



REASSESSMENT OF THE RESPONSE TO PIPELINE SAFETY RECOMMENDATION P95-02 – P94H0003

Background

On 15 February 1994, a rupture and a fire occurred on the Foothills Pipe Lines (Sask.) Ltd. (FPL) 1067-millimetre (42-inch) natural gas pipeline at Kilometre Post (kmp) 66 + 041 near Maple Creek, Saskatchewan. The rupture initiated at the mid-wall of the pipe wall under or adjacent to a “sulphurcrete” saddle weight. There were no injuries.

The Transportation Safety Board of Canada (the Board) determined that the rupture was caused by the ductile fracture of a delamination in the mid-wall of the pipe. The delamination was produced by the diffusion of atomic hydrogen at inclusions in the pipe steel during normal pipeline operations. This mechanism is known as hydrogen induced cracking (HIC) and requires both a source of atomic hydrogen and a mechanism to drive or permit the hydrogen atoms to enter the steel. The susceptibility of line pipe steels to HIC depends on several metallurgical and environmental factors which must occur concurrently to cause a HIC flaw to initiate and propagate to failure. All these factors were present in the vicinity of the rupture at kmp 66 + 041.

The Board concluded its investigation and released report P94H0003 on 23 August 1995.

Board Recommendation P95-02

FPL has identified other locations on its pipeline system where soil conditions were similar to those found at the site of this occurrence and where the pipe may also be susceptible to HIC. Since HIC was thought to be associated mainly with the transmission of sour gas, other companies transporting sweet gas may have also installed pipe manufactured to standard CAN/CSA-Z245.2-M1979 Grade 483 Category II, and have pipelines constructed in environments where there is a potential for HIC. Therefore, the Board recommended that:

The National Energy Board identify and undertake corrective measures for pipelines manufactured to standard CAN/CSA-Z245.2-M1979 Grade 483 Category II operating in environments where there is a potential for hydrogen induced cracking.

P95-02

Response to P95-02 (30 November 1995)

The National Energy Board (NEB) indicated that since FPL had confirmed through laboratory and field analysis that the sulphurcrete weights contributed to the rupture, the NEB intended to require all pipeline operators under its jurisdiction to provide their remedial action plans to address the potential for HIC on their systems.

Board Assessment of Response to P95-02 (30 January 1996)

The NEB's response to this recommendation is based on the premise that the sulphurcrete saddle weights were the main factor contributing to the HIC found in this occurrence. Given that the response is limited to one, but not necessarily the only, environmental condition, the response to Recommendation P95-02 was assessed as "*Satisfactory Intent*".

Board Reassessment of Response to P95-02 (February 2006)

Since the NEB has not taken further action to determine other operating conditions which could make pipelines susceptible to HIC, the Board maintained the assessment of the response to this recommendation as "*Satisfactory Intent*".

Additional Response to P95-02 (January 2011)

The use of "sulphurcrete" saddle weights has been eliminated from the pipeline industry. Pipeline companies closely monitor the levels of Cathodic Protection applied to buried pipeline systems. This ensures that these levels do not exceed the upper design range permitted by the Z662, thus preventing CP overcharging and associated hydrogen production. The NEB indicated that pursuant to CSA Z662, pipeline companies now have in place integrity management programs to identify threats to their systems, such as HIC, as well as plans and procedures to mitigate those threats. The NEB conducts compliance monitoring programs, comprising inspections, audits and incident investigations, to verify that the integrity management programs are functioning as intended.

Board Reassessment of Response to P95-02 (February 2011)

The Board considers that the elimination of "sulphurcrete" saddle weights, close monitoring of the levels of Cathodic Protection and the use of integrity management programs has addressed the risk of hydrogen induced cracking of pipe manufactured to the referenced standard. Therefore the Board has reassessed the response to this recommendation as "*Fully Satisfactory*".

Next TSB Action

This deficiency file is assigned an "*Inactive*" status.