b. Step two: Enbridge shall estimate the Tensile Strain Demand imposed on the "worst case" Circumferential Crack feature likely to remain in the unexcavated portions of the Dual-Seam Joints. To estimate this Tensile Strain Demand, Enbridge shall first determine the range of axial strains imposed on Dual-Seam Joints by pumping operations and external forces based upon a review of strain information collected through inertial measurement unit tools and

other relevant information available from the operation and maintenance of Line 4 ("AS-Data Set"). Enbridge shall then apply a statistical distribution curve that best fits the AS-Data Set. Finally, Enbridge shall select the value that marks the top 1 percentile of this distribution curve. For example, assuming the hypothetical distribution curve in the chart below (included for demonstrative purposes only), Enridge would select 0.239 as the Tensile Strain Demand imposed on the worst-case Circumferential Crack feature likely to remain in the unexcavated portions of the Dual-Seam Joints.




c. Step three: Enbridge shall divide the Tensile Strain Capacity of the "worst case" Circumferential Crack feature (as determined in Step One) by the Tensile Strain Demand imposed on the "worst case" Circumferential Crack feature (as determined in Step Two). The resulting quotient is the safety ratio.

2) If the safety ratio determined in Step Three above, is equal to, or greater than, 1.25, Enbridge shall, within ten days of making such determination or, if determined prior to Court approval of the Eighth Modification, within 10 Days of Court approval of the Eighth Modification, send written notice to the United States and EPA Region 5 in accordance with Paragraph 196 of the Consent Decree, stating that Enbridge has demonstrated the safety of the Dual-Seam Joints with respect to threats posed by Circumferential Crack features. Within 50 Days of providing such notice, Enbridge shall provide the United States and EPA Region 5 with a report demonstrating its compliance with this Appendix J, summarizing its findings as to Circumferential Crack features in the Dual-Seam Joints, and explaining why it has successfully demonstrated a safety ratio of 1.25 or greater with respect to the "worst case" Circumferential Crack feature that could potentially remain in the unexcavated portions of the Dual-Seam Joints. If the United States concurs that Enbridge has complied with the requirements of this Appendix J and successfully demonstrated the safety case under Subparagraph C.1 by the deadline set forth in Paragraph 29.b of the Consent Decree, the United States shall file notice of this determination with the Court in accordance with Paragraph 205.b.(1). of Section XX ("Termination"), although such notice does not need to be filed unless and until the United States also determines that Enbridge has complied with the requirements in Paragraphs 37.f and g relating to the Circumferential Crack Look-back Assessment Program. If the United States does not agree that Enbridge has complied with the requirements of this Appendix J or does not agree that Enbridge

has successfully demonstrated the safety case under Subparagraph C.1 by the deadline set forth in Paragraph 29.b of the Consent Decree, the parties may proceed as provided in Subparagraph E, below.

3) If the safety ratio determined in Step Three above, is less than 1.25, Enbridge shall (i) undertake Follow-up Assessment under Subparagraph B, above, (ii) propose modifications of the direct assessment program in accordance with Subparagraph C, below, (iii) inform the United States under Subparagraph D, below, that the safety case cannot be achieved, or (iv) undertake some combination of these three options. In the event that Enbridge elects to undertake Follow-up Assessment under Subparagraph B, Enbridge shall conduct all the actions described above in Subparagraphs B.1 to B.4 beginning with the selection of six Follow-up Target Joints for excavation. After completing such actions, Enbridge may attempt, once again, to demonstrate the safety case under this Subparagraph C if none of the six Follow-up Target Joints contained a Circumferential Crack feature with a Field Tensile Strain Capacity less than 1.25 times Tensile Strain Demand. Otherwise, unless Enbridge informs the United States in accordance with Subparagraph E.1 that further excavations will prove pointless in terms of proving the safety case, Enbridge shall continue to repeat the follow-up assessment under Subparagraph B until it excavates a group of six Follow-up Targets Joints that contain no Circumferential Crack features with a Field Tensile Strain Capacity less than 1.25 times the Tensile Strain Demand at the location of such features, in which event Enbridge may attempt, once again, to demonstrate the safety case under this Subparagraph C.

D. Modification of the Direct Assessment Program

1) After attempting and failing to prove the safety case under Subparagraph C, Enbridge may submit to the United States for review and approval a proposed modification of the direct assessment program. The modification shall be accompanied by a report detailing the actions undertaken by Enbridge under this Appendix J and explaining the justification for changing the direct assessment program, including any new information or conditions relating to Circumferential Crack features or the Dual-Seam Joints.

2) The United States shall review any proposed modification to determine whether the direct assessment program, as revised, would make it highly improbable that any unexcavated Circumferential Crack features in the Dual-Seam Joints would require excavation and repair if they were discovered through deployment of an ILI tool designed to investigate such features. If the United States agrees with the proposed modification, or if the parties negotiate and agree other changes to the direct assessment program, they shall comply with the procedures in Section XIX ("Modification") of the Consent Decree for modifying the Consent Decree.

E. Failure of Safety Case

1) If Enbridge fails to prove the safety case in Subparagraph C.1 by the deadline set forth in Paragraph 29.b of the Consent Decree, it shall submit a notice to EPA within 30 Days of

the deadline and include with the notice a report documenting its efforts to comply with this Appendix J and explaining the reasons for its failure to prove the safety case. Alternatively, if Enbridge concludes at any time that it cannot meet the safety case and that further excavations in accordance with Subparagraph B will prove pointless in terms of proving the safety case, Enbridge shall notify EPA within 30 days of making this determination and simultaneously submit a report documenting its efforts to comply with this Appendix J and explaining why it believes that further efforts would not result in a successful demonstration of the safety case. As part of either submission, Enbridge may also propose modification of the direct assessment program in accordance with Subparagraph D, above.

2) Upon receipt of either notice described in Subparagraph E.1, above, or upon its own initiative after determining that Enbridge has not proven (or will not be able to prove) the safety case by the deadline set forth in Paragraph 29.b of the Consent Decree, the United States may move for the Court to enforce (i) the requirement in Paragraph 28 of the Consent Decree to complete a valid ILI of the unexcavated portions of the Dual-Seam Pipeline using a tool that is the most appropriate for accurately detecting, characterizing, and sizing Circumferential Crack feature, and (ii) other requirements in Section VII.D of the Consent Decree to repair and mitigate all Circumferential Crack features in the Dual-Seam Joints that meet the dig selection criteria Tables 1 and 5. In such an event, Enbridge reserves all arguments to oppose the United States' motion, including but not limited to, the contention that the original Consent Decree, approved by the Court in May of 2017, did not require Enbridge to deploy ILI tools to investigate Circumferential Crack features in the Lakehead System.

3) Enbridge may invoke Dispute Resolution under Section XIII if the United States, after receipt of the report provided by Enbridge under Subparagraph C.2, does not agree that Enbridge has complied with the requirements of this Appendix J or does not agree that Enbridge has successfully demonstrated the safety case in this Appendix J. However, Enbridge shall not seek Dispute Resolution of any dispute regarding the Direct Assessment Program of Circumferential Cracks in Dual-Seam Joints on Line 4 until: (i) 90 Days after service of their report under Subparagraph C.2 of Appendix J; or (ii) 30 Days after the United States informs Enbridge that the United States will not file a notice stating that the Defendants have met the safety case in Appendix J (whichever date is earlier). In such an event, Enbridge reserves all arguments, including but not limited to, the contention that the original Consent Decree, approved by the Court in May of 2017, did not require Enbridge to deploy ILI tools to investigate Circumferential Crack features in the Lakehead System.

# APPENDIX K

# Appendix K

## Work Instruction: ILI-based Circumferential Crack Integrity Management Program

This Work Instruction provides for implementation of measures that the United States and Enbridge agreed upon in the Eighth Modification of the Consent Decree entered by the Court in the matter of *United States v. Enbridge Energy, Limited Partnership et al.,* Civil Action No. 1:16-cv-914 (W.D. Mich.). The Work Instruction sets forth procedures to investigate, assess, repair, and mitigate Circumferential Crack features in certain Lakehead System pipelines, identified below, based upon the results of investigations using in-line inspection ("ILI") tools. This Work Instruction may be terminated or revised upon completion of the general requirements in Section B, below.

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## A. Definitions

For the purpose of implementing this Work Instruction, the following definitions, which were agreed upon by the United States and Enbridge, shall apply:

"*80/60 Interim Pressure Restriction*" shall mean a pressure restriction that limits operating pressure at the location of a feature to 80% of the highest actual operating pressure at that location during the last 60 Days.

"*Assumed Saturated Depth*" shall have the meaning set forth in Section E (Paragraph 2.a.ii.(e) of this Work Instruction.

"*Circumferential Crack*" shall mean any Crack feature that is predominantly oriented in the direction of the pipeline's circumference as opposed to the pipeline's axis.

"*Circumferential Crack FRE*" shall have the meaning set forth in Section H of this Work Instruction.

"*Consent Decree*" shall mean the Consent Decree, together with all Appendices attached thereto, approved and entered by the United States District Court for the Western District of Michigan on May 23, 2017 in the matter of *United States v. Enbridge Energy, Limited Partnership et al.*, Civil Action No. 1:16-cv-914, and as later modified by the Court and the parties.

"*Corrosion feature*" shall mean any feature on a pipeline detected by any tool, field measure device, or other field observation that detects metal loss due to corrosion; provided, however, that for the purposes of this Work Instruction, "Corrosion feature" shall not include any feature that Enbridge is able to determine reflects metal loss that is attributable to a grinding repair rather than to corrosion.

"*Crack feature*" or "*Crack*" shall mean any feature on a pipeline detected by any tool, field measurement device, or other field observation that detects any crack or crack-like feature on the pipeline, irrespective of the orientation of the feature or whether the feature type is classified as crack-like, crack field, notch-like, surface-breaking lamination, linear indication, seam-weld manufacturing anomaly, hook cracks, Axially-Aligned Cracks, Circumferential Cracks, or any other label denoting a crack or cluster of cracks. In addition, for purposes of this Consent Decree, Crack features shall be deemed to include Axial Slotting features, Axial Grooving features, selective seam Corrosion features and features identified in ILI reports as Seam Weld Anomaly A/B.

"*Day*" shall mean a calendar day unless expressly stated to be a business day. In computing any period of time under this Work Instruction, where the last Day would fall on a Saturday, Sunday, or U.S. federal holiday, the period shall run until the close of business of the next business day.

"*Dig List*" shall mean the list of Features Requiring Excavation scheduled for excavation and repair or mitigation in accordance with Section G of this Work Instruction.

"*Established MOP*" shall mean, with respect to each Lakehead System pipeline segment addressed under this Work Instruction, the MOP values that are specified in column [E] of the spreadsheets located at https://www.epa.gov/enbridge-spill-michigan/enbridge-revised-maximum-operating-pressure-values. Each line in the referenced spreadsheets lists an MOP value that is applicable to the entire distance between (i) the girth weld location identified in column D of that line and (ii) the girth weld location identified in Column D of the next line of the spreadsheet.

"*Feature Requiring Excavation*" or "*FRE*" shall mean any Circumferential Crack feature that meets one or more of the dig selection criteria in Appendix K-Tables 1 and 2 of Section G of this Work Instruction. The plural version of Feature Requiring Excavation is "*Features Requiring Excavation*" or "FREs."

"*Geometric feature*" shall mean any feature that involves deformation of the pipe as defined in 4.28 of API Standard 1163 (1st Edition), including any bend, buckle, dent, ovality, ripple, wrinkle, or other change that affects the roundness of the pipe's cross section or straightness of the pipe. For purposes of this Work Instruction, the term "dent" shall refer to a local change in piping surface contour caused by an external force such as mechanical impact or rock impact, regardless of depth of the feature.

"*High Consequence Area*" or "*HCA*" shall have the meaning set forth in 49 C.F.R. § 195.450.

"*High-Resolution Circumferential Crack Detection ILI Tool*" or "*HRCCD ILI Tool*" shall include any ultrasonic Circumferential Crack-detection ILI tool where the design specification intends for the tool to be capable of detecting, at least 90% of the time, any (1) Circumferential Crack in a pipe girth weld when such a Crack feature has a minimum depth of 2 millimeters ("mm") and a minimum length of 25 mm, and (2) Circumferential Crack in the base metal of a pipe Joint, or in the heat-affected zone adjoining a pipe girth weld, when such a Crack feature has a minimum depth of 1 millimeter and a minimum length of 25 mm.

"*Initial II Report*" shall have the meaning set forth in Section C of this Work Instruction.

"*Joint*" shall refer to a single length of pipe, typically 40 feet or less, between two adjacent girth welds.

"*Non-Priority Saturated Signal*" shall have the definition provided in Section E (Paragraph 2.b) of this Work Instruction.

"*OneSource*" shall mean the data-integration database that Enbridge is required to establish and maintain under Paragraph 74 of the Consent Decree for the purpose of integrating information about features, including Crack features and Corrosion features, from multiple ILIs and field measurement devices.

"*Priority Feature*" shall mean any Circumferential Crack, by itself or in conjunction with another type of feature, that may require priority attention over other Circumferential Crack features based upon criteria specified by Enbridge in its contract or work order with the vendor

for ILI services. In such a contract or work order, Enbridge shall define a Priority Feature as including, among other things, any Circumferential Crack that the ILI vendor may consider to be an immediate threat to the integrity of the pipeline. At a minimum, Priority Features shall include Circumferential Crack features that meet the criteria set forth in Section E (Paragraph 1) of this Work Instruction.

"*Priority Saturated Signal*" shall have the definition provided in Section E (Paragraph 2.a) of this Work Instruction.

"*Remaining Life*" shall mean, for Circumferential Crack features, the estimated period of time remaining before Tensile Strain Demand on a feature is predicted to equal or exceed Tensile Strain Capacity of the pipeline at the location of the feature. Remaining Life determinations shall be made in accordance with Section J, below.

"*Remaining Life at 180 Days*" shall mean the Remaining Life of a feature as of the date that marks the end of the 180-Day period for repair or mitigation of such feature as initially prescribed under Section G (Tables 1 or 2) of this Work Instruction.

"*Tensile Strain Capacity*" shall mean the lowest predicted axial strain (*i.e.*, strain along the axis of the pipeline) at which the Circumferential Crack is predicted to fail, either by leaking or rupturing.

"*Tensile Strain Demand*" shall mean the axial strain in the pipeline due to the strain state and loading conditions imposed on the pipeline by internal pressurization and other forces.

"*Tool Run*" shall mean the process of running an ILI tool with sensors through a pipeline, or section of pipeline, for the purpose of detecting, sizing, and classifying Crack features, Corrosion features, and Geometric features.

"*Updated Assumed Saturated Depth*" shall have the meaning set forth in Section M of this Work Instruction under the subheading *Statistical Analysis of Circumferential Crack FREs.*

## B. General Requirements

Enbridge shall implement the requirements of this Work Instruction on certain pipelines in the Lakehead System in order to assure the timely identification and evaluation of Circumferential Crack features, including features that pose either leak threats or rupture threats, whether such features are located in the base metal (either interior or exterior surfaces), long seam, or girth welds. For the purposes of this Work Instruction, the terms "rupture" and "leak" shall include any "discharge" within the meaning of Section 311 of the Clean Water Act, 33 U.S.C. § 1321(a)(2).

By no later than July 1, 2025, Enbridge shall investigate the Clearbrook, Minnesota to Superior, Wisconsin ("CR-PW") segment of Line 1 and the entirety of Lines 2 and 62 using an ultrasonic ILI tool designed to detect, characterize, and size Circumferential Crack features.

Following each ILI Tool Run, Enbridge shall repair and mitigate all Features Requiring Excavation in accordance with this Work Instruction.

In addition, Enbridge shall undertake and complete two tasks under the Consent Decree as modified by the Eighth Modification of the Consent Decree. First, Enbridge shall undertake and complete the Circumferential Crack Look-back Assessment Program as required under Paragraphs 37.f. and 37.g of the Consent Decree. Second, Enbridge shall undertake and complete the Line 4 Direct Assessment Program as required under Paragraphs 29.b and c and Appendix J of the Consent Decree.

## C. ILI Vendor Requirements

*Invalid ILIs*: Enbridge shall require each of its ILI vendors to notify Enbridge immediately of any instance in which the vendor determines that (i) a scheduled ILI to investigate Circumferential Cracks could not be completed due to an ILI tool malfunction or other circumstance that prevented the collection of valid, reliable data, or (ii) a completed ILI to investigate Circumferential Cracks is not valid or reliable for any reason. In each such case involving an incomplete or invalid ILI, Enbridge shall take all steps necessary to complete a valid ILI by no later than the date specified in Section B, above.

*Tool Operation*: Enbridge shall assure that ILI tools are operated consistently within manufacturer/vendor specifications, including tool speed.

*ILI Report*: Enbridge shall require each of its vendors of ILI services to submit an initial report to Enbridge promptly after each ILI to investigate Circumferential Cracks ("Initial ILI Report"), except in cases where the ILI vendor has previously notified Enbridge that an ILI could not be completed or was not valid. This Initial ILI Report shall include all data relating to all features detected by the ILI tool, as well as all information relevant to tool speed and performance, including whether the tool operated outside its specifications. Initial ILI Reports shall be submitted to Enbridge within 120 Days after the tool is removed from the pipeline at the conclusion of the ILI.

*Priority Features*: Enbridge shall require each of its vendors of ILI services to notify Enbridge of any Priority Feature identified during an ILI to investigate Circumferential Cracks and to provide Enbridge with the ILI data relating to such Priority Feature immediately upon identification of the Priority Feature, without waiting for preparation and submission of the Initial ILI Report.

## D. ILI Data Quality Review

Within 30 Days after receiving any Initial ILI Report, Enbridge shall complete a preliminary review of the Initial ILI Report. As part of the preliminary review, Enbridge shall identify all concerns with respect to the quality of any reported ILI data, and Enbridge shall identify all pipeline sections and/or features affected by the identified data quality concerns. Enbridge shall complete any evaluations required to resolve all of the identified data quality concerns as expeditiously as practicable, but in no event should such evaluations exceed 180 Days after the ILI tool is removed from the pipeline at the conclusion of the investigation of

Circumferential Cracks. The data quality evaluations undertaken by Enbridge shall not affect or delay Enbridge's obligation to timely identify Features Requiring Excavation and complete Dig Lists as provided in Sections G and H, below.

**E. Circumferential Cracks that are Priority Features**

1. *Priority Feature*: A Circumferential Crack shall be a Priority Feature if it meets one or more of the criteria below:

a. Circumferential Crack $\geq$ 2.5 mm (0.098 inch) that has been detected on the internal or external pipe surface at the same location where a Circumferential Crack of comparable size (*i.e.*, a crack $\geq$ 2.5 mm) has been detected on the opposite side of the pipe surface.

b. A Circumferential Crack that meets the priority notification criteria specifically identified in the contract or work order with the vendor for ILI services.

c. A Circumferential Crack that meets or exceeds the saturation limit of a Circumferential Crack-detection tool ("Crack with Saturated Signal"), unless the Circumferential Crack exceeds the saturation limit of a High-Resolution Circumferential Crack Detection ILI Tool ("HRCCD ILI Tool"), in which event the Circumferential Crack shall qualify as a Priority Feature only if it has a "Priority Saturated Signal," as defined below in Subparagraph 2.a.

2. *Circumferential Cracks with Saturated Signals Detected by HRCCD ILI Tool*. If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI tool, Enbridge shall, if possible, determine the depth of the Circumferential Crack relying upon secondary signals reflected by the Circumferential Crack. If Enbridge determines the depth of the Circumferential Crack from its secondary signals, Enbridge shall determine the fitness-for-service of the Circumferential Crack in accordance with Section F, below. Otherwise, if Enbridge is unable to determine the depth of the Circumferential Crack, Enbridge shall determine whether the primary saturated signal is either a "Priority Saturated Signal" or a "Non-Priority Saturated Signal," as defined in Subparagraphs 2.a and 2.b, below. If the primary saturated signal is a "Priority Saturated Signal," the Circumferential Crack is a Feature Requiring Excavation and Enbridge shall add the Circumferential Crack to the Dig List in accordance with Section G, below. If the primary saturated signal is a "Non-Priority Saturated Signal," Enbridge shall determine the fitness-for-service of the Circumferential Crack in accordance with Section F (Paragraph 4), below, and, if required, add the Circumferential Crack to the Dig List in accordance with Section G, below.

a. *Priority Saturated Signal*: If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI Tool, such signal

shall be a Priority Saturated Signal when either of the following criteria are met:

i. *Criteria One*: Ten or more adjacent sensors are saturated by the ultrasonic signal reflected from the Circumferential Crack.

ii. *Criteria Two*. (1) Two or more adjacent sensors are saturated by the primary ultrasonic signal reflected from the Circumferential Crack, and (2) the estimated depth of the Circumferential Crack is greater than 70% of the wall thickness of the pipe Joint containing the feature. For the purpose of applying this criteria, the following definitions shall apply:

(a) *Wall Thickness of the Pipe Joint*: The phrase "wall thickness of the pipe Joint containing the feature" shall mean the wall thickness of the Joint as measured by an ultrasonic wall measurement ("USWM") tool. If no USWM tool data exists, Enbridge shall apply the wall thickness of the Joint as determined by the best available ILI tool for measuring wall thickness.

(b) *Estimated Depth of the Crack:* The phrase "estimated depth of the Circumferential Crack" shall be equal to the maximum depth of the equivalent ellipse selected from the two equivalent ellipses computed in accordance with Subparagraph 2.a.ii.(c), below.

(c) *Equivalent-Ellipse Analysis:* Enbridge shall compute two semi-ellipses – each with a Tensile Strain Capacity equivalent to the Tensile Strain Capacity of the Circumferential Crack based upon its Crack Profile and its Assumed Saturated Depth, as defined below. One equivalent ellipse shall reflect the lowest achievable Tensile Strain Capacity yielded by an analysis that assumes the failure mode of the Circumferential Crack is brittle fracture. The other equivalent ellipse shall reflect the lowest achievable Tensile Strain Capacity yielded by an analysis that assumes the failure mode of the Circumferential Crack is net-section collapse. Enbridge shall compute each equivalent ellipse in accordance with the procedures described by JA Beavers in *Integrity and Remaining Life of Pipe with Stress Corrosion Cracking*, PR-188-9709 (PRCI, 2001) and SJ Polasik in *Review of Engineering Fracture Mechanics Model for Pipeline Applications*, IPC2016-64605 (Calgary 2016). Upon computing the two equivalent ellipses, Enbridge shall select the deepest of the two equivalent ellipses and use the maximum depth of this ellipse as the "estimated depth of the Circumferential Crack" for the purposes of Subparagraph 2.a.ii.(b), above.

(d) *Crack Profile*: The term "Crack Profile" shall mean the shape of the Circumferential Crack in depth and length as measured by the HRCCD ILI Tool.

(e) *Assumed Saturated Depth:* The term "Assumed Saturated Depth" shall mean the estimated depth for the portion of the Circumferential Crack profile that generates a saturated signal. For the purpose of determining whether the Circumferential Crack should be placed on the Dig List within the timeframes specified in Section G, below, Enbridge shall use an Assumed Saturated Depth of 5 mm. Later, if Enbridge should determine that an increase in the Assumed Saturated Depth is warranted under Section M, below, Enbridge shall use the Updated Assumed Saturated Depth (as defined in Section M, below) to evaluate whether any unexcavated Circumferential Cracks should be added to the Dig List.

b. Non-Priority Saturated Signal: If a Circumferential Crack generates a primary signal that exceeds the saturation limit of a HRCCD ILI Tool, such signal shall be a Non-Priority Saturated Signal when it meets neither "Criteria One" nor "Criteria Two" in Subparagraph 2.a, above, in this Section E. Enbridge shall evaluate the fitness-for-service of each Circumferential Crack with a Non-Priority Saturated Signal in accordance with Section F (Paragraph 4), below.

**F. Fitness-for-Service Determination with Respect to Circumferential Cracks**

1. *Circumferential Cracks Excepted from Fitness-for-Service Determination*: Enbridge shall determine the fitness-for-service of all Circumferential Crack features identified by an ILI tool, except it shall not be required to do so with respect to:

- any feature that Enbridge verifies was previously excavated and mitigated by installation of a sleeve around the section of pipe where the feature is located;
- any feature that Enbridge verifies was mitigated by grinding or blasting and recoating, provided that the feature dimensions reported by the ILI, factoring in the ILI tool tolerance, are no larger than the dimensions of the mitigated feature at the time mitigation was performed;
- any Circumferential Crack that is a Priority Feature under Section E (Paragraph 1) above; provided, however, that all such Crack features shall be excavated and repaired or mitigated in accordance with the dig selection criteria in Section G; or
- Circumferential Cracks within dents.

2. *Schedule for Fitness-for-Service Determination*: For those Circumferential Cracks not excepted from a fitness-for-service determination, Enbridge shall complete fitness-for-service calculations for all such features as expeditiously as practicable after completing data quality review in accordance with Section D above, but in no event later than the earlier of the following: (a) 8 weeks after completing data quality review with respect to the feature and/or pipeline section where the feature is located, or (b) 175 Days after the ILI tool was removed from the pipeline at the conclusion of the ILI.

3. Fitness-for-Service Determination for Circumferential Crack Features Other Than Those with a Non-Priority Saturated Signal: Except as provided, below, in Paragraph 4 ("Fitness-for-Service Determination for Circumferential Cracks with a Non-Priority Saturated Signal"), Enbridge shall estimate the fitness-for-service of Circumferential Cracks based on a three-step process. In step one, Enbridge shall select a fitness-for-service method in accordance with the first Subparagraph below (entitled *Step One: Selection of Fitness-for-Service Model*). If Enbridge elects to assess a Circumferential Crack feature using the API-579 method in step one, and if such assessment demonstrates that the feature does not pose a leak or rupture threat, the Circumferential Crack feature shall not qualify as a Feature Requiring Excavation. Otherwise, if Enbridge does not elect to use API-579, or if an analysis using API-579 fails to demonstrate that the Circumferential Crack is fit-for-service, Enbridge shall proceed to step two (entitled *Step Two: Calculate Tensile Strain Capacity)* and determine the Tensile Strain Capacity of the Circumferential Crack feature, and then proceed to step three (entitled *Step Three: Calculate Tensile Strain Demand*) and determine the Tensile Strain Demand at the location of the Circumferential Crack, as described below.

*Step One: Selection of Fitness-for-Service Model*

Enbridge shall assess each Circumferential Crack feature using one or more methods suitable for assessing the feature's fitness-for-service based upon its strain state and loading conditions. Such loading conditions shall include not only the stresses imposed on the Circumferential Crack feature from pumping operations, but also stresses caused by the welding of the pipe, installation of the pipe, ground movement, and proximity to pipe bends. Stresses caused by other external forces (*e.g.*, stream crossings, road crossings, train rail crossings, temperature differentials between the pipe and ground, etc.) do not need to be included in the initial assessment of a feature's fitness-for-service, provided that such stresses shall be considered with respect to Circumferential Cracks that meet the criteria set forth in the Subparagraph, below entitled *Evaluation of Stresses Caused by Stream Crossings, Rail Crossing, and Other External Forces Not Considered in Initial Assessment of Tensile Strain Capacity and Tensile Strain Demand.* All stresses determined in accordance with this Work Instruction shall be reasonably estimated using valid engineering methods based upon all available information, including but not limited to data derived from ILI tools (*e.g.*, inertial measurement unit ILI tools) and field investigations.

Irrespective of the method selected by Enbridge to assess a Circumferential Crack feature's fitness-for-service, Enbridge shall comply with all written specifications and

requirements applicable to the method. Such written specifications and requirements ("FFS Specifications") shall include (but are not limited to) any restrictions that preclude use of the method based upon a Circumferential Crack feature's length, depth, location, or orientation.

Notwithstanding the duty to comply with all FFS Specifications, Enbridge may depart from any FFS Specification to reflect operating experience, conclusions drawn from the results of past integrity assessments and other maintenance and surveillance data, and evaluation of the consequences of a leak or rupture from a pipeline due the failure of a Circumferential Crack. The decision to depart from any FFS Specification shall be documented in a written report ("FFS Specification Modification Report") that (a) identifies the FFS Specification at issue, (b) explains the rationale, if known, for the FFS Specification, (c) identifies all actions or inactions that Enbridge has taken (or, if not yet taken, that Enbridge proposes to take) that do not comply with the FFS Specification, (d) explains each rationale for not complying with the FFS Specification, and (e) describes all documentation, reports, analyses, or other material upon which Enbridge relies as support for its view that non-compliance with the FFS Specification is reasonable and complies with PHMSA's regulations. Each FFS Specification Modification Report shall be maintained for review by PHMSA during an inspection in accordance with 49 C.F.R. § 195.452(l).

*Step Two: Calculate Tensile Strain Capacity*

Enbridge shall determine the Tensile Strain Capacity of each Circumferential Crack feature based upon the results of any fitness-for-service assessment method that complies with the criteria set forth in Step One, above. The Tensile Strain Capacity for a Circumferential Crack shall be based upon the inputs set forth in the Subparagraph below (entitled *Inputs Used to Calculate Tensile Strain Capacity*) and shall reflect the lowest predicted axial strain (*i.e.*, strain along the axis of the pipeline) at which the Circumferential Crack is predicted to fail, either by leaking or rupturing. In calculating the lowest predicted Tensile Strain Capacity of a Circumferential Crack feature, Enbridge shall assume that the feature will fail, either by leaking or rupturing, if it is placed under an axial strain greater than 2% – *i.e.*, ([gage length at outer diameter of pipe when loaded] – [initial gage length with no loading at outer diameter of pipe]) / [initial gage length with no loading at outer diameter of pipe] > .02. For each Circumferential Crack, Enbridge shall apply the data inputs specified at the end of this Section F (*e.g.*, wall thickness, depth of feature, length of feature, and notch toughness) in calculating the Tensile Strain Capacity of the feature.

If Enbridge cannot calculate the Tensile Strain Capacity of a Circumferential Crack feature because it cannot identify any fitness-for-service assessment method that complies with the criteria set forth in step one, above, Enbridge shall place the Circumferential Crack feature on the Dig List within the same time period specified in this Section F (Paragraph 2) for completing the fitness-for-service calculations and, in such event, shall excavate and repair or mitigate the Circumferential Crack feature within 180 Days of being placed on the Dig List if the feature is located in an High-Consequence Area ("HCA") or within 365 Days if the feature is located in a non-HCA.

*Step Three: Calculate Tensile Strain Demand*: Enbridge shall calculate the axial strain, resolved to the location of the Circumferential Crack, due to the strain state and loading conditions imposed on the pipeline by internal pressurization and other forces. The strain state and loading condition applicable to the pipeline shall be identical to those used to assess the Circumferential Crack's fitness-for-service under Steps One and Two, above.

*Evaluation of Stresses Caused by Stream Crossings, Rail Crossing, and Other External Forces Not Considered in Initial Assessment of Tensile Strain Capacity and Tensile Strain Demand*: After completing the steps above, Enbridge shall divide the Tensile Strain Capacity of a Circumferential Crack by its Tensile Strain Demand. If the resulting quotient is less than or equal to 1.5, Enbridge shall determine whether the Circumferential Crack is subject to any strains caused by stream crossings, roads crossings, rail crossings or other strains not considered when initially calculating the Tensile Strain Capacity in accordance with Paragraph 1, above. If the Circumferential Crack is subject to such strains, Enbridge shall determine these stresses and recalculate the Tensile Strain Capacity and Tensile Strain Demand, taking these strains into account.

*Inputs Used to Calculate Tensile Strain Capacity*: Irrespective of the method used to determine the Tensile Strain Capacity of a Circumferential Crack feature, Enbridge shall calculate the Tensile Strain Capacity using the data inputs specified in the bullets below. For those inputs that are not specified below, Enbridge shall use all applicable and appropriate data inputs for achieving accurate and reasonable estimates of the Tensile Strain Capacity of a Circumferential Crack detected by an ILI tool. Such inputs shall include, among other things, all information regarding the Joint where the feature is located, including (but not limited to) pipe grade, pipe diameter, specified minimum yield strength ("SMYS"), ultimate tensile strength, fracture toughness, and flow stress.

- "Wall Thickness" Input: Enbridge shall select a value for wall thickness equal to the wall thickness of the Joint as measured by a USWM tool. If no USWM tool data exists, Enbridge shall apply the wall thickness of the Joint as determined by the best available ILI tool for measuring wall thickness.

- "Depth of Feature" Input: In selecting an input value for the depth of a Circumferential Crack feature detected by an ILI tool, Enbridge shall select a value equal to the depth of the feature as reported by the ILI tool plus an appropriate value representative of the tool tolerance of the ILI tool. If the ILI tool did not report a specific depth for a Circumferential Crack feature but reported instead a minimum and maximum depth for the feature, Enbridge shall input a value for the depth of the Circumferential Crack feature equal to either of the following, whichever is greater: (1) the maximum depth of the feature as reported by the ILI tool or (2) the minimum depth of the feature as reported by the ILI tool plus an appropriate value representative of the tool tolerance of the ILI tool.

- "Length of Feature" Input: In selecting an input value for the length of a Circumferential Crack feature detected by an ILI tool, Enbridge shall select a value equal to the length of the feature reported by the ILI tool, unless the feature is

classified as a "crack field." With respect to crack fields, Enbridge shall select a value representative of the total interacting length of cracks in the field as reported by the ILI tool vendor.

- "Notch Toughness" Input: Enbridge shall select an input value equal to a Charpy V-notch energy value (or an equivalent J integral value or a crack tip opening displacement (CTOD) value) that is no greater than 15 foot-pounds, unless an alternative value is permissible under the FFS Specifications applicable to the fitness-for-service method used by Enbridge to assess the Circumferential Crack feature and the alternative value selected is less than 25 foot-pounds. In no event shall Enbridge select an input value that falls outside the range of permissible values set forth in the FFS Specifications, unless and until Enbridge has prepared and finalized an FFS Specification Modification Report in accordance with step one, above, documenting its decision to depart from the FFS Specifications.

4. Fitness-for-Service Determination for Circumferential Cracks with a Non-Priority Saturated Signal: For each Circumferential Crack with a Non-Priority Saturated Signal, Enbridge shall determine the feature's Tensile Strain Capacity and Tensile Strain Demand as follows:

*Tensile Strain Capacity*: Enbridge shall determine the Circumferential Crack's Tensile Strain Capacity through a three-step process. First, Enbridge shall compute two semi-ellipses following the same Equivalent-Ellipse Analysis set forth, above, in Section E (Subparagraph 2.a.ii.(c)) above, except, in computing the ellipses, Enbridge shall use the Modified Crack Profile and the Modified Assumed Saturated Depth described in the bullets below. Second, upon computing the two semi-ellipses, Enbridge shall calculate the Tensile Strain Capacity of each semi-ellipse using the procedures set forth above in Paragraph 3 (Steps One and Two) of this Section F, except that the "length of feature" and "depth of feature" inputs for each calculation should be equal to the length and depth of the applicable equivalent ellipse. Third, after calculating the two Tensile Stain Capacity values, Enbridge shall select the lowest value as the Tensile Strain Capacity of the Circumferential Crack with the Non-Priority Saturated Signal.

- *Modified Crack Profile*: Enbridge shall determine the tool tolerance of the HRCCD ILI Tool and add this tool tolerance to the portions of the Crack Profile where the HRCCD ILI Tool was able to measure the depth of the Circumferential Crack.

- *Modified Assumed Saturated Depth*: For the purposes of determining whether the Circumferential Crack should be placed on the Dig List within the time periods required under Section G, below, Enbridge shall initially use an Assumed Saturated Depth of 5 mm, plus the tool tolerance of the HRCCD ILI Tool. Later, if Enbridge should determine that an increase in the Assumed Saturated Depth is warranted under Section M, Enbridge shall use the Updated Assumed Saturated Depth (as defined in Section M), plus the tool tolerance of the HRCCD ILI Tool, to evaluate whether any unexcavated Circumferential Cracks should be added to the Dig List.

*Tensile Strain Demand*: Enbridge shall calculate the Tensile Strain Demand of the Circumferential Crack using the procedures set forth above in Paragraph 3 (Step Three) of this Section F.

## G. Determination of Features Requiring Excavation and Establishment of Dig List

Following each ILI required under this Work Instruction, other than an ILI that is determined to be invalid, Enbridge shall identify all Circumferential Crack features detected by the ILI tool that are Features Requiring Excavation and add such features to the Dig List, in accordance with this Section G, but in no event shall such features be added to the Dig List more than 180 Days after the ILI tool is removed from the pipeline at the conclusion of the ILI investigation.

- Within two (2) Days after receiving notification of any Priority Feature from the ILI vendor, Enbridge shall review the ILI data relating to each such feature and any other relevant information and determine whether such feature was correctly identified as a Priority Feature and whether the feature was previously repaired or mitigated. As expeditiously as practicable after confirming that the Circumferential Crack is an unrepaired Priority Feature, but in no event more than two (2) Days after receipt of the notification from the ILI tool vender, Enbridge shall add the Circumferential Crack feature to the Dig List and, based upon the applicable dig selection criteria in Table 1, below, determine the maximum time from the date that the feature is placed on the Dig List until the date that the feature is repaired/mitigated.

- Upon receipt of the Initial ILI report from the ILI vendor, Enbridge shall evaluate each Circumferential Crack feature identified by the ILI tool to determine whether the feature is a Feature Requiring Excavation based upon one or more of the dig selection criteria in Table 1, below. Enbridge shall immediately proceed to make this determination with respect to all pipeline segments and/or features for which Enbridge did not identify data quality concerns during its preliminary review of any Initial ILI Report. For all other pipeline segments and/or features, Enbridge shall proceed to make such determination immediately upon resolving all data quality concerns, but in no event later than the deadlines required under this Work Instruction.

- Finally, within 30 Days after receiving any Initial ILI Report, Enbridge shall review OneSource for the purpose of determining whether any Circumferential Crack feature reported by the ILI tool intersects or interacts with a feature of a different feature type that was detected during a previous ILI Tool Run but not repaired or mitigated (*e.g.*, a Corrosion or Geometric feature), and it shall complete any additional review or analysis necessary to identify all intersecting or interacting features that have not previously been excavated and repaired or mitigated. Based upon this review, Enbridge shall determine whether the Circumferential Crack is a Feature Requiring Excavation based upon one or more of the dig selection criteria in Table 2, below.

- If Enbridge determines that a feature is a Feature Requiring Excavation based upon the dig selection criteria in either Table 1 or Table 2, below, Enbridge shall add the feature to the Dig List within five (5) Days of making such a determination, but in no event shall such feature be added to the Dig List more than 180 Days after the ILI tool is removed from the pipeline at the conclusion of any ILI investigation. The dig selection criteria set forth in Tables 1 and 2 are applicable to Circumferential Crack features in all sections of pipelines, regardless of whether the feature is located in a High Consequence Area or not.

**Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features**

| Dig Selection Criteria | Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated | Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated |
|---|---|---|
| Any Crack with a Saturated Signal (other than a Circumferential Crack with a Saturated Signal detected by a High-Resolution Circumferential Crack Detection ILI Tool) | As expeditiously as practicable but not to exceed 30 Days | No later than 2 Days after determination that the feature meets the dig selection criteria, Enbridge shall establish and maintain a pressure restriction that limits operating pressure at the location of the feature to 80% of the highest actual operating pressure at that location during the last 60 Days ("80/60 Interim Pressure Restriction"). |
| Circumferential Crack feature with a Priority Saturated Signal based upon Criteria One in Section E (Subparagraph 2.a.i) | As expeditiously as practicable but not to exceed 90 Days | No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature. |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| Circumferential Crack feature with a Priority Saturated Signal based upon Criteria Two in Section E (Subparagraph 2.a.ii) | As expeditiously as practicable but not to exceed 90 Days | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than 270 Days, in which event Enbridge shall establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after its determination that the feature meets dig selection criteria. |
| Any Circumferential Crack feature (including those with a Non-Priority Saturated Signal) with a Tensile Strain Capacity less than or equal to 1.05 times the Tensile Strain Demand | Not to exceed 180 Days in all circumstances (*i.e.*, no extension of deadline under Section K below). If the feature is subject to fatigue crack growth (as determined in Section J) and the Remaining Life of the Circumferential Crack is less than or equal to 540 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 540 Days, in which event Enbridge shall establish and maintain an interim pressure restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is placed on the Dig List until date that feature is repaired/mitigated"). |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | than 180 Days and establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after determination that the feature meets dig selection criteria. Deadline for repair cannot be extended under Section K, below.<br><br>Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 3. No pressure restriction is required and deadline for repair cannot be extended under Section K, below.<br><br>Action 3: No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain at the location of the feature an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than | Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination that the feature meets dig selection criteria. |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the feature within a time period less than the Remaining Life divided by 3. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Section K, below. | |
| Any Circumferential Crack feature with a depth greater than 70% of the wall thickness | Not to exceed 180 Days, except as provided below in Section K, for any feature that is stable or has a Remaining Life greater than 360 Days. If the feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater than 180 Days and establish and maintain an 80/60 | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 360 Days, in which event Enbridge shall establish and maintain an interim pressure restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is placed on the Dig List until date that feature is repaired/mitigated"). Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Interim Pressure Restriction at the location of the feature no later than 2 Days after determination that the feature meets dig selection criteria. Deadline for repair can be extended under Section K, below.<br><br>Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Section K, below.<br><br>Action 3: No later than 2 Days after determination that the feature meets dig selection criteria, Enbridge shall establish and maintain at the location of the feature an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and | that the feature meets dig selection criteria. |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | repair the feature within a time period less than the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. Deadline for repair cannot be extended under Section K, below. | |
| Any Circumferential Crack feature (including those with a Non-Priority Saturated Signal) with a Tensile Strain Capacity that is less than 1.25 x the Tensile Strain Demand (but greater than 1.05 x the Tensile Strain Demand) | Not to exceed 365 Days for any feature that is stable or has a Remaining Life greater than 730 Days. If the feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 730 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the Circumferential Crack within a period no greater than 365 Days and establish and maintain an 80/60 Interim Pressure Restriction at the location of the feature no later than 2 Days after determination that the feature meets dig selection criteria. | No pressure restriction is required unless the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 730 Days, in which event Enbridge shall establish and maintain an interim pressure restriction as required by the action selected under the column to the left ("Maximum time from the date that the feature is placed on the Dig List until date that feature is repaired/mitigated"). Enbridge shall establish the interim pressure restriction, if required, no later than 2 Days after its determination that the feature meets dig selection criteria. |

| **Appendix-K Table 1 – Criteria and Timelines Governing Excavation, Repair and Imposition of Pressure Restrictions for Circumferential Crack Features** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | **Pressure Restriction – Maximum allowable pressure at location of feature until feature is repaired/mitigated** |
| | Action 2: Enbridge shall excavate and repair the feature within a time period less than the Remaining Life divided by 2. No pressure restriction is required.<br><br>Action 3: No later than 2 Days after the determination that the feature meets dig selection criteria, Enbridge shall establish and maintain an interim pressure restriction that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the feature within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 365 Days. | |

| **Appendix-K Table 2 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types** | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | **High Consequence Area ("HCA")** | **Non-HCA** |
| Any dent located in the top of the pipeline (above the 4 and 8 o'clock positions) that has any indication of Circumferential Crack features | As expeditiously as practicable, but not to exceed 30 Days | As expeditiously as practicable, but not to exceed 60 Days, for each dent deeper than 2% of the outer diameter of the pipeline; otherwise, excavate and repair within 365 Days |
| Any dent located in the bottom of the pipeline (below the 4 and 8 o'clock positions) that has any indication of Circumferential Crack features | Not to exceed 60 Days | 180 Days for a dent deeper than 2% of the outer diameter of the pipeline; otherwise, excavate and repair within 365 Days |
| Any case in which a Circumferential Crack feature (including those with a Non-Priority Saturated Signal) intersects or interacts with a Corrosion feature and the Tensile Strain Capacity of such interacting or intersecting features is less than 1.25 x the Tensile Strain Demand of the features. | Not to exceed 180 Days, except as provided in Section K, for any interacting or intersecting features where the Circumferential Crack is stable or has a Remaining Life greater than 360 Days. If the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the features within a period no greater than 180 Days and establish an 80/60 Interim Pressure Restriction at the location of the intersecting or interacting features no later than 2 Days after the | Not to exceed 180 Days, except as provided in Section K, for any interacting or intersecting features where the Circumferential Crack is stable or has a Remaining Life greater than 360 Days. If the Circumferential Crack feature is subject to fatigue crack growth (as determined in Section J) and has a Remaining Life less than or equal to 360 Days, Enbridge shall take one of the following actions:<br><br>Action 1: Enbridge shall excavate and repair the features within a period no greater than 180 Days and establish an 80/60 Interim Pressure Restriction at the location of the intersecting or interacting features no later than 2 Days after the |

| Appendix-K Table 2 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | **High Consequence Area ("HCA")** | **Non-HCA** |
| | determination that such features meet dig selection criteria. Deadline for repair can be extended under Section K.<br><br>Action 2: Enbridge shall excavate and repair the features within a time period less than the Remaining Life of the Circumferential Crack feature divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Section K.<br><br>Action 3: No later than 2 Days after the determination that the features meet dig selection criteria, Enbridge shall establish an interim pressure restriction at the location of such features that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the features within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. | determination that such features meet dig selection criteria. Deadline for repair can be extended under Section K.<br><br>Action 2: Enbridge shall excavate and repair the features within a time period less than the Remaining Life of the Circumferential Crack feature divided by 2. No pressure restriction is required and deadline for repair cannot be extended under Section K.<br><br>Action 3: No later than 2 Days after the determination that the features meet dig selection criteria, Enbridge shall establish an interim pressure restriction at the location of such features that is less restrictive than an 80/60 Interim Pressure Restriction but more restrictive than Established MOP. Enbridge shall recalculate the Remaining Life based on the interim pressure restriction and excavate and repair the features within a time period less than or equal to the Remaining Life divided by 2. In no event shall the time period for excavation and repair exceed 180 Days. |

| Appendix-K Table 2 – Criteria and Timelines for Excavation and Repair of Intersecting or Interacting Feature Types | | |
|---|---|---|
| **Dig Selection Criteria** | **Maximum time from date that feature is placed on the Dig List until date that feature is repaired/mitigated** | |
| | **High Consequence Area ("HCA")** | **Non-HCA** |
| | Deadline for repair cannot be extended under Section K. | Deadline for repair cannot be extended under Section K. |

**H. Excavation and Repair of Circumferential Crack features Added to the Dig List and Other Unreported Circumferential Cracks**

*Duty to Repair Circumferential Cracks Added to the Dig List*: Enbridge shall excavate and repair or mitigate each Circumferential Crack that qualifies as a Feature Requiring Excavation and that is added to the Dig List under Section G, above ("Circumferential Crack FRE"). During such excavations, Enbridge shall inspect all excavated portions of the pipeline and obtain and record field measurements of all features on the excavated sections of the pipeline. If Enbridge excavates any additional sections of such pipeline following the ILI, Enbridge shall also obtain and record field measurements of all features on such additional pipeline sections.

Notwithstanding the foregoing, Enbridge shall not be required to record any field measurement values that are below the ILI tool detection thresholds. Likewise, in cases where an excavated section of pipe contains a high volume of Circumferential Cracks unreported by the ILI tool, Enbridge need not collect and record field measurements of all features observed in the field, provided that (1) Enbridge obtains and records field measurements of all features that were identified by the ILI tool, as well as the five worst Circumferential Cracks not identified by the ILI tool; (2) Enbridge records the total number of unreported features that are detectible within ILI tool specification; and (3) Enbridge repairs or mitigates the features on such section of pipe by sleeving or replacing such section of pipe, or by grinding or blasting and recoating features on such section of pipe. For the purposes of this Section, Circumferential Cracks with the lowest Tensile Strain Capacity shall be deemed to be the worst features.

*Schedule for Repair*: For each Circumferential Crack FRE, Enbridge shall establish excavation and repair deadlines that take into account the level of threat posed by the feature, but in no event shall the deadline for any Circumferential Crack FRE exceed the number of Days allotted for excavation and repair of the feature under Section G, above, as specified in either Table 1 (column 2) or Table 2 (columns 2 and 3). If a Circumferential Crack FRE meets more than one dig selection criteria in Tables 1 and 2, Enbridge shall excavate and repair the feature in accordance with shortest applicable timetable for excavation and repair of the feature.

*Repair of Unreported Circumferential Crack*: Based on its inspection of the excavated portions of the pipeline, Enbridge shall (1) determine, based on an analysis of field measurement values of feature length and depth and any other relevant field observations, whether such excavated portions of the pipeline contain any additional Circumferential Crack features, not

previously identified on the Dig List, that satisfy one or more of the dig selection criteria identified in Section G, above, under Tables 1 and 2 and (2) repair or mitigate all such additional features at the time of the excavation. To determine whether such features satisfy one or more of the dig selection criteria, Enbridge shall determine the fitness-for-service of such features in accordance with the procedures set forth above in Section F (Paragraph 3), except that the inputs for "Depth of Feature" and "Length of Feature" shall be based upon field measurements of the feature, as described below.

- "Depth of feature" Input: In selecting an input value for the depth of a Circumferential Crack feature analyzed in the field, Enbridge shall not select a single value for depth for the feature, but rather should input a number of values equal to the depth measurements collected by field personnel as they measured the feature's varying depth over its entire length. In the event that the feature is a Circumferential Crack feature that is located within a Corrosion feature, Enbridge shall ensure that the depth reported by field personnel reflects the combined depth of the features.

- "Length of feature" Input: In selecting an input or the length of a Circumferential Crack feature or analyzed in the field, Enbridge shall select a value equal to the length reported by field personnel using non-destructive examination ("NDE") methodologies to measure the feature's length.

## I. Interim Pressure Restrictions

On the same day that Enbridge places a Circumferential Crack FRE on the Dig List pursuant to Section G, above, Enbridge shall, if required, establish an interim pressure restriction for the feature. Enbridge shall establish and maintain interim pressure restrictions in accordance with applicable requirements and timeframes specified in either Table 1 (columns 2 and 3) or Table 2 (columns 2 and 3) of Section G, above. With respect to each Circumferential Crack FRE that intersects or interacts with a dent, Enbridge shall establish and maintain an 80/60 Interim Pressure Restriction. In any case where a Circumferential Crack FRE is subject to more than one pressure restriction, Enbridge shall establish the pressure restriction that results in the lowest operating pressure at the location of the feature.

Although the pressure restriction requirements for Circumferential Crack FREs are expressed in terms of "point pressure restriction values" (*i.e.*, the maximum permissible pressure at the location of the feature), the pressure restriction requirement may be satisfied by limiting the discharge pressure at the nearest upstream pump station to a level that assures compliance with the point pressure restriction value at the location of the feature. In any case where a feature subject to a pressure restriction under Section G, above, is located in a pipeline segment for which any discharge pressure restriction has been established, Enbridge must maintain compliance with the applicable discharge pressure restriction even if it reduces operating pressure at the location of such feature below the point pressure restriction required under Section G, above.

## J. Fatigue Growth and Remaining Life of Circumferential Crack FREs

*Fatigue Growth*: No later than the date that a Circumferential Crack is added to the Dig List, Enbridge shall determine whether such a feature is subject to fatigue crack growth through Steps One to Four, below. Such analysis is necessary under Section G, above, to determine (1) the maximum time for repair of the feature once it is added to the Dig List and (2) whether such feature requires an interim pressure restriction. Enbridge does not need to conduct a fatigue growth analysis of any Circumferential Crack FRE that meets the dig selection criteria labelled "*Circumferential Crack with a Priority Saturated Signal Based upon Criteria One in Section E (Subparagraph 2.a.i)*" in Appendix K-Table 1 because such a feature requires an interim pressure restriction irrespective of whether it is subject to fatigue growth.

- *Step One:* Enbridge shall determine the mean stress and stress amplitude at the location of the Circumferential Crack FRE based upon external load conditions and pressure cycling ("Stress Cycle Range"). Pressure cycling shall take into account the worst cycling quarter in the five years prior to the ILI Tool Run that identified the Circumferential Crack FRE. For the purposes of this Work Instruction, the worst cycling quarter shall reflect the quarter with the worst combination of cycling frequency and cycling magnitude for the applicable line or line segment.

- *Step Two:* Enbridge shall determine the length and depth of the Circumferential Crack FRE, as well as any other variables that may affect growth of the feature ("Crack Geometry"). In determining Crack Geometry, Enbridge shall use the same length and depth inputs that it used to determine whether the Circumferential Crack FRE should be added to the Dig List based upon the dig selection criteria set forth in Section G, above.

- *Step Three*: Based upon the Stress Cycle Range (determined in Step One) and the Crack Geometry (determined in Step Two), Enbridge shall determine the stress intensity factor range that occurs at the tip of the Circumferential Crack FRE *(i.e.*, the point at which the Circumferential Crack propagates). In making this determination, Enbridge shall choose the fracture mechanics model that is most appropriate to the Crack Geometry and the loading condition (*e.g.*, tension, bending, or a combination of the two) applicable to the Circumferential Crack. If the Crack Geometry is outside the scope of the specifications applicable to the fracture mechanics model (*e.g.*, the length of the major axis of the equivalent ellipse relative to its minor axis exceeds the aspect ratio of the fracture mechanics model), Enbridge shall either (1) use the fracture mechanics model and prepare a written report documenting this decision for later review by PHMSA, or (2) use the fracture mechanics model of a circumferential edge crack in a pipe with uniform depth. In the event that Enbridge chooses the first option, the written report shall identify the relevant specifications of the fracture mechanics model, describe the impact of departing from this specification, and

present all facts or data that Enbridge relies upon to support its decision to use the fracture mechanics model notwithstanding this variance.

- *Step Four*: Enbridge shall compare the stress intensity factor (determined in Step Three) with the no-growth threshold values for sharp cracks in air. If the stress intensity factor range is greater than the threshold value, the Circumferential Crack FRE is subject to fatigue crack growth. For the purposes of making this determination, the term "no-growth threshold values for sharp cracks in air" shall mean threshold stress intensity factors for sharp cracks that yield a threshold value ("$K_{th}$") of 4 MPa $m^{1/2}$ for a Stress Cycle Range with a stress ratio ("R") of 0.6 and assumes that $K_{th}$ will decrease as R increases. R is the ratio of the minimal stress to the maximal stress of the Stress Cycle Range.

Determination of Remaining Life for Circumferential Crack FREs: If a Circumferential Crack FRE is subject to fatigue crack growth, Enbridge shall determine the number of pressure cycles that remain until the Circumferential Crack FRE grows to the point where the Tensile Strain Demand at the location of the feature is predicted to equal or exceed the feature's Tensile Strain Capacity. Based upon the number of remaining pressure cycles, Enbridge shall estimate the Remaining Life of the Circumferential Crack FRE, which is defined as the estimated period of time remaining before the Circumferential Crack is predicted to grow to the point where the Tensile Strain Demand at the location of the feature is greater than or equal to the feature's Tensile Strain Capacity.

## K. Extension of Certain 180-Day Deadlines for Excavation and Repair of Circumferential Crack FREs

*Ability to Extend 180-Day Deadlines:* When expressly permitted in accordance with Tables 1 and 2 of Section G, above, Enbridge may extend 180-Day Deadlines for excavation and repair if Enbridge concludes and documents that it is not practicable to complete the excavation and repair or mitigation of any Circumferential Crack FRE within any 180-Day period due to seasonal considerations or unusual circumstances. In such instances, Enbridge shall determine the revised schedule for repair or mitigation, as well as establish and/or maintain appropriate pressure restrictions (if required), as provided, below, in this Section K under the Subparagraph, below, entitled *Revised Schedule for Repair or Mitigation and Interim Pressure Restriction.*

*Justification for Extension:* For purposes of this Section K, seasonal considerations or unusual circumstances may include: situations in which excavations during winter months will substantially reduce potential adverse impacts of the excavation on wetland ecosystems and the risk that the identified feature will result in a leak or rupture is low; situations in which excavations during periods of low flow conditions will substantially reduce adverse impact on riverine or floodplain ecosystems and the risk that the identified feature will result in a leak or rupture is low; or situations involving excavations near known populations of Threatened or Endangered Species where a delay in the excavation will reduce adverse impacts on the identified species and the risk that the identified feature will result in a leak or a rupture is low. For purposes of this Section K, neither the number of required excavations, nor the costs of any required excavation, nor the availability of staff, contractors or equipment, nor the ability to

obtain a permit or authorization, shall be considered unusual circumstances that establish the impracticability of completing excavation and repair of features within a 180-Day time period.

*Documentation of Extension*: For each instance in which Enbridge asserts that an excavation is subject to an extended deadline pursuant to the provisions of this Section K, Enbridge shall prepare and maintain (and provide to PHMSA upon request) a report documenting the basis for the extension. Such report shall include: (1) a detailed description of the seasonal considerations or unusual circumstances that support extension of the excavation deadline; (2) an explanation of the specific reasons why the seasonal considerations or unusual circumstances caused such a delay; and (3) a schedule for completing the excavation within 365 Days from the date the Feature Requiring Excavation was placed on the Dig List.

*Revised Schedule for Repair or Mitigation and Interim Pressure Restriction*: If Enbridge concludes and documents that it is not practicable to complete the excavation and repair or mitigation of any Circumferential Crack FRE within any 180-Day period due to seasonal considerations or unusual circumstances, Enbridge shall complete the excavation and repair of such Circumferential Crack FRE as expeditiously as practicable after the applicable 180-Day time period, but in no event shall Enbridge exceed the deadlines applicable to the feature, as set forth in the bullets below. In addition, where required in the bullets below, Enbridge shall establish and/or maintain a pressure restriction at the location of the feature as of the end of the initially prescribed 180-Day period for the repair or mitigation of the feature. Enbridge shall maintain such pressure restriction until such time that the Circumferential Crack feature is excavated and repaired. For the purposes of this Section K, the term "Circumferential Crack features" includes any Circumferential Crack that interacts or intersects with a Corrosion feature or Geometric feature and, as such, is a Feature Requiring Excavation under Table 2 of Section G, above.

- *Circumferential Crack feature that is stable*: If a Circumferential Crack feature is not subject to a pressure restriction because the feature was determined to be stable (*i.e.*, it is not subject to fatigue growth under Section J) at the time it was placed on the Dig List, Enbridge may extend the schedule for repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List. No interim pressure restriction is required.

- *Circumferential Crack feature that is subject to fatigue growth but not subject to pressure restriction under Sections G and I:* If a Circumferential Crack feature is not subject to a pressure restriction under Sections G and I, above, because its Remaining Life was determined to be greater than 360 Days at the time the feature was placed on the Dig List, Enbridge shall recalculate the Remaining Life (following the procedures set forth in Section J) to determine the Remaining Life of the feature as of the date that marks the end of the initially prescribed 180-Day period for repair or mitigation ("Remaining Life at 180 Days"). If the Remaining Life at 180 Days is greater than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge does not need to establish a pressure restriction for the feature and may extend the schedule for excavation and repair or mitigation to a date within 365 Days from the date of

the feature was initially placed on the Dig List. If the Remaining Life at 180 days is less than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair and mitigation, Enbridge shall select one of the following actions in Subparagraph (1), (2), or (3) of this Section K, below:

(1) First, Enbridge shall establish an 80/60 Interim Pressure Restriction at the location of the feature no later than the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, and, second, Enbridge shall extend the schedule for excavation and repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List.

(2) From the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall extend the schedule for excavation and repair or mitigation by no more than the number of days equal to the Remaining Life at 180 Days divided by 2. No pressure restriction is required.

(3) First, Enbridge shall establish a pressure restriction that is less stringent than an 80/60 Interim Pressure and do so at the location of the feature no later than the date that marks the end of the initially prescribed 180-Day period for repair or mitigation; second, taking into account the effect of this pressure restriction, Enbridge shall recalculate the Remaining Life at 180 Days following the procedures set forth in Section J; and, third, from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall extend the schedule for excavation and repair or mitigation by no more than the number of days equal to the Remaining Life at 180 Days divided by 2.

- *Circumferential Crack feature that is subject to interim pressure restriction under Sections G and I.* If the feature is already subject to a pressure restriction under Section G and I, above, Enbridge shall calculate the Remaining Life at 180 Days taking into account the effect of this pressure restriction. If the Remaining Life at 180 Days is greater than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge may extend the schedule for repair or mitigation to a date within 365 Days from the date that the feature was placed on the Dig List, provided that Enbridge continues to maintain the pressure restriction. If the Remaining Life at 180 Days is less than 365 Days from the date that marks the end of the initially prescribed 180-Day period for repair or mitigation, Enbridge shall continue to maintain the pressure restriction and may extend the 180-Day Deadline for excavation and repair or mitigation by the number of days equal to the Remaining Life at 180 Days divided by 2.

## L. Post-Excavation ILI-Tool Depth Bias Study

Within 30 Days after completing excavation of all Circumferential Crack FREs identified on a pipeline based on an Initial ILI Report, Enbridge shall complete an analysis of field data obtained during all excavations conducted on such pipeline subsequent to the ILI for the purpose of determining whether field data indicate that the ILI tool tended to understate the actual

severity of features on the excavated sections of the pipeline. In performing the analysis, Enbridge shall consider all field data that has sufficient precision and reliability to assess the accuracy of the ILI-reported data. Enbridge must complete a statistical analysis that compares field measurements of the depth of Circumferential Cracks with the ILI-reported depths for such features. If such analysis reveals that field measurements of feature depth exceed ILI-reported feature depth values by more than one tool tolerance, Enbridge shall quantify the magnitude of any ILI tool depth bias. Not more than five (5) Days after determining the magnitude of any ILI tool depth bias, Enbridge shall add the ILI tool bias to the ILI-reported depth of all unrepaired Circumferential Crack features, complete revised Tensile Strain Capacity calculations in accordance with Section F (Paragraph 3, Step Two), above, and determine whether any additional Circumferential Crack features qualify as Features Requiring Excavation under Section G, above, when the revised feature depth is taken into account. Upon determining that any feature is a Feature Requiring Excavation, Enbridge shall add such feature to the Dig List immediately, but in no event longer than five (5) Days after the determination required by this Section L.

**M. Post-Excavation Saturated Depth Study**

*Predicate for Saturated Depth Study*: Within 30 Days after completing excavation of all Circumferential Crack FREs identified on a pipeline based on an Initial ILI Report, Enbridge shall conduct a study of the depth of Circumferential Cracks with saturated signals if (1) the ILI tool used to investigate Circumferential Crack features in the pipeline was an HRCCD ILI Tool, (2) Enbridge excavated ten or more Circumferential Crack FREs whose depth could not be measured by the ILI tool based solely upon the tool's primary ultrasonic signal, and (3) field measurement of such Circumferential Crack FREs revealed that that at least one Circumferential Crack FRE had a depth greater than 5 mm. If all three of these conditions are met, Enbridge must conduct a study to evaluate the field data from the excavation of all Circumferential Crack FREs whose depth could not be measured by the ILI tool based solely upon the tool's primary ultrasonic signal ("Saturated Data Set") to determine whether the Assumed Saturated Depth used in Section E (Subparagraph 2.a.ii.(e)), above, shall be increased for the purpose of determine whether additional Circumferential Cracks with saturated signals should be placed on the Dig List.

*Statistical Analysis of Circumferential Crack FREs*: Enbridge shall evaluate, using either a t-test or an analysis of variance (ANOVA), whether the Circumferential Cracks in the Saturated Data Set are statistically similar to the statistical distribution of the field data for Circumferential Cracks with saturated signals that were excavated and repaired in Line 6A between 2019 and 2020. If the two populations are statistically different, Enbridge shall undertake the following evaluations:

(1) Based upon Circumferential Cracks in the Saturated Data Set, Enbridge shall compute the distribution curve showing the range of probable depths of all Circumferential Cracks with saturated signals on the newly investigated pipeline or pipeline segment ("Post-Excavation Distribution Curve"). If the depth at the 95th percentile on this curve ("95th Percentile Depth") is greater than 5 mm, Enbridge shall consider whether to increase the

Assumed Saturated Depth used in Section E (Subparagraph 2.a.ii.(e)), above, to determine whether a Circumferential Crack has a Priority Saturated Signal. If Enbridge determines that no increase in the Assumed Saturated Depth is warranted, Enbridge shall document its determination in a report that it shall maintain on file for later review by PHMSA. Conversely, if Enbridge determines that an increase to the Assumed Saturated Depth is appropriate, Enbridge shall select an Assumed Saturated Depth greater than 5 mm ("Updated Assumed Saturated Depth") based upon the Post-Excavation Distribution Curve and other relevant information collected by Enbridge from its operation and maintenance of pipelines in the Lakehead System. Enbridge shall apply the Updated Assumed Saturated Depth for the purpose of conducting the Equivalent-Ellipse Analysis required under Section E (Subparagraph 2.a.ii.(c)) above. Enbridge shall apply this analysis to each unexcavated Circumferential Crack with a Non-Priority Saturated Signal. Upon determining that any such feature, when evaluated using the Updated Assumed Saturated Depth, now qualifies as a Circumferential Crack with a Priority Saturated Signal under Section E (Paragraph 2.a), above, Enbridge shall immediately add the feature to the Dig List, but in no event later than 5 Days after such a determination is made. All such features added to the Dig List shall be excavated and repaired in accordance with Sections G and H, above, and, if necessary, shall be subject to an interim pressure restriction in accordance with Sections G and I, above.

(2) If the evaluation in the preceding Subparagraph (1) of this Section M shows that one or more unexcavated Circumferential Cracks continue to have a Non-Priority Saturated Signal, Enbridge shall re-calculate the Tensile Strain Capacity of all such features in accordance with Section F (Paragraph 4), above, using the Updated Assumed Saturated Depth in lieu of the 5 mm depth that Enbridge initially used in calculating Tensile Strain Capacity. If the revised Tensile Strain Capacity of an unexcavated Circumferential Crack results in the feature meeting any of the dig selection criteria in Section G, above, Enbridge shall immediately place the feature on the Dig List, but in no event later than 5 Days after such a determination is made. All such features added to the Dig List shall be excavated repaired in accordance with Sections G and H, above, and, if necessary, shall be subject to an interim pressure restriction in accordance with Sections G and I, above.

## N. Information to Be Collected and Maintained by Enbridge

For each ILI investigation of Circumferential Cracks under this Work Instruction, Enbridge shall collect and maintain records (and provide them to PHMSA upon request) records relating to its implementation of this Work Instruction, including, but not limited to, the following:

*ILI Data*: Enbridge shall collect and maintain ILI data, including, but not limited to: (1) identification of the ILI vendor and the tool used for each inspection; (2) any notification from the ILI vendor that an ILI could not be completed or was invalid; (3) information relating to any Priority Features, including the date the vendor notified Enbridge of the feature, the date Enbridge confirmed the feature, if applicable, and the excavation/repair date of each such feature; (4) the date on which the ILI tool was removed from the pipeline at the conclusion of the ILI; (5) the date Enbridge received the Initial ILI Report from the vendor; (6) the date on which

Enbridge completed its preliminary review of the Initial ILI Report; (7) a description of each data quality concern identified by Enbridge in its preliminary review of the Initial ILI Report, and the pipeline section(s) affected by each such identified data quality concern; and (8) the date or dates on which Enbridge resolved each identified data quality concern and a description of how the concern was resolved.

*Establishment of Dig List and Interim Pressure Restrictions*: Enbridge shall collect and maintain records relating to its establishment of the Dig List and its determination as to whether a Circumferential Crack FRE requires an interim pressure restriction, including, but not limited to: (1) reports provided by the ILI vendor concerning the identification, size, and characterization of Circumferential Cracks detected by the ILI tool, (2) evaluations and identifications of Priority Features, (3) assessments of the fitness-for-service of Circumferential Cracks, (4) determinations as to whether features detected by the ILI tool are Circumferential Crack FREs, (5) determinations as to whether a Circumferential Crack FRE is subject to fatigue growth and, if so, the Remaining Life of such feature, (6) determinations as to interim pressure restriction applicable to Circumferential Crack FREs, (7) determinations of the applicable excavation and repair deadlines for the Circumferential Crack FREs, and (8) determinations to extend the deadline for repair of Circumferential Crack FREs pursuant to Section K, above, including the basis for findings that compliance with the 180-Day Deadline was impracticable.

*Field Data*: Enbridge shall collect and maintain records of field data collected during the excavation and repair of Circumferential Crack FREs and all reports based upon such field data, including, but not limited to: (1) all reports prepared and submitted by the NDE team responsible for excavating and repairing Circumferential Crack FREs, (2) the number of Circumferential Cracks that were not detected by the ILI tool, (3) the size and depth of Circumferential Cracks as measured in the field, (4) any evaluation of ILI tool bias, and (5) any evaluation of the depth of Circumferential Cracks with saturated signals.

## O. Force Majeure

*Tolling of Deadlines Due to Force Majeure*: Any deadline set forth in this Work Instruction may be tolled in the event that a Force Majeure event prevents Enbridge from complying with the deadline. The deadline shall be extended for such time as is necessary to complete the obligations affected by the Force Majeure event. An extension of the time for performance of the obligations affected by the Force Majeure event shall not, of itself, extend the time for performance of any other obligation.

*Events Constituting a Force Majeure*: For the purposes of this Work Instruction, a "Force Majeure" is defined as any event arising from causes beyond the control of Enbridge, of any entity controlled by Enbridge, or of Enbridge's contractors, that delays or prevents the performance of any obligation under this Work Instruction despite Enbridge's best efforts to fulfill the obligation. The requirement that Enbridge exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential Force Majeure event and best efforts to address the effects of any such event (a) as it is occurring and (b) following its occurrence, such that the delay and any adverse effects of the delay are minimized to the greatest

extent possible. "Force Majeure" does not include Enbridge's financial inability to perform any obligation under this Work Instruction.

*Force Majeure Report*: In the event that Enbridge believes that compliance with an applicable deadline under this Work Instruction may not be possible due to a Force Majeure event, Enbridge shall prepare and maintain (and provide to PHMSA upon request) a written report of this determination no later than 15 Days after Enbridge first knew that such an event might cause a delay. The report shall include an explanation and description of the reasons for the delay, the anticipated duration of the delay, all actions taken or to be taken to prevent or minimize the delay, a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay, and Enbridge's rationale for attributing such delay to a Force Majeure event. Enbridge shall include within the report all available documentation supporting the claim that the delay was attributable to a Force Majeure event.

Update of Force Majeure Report: If Enbridge concludes that a delay due to a Force Majeure event may be longer than originally anticipated when Enbridge prepared the original Force Majeure Report, Enbridge shall prepare and maintain (and provide to PHMSA upon request) a supplemental report no later than 30 Days after Enbridge first knew of the additional delay. Depending upon the length and nature of the delay, additional supplemental reports may be required. Each supplemental report shall update and revise the information in the original Force Majeure Report by, among other things, explaining why the delay is lasting longer than previously anticipated, identifying all actions taken and to be taken to prevent or minimize the additional delay, and providing a revised schedule for implementation of any measures taken or to be taken to prevent or mitigate the additional delay or its effect.