

Bulletin 2021-36

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Stress Corrosion Cracking on Insulated High-Temperature Pipelines

There have been a number of pipeline incidents over the past five years resulting from a form of stress-corrosion cracking on high-temperature carbon steel surface pipelines. These pipelines had mineral wool insulation and aluminum cladding, but no external corrosion barrier under the insulation due to the high temperatures at which they operate. The issues occurred when water entered through gaps in the aluminum cladding and saturated the insulation, which results in leachate causing the pipe to crack, predominantly on the bottom of the pipe.

While stress corrosion cracking typically occurs on higher stressed areas, like bends, the recent incidents involved cracking on both bends and straight sections of the pipe, at operating temperatures ranging from 70°C to 190°C, and on pipelines built after the year 2000. In addition, cracking was observed to occur in any direction and at pipe hoop stress levels typically lower than those normally associated with stress-corrosion cracking seen on buried pipelines. Although stress corrosion cracking has been identified on pipelines within these parameters, it is important that licensees still assess their entire insulated aboveground infrastructure and use these parameters only as a starting point when conducting their assessments.

Stress corrosion cracking on these types of surface pipelines is still an emerging issue. However, third-party laboratory results indicate that cracking can occur on pipelines with all alternate insulation materials. Cracking may also occur in *buried* high-temperature insulated pipelines that do not include a corrosion barrier coating. At this time, there is no indication that different steels or manufacturing techniques are contributing factors, nor is there confirmation that cracking only occurs at certain operating temperatures or on pipelines built in certain years.

Licensees must consider the risk of stress corrosion cracking as part of their integrity management programs. The *Pipeline Rules* require licensees to follow the requirements contained in *Canadian Standards Association (CSA) Z662-19: Oil and Gas Pipeline Systems*. In particular, clauses 3.1.2, 3.2, 3.3, and 10.3.2.1 require licensees to have a safety and loss management system, manage risks, have integrity management programs that monitor for conditions that can lead to pipeline failure (including stress corrosion cracking), and act to eliminate or mitigate such conditions. As well, Annex N outlines in more detail activities that must be conducted by all licensees to identify and control hazards through

proper risk management of their entire pipeline inventory. Failure to comply with these requirements may be a noncompliance under the *Pipeline Act* and *Pipeline Rules*.

We recommend licensees do the following:

- Conduct an engineering assessment to determine whether the insulated pipelines are susceptible to stress corrosion cracking and what portions could be susceptible to failure.
- Inspect pipelines that may be at risk. If there is a potential that the insulation is wet, select representative locations on the pipeline and conduct investigative inspections to identify corrective actions.
- Evaluate and repair potential defects according to *CSA Z662-19* clauses 10.10 and 10.10.5.
- Consider replacing old cladding and incorporate new cladding designs and techniques into pipeline construction practices to help prevent moisture from accumulating.
- Review leak detection programs, including right-of-way inspection, and adjust as necessary.
- Report any leak and rupture incidents to the AER as per standard reporting requirements.
- Advise the local AER field centre of insulated pipelines with stress corrosion cracking, even if they are not leaking, and adjust inspection and leak detection programs in response to findings.

Additional information about potential root causes of stress corrosion cracking incidents on insulated lines in Alberta can be found in the following conference papers, which are available for purchase through The American Society of Mechanical Engineers and The Association for Materials Protection and Performance.

- [Root Cause Analysis of an Above-Ground Pipeline With Stress Corrosion Cracking](#)
- [Laboratory Testing in Leachate Environments to Understand Stress Corrosion Cracking on an Insulated Above Ground Pipeline](#)

If you have any questions, please contact our Customer Contact Centre by phone at 403-297-8311 (1-855-297-8311 toll free) or by email at inquiries@aer.ca.