

Crack ILI Program Summary Document

Line 5 ENO-EMA 2017 NDT UCc

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1.0 Purpose

This document will provide a summary of all aspects associated with the crack management program. Contents of this summary may include but it is not limited to:

- ILI QA/QC results and remarks
- Summary of preliminary results, as well as learnings from previous excavation program
- Summary of preliminary field results and trending (if available)
- Back to back ILI inspection comparison (if available)
- Summary of priority notification features
- Summary of pressure restrictions associated with crack features reported by the Inspection
- Summary of crack features meeting “Code Criteria” as per of PI-38
- Summary of crack features meeting “Investigative Criteria” as per PI-38
- Summary of crack features identified through threat integration
- List of crack feature selected for detail feature review

It is important to consider that this document is a working file that tracks learnings and/or status of the crack program. Therefore, all changes to the selection process should be included in the corresponding sections and a clear summary of the learnings and resultant actions should be documented within this document.

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 IMS-09.

3.0 Basic Inspection Remarks

This inspection is the second comprehensive circumferential crack inspection for this section of pipe. The previous inspection was in 2014.

Hazard specific susceptibility ranking for the line is:

Cracking (axial)	low
Stress Corrosion Cracking (axial)	low
Cracking (circumferential)	low
Stress Corrosion Cracking (circumferential)	low

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The minimum detection threshold for this is inspection is:

• 1.18" long by 0.04" deep

This inspection was completed using the Evo Series 1.0 UCc tool in 45 degrees and increased circumferential resolution.

4.0 Priority Notification for Imperative Condition

Were there any features reported meeting imperative condition?

☐ Yes
☒ No

If Yes, summarize additional actions taken to ensure a successful program.

Were there any features not reported as imperative condition that meet the imperative condition criteria?

☐ Yes
☒ No

If Yes, summarize additional actions taken to ensure a successful program.

5.0 Inspection Report Review (PI-36) and Remarks

Complete review based on PI-36 Crack ILI Report Review.

Completion of this review presumes the PI-listing has been prepared and relevant information has been assembled.

Step 2.1 Was the tool speed within acceptable limits?

☒ Yes
☐ No

If Yes, continue to Step 3.0.

Below 3.69 mph for the entire run.

Step 2.2 Were there any tool stoppages or speed excursions?

☐ Yes
☒ No

If Yes to tool stoppage, continue to Step 2.3.

If Yes to speed excursion, continue to Step 2.6

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Step 2.3 Was this a baseline tool run?

☐ Yes

☒ No

If Yes, continue to Step 2.5.

If No, continue to Step 2.4.

Step 2.4 Can previous tool run data be used to supplement current tool run data?

☐ Yes

N/A.

☐ No

If Yes, continue to Step 3.0.

If No, continue to Step 2.5.

Step 2.5 Determine response based on crack susceptibility

If Low, accept the data.

If Medium or High, activate the Reliability Team to perform probabilistic analysis for unacceptable portions of the data, and summarize actions to manage these portions of the data.

Continue to Step 3.0.

Step 2.6 Determine effect of speed excursion

Summarize effect of axial sampling on the detection thresholds.

Step 3.0 Did tool rotation cause a degraded inspection?

☐ Yes

☒ No

If Yes, continue to Step 3.1

If No, continue to Step 4.0.

Step 3.1 Determine response based on crack susceptibility

Continue per Step 2.5 and then per Step 4.0

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Step 4.0 Was data degraded due to other reasons?

☐ Yes

☒ No

If Yes, continue to Step 4.1.

If No, continue to Step 5.0.

Step 4.1 Define the area affected by data degradation

Summarize reasons for degraded data.

Continue to Step 4.2

Step 4.2 Determine response based on crack susceptibility

Continue per Step 2.5 and then per Step 5.0.

Step 5.0 Do features align with expectations?

☒ Yes

☐ No

If Yes, continue to Step 6.0.

If No, continue to Step 5.1.

Step 5.1 Vendor Review

Summarize

- Investigation plan with vendor
- Change in feature type density or severity
- Review of pertinent elements
- Requirements for excavations to support investigation

Continue to Step 6.0

Step 6.0 Are priority unmitigated features identified?

☐ Yes

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☒ No

If Yes, continue to Step 7.0.

If No, continue to Step 8.0.

Step 7.0 Priority Assessment and ELP

Summarize actions to assess and assign excavations per PI-38

Initiate PI-14

Step 8.0 Update this document

Complete documentation above

Step 9.0 SME Approval?

☒ Yes

☐ No

If Yes, continue to PI-37.

If No, work with SME(s) to resolve and document any discrepancies until approved.

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

Complete review based on PI-37 Fitness-for-Service Calculations.

Completion of this assessment presumes the requirements of PI-36 have been completed and the ILI data has been exported to the Crack ILI Assessment Sheet.

Step 2.0 Determine feature depths from crack ILI reports

Summarize any difficulties encountered with depth determination, and work with SME(s) to resolve and document.

Continue to Step 3.0

Step 3.0 Determine grade for each joint

Summarize any assumptions required to account for uncertainties in the data

Continue to Step 4.0

Step 4.0 Determine flow strengths for each joint

Summarize any assumptions required to account for uncertainties in the data.

Continue to Step 5.0

Step 5.0 Determine notch toughness

☐ CVN 5ft-lb for LFERW or Flash

☒ CVN 15ft-lb for HFERW, DSAW, spiral, base metal

Continue to Step 6.0

Step 6.0 Wall thickness used for FfP

☐ Lowest of Nominal or USWM

☒ Lowest of Nominal or UCc

Summarize any investigations necessary if nominal wall thickness and tool reported wall thickness vary by more than 15%.

Continue to Step 7.0

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Step 7.0 Determine diameter

☒ Nominal diameter for >12 inch

☐ Actual diameter per API 5L for =< 12 inch

Continue to Step 8.0

Step 8.0 Determine feature lengths from crack ILI reports

Summarize any difficulties encountered with length determination, and work with SME(s) to resolve and document.

Continue to Step 9.0

Step 9.0 Determine flaw Profile

☒ Elliptical

☐ Rectangular Lines 65, 81, 82, 83

Continue to Step 10.0

Step 10.0 Update this document and crack assessment sheet

Complete documentation above.

Continue to Step 11.0

Step 11.0 Generate Fitness-for-Service assessment results

Complete documentation above.

Continue to Step 12.0

Step 12.0 Determine features remaining lives

Summarize inputs, including dates of pressure cycling data used, any assumptions, and estimated SCC crack growth rates if applicable.

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7.0 Excavation Selection Crack Inline Inspection (PI-38) and Remarks.

Complete review based on PI-38 Excavation Selection Crack Inline Inspection.

Completion of this assessment presumes the requirements of PI-36 and PI-37 have been completed.

Step 2.0 Are actions required from PI-36?

☐ Yes

☒ No

Summarize reasons for PI-36 recommended actions.

If Yes, continue to Step 2.1.

If No, continue to Step 3.0.

Step 2.1 Implement recommendations

Summarize reasons for PI-36 recommended actions.

If density driver, continue to Step 2.2

If severity driver, continue to Step 2.3

If unexpected feature type, continue to Step 2.4

Step 2.2 Severity driver

Summarize pressure restrictions imposed, excavation selection criteria and excavation deadlines.

Continue to Step 4.0

Step 2.3 Density driver

Summarize pressure restrictions imposed, excavation selection criteria and excavation deadlines.

Continue to Step 4.0

Step 2.4 Density driver

Summarize pressure restrictions imposed, excavation selection criteria and excavation deadlines.

Continue to Step 4.0

Step 3.0 Apply default criteria

Summarize counts for features meeting default criteria.

Table 1. Dig selection summary

Criteria	Number of Features Reported	Number of Features Issued for Excavation	Number of Joints Issued for Excavation
Fitness-for-Service			
Saturated – FfS unknown or < MOP	0	0	0
Saturated FfS > MOP	0	0	0
Depth > 70% and FfS < MOP	0	0	0
Depth > 70% and FfS > MOP	0	0	0
CL or NL (without TT) or CF and FfS < MOP	0	0	0
CL or NL (with TT) or CF and FfS < 1.1 MOP	0	0	0
CL or NL (with TT) or CF and FfS < 1.25 MOP	0	0	0
CL or NL or CF in topside dent depth > 1%	0	0	0
CL or NL or CF in bottomside dent depth > 1%	0	0	0
CL or NL or CF with ND depth and comments "internal / external indications"	0	0	0
Time Dependant			
Remaining life < 5 years	0	0	0
(Remaining life / 2) < planned re-inspection interval	0	0	0
Investigative			
CL or NL or CF with dent depth >1% where geometry affects POD/POI	0	0	0
Crack (>1 mm) interacting with corrosion (>30%)	0	0	0
Features with comments "internal external indications" here ILI signal indicates severity	0	0	0
Discontinuous cracking length > 48 inch	0	0	0
Unique comments	0	0	0
Totals	0	0	0

Continue to Step 4.0

Step 4.0 Update PI-listing and this documentation

Complete documentation above.

Continue to Step 5.0

Step 5.0 and Step 6.0 Coordinate pressure restriction study and review results

Summarize any capacity impacting pressure restrictions and work with SME(s) to resolve and document any alternative approaches used, included expedited timelines.

Continue to Step 7.0.

Step 7.0 SME Approval?

☒ Yes

☐ No

If Yes, continue to PI-04.

If No, work with SME(s) to resolve and document any discrepancies until approved.

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8.0 Line Integrity Status

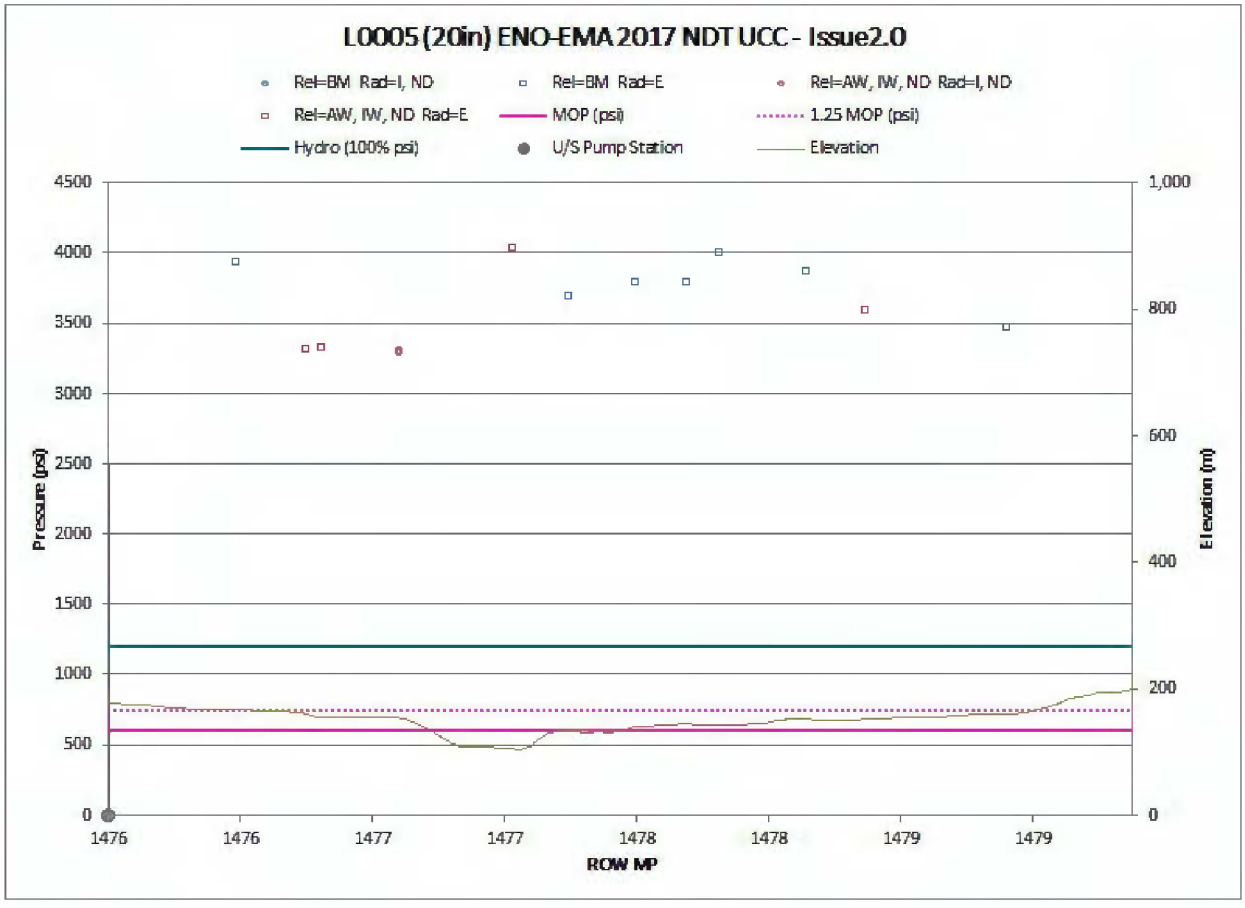


Figure 1: Fitness-for-Purpose, as reported, pre-dig program.

Table 2. Dig selection summary, based on proposed dig program.

Program Component	Applicable	Selection Criteria	Selection Code	Number of Features Selected												Inf
				CL Depth (in)				CF Depth (in)				NL Depth (in)				
				CL 0	CL 1	CL 2	CL 3	CF 0	CF 1	CF 2	CF 3	NL 0	NL 1	NL 2	NL 3	Inf 0
Core Program	CL,CF,NL	Depth associated with a saturated response	3.0.a.1	0				0				0				0
Select all that meet criteria	CL,CF,NL	P_f < MOP	3.0.b.1	0	0	0	0	0	0	0	0	0	0	0	0	0
		P_f < 1.25 MOP	3.0.b.2	0	0	0	0	0	0	0	0	0	0	0	0	0
		P_f(depth + bias) < MOP	3.0.b.3	0	0	0	0	0	0	0	0	0	0	0	0	0
		P_f(depth + bias) < 1.25 MOP	3.0.b.4	0	0	0	0	0	0	0	0	0	0	0	0	0
	CF	CF with LI >3"	3.0.c	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinspection Interval Consideration	CL,CF,NL	all with fatigue life <2* reinspection interval	3.1.a	0	0	0	0	0	0	0	0	0	0	0	0	0
		all with fatigue life <10 years	3.1.b	0	0	0	0	0	0	0	0	0	0	0	0	0
Risk Mitigation Consideration	CL, CF located within 10% of pump stn dsc	within 3" of long seam and length > leak rupture boundary	3.2.a	0	0	0	0	0	0	0	0	0	0	0	0	0
		within pipe body and length > leak rupture boundary	3.2.b	0	0	0	0	0	0	0	0	0	0	0	0	0
		within 3" of long seam and length <= leak rupture boundary	3.2.c	0	0	0	0	0	0	0	0	0	0	0	0	0
		within pipe body and length <= leak rupture boundary	3.2.d	0	0	0	0	0	0	0	0	0	0	0	0	0
Selection considers results from Mainline Risk Assessment	CL,CF,NL	Radial position of feature not-determinable	3.2.e.1	0	0	0	0	0	0	0	0	0	0	0	0	0
		Internal/ External Feature Indication	3.2.e.2	0	0	0	0	0	0	0	0	0	0	0	0	0
	CL,NL	High Density of Crack Features (on the Joint)	3.2.f.1	0	0	0	0	0	0	0	0	0	0	0	0	0
	CL,CF,NL	High Density of Crack Features (per mile)	3.2.f.2	0	0	0	0	0	0	0	0	0	0	0	0	0
		Unique Crack Features	3.2.g	0	0	0	0	0	0	0	0	0	0	0	0	0
		No Reported Depth	3.2.h	0				0				0				0
Threat Integration	CL,CF,NL	Dent with Cracking	6.1.a	0	0	0	0	0	0	0	0	0	0	0	0	0
	CL,CF,NL	Dent with Metal Loss	6.1.b	0	0	0	0	0	0	0	0	0	0	0	0	0
ILI Validation	CL,CF,NL, ML, IL, ND	Associated with secondary characteristics to the feature	3.3.a	0	0	0	0	0	0	0	0	0	0	0	0	0
		Additional Features on Target Joint	3.3.b	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Feature Population Selected				0	0	0	0	0	0	0	0	0	0	0	0	0
Total Feature Mitigated (as of Date)																
Tool Performance Validation	CL, CF, NL	Target number of features to achieve 80% confidence level														
		Achieved confidence level (as of Date) (%)														

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Issue 2 Summary:

- Thirteen notch-like features were reported
- Maximum NL depth (no TT): 0.031”
- Minimum SF over H/T pressure (1200psi) including 1 TT: 2.75
- Minimum Fatigue Life (years): 200
- In back to back comparison with the 2014 inspection, 12 features matched and had similar depths. One feature in the 2017 inspection wasn’t reported in the 2014 inspection. The automatic algorithm created a box for this area in the 2014 inspection data but the parameters for this box were below the analysis thresholds. The calculated depth for this feature in 2014 would be 0.3 mm (the depth in 2017 was 0.508mm).
- Two features had significant increases in length (increase by more than 15”). This is due to updated sizing rules in 2017. In both data sets the features show similar indications.
- No circumferential features interacting with any secondary feature (corrosion, deformation, strain).
- Four NLs potentially located on a span (maximum span length of 65ft).

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