

Appendix 5-2
Results of Engineering Assessment
(Prairies Line – MLV 17 to 25)

1.0 APPENDIX VOL 5-2: ENGINEERING ASSESSMENT RESULTS – PRAIRIES LINE MAINLINE VALVE 17 TO 25

As per its response to NEB 5.16 a), TransCanada offers a summary of engineering assessment (EA) results informed by review of in-line inspection (ILI) data collected on the Prairies Line's NPS 42 MLV 17-25-4 valve sections by way of a caliper and MFL combo tool run on 11 August 2010.

The following analysis, conclusions, and clarifications are derived from the assessment of 17 reported geometric anomalies detailed in Table 5.16-1.¹ Thirteen (13) of the anomalies were classified as dents, while the remaining four anomalies were identified by the ILI vendor as possible buckles. No anomaly was reported to be interacting with metal loss, gouges, or cracks. The analysis and EA was performed in light of updated requirements in CSA Z662-15. It utilized dated but high quality and preferred 2010 ILI data to determine the acceptability of each anomaly, and whether it represented integrity concerns within its subject valve section anticipated to be converted to liquid service as part of the Energy East Project.

1.1 ANALYSIS

The analysis of the reported anomalies was performed in two stages. First, an analysis of the acceptability of each anomaly against specific criteria in CSA Z662-15 Clause 10.10.4.2 and Clause 10.10.8.3 was performed. Second, and for those anomalies that did not meet CSA Z662-15 acceptability criteria, a detailed EA was performed.

1.1.1 Anomaly Acceptability Assessment

The analysis concluded that all 13 dent anomalies reported meet the acceptability criteria established in CSA Z662-15 Clause 10.10.4.2.² These anomalies will however, be monitored and reassessed during the next planned ILI.

The four anomalies identified as possible buckles were conservatively assumed to be buckles and assessed as such, according to the acceptability criteria outlined in Clause 10.10.8.3 of CSA Z662-15. The analysis concluded that all four buckles identified did not meet these criteria. Accordingly, an EA was conducted to further determine their serviceability, which is detailed below.

1.2 ENGINEERING ASSESSMENT OF BUCKLES

An EA was conducted in accordance with CSA Z662-15 Clause 10.10.8.4. During the EA it was confirmed through review of TransCanada records, that one of the four buckles originally identified was in fact remediated and its mainline valve section

¹ See NEB 5.16, Exhibit No. A74256-1.

² The strain analysis component of this assessment was conducted according to ASME B31.8, Appendix R.

replaced, in 2012.³ As part of the EA, in addition to a threat assessment, the three residual buckles were subject to an assessment to determine their remaining fatigue life under the normal gas operating profile for the Prairies Line to ultimately determine if any of them constitute an integrity concern prior to their valve sections being converted to liquid service.

1.2.1 Threat Assessment

A threat assessment was performed in accordance with the specific requirements outlined in CSA Z662-15 Clause 10.10.8.4, being, Weather and Outside Forces, Mechanical Damage, and Manufacturing, Fabrication, and Construction Anomalies. The buckles were not associated with corrosion or cracking indications from the MFL and EMAT inspections, and as a result, Corrosion and Cracking were not considered as threats of concern.

At the time of the EA, there was no known weather and outside force threat for consideration at any buckle's location. With respect to the Mechanical Damage threat, a review of TransCanada's records indicated no unauthorized activities occurring near the buckles. Finally, the ILI data recorded no manufacturing feature with a peak depth greater than 10% NWT at the buckle locations and with all affected valve sections being hydro-tested, any remaining manufacturing anomalies are considered to be stable under normal operating gas service conditions.

Overall, and relative to the threats considered, it was concluded that the three existing buckles are stable, and do not pose a risk for growth.

1.2.2 Fatigue Analysis

Representative Pressures/Temperatures for Fatigue Analysis were obtained from the most representative SCADA data for each buckle. A Rainflow algorithm was applied to the pressure/temperature time history. The Rainflow analysis results show that the line experienced very low pressure cycling in the range of 1 cycle per year at 35% of MAOP.

1.2.3 Fatigue Life Prediction

Utilizing the Wrinkle Fatigue Assessment tool 'WPFatigueLife,' a fatigue life assessment for each of the buckles was performed considering the material properties, buckle geometry, and the detailed knowledge of the operation pressure/temperature spectrum. The estimated fatigue life for each buckle was calculated to be above

³ As part the original analysis of the buckles in accordance with CSA Z662-11, this particular feature was selected for further investigation and validation as its estimated depth was the greatest of the four buckles identified. With its depth validated to be greater than 1%, it was determined to exceed ASME B31.8 and constitute an integrity concern.

100 years. Based on the assessment it was concluded that none of the three buckles pose an integrity concern under normal gas operations.

1.3 CONCLUSIONS AND RECOMMENDATIONS

1.3.1 Dent Anomalies

All dent anomalies reported during the inspection of NPS 42 MLV 17-25-4 meet applicable CSA Z662-15 acceptability criteria. Notwithstanding, they will be monitored during the next planned ILI and reassessed.⁴

1.3.2 Buckles

None of the three buckles are anticipated to represent a risk for failure during the operational life of the Prairies Line under normal gas operations. In oil service that is anticipated as part of the Energy East Project however, it was concluded that with the number of pressure cycles possible, all four buckles may eventually become integrity concerns requiring repair. Accordingly, and with a view to minimizing both potential future service interruptions and impacts associated with required maintenance activities, these valve sections will be opportunistically replaced during Phase 3 of the conversion integrity program prior to entering liquid service.

⁴ In the event it is determined that any current dent anomaly does not meet acceptability criteria, TransCanada will perform an EA as required and update the NEB as appropriate.