INFORMATION REQUEST AND RESPONSE

Information Request	DR 124
Source	Email reference June 18, 2020
Requested by	Alexandria Colletti (NTSB)
Response Date	July 20, 2020
Revision	0

IR – DR 124: Description of Request

From: Colletti Alexandria <[redacted]
Sent: Thursday, June 18, 2020 9:01 AM
To: Nathan Atanu <[redacted]
Cc: Thomas Wooden <[redacted]; Rick Kivela <[redacted]; Miroslava Antoniouk <[redacted]
Subject: [External] RE: Danville Document Request - PLD19FR002 - Due COB 06/26/20
Importance: High

EXTERNAL: PLEASE PROCEED WITH CAUTION.
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Nathan,

In addition to the prior requests, please add the below item as well to the list due COB 6/26/20.

- Annual Assessment Plan (AP) for the assessment segment containing Danville rupture site from 2000 through 2019

As a side note, I recognize the Danville rupture site did not fall within a PHMSA-defined covered segment, as it was not within a HCA. However, due to the vintage of pipe and the procedures outlined within the IM Plan Manual regarding hard spots, it should have still been within an assessment segment, just a non-covered one.

Thank you,
Alex

Additional Clarification Regarding Scope of the IR:

As per the teleconference held on July 13, 2020, TETLP needs to:

1. Provide detailed description regarding threats identified for integrity assessment on Valve Section 04 of the TOMP-DANV/15 Line Segment
   - Line 15 (TOMP-DANV/15) Valve Section 04 (Valve 04 at approx. MP 408.5 – Valve 05 at approx. MP 427.5)
   - Inspected as part of the VS-00 to VS-05-R section of TOMP-DANV/15 75.448 miles (approximate MP 352.0 – MP 427.5)
2. Description should include steps taken and data relied upon for: integrity assessment method selection, quality assurance, and program validation.

Response:

INTRODUCTION AND SUMMARY

This response focuses on the primary threats of external corrosion and hard spots, and specifically to Line 15, VS-04 of the Tompkinsville to Danville Section (segment). Presented herein is an overview of the assessments performed that led to the inspections and subsequent results presented.

Risk assessment[1] initially completed for this line segment by TETLP targeted metal loss as the primary driver for assessment scheduling. Subsequent to a 2003 failure, manufacturing defects (hard spots) were elevated as a threat of concern on the TETLP system and a program was developed to prioritize certain line segments for assessment. The hard spot program is documented in IMP 440 *Manufacturing* and IMP 511 *Hard Spots*, (initially effective in 2004). A review was performed in 2006 by an external consultant to review the hard spot management program, and conclusions supported that the program was consistent with industry best practices.

For this line segment, hard spots were identified as a threat in 2006, prioritized for assessment in 2007, and inspection was performed in 2011 using ILI survey capable of identifying hard spots. Target locations were evaluated, excavated, and remediated, as necessary. Following the 2011 assessment and remediation program, the established threat identification process embodied in IMP 440 no longer identified hard spots as a threat for integrity assessment on this segment.

A subsequent program review was performed in 2012. Conclusions, based on review of field data, supported generally good agreement between the ILI and field results. Limited integrity assessment with ILI was performed following 2012 due to tool availability.

Presented herein:

- Section A – Threat and Risk Assessment Processes, Establishing the Assessment Plan
- Section B – Assessment Plan Updates
- Section C – Inspection Summary
- Section D – Corrosion Control / CP

[1] TETLP performed annual risk assessments dating back to approximately 2000. During the time period prior to 2007, the risk assessment process was SME-based using a data sheet Risk Management Tool. In approximately 2007, TETLP transitioned to a semi-quantitative computer-based risk model. The current risk assessment model is a succeeding iteration of this semi-quantitative model, considers approximately 75 attributes to assess the identified threats, and is applied across the approximately 20,000 miles of the gas transmission system within Enbridge.

Section A – Threat and Risk Assessment

Assessment Method Selection, VS-04

A general description of relevant IMP-guidance for the assessment of threats and assessment methods selected for threats where periodic assessment is potentially required, is shown here in Table 1. The documents noted here were in effect beginning in approximately 2004 and through to 2019. Additional detail on the primary threats assessed with ILI (Metal Loss, Deformations, and Hard Spots) follows the table.

This valve section had seven ILI surveys performed between 1985 and 2020. These assessments included integrity assessments for multiple threats including metal loss (internal and external), deformation, and manufacturing threats, including hard spots, as required by the IMP.

Table 1: Integrity Assessment Methods per IMP

IMP Threat	IMP Reference	Potential Technologies	Technology Chosen for TOMP-DANV/15 based on IMP Requirements
External Corrosion	IMP 410	ILI (MFL), DA, Hydrostatic Test	ILI (MFL)
Internal Corrosion	IMP 420	ILI (MFL), DA, Hydrostatic Test	ILI (MFL)
Stress Corrosion Cracking	IMP 430	Excavation Program, Hydrostatic Testing Program, EMAT ILI	Subject to ongoing monitoring. Baseline EMAT assessment scheduled. • No History of SCC. • Prior SCC hydrostatic test with no failures.
Manufacturing	IMP 440	ILI (Hard Spot), Hydrostatic Testing	ILI (Hard Spot)
Construction	IMP 450	ILI (Original Construction Dents), Hydrostatic Test	ILI
Equipment Failure	IMP 460	Operational Procedures for Equipment Maintenance and Inspection	Periodic Integrity Assessment not required
Third Party Damage	IMP 470	ILI (Deformation)	ILI
Incorrect Operations	IMP 480	Execution of Operator Qualification Program	Periodic Integrity Assessment not required
WROF	IMP 490	SME-based inspection of identified threats	SME-based inspection of identified threats

Metal Loss / Deformation Threat Assessment Process Summary

Internal and external corrosion are primarily monitored through a high-resolution axial magnetic flux leakage (MFL-A) ILI program. Mechanical damage is also assessed using a high-resolution caliper ILI program, and MFL surveys are aligned with the caliper surveys to compare any potential dents with metal loss indications.

All reported ILI features are managed in accordance with TETLP 9-3010 *Response to In-Line Tool Inspection* (SOP 9-3010), with severity classifications and associated anomaly descriptions. A prioritized

schedule for baseline assessment was developed for each pipeline segment based on initial risk assessment and subsequent assessments established using guidance within the IMP and SOP 9-3010 using ASME B31.8S-2004 Figure 4. The assessment intervals are reviewed annually per the IMP. This process is described below in Section B.

Manufacturing Threat Assessment Process Summary

TETLP IMP 440, *Manufacturing* provides guidance on assessment of Manufacturing threats, and additionally, IMP 511 provides additional guidance on the assessment of hard spots. These documents have been in effect since 2004 (Reference Attachment 1).

A hard spot management program was initiated subsequent to the 2003 failure, and DEGT[2] subsequently engaged a consultant to evaluate the program in 2006. The hard spot program is summarized below based on pre-2006 (the program review in 2006 by an external consultant), 2006-2012 (the development of the Hard Spot Program Review summarized in Attachment 1), and post 2012 to 2019.

Time Period 2003-2006

As provided in IMP 511, the following provides a summary of activities during this time period.

> *Subsequent to a service failure in November, 2003, DEGT Gas Transmission implemented a hard spot management program. The primary focus of this program is to identify susceptible pipeline segments, prioritize these locations with respect to risk severity, perform an in-line inspection, and excavate hard spot areas which have the potential for hydrogen induced cracking. Based on the assessment, CC Technologies concluded DEGT's hard spot management program is consistent with best practices. Based on the results evaluated here, no evidence was found to indicate a significant hard spot "problem" exists on DEGT's pipeline systems.*
>
> *There is strong evidence that the pipe manufacturer most frequently associated with hard spot failures is A. O. Smith. Most A. O. Smith hard-spot incidents are attributed to pipe made between 1952 and 1958. DEGT identified and assessed A. O. Smith pipe from this vintage, finding no evidence of a significant hard-spot "problems."*
>
> *DEGT plans to continue using MFL hard spot in-line inspection tools on a base-by-case basis in what may be considered susceptible materials.*

Time Period 2006-2012

A program evaluation of the hard spot program within Spectra Energy was performed in 2012 (Attachment 1). Key findings of that review included:

IMP 511 was implemented in 2004 and 9 lines were assessed between 2004 and 2012 based on the guidance provided. This included 558 miles of pipe, with 307.29 miles of pipe considered to be high risk for hard spots based on manufacturer and vintage.

[2] Duke Energy Gas Transmission at the time of the hard spot program evaluation in 2006.

Excavation results concluded that there was generally good agreement between the ILI and the field measurements.

Time Period 2012-2019

The following is a summary of the IMP 440 process that provided guidance to TETLP for management of hard spots. It should be noted that the hardness inspection program was generally not continued past 2012 due to tool availability as the preferred vendor discontinued providing the service (Reference NTSB Request DR 109). Several of the Annual Area Periodic Review meetings (Attachments 14-18) discussed the lack of tool availability, and TETLP continued to evaluate potential replacement vendors and technologies in the time period post-2012; however, limited integrity assessments for hard spots were performed with ILI after 2012.

Per IMP 440[3]:

> *4.4.1 Determination Of Manufacturing Threat*
>
> *As part of the analysis by the SME, a determination of the threat level will be made. These relative threat levels are classified as "Not a Threat", "Low", or "High". The conclusion of "Low" or "High" will dictate the appropriate course of action in regards to how the construction threat is addressed.*
>
> *4.4.1.5 Potential Threat Due To Hard Spots*
>
> *When the process flow chart in Figure 3-0 indicates a threat may exist, the process flow diagram in Figure 3-4 in Appendix A is used to determine if the material poses a potential threat in terms of operational seam failures. If the material poses a potential threat, the flow diagram also indicates the assessments and/or mitigative actions to be performed.*
>
> *5.0 Integrity Assessment*
>
> *When the risk assessment of a covered segment indicates that there is a "high" relative threat potential due to manufacturing imperfections, then these segments will be identified and subjected to an Integrity Assessment. An integrity assessment will be conducted for each covered segment where the manufacturing threat has been identified as a "high" relative risk and the threat is not effectively mitigated.*
>
> *5.2.4 Potential Threat Due to Hard Spots*
>
> *For hard spot threats, as per the process flow diagram (Figure 3-4), the assessment will be performed utilizing one of the following methods:*
>
> - *Pipeline In-line Inspection (capable of assessing hard spots)*
> - *Pressure Testing*
> - *Direct NDE Examination (100% of segment length)*

[3] Version 09/06/2013

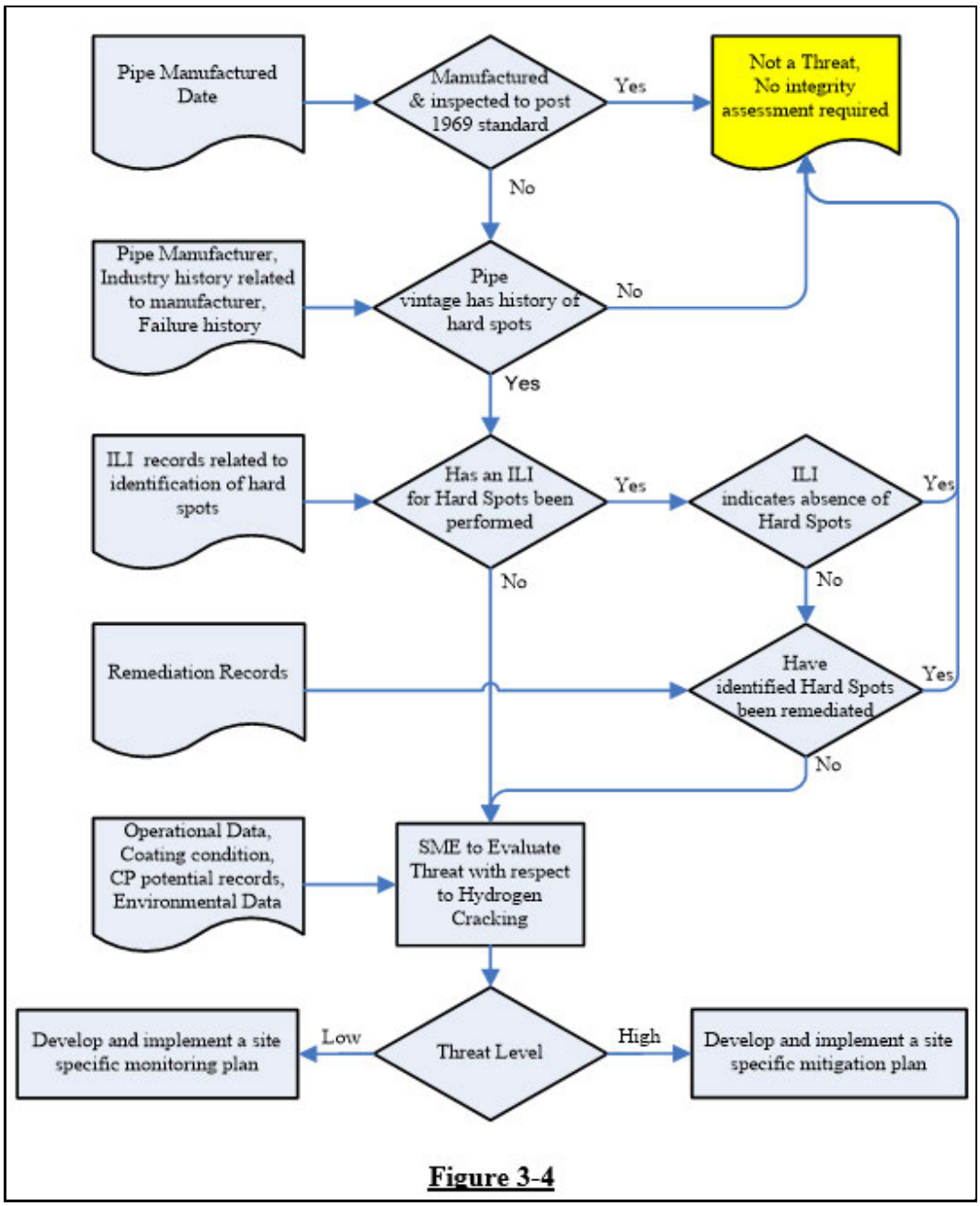

Figure 1: IMP 440 Manufacturing Threat Response Guidance Document (ver. 09/06/2013)

Section B – Assessment Updates

Assessment Plan Review/Updates, VS-04

The IMP requires annual review of the Assessment Plan to identify any changes to the assessment strategy, including tool selection and assessment intervals. Annual review meetings were held and these were documented on worksheets. Worksheets were located and reviewed which documented the reviews held during the time period 2015-2019. No changes were made to the initially targeted assessment intervals based on the annual review meetings during this time period (Reference Attachments 9-13).

Note the threat of hard spots, using IMP 440 guidance and Figure 3-4 (Figure 1 of this document), and based on the completed assessment and remediation, does not support hard spots as a threat on the segment post-2011.

Assessment Plan Review/Update Stanford Area

Additionally, a review is held for all pipelines at the Operating Area level. This review is documented on worksheets (Attachments 14-18). Significant highlights from that Area-wide review, pertaining to this line segment were not noted, however several program level discussions regarding hard spots were noted.

- 2015 Area Periodic Evaluation (Attachment 14) – Noted that the DANV-OWSV/15 segment had not received a hard spot assessment (as per Attachment 1 recommendation).
- 2016 Area Periodic Evaluation (Attachment 15) – No notes specifically pertaining to TOMP-DANV/15 or hard spots.
- 2017 Area Periodic Evaluation (Attachment 16) – A discussion was documented regarding tool availability for use on Line 15 hard spots. The conclusion was that there was no new progress on tool availability.
- 2018 Area Periodic Evaluation (Attachment 17) – No notes specifically pertaining to TOMP-DANV/15 or hard spots.
- 2019 Area Periodic Evaluation (Attachment 18) – No notes specifically pertaining to TOMP-DANV/15 or hard spots.

Section C – Inspection Summary

TOMP-DANV/15, VS-04 Assessment History

The assessment history for the valve section is detailed below in Table 2.

The line segment was assessed using MFL for metal loss and deformations six times between 1985 and 2018 and twice for hard spots in 2011 and 2020.

The MFL and Geometry inspections were performed based on IMP and SOP Requirements for periodic assessment.

The segment was identified for assessment using a hard spot tool based on IMP 440 threat identification and risk prioritization processes and was subsequently inspected in 2011. The assessment was performed using the NDT/Tuboscope ILI technology.

Table 2: TOMP-DANV/15 Assessment History; VS-04-VS-05

Assessment Date	Vendor	Tool
6/3/85	*Prior assessment*	*Prior assessment*
6/22/92	*Prior assessment*	*Prior assessment*
5/12/03	Tuboscope	MFL (Std Resolution)
6/24/10	GE/PII	MFL/GEO
4/5/11*	NDT/Tuboscope	MFL/Hard Spot
10/25/12	-	CIS
5/1/18	GE/PII	MFL/GEO
8/24/18	-	CIS
5/7/20	Rosen	Geo/HS/IMU
11/2/20 (scheduled)	BHGE	EMAT

Hard Spot Tool Quality Assurance and Validation, VS-04

Data Quality

ILI Vendor contractual requirements, and confirmation using the vendor's quality checks were relied upon regarding data coverage and quality. Reference the NDT Standing Agreement and Activation Order (Attachments 19 and 20).

Reference the NDT Tuboscope Report for the 4/5/11 NDT ILI Survey (DR 28):

2.3 Data Quality

During the survey, data were recorded by all channels, covering the complete circumference of the pipe and the entire length of the pipeline. The data were downloaded from the recorder flash drive to a hard drive, converted with the LinaView software suite, and inspected by NDT personnel in the field. Internal diagnostics on the tool and visual inspection confirmed that the data quality was acceptable for full circumferential analysis.

3.1 Reporting Criteria
Hard Spot

The hard spot results are reported using the Brinell Hardness Scale.
For each indication, the area of maximum hardness is reported.

3.2 Results
Hard Spot

The tolerance of the reported hard spot measurements is ± 50 Brinell, which is in compliance with API Specification 5L, Section 7.8.7.

Tool Performance

The NDT Tuboscope Report for the 4/5/11 NDT ILI Survey (DR 28) provides guidance on tool performance validation:

> 3.3 *As denoted in the Pipeline Register, hard spots were identified by comparing the data collected from this survey with other known hard spots. "Known hard spots" are indications compare in magnetic flux leakage signature that have been detected using the same technology in the same/similar pipeline environments. The known indications have been excavated and had their Brinell classifications confirmed and documented according to peak deflection, flux leakage characteristics, physical dimensions, and appearance.*

Analysis relies on highly specialized, proprietary processes. Validation of the hard spot tool performance is primarily based on in-field non-destructive testing. Samples are typically not removed from the pipeline for metallurgical analysis. The guidance for repair criteria within SOPs was developed to account for potential variability in the NDT results, and TETLP actioned its excavation and repair criteria based upon in the information provided by the tool vendor.

In the 2012 Hard Spot Program Review (Attachment 1), it was noted that within the Tompkinsville to Danville Segment, 14 features were identified by the ILI with a predicted hardness of 200-300 Brinell, and 2 features were identified with a hardness of 300-400 Brinell. Excavation results concluded that there was generally conservative and good agreement between the ILI and the field measurements. The maximum hardness was 308 Brinell and no repairs were required.

Metal Loss / Deformation Quality Assurance and Validation, VS-04

Assessment intervals were evaluated post-assessment in 2010, 2011, and 2018 based on lowest remaining Failure Pressure Ratio (FPR) with consideration for tool tolerance (FPR_{TC} or "tolerance compensated"). (Attachments 2-4)

Section D – Corrosion Control

Rectifier History, (MP 420.7 – MP 423.9)

Rectifier maintenance summary:

- Rectifier readings included dating back to 2000. (Attachment 6)
- Upstream: Rectifier 56-9 Harris Creek MP 420.7401(Attachment 7)
    - 2/16/17 – Amps noted as dropping. Current increased
    - 4/21/18 – New deepwell added
    - 6/24/19 – Adjusted taps to increase current.
- Downstream: Rectifier 56-10 Goodnight MP 423.9177 (Attachment 7)
    - 3/18/10 – Anodeflex broken. Installed new linear anode

Test Point History, Test point at MP 423.4

Summary of test point surveys:

- History of annual CP survey readings dating back to 2000. (Attachment 5)
    - Readings consistently ~-1.9V using -0.850VDC "ON" Criterion (time period 2000-2019)
    - Readings consistently ~-1.0V using -0.850VDC Polarized Potential Criterion (2013-2019[4])
- The consistent "On" measurements over the 19-year period from 2000-2019, in combination with the polarized measurements beginning in 2013 supports an appropriate level of applied Cathodic Protection during the entire time period (i.e. CP consistently met the -0.850VDC Polarized Potential minimum without excessive overcharging).

[4] Annual surveys utilized only a -0.850VDC "On" Criterion prior to 2013. Beginning in 2013, interrupted surveys were also performed to enable the application of the -0.850VDC Polarized Potential Criterion. SOP 2-2200 *Application of Cathodic Protection Criteria* provides guidance.

Conclusion

For this line segment, periodic risk assessments for metal loss and deformations have been performed since approximately 2000. Additionally, prior integrity assessments primarily for the threat of metal loss, were performed dating back to 1985. The threat of hard spots was identified in 2006, prioritized for assessment, and the segment received an integrity assessment with ILI in 2011. Subsequent to the 2011 assessment and remediation program, the established threat identification process no longer identified hard spots as a threat for integrity assessment on this segment.

As an additional step, TETLP relies upon an Enhanced Survey Analysis, or ESA process for evaluation of ILI data. This process was initiated in 2015. The ESA is a process designed to provide a detailed supplemental review of the ILI signal trace data by ILI analysts and to identify anomalies that might not fit the anomaly filtering criteria in TETLP SOPs. The ESA is intended to allow for a detailed quality check to verify documentation and perform a series of data checks, including data validation and integration. Reference TETLP SOP 0-3040 *Enhanced Survey Analysis*. It must be noted, however, that the same approach to review signal trace data is not possible for hard spots, EMAT, or other specialized ILI technologies due to certain barriers that exist due to the proprietary nature of the data, specialized expertise for reviewing the data, and limited industry experience when compared to MFL technology.

Attachments:

1. 2012 Annual Review of Spectra Energy's Hard Spot IMP Program
2. 2010 30IN Line 15 – Tompkinsville-Danville 7T-288[5]
3. 2011 30IN Line 15 – Tompkinsville-Danville 7T-288
4. 2019 30IN Line 15 – Tompkinsville-Danville ILI Completion
5. DANV-TOMP_15 VS-04 Annual Test Point Report
6. DANV-TOMP_15 VS-04 Rectifier Inspections Report
7. DANV-TOMP_15 VS-04 Rectifier Maintenance Report
8. DANV-TOMP_15 VS-04 Test Point Maintenance Report
9. TOMP-DANV Segment 2015 (Periodic Eval)
10. TOMP-DANV Segment 2016 (Periodic Eval)
11. TOMP-DANV Segment 2017 (Periodic Eval)
12. TOMP-DANV Segment 2018 (Periodic Eval)
13. TOMP-DANV Segment 2019 (Periodic Eval)
14. Stanford Area 2015 Periodic Eval
15. Stanford Area 2016 Periodic Eval
16. Stanford Area 2017 Periodic Eval
17. Stanford Area 2018 Periodic Eval
18. Stanford Area 2019 Periodic Eval
19. Activation Order for NDT Standing Agreement, April 1, 2011
20. NDT Standing Agreement 3573_3-29-2011

[5] ILI reinspection interval determination for corrosion caused metal loss