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12 May 2017

To: All companies under National Energy Board jurisdiction
Canadian Energy Pipeline Association
Canadian Association of Petroleum Producers
Provincial and Territorial Regulators

**National Energy Board Amended Safety Advisory
NEB SA 2016-01A2
Pipeline Fitting Materials Quality Assurance**

The attached, Safety Advisory SA 2016-01A2 is an amendment to SA 2016-01A that was issued 12 April 2016. This amendment provides additional detail on measures taken by manufacturers to improve quality assurance for fittings.

The National Energy Board (NEB or the Board) expects regulated companies to demonstrate a proactive commitment to continual improvement in safety, security and environmental protection, and to promote a positive safety culture as part of their management systems.

Safety Advisories are issued periodically in order to improve the oil and gas industry's awareness of an identified safety or environmental concern with the goal of preventing incidents from occurring. A Safety Advisory also serves to further highlight NEB requirements, and conveys the Board's expectation that regulated companies take appropriate action to mitigate any potential impacts to people or the environment.

If you have any questions regarding this advisory please contact Pipeline Integrity personnel at the Board through our toll free number at 1-800-899-1265.

Yours truly,

Original signed by

Sheri Young
Secretary of the Board

Attachment



SAFETY ADVISORY

Pipeline Materials Quality Assurance

Background

The National Energy Board (NEB or the Board) is aware of instances of pipe and components¹ not meeting material specifications on pipelines under NEB or other regulatory bodies' jurisdiction. In the cases examined, documentation from the manufacturers indicated that the materials met the required specifications when received by companies. Subsequent testing indicated that some of the pipe and fittings² did not meet all of the required material specifications. In some instances, the materials were determined to have been a contributing factor to pipeline failure during pressure testing.

Although the cases described below appear to have been isolated, the Board has subsequently identified additional cases on pipelines in Canada and the United States (US). The issue of substandard pipe and fittings entering the market place, and subsequently being installed on pipeline systems, is an industry wide concern, which must be addressed through improved quality assurance (QA) practices.

US Advisory Bulletin on Inconsistent Pipe Material Properties

In 2008, the United States (US) Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) observed hydrostatic test failures and excessive expansions on a number of pipelines under construction in the US. Upon investigation, PHMSA attributed the cause of the incidents to the installation of pipe with material properties that did not meet specifications.

In 2009, PHMSA issued an advisory bulletin (ADB-09-01) warning of the potential for micro-alloyed high strength line pipe to exhibit inconsistent chemical and mechanical properties, with yield strengths below specified requirements. The advisory also warns that in some cases, the pipe materials may successfully pass a hydrostatic test but still present a future concern.

Canadoil Asia Fitting Case

In December 2010, the NEB was notified of a steel fitting (elbow) that had expanded following a hydrostatic test at a pipeline facility in the US. PHMSA attributed the cause of the elbow expansion to the fitting having a yield strength lower than the specified minimum yield strength. The pipeline operator removed a number of other fittings at the facility for mechanical testing and identified additional fittings with similar characteristics.

¹ Component(s) are pressure-retaining member(s) of the pipeline, other than pipe.

² Fittings are manufactured components such as elbows, reducers, and tees that connect sections of pipeline.



The suspect fittings were traced to a manufacturer identified as Canadoil Asia³ with production originating from Thailand. The fittings were manufactured to the Manufacturers Standard Society (MSS) SP-75 Specification for High-Test, Wrought, Butt-Welding Fittings and were documented as having met the specified material requirements on the Material Test Report (MTR). However, due to inadequacies in some processes at the manufacturing plant, not all fittings met the specified material requirements.

Ezeflow Fitting Case

In 2013, a pipeline rupture occurred on a NEB-regulated natural gas pipeline in Alberta. The Transportation Safety Board of Canada (TSB) released its Pipeline Investigation Report on the incident (P13H0107) on 3 November 2015.

Investigations by the TSB, the NEB, and the pipeline operator indicated the pipeline was operating beyond its temperature design limits at the time of failure, thus subjecting the pipe and fittings to a thermal load beyond that used in the pipeline design.

Although low yield strength was not determined to be a contributing cause to the failure, subsequent investigation by the pipeline operator indicated that certain fittings on the pipeline might have yield strengths lower than required. These fittings were reinforced or replaced before the pipeline was put back into service. Although the fitting that failed appears to have met design requirements, it was substandard in that it did not meet the yield strength or thickness specified by the pipeline operating company. Prior to being put into service, the fittings had successfully passed two hydrostatic tests.

Since this incident, the pipeline operating company has increased its manufactured fitting specifications beyond the manufacturing standards acceptable under the current Canadian Standards Association (CSA) Z662-15 *Oil and Gas Pipeline Systems* to prevent a similar incident from occurring. The fitting manufacturer, Ezeflow, has made improvements to both its manufacturing procedures and its quality assurance (QA) programs. The quality issue appears to be limited to Grade 550 elbows manufactured for a single customer.

Additional Cases Identified Following Safety Advisory SA 2016-01:

TK Corporation Fittings Case

In September 2012, a fitting manufactured by TK Corporation (TK) was deformed during a hydrostatic test conducted by a pipeline operator at a pump station on a provincially regulated pipeline. As a result, further testing was conducted on additional TK manufactured fittings which resulted in the pipeline operator being unable to identify which fittings potentially did not meet specifications. An engineering assessment was conducted to determine the criteria for replacing over 400 of the fittings.

The pipeline operator that discovered the issue advised other pipeline operators and instituted revisions to internal engineering standards as well as quality assurance procedures.

³ Canadoil Asia is no longer affiliated with Canadoil Forge and CFC Canadoil.



In addition, manufacturers and distributors were provided with improved guidance on the operator's requirements for materials.

The Board has been informed by TK that once it learned of the hydrostatic test failure, it conducted an investigation into the manufacturing process of its high strength welded fittings and, based upon its findings, it made improvements to its equipment, starting materials and quality assurance programs. TK also confirmed to the Board that it is committed to protecting public safety.

Tecnoforge Fitting Case

In August 2016, the Board was notified by one of its regulated pipeline companies that a fitting (elbow) manufactured by Tecnoforge was found to not meet minimum strength requirements. The fitting was discovered to not meet specifications before being installed. The pipeline operating company proceeded to inspect several hundred similar fittings installed since 2011. All fittings passed hydrostatic testing, so the risk of failure is considered low. However, all related fittings in pipe assemblies were put under a temperature and pressure hold until fittings were replaced, mitigated or engineering assessments were performed to demonstrate suitability for continued service.

The fitting had been over-tempered due to a QA process issue. Subsequent testing identified localized lower than specified yield strength locations. This localized issue appears to be related to contact of the fittings with other fittings or pallets during the heat treatment process. Preliminary analysis of manufacturing processes indicates that this issue may occur at other manufacturers.

Tecnoforge has confirmed with the Board that safety is its top priority and that it has conducted a joint investigation with the pipeline operator to understand the root cause of any low yield strength areas, to mitigate it and to confirm that it has not impacted the structural integrity of its fittings. Both the pipeline operator and Tecnoforge have advised the Board that in their view, fitness for service and safety of Tecnoforge's fittings have not been compromised.

Preventive Actions

The Board holds pipeline operators, which includes processing plant operators, responsible for assuring that the pipe and fittings they purchase meet the specifications requested and required for the intended service.

As part of the NEB's mandate to promote safety and security of pipelines⁴, a more widespread and proactive approach is being taken. The NEB may issue additional guidance to operators on what changes are expected to be made to operators' internal specifications and QA programs as more information on the issue is acquired.

⁴ Pipeline means "pipeline" as defined in section 2 of the *National Energy Board Act*, R.S.C., 1985, c. N-7, which includes processing plants.



Existing industry standards such as CSA Z245.11, CSA Z245.1, ASME B16.9, and MSS SP-75 are essential in preventing the manufacture of pipe and fittings that do not meet required material properties. These standards are living documents that are updated as needed. All standards bodies are receptive to making any required updates to the standards and the Board will continue to communicate with them on this issue. In the interim, the Board expects pipeline operators to develop or enhance their own fitting specifications beyond the current standards, to ensure that the fittings they acquire and install meet material property requirements.

Ongoing safety measures for pipeline companies regulated by the NEB include a requirement for companies to develop specifications for the pipe and components to be used in a pipeline. Companies shall submit specifications to the Board when required to do so, as per section 14 of the *National Energy Board Onshore Pipeline Regulations (OPR)*. In addition, companies must have QA programs in place to ensure that the pipe and components meet the specifications developed by the company, as required by section 15 of the OPR and section 10 of the *National Energy Board Processing Plant Regulations*. In this case, reviewing MTRs, without independent onsite verification, may not provide sufficient protection against the introduction of components that do not meet specifications. Companies are also expected to exert greater oversight in the manufacturing process directly and/or indirectly through third party QA.

Further Information

If you have any questions regarding this advisory please contact Pipeline Integrity personnel at the Board through a toll free number at 1-800-899-1265.