Recommended Practice for Assessment and Management of Cracking in Pipelines

API RECOMMENDED PRACTICE 1176
FIRST EDITION, JULY 2016

ERRATA 1, FEBRUARY 2021

REAFFIRMED, MARCH 2024

American
Petroleum
Institute

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Contents

Contents

Contents

Contents

Introduction

This recommended practice (RP) provides guidance to the pipeline industry for assessment and management of defects in the form of cracking, with particular emphasis on contributing threats and the applicable assessments. The RP presents detailed guidance for developing a crack management program. The crack management RP includes the following:

— selecting suitable methods for assessing the condition of the pipeline with respect to applicable forms of cracking;

— establishing response criteria for in-line inspection (ILI) results and determining a pressure reduction where the excavation is delayed beyond the intended timeline;

— determining appropriate hydrostatic test levels and duration;

— calculating the remaining lives of anomalies that may remain in the system so that reassessment can be carried out to reevaluate the anomalies and remediate if necessary;

— developing preventive and mitigative measures for cracking-related conditions in lieu of or in addition to periodic integrity assessment.

This RP is intended for use by operators in planning, implementing, and improving a pipeline crack management program.

Although the genesis and structure of this RP is the API 1160 RP for liquid hazardous pipeline managed under U.S. Department of Transportation (DOT) 49 C*ode of Federal Regulations* (*CFR*) 195.452 of the U.S. federal pipeline safety regulations, this RP is written as a broadly applicable framework for both hazardous liquid and gas pipelines located in any location or under any jurisdiction. This RP augments API 1160 in aiding the development of integrity management programs that are required under U.S. federal pipeline safety regulations.

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1 Scope

This recommended practice (RP) is applicable to any pipeline system used to transport hazardous liquid or natural gas, including those defined in U.S. Title 49 *Code of Federal Regulations (CFR)* Parts 192 and 195.

This RP is specifically designed to provide the operator with a description of industry-proven practices in the integrity management of cracks and threats that give rise to cracking mechanisms. The guidance is largely targeted to the line pipe along the right-of-way (ROW), but some of the processes and approaches can be applied to pipeline facilities, including pipeline stations, terminals, and delivery facilities associated with pipeline systems. Defects associated with lap-welded (LW) pipe and selective seam weld corrosion (SSWC) are not covered within this RP.

This RP presents the pipeline industry's understanding of pipeline cracking. Mechanisms that cause cracking are discussed, methods to estimate the failure pressure of cracks are reviewed, and methods to estimate crack growth are presented. Selection of the appropriate integrity assessment method for various types of cracking, operating conditions, and pipeline characteristics is discussed. This RP also reviews current knowledge about in-line inspection (ILI) technology and in-the-ditch (ITD) nondestructive evaluation technology. A methodology for responding to ILI indications and specific criteria for when to respond to certain results is presented. Applicable repair techniques are reviewed. Sections are included for the discussion of reassessment interval determination and the consideration of appropriate preventive and mitigative measures. Finally, some meaningful performance metrics for measuring the effectiveness of a crack management program are discussed.

The technical discussion about crack formation, growth, and failure is to provide the knowledge needed by operators to effectively make integrity decisions about managing cracking on their pipeline systems.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API 579-1/ASME FFS-1 [1], *Fitness-For-Service*, June 2007

API Recommended Practice 1110, *Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide*

API Recommended Practice 1160, *Managing System Integrity for Hazardous Liquid Pipelines*, Second Edition

ASME B31.4-2012, *Pipeline Transportation Systems for Liquids and Slurries*

ASME B31.8-2012, *Gas Transmission and Distribution Piping Systems*

ASME B31G-2012, *Manual for Determining the Remaining Strength of Corroded Pipelines*

BS 7910:2013 [2], *Guide to Methods for Assessing the Acceptability of Flaws in Metallic Structures*

NACE SP0204 [3], *Stress Corrosion Cracking (SCC) Direct Assessment Methodology*, 2008

[1] ASME International, 2 Park Avenue, New York, New York 10016-5990, www.asme.org.
[2] British Standards Institution, Chiswick High Road, London, W4 4AL, United Kingdom, www.bsi-global.com.
[3] NACE International (formerly the National Association of Corrosion Engineers), 15835 Park Ten Place Houston, Texas 77084, www.nace.org.