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Control of Internal Corrosion in Steel Pipelines and Piping Systems

ABSTRACT

This standard presents recommended practices for the control of internal corrosion in steel pipelines and piping systems used to gather, transport, or distribute crude oil, petroleum products, or gas. It is meant to serve as a guide for establishing minimum requirements for control of internal corrosion in crude oil gathering and flow lines, crude oil transmission, hydrocarbon products, gas gathering and flow lines, gas transmission, and gas distribution. This standard is maintained by Task Group 038.

KEYWORDS

Pipelines, internal corrosion, corrosion control.

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Foreword

The purpose of this NACE standard practice is to describe procedures and practices for achieving effective control of internal corrosion in carbon steel pipe and piping systems used to gather, transport, or distribute crude oil, petroleum products, and gas, including produced water and water injection pipe. Certain constituents that are found in the gas and liquid transported in these systems (e.g., oxygen, carbon dioxide, hydrogen sulfide, bacteria, etc.) can cause corrosion. Additionally, the complex nature and interaction between constituents in the pipeline may affect whether a corrosive condition exists or increase the severity of a corrosive condition. These corrosive conditions can lead to localized pitting corrosion, underdeposit corrosion, microbiologically influenced corrosion and general corrosion. The predominant failures occur by localized pitting mechanism; therefore controlling pitting corrosion is paramount. Identification of potentially corrosive gas and liquids in a pipeline can only be achieved by analysis of operating conditions, fluid composition, physical monitoring and/or inspection results, or other considerations. There are many mitigation methods that can be implemented in systems where corrosive conditions exist. This standard presents general practices in regard to control of internal corrosion in steel pipeline systems. This standard is intended for use by pipeline operators, pipeline service providers, government agencies, and any other persons or companies involved in planning, designing, or managing pipeline integrity.

This standard was prepared by Task Group (TG) 038 on Control of Internal Corrosion in Steel Pipelines and Piping Systems. It was revised in 2018 by TG 038. TG 038 is administered by Specific Technology Group (STG) 35 on Pipeline, Tanks, and Well Casings. This standard is issued by NACE International under the auspices of STG 35.

In NACE standards, the terms ***shall, must, should,*** and ***may*** are used in accordance with the definitions of these terms in the NACE Publications Style Manual. The terms ***shall*** and ***must*** are used to state a requirement, and are considered mandatory. The term ***should*** is used to state something good and is recommended, but is not considered mandatory. The term ***may*** is used to state something considered optional.

Control of Internal Corrosion in Steel Pipelines and Piping Systems

Section 1: General

1.1 This standard presents recommended practices for the control of internal corrosion in steel pipelines and piping systems used to gather, transport, or distribute crude oil, petroleum products, or natural gas.

1.2 This standard serves as a guide for establishing minimum requirements for management of internal corrosion in the following systems:

(a) Crude oil gathering and flow lines
(b) Crude oil transmission
(c) Hydrocarbon products
(d) Gas gathering and flow lines
(e) Gas transmission
(f) Gas distribution
(g) Storage systems
(h) Produced water lines
(i) Injection water lines

1.3 This standard does not designate specific practices for every situation because the complexity of systems precludes standardizing internal corrosion control practices.

1.4 This document does not cover internal cracking mechanisms, nor does it address steam lines.

1.5 Corrosion control of equipment such as tanks, vessels, processing units, valves etc. is outside the scope of this document.

1.6 This document does not specifically address corrosion resistant alloys (CRAs) or well tubulars. Although many of the same principles could be applied to these materials and environments, there will be exceptions.

1.7 The internal corrosion control process described in this document is a continual feedback loop. It begins with performing an internal corrosion threat assessment to identify relevant internal corrosion mechanisms and contributing factors for the pipeline/system, creating a corrosion control plan to evaluate, mitigate and monitor those threats, and utilizing information obtained from monitoring, inspection and other activities (e.g., maintenance) as feedback to update the identified threats and corrosion control plan.

1.8 Local government regulations or permits may dictate particular requirements related to implementation of various section of this standard.

1.9 The provisions of this standard should be applied under the direction of competent persons who, by reason of knowledge of the physical sciences and the principles of engineering and mathematics acquired by education or related practical experience, are qualified to engage in the practice of corrosion control on carbon steel piping systems. Such persons may be registered professional engineers or persons recognized as corrosion specialists by organizations such as NACE, or engineers, scientists or technicians with suitable levels of experience, and their professional activities include internal corrosion control of buried carbon steel piping and pipeline systems.

Section 2: Definitions

Archaea: Unicellular microorganisms that are generally distinct from bacteria, which often inhibit extreme environmental conditions.

Atomization: To a chemical to fine particles or spray.

Biocide: A chemical product that is intended to kill biological microorganisms or render them harmless.

Biofilm: Microbial growth at an interface in which individual cells are bound within a matrix of extracellular polymeric materials.

Cavitation: The formation and rapid collapse of cavities or bubbles of vapor or gas within a liquid resulting from mechanical or hydrodynamic forces.

Coating: A liquid, liquefiable, or mastic composition that, after application to a surface, is converted into a solid protective, decorative, or functional adherent film.