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To: All Companies under the Jurisdiction of the Canada Energy Regulator

Safety Advisory SA 2025-01
Evaluation of Dents in Pipe

Please find attached Safety Advisory SA 2025-01.

The Canada Energy Regulator (CER) expects regulated companies to take all reasonable care to ensure the safety and security of persons, the safety and security of regulated facilities and abandoned facilities, and the protection of property and the environment.

Safety Advisories are issued periodically to inform the oil and gas industry of an identified safety or environmental concern with the goal of preventing the occurrence of related incidents. A Safety Advisory serves to highlight CER requirements, and to convey the CER's expectation that regulated companies take appropriate action to mitigate any potential impacts to people or the environment.

The attached Safety Advisory provides information about two distinct issues concerning pipe dents that have been identified, both of which have the potential to compromise safety and protection of the environment.

The CER directs your attention to the Safety Advisory and expects that it will be given wide circulation to company personnel and contractors involved in pipeline construction, integrity, maintenance and operation.

If you have any questions, please contact the Director of Research and Innovation through our toll-free number at 1-800-899-1265.

Yours sincerely,

Signed by

Chris Loewen
Executive Vice President, Regulatory

Attachment

Canada

Safety Advisory
SA 2025-01
19 June 2025

Evaluation of Dents in Pipe

Purpose of the Safety Advisory

The purpose of this Safety Advisory is to inform industry of two distinct issues concerning pipe dents that have been identified, both of which could compromise safety and protection of the environment. Firstly, a method used to assess dent fatigue life has shown inconsistencies in its screening processes, potentially underestimating the severity of dents. Secondly, there are discrepancies in dent assessments between the construction and operational phases of pipelines, with less stringent criteria applied during construction.

ISSUE 1: USE OF API RP 1183 TO EVALUATE DENTS

The Canada Energy Regulator (CER) is aware that the American Petroleum Institute (API) Recommended Practice (RP) 1183 – Assessment and Management of Pipeline Dents, First Edition, may provide potentially overestimated values related to the initial fatigue life screening of pipeline dents.

This Safety Advisory is being issued to inform CER-regulated companies of the identified non-conservatism associated with the Table 6 fatigue life screening methodology provided. The use of Table 6 can lead to an underestimation of dent severity, potentially misclassifying injurious dents as non-injurious. Consequently, pipelines with dents requiring repair may remain in service without necessary interventions, compromising the pipeline's actual integrity below what is projected by API RP 1183 and increasing the risk of failure.

BACKGROUND

The API RP 1183 First Edition was published in 2020 and has been used to evaluate the severity and the fatigue life of pipeline dents with a single peak.

API RP 1183 provides three screening methods for estimating the fatigue life of pipeline dents:

1) The Spectrum Severity Indicator (SSI) Fatigue Life Screening providing lower bound estimates of fatigue life (i.e., Section 7.4.1 – Table 6). Initially published by the Interstate Natural Gas Association of America (INGAA) and known as the "INGAA approach", this screening methodology is a conservative estimate of the fatigue life for both restrained and unrestrained dents[1] based on In-line Inspection (ILI) reported total dent deformation depth;

[1] A restrained dent occurs when the object causing the dent remains in contact with the pipe, influencing its behavior, particularly under pressure changes. Conversely, an unrestrained dent is one where the object is no longer in contact, allowing the pipe wall to flex freely.

2) The SSI Fatigue Life Screening (i.e., Section 7.4.2), developed to evaluate the dent cyclic loading severity for shallow restrained and all unrestrained dents, where the spectrum severity of a pipeline operational pressure time history is defined using the SSI and the restrained condition of the dent is evaluated based upon its shape; and

3) The Operational Pressure Spectrum Fatigue Life Screening (i.e., Section 7.4.3), also developed for shallow restrained and unrestrained dent cyclic loading severity evaluation, where the operational pressure spectrum severity of a pipeline operational pressure time history is defined using a histogram of pressure range magnitudes from the rain flow counting process and the restrained condition of the dent is evaluated based upon its shape.

Furthermore, API RP 1183 provides a shape-based fatigue life assessment method (i.e., Section 8.3.4).

Recent research (see references) has revealed inconsistencies in API RP 1183's screening methods, both internally and when compared to shape-based fatigue life assessments. These findings raise concerns about potentially overestimated fatigue life predictions from API RP 1183 First Edition Table 6. This discrepancy appears to stem from the limited dataset used to develop the original screening methodologies.

In May 2024, the API published Addendum 1 to the API RP 1183 First Edition, in which Table 6 has been removed. This original addendum did not provide any recommendation to the industry on the re-evaluation of the results from the past fatigue life of pipeline dents based on API RP 1183 First Edition Section 7.4.1, Table 6 screening methodology.

In 2025, the API issued an updated Addendum that provided more commentary and rationale on why Table 6 was removed due to the non-conservatism. Further review of the dent screening methods of Section 7.4 in API RP 1183 First Edition is ongoing.

PREVENTIVE ACTIONS

Companies should be aware of the potentially overestimated fatigue life predictions for pipeline dents derived from Table 6 of API RP 1183 First Edition, as discussed in the referenced publications. Additionally, there are identified inconsistencies within the API RP 1183 screening methods, and between these methods and the shape-based fatigue life assessment.

The CER expects companies to review and reassess the pipeline dents that were previously determined to be non-injurious based on Table 6 of API RP 1183 First Edition’s conservative estimates, using alternative industry recognized screening or assessment methodologies.

Additionally, the CER expects companies to be informed of current and future published research addressing these issues. Companies should ensure the methods they use are appropriate and conservative, considering the various viewpoints and the evolving understanding of API 1183 screening methodologies' validation and applicability.

Given ongoing re-evaluations and updates to API RP 1183, companies are expected to exercise caution when applying its methodologies.

ISSUE 2: INCONSISTENCIES IN EVALUATION OF DENTS DURING CONSTRUCTION AND OPERATION

BACKGROUND

Canadian Standards Association (**CSA**) Z662 *Oil and gas pipeline systems* (**Z662**), incorporated by reference in the *Canadian Energy Regulator Onshore Pipeline Regulations*, uses two different dent acceptance criteria. Clause 6 applies during construction (pre-service), providing less conservative criteria than Clause 10. Once the pipeline is operational, typically assessed via in-line inspection, Clause 10 applies. This clause mandates a more rigorous evaluation, considering the combined effects of pressure cycle fatigue within the dent, reflecting the importance of operating conditions for long-term pipeline safety.

The relevant Clause 10.10.4.2 states that (g) dents that are susceptible to pressure cycle fatigue failure are considered defects unless determined by an engineering assessment to be acceptable.

During construction while applying Clause 6, companies may not evaluate dents against the more stringent criterion of Clause 10.10.4.2 (g), which addresses the impact of operating conditions. A dent meeting the dimensional criteria of Clause 6 would be deemed acceptable without further assessment of its potential impact under operating conditions. A dent may meet Construction criteria, however, there is no requirement to record its location on the pipe or its characteristics and evaluation and provide this information to the operator or department responsible for pipeline integrity for awareness and subsequent evaluation against CSA Z662 Clause 10.

Furthermore, neither CSA Z245.1 nor API 5L, the primary pipe manufacturing standards referenced by CSA Z662, account for pipeline operating conditions. Pipe manufacturers, unaware of the pipe's final application, may not consider the operational factors addressed in Clause 10 during dent evaluations. Consequently, while a dent may meet manufacturing criteria, there's no requirement to record its location on the pipe and the dent characteristics or provide this information and evaluation to the purchaser for subsequent evaluation against CSA Z662 Clause 10. Although CSA Z662 Clause 6.5 mandates dent inspection, the presence of coatings may hinder the identification of dents deemed acceptable under manufacturing standards, potentially masking issues that require operational assessment.

While the CSA Z662 committee is evaluating this issue, there has been no commitment to implement any changes to the standard and any changes may not be adopted before the next planned edition is published in mid-2027.

PREVENTIVE ACTIONS

The CER expects companies to review and update their dent evaluation procedures for dents identified during manufacturing and construction, aligning them with the more rigorous criteria of Clause 10 in CSA Z662. This review should ensure that operational considerations, including the potential impact of pipeline operation on dent acceptability, are incorporated.

Additionally, the CER recommends that companies implement a robust system for tracking and recording dent acceptance decisions made during manufacturing and construction. This system should enable location identification of these dents once the pipeline is in operation, facilitating accurate reassessment and monitoring if required.

FURTHER INFORMATION:

If you have any questions regarding this Safety Advisory, please contact the Director of Research and Innovation through our toll-free number at 1-800-899-1265.

References

1) American Petroleum Institute. *Addendum 1 to API Recommended Practice 1183*. API, www.api.org/products-and-services/standards/important-standards-announcements/addendum-1-rp-1183.

2) American Petroleum Institute, "IPC2022-87301," Proceedings of the 2022 14th International Pipeline Conference, IPC2022-87301, September 26-30, 2022, Calgary, Alberta, Canada.

3) Pipeline Research Council International, "PR-214-223806-R01 Guidance for Performing Engineering Critical Assessments for Dents on Natural Gas Pipelines (2)," September 28, 2023.

4) Leis B., Eshraghi A., Dew B., Cheng F., "Dent Strain and Stress Analyses and Implications Concerning API RP 1183 - Part I: Background for Dent Geometry and Strain Analyses During Contact and Re-Rounding," SSRN, June 16, 2023.

5) Zhu, X.K., "A verification study of fatigue-based methods in API RP 1183 for estimating fatigue life of pipeline dents," *International Journal of Pressure Vessels and Piping*, 205 (2023) 1049