

Crack ILI Program Summary Document

Line 05 WNO-WMA 2018 NDT UCc

Latest Revision Date: 2018/11/21

Version #: 1.1

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1.0 Purpose

This document serves as a checklist and summary of Crack ILI assessment results, with provisions for commentary.

2.0 Scope

This record applies to the ILI reports indicated on the front page of this document. This document will reference Pipeline Integrity (PI) procedures as part of the Fitness for Service (FfS) process defined further in Integrated Management System. Information found elsewhere within PI documentation is not to be duplicated herein.

3.0 Basic Inspection Remarks

This inspection is the third circumferential crack inspection for this section of pipeline. The most recent prior inspection was conducted in April 2017 with NDT UCc.

The minimum detection threshold for this inspection is:

- 30 mm long by 2.0 mm deep at weld
- 30 mm long by 1.0 mm deep in base metal

Tool depth tolerances are:

- ± 1.0 mm depth at 80% confidence at weld
- ± 1.0 mm depth at 80% confidence in base metal

Link to Vendor Final ILI Report

Is this a Lakehead regulated line segment?

☒ Yes

☐ No

4.0 Priority Notification for Imperative Condition

Were there any features reported meeting imperative condition?

☐ Yes

☒ No

5.0 Inspection Report Review (PI-36) and Remarks

Complete steps in PI-36, adding explanatory notes below for any data quality issues, corrective actions (if applicable), and why inspection results meet expectations.	☒ Complete

Pipeline name	Line 5
Construction year	1953
Launcher – receiver	North Straits West – Mackinaw
Length of pipeline section	4.10 mi.
Length of recorded pipeline section	21795.50 ft.
Outer diameter	20"
Minimum bend radius	5D/90°
Wall thickness range	0.500 in. – 0.812 in., predominant: 0.812 in.
Weld type	Seamless
Steel grades	API 5L X30, API 5L X52, API 5L X60, API 5L X65

During the inspection, data was recorded by all channels, covering the complete circumference and length of the pipeline. Based on the statistics and results of the data quality assessment it can be concluded that the quality of the recorded data is good, complete and has consistent amplitudes over the total inspection distance. No coupling loss was identified. The tool speed was within acceptable limits. The stated performance specifications can be achieved over the entire pipeline length and circumference.

The number of reported features between the 2017 and 2018 UCc inspections is listed below:

East Straits	2017 UCc	2018 UCc
Notch-like features	21	0
Crack-like features	3	2

As can be seen, there is a discrepancy in the number of reported features, especially in notch-like features. After investigation with NDT:

In 2018 all notch-like features have a calculated depth < 39 mils and are therefore below the reporting threshold and not reported.

The 21 notch-like features in 2017 were also below the reporting threshold. They were nevertheless reported because they were reported as crack-like features in 2014. NDT has been updating their feature classifications based on field verification results and newest knowledge in UCc data analysis, explaining the migration of tool feature calls.

DQA Issues:
NDT has stated: *"Please be aware that the UCc tool is not the best tool to detect geometric features. It has also to be mentioned that detection, discrimination, and sizing of linear anomalies at geometric features is limited due to lift off of the sensor carrier."* and *"Several features with a length below the reporting threshold were entered into the listing. The specified confidence level is not applicable to features with dimensions below the performance specifications and may therefore be reduced." "In UCc data analysis, it is sometimes difficult to distinguish crack-like or crack field anomalies from notch-like or metal loss anomalies. Therefore, these anomalies were, in a conservative way, classified as crack-like or crack field anomalies. However, it cannot be excluded that they are really manufacturing-related or metal loss anomalies."*

Based on these statements, NDT does not have the confidence to reliably classify features located within geometric features, especially with features that are below the stated reporting threshold. NDT has reviewed their feature classifications below detection threshold and within geometric features with additional considerations for field verification results. Based on this review, NDT has issued an updated report with revised feature classification and sizing for affected features. Only one feature was impacted by this update:

FID 1000001:
Issue 1.1 – external CL feature in BM with 0.5 mm depth and 32 mm circumferential length. At Enbridge requested reporting threshold. Note that this report was considered Issue 2.
Issue 3 – external NL feature in BM with 0.2 mm depth and 32 mm circumferential length. Below reporting and detection threshold.
Issue 4 – external NL feature in BM with 0.2 mm depth and 32 mm circumferential length removed from feature list since depth is far below reporting and detection threshold.

Note that between Issue 1 and Issue 1.1, the naming convention of GEOMETRIC ANOMALY was updated to DEFORMATION – GEOMETRIC ANOMALY. Also, in Issue 4 the Executive Summary

erroneously still indicates "3 crack-like anomalies" but the body of the report reinforces only 2 are reported.

6.0 ILI Fitness-for-Service Evaluation (PI-37) and Remarks

The Fitness for Service Evaluation checklist is as follows:

WI-32 Threat Integration is complete and interacting crack features are addressed in Detailed Feature Review ☒ Complete

Is this a circumferential crack ILI tool assessment? ☒ Yes ☐ No

If yes, complete steps in WI-54/PI-54, delete the rest of the template below, and describe the FfS results, mitigation selection, and conclusions below.

Only 2 unmitigated CL features were reported in this inspection.

None of the CL features were located within strain sites.

The most severe SF is 4.47 and the shortest fatigue life is in excess of 200 years.

Based on this assessment, no features meet Consent Decree excavation criteria.

No pressure restrictions are required.

In Issue 3, one possible NL feature (FID 1000001) was reported to be interacting with a geometric anomaly. This feature has since been removed from the report since it is below detection and reporting threshold:

The Geometric Anomaly (GA) with ID 65575 (GW 6040) was previously reported in the 2014 and 2017 UCc inspections. As well, it was confirmed in the 2018 Geopig raw data (was not reported since it was a plain GA < 2% OD). Based on the 2018 Geopig, the GA is identified as a smooth, plain bottom-side (MSP at 124 deg) deformation ~1.2% OD, not reported to be interacting with any other features. No close proximity, off-axis, or multi-apex characteristics.

In the 2018 UCc Issue 3 Report, this geometric anomaly was reported to be interacting with a notch-like anomaly with a calculated depth of 0.2 mm and a circumferential length of 32 mm (depth far below UCc stated detection threshold of 1 mm). It is not interacting with any welds and is reported at the edge of the GA, in the base metal. The UCc inspection data from 2014 and 2017 also show external indications at the location of the reported notch, but with low amplitudes (depths of 0.2 mm and 0.3 mm, respectively). Based on discussions with NDT, they cannot say with confidence that this feature is not a manufacturing related anomaly or an erroneous signal resulting from the geometry of the GA (the feature classified as notch-like anomaly shows no patterns that could be used to distinguish between a real crack/notch and a manufacturing related

anomaly). The POI for features at GAs is generally impacted due to the lift-off of the sensor carrier. In addition, the orientation and location of the circumferential feature are not aligned with expected development of a fatigue crack due to stress distribution within the GA. No further actions are required at this time. The Line 5 straits are inspected via UCc on an annual basis; this feature will be monitored in future inspections.

7.0 Excavation Selection (PI-38) and PI Listing Approval

Select features for mitigation based on PI-38 and WI-38.

Complete steps in PI-38 Mitigation Selection and PI Listing Approval, including steps of WI-38 Mitigation Selection, Crack, In-Line Inspection	☒ Complete
Ensure comments columns in the Crack ILI Assessment Sheet have appropriate entries for features to be mitigated.	☒ Complete
Any additional features meriting a detailed review due to mitigation selection process have been assessed in the Detailed Feature review document.	☒ Complete
The Crack ILI Assessment tool has generated the before and after mitigation program Fitness for Purpose graphs and they have been checked for accuracy and completeness	☒ Complete
Pressure restrictions and safe excavation pressures have been determined and entered. If required, a pressure restriction study has been completed.	☒ Complete
The Crack ILI Assessment tool has created a Dig Selection Summary Table and has been checked for accuracy and completeness	☒ Complete
Priority Dig Total: 0 Phase 1 Dig Total: 0 Phase 2 Dig Total: ___	
Consult Crack SME if special circumstances or deviations from standard analysis methods are employed. This will usually involve writing an Engineering Assessment per PI-150, with crack SME approval.	☒ Complete
WI-15 Below Grade Appurtenances steps are followed.	☒ Complete
A crack program summary stakeholder meeting (Crack SME, PI Planning Supervisor, Dig Program and Safety Case engineers) has been held and any action items addressed. Invite crack SME to review this document.	☒ Complete

SME Approval Box: Reviewed and Approved? Lyndon Lamborn	☒ Yes
Most recent review (NDT Report Issue #4): 11/23/2018	☐ No

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