Internal Corrosion Direct Assessment Methodology for Pipelines Carrying Normally Dry Natural Gas (DG-ICDA)

This NACE International standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. Its acceptance does not in any respect preclude anyone, whether he or she has adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this NACE standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by letters patent, or as indemnifying or protecting anyone against liability for infringement of letters patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. NACE assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official NACE interpretations issued by NACE in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this NACE standard are responsible for reviewing appropriate health, safety, environmental, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This NACE standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment, and/or operations detailed or referred to within this standard. Users of this NACE standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: NACE standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with NACE technical committee procedures. NACE requires that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication and subsequently from the date of each reaffirmation or revision. The user is cautioned to obtain the latest edition. Purchasers of NACE standards may receive current information on all standards and other NACE publications by contacting the NACE FirstService Department, 15835 Park Ten Place, Houston, TX 77084-5415 (telephone +1 281-228-6200).

ABSTRACT
Formalizes the process of internal corrosion direct assessment (ICDA) for pipelines carrying normally dry natural gas that can be used to help ensure pipeline integrity. The basis of DG-ICDA is a detailed examination of locations along a pipeline where water would first accumulate to provide information about the downstream condition of the pipeline. If the locations along a length of pipe most likely to accumulate water have not corroded, other downstream locations less likely to accumulate water may be considered free from corrosion.

KEYWORDS
internal corrosion, direct assessment, dry gas, pipelines.
Foreword

This standard practice formalizes a methodology termed internal corrosion direct assessment for pipelines carrying normally dry natural gas (DG-ICDA)\(^1\) that may be used to help ensure pipeline integrity. The methodology is applicable to natural gas pipelines that normally carry dry gas, but may suffer from infrequent, short-term upsets of liquid water (or other electrolyte). This standard does not address situations in which water vapor condensation occurs at locations along the length of the pipeline. Such situations are intended to be addressed using wet gas internal corrosion direct assessment (WG-ICDA).\(^1\) This standard is intended for use by pipeline operators and others who manage pipeline integrity.

The basis of DG-ICDA is a detailed examination of locations along a pipeline where water would first accumulate and provides information about the downstream condition of the pipeline. If the locations along a length of pipe most likely to accumulate water have not corroded, other downstream locations less likely to accumulate water may be considered free from corrosion. The presence of extensive corrosion found at many locations during the evaluation suggests that the transported gas was not normally dry, and this standard is not considered applicable.

DG-ICDA methodology for natural gas systems is described in terms of a four step process. The DG-ICDA method provides the greatest benefit for pipelines that cannot be in-line inspected; however, the method is not limited to unpiggable pipelines. Sample field data are provided in Appendix A (nonmandatory) to illustrate an example application of DG-ICDA. Appendix B (nonmandatory) provides example region definitions.

This standard was prepared by Task Group (TG) 293, “Pipeline Direct Assessment Methodology,” in 2006, and revised by TG 293 in 2015. TG 293 is administered by Specific Technology Group (STG) 35, “Pipelines, Tanks, and Well Casings.” This standard is issued by NACE International under the auspices of STG 35.
Internal Corrosion Direct Assessment Methodology for Pipelines Carrying Normally Dry Natural Gas (DG-ICDA)

1. General ....................................................................................................................4
2. Definitions ................................................................................................................9
3. Preassessment ........................................................................................................10
4. Indirect Inspection ..................................................................................................14
5. Detailed Examinations ............................................................................................18
6. Post-Assessment ......................................................................................................21
7. DG-ICDA Records ..................................................................................................22

References ..................................................................................................................23
Bibliography ................................................................................................................24
Appendix A (Nonmandatory) Example DG-ICDA Application .................................27
Appendix B (Nonmandatory) Example Region Definition .........................................32

Figures
Figure 1(a): Dry Gas Internal Corrosion Direct Assessment Flow Chart ...............6
Figure 1(b): Dry Gas Internal Corrosion Direct Assessment Flow Chart ...............7
Figure 1(c): Dry Gas Internal Corrosion Direct Assessment Flow Chart ...............8
Table 1: Essential Data for Use of DG-ICDA Methodology ......................................13
Table A1: Example Conditions .................................................................................27
Figure A1: Example Inclination and Elevation Profiles, with Critical Inclination Angles .................................................................29
Table A2: Example—Illustration of ICDA Region Definitions .................................32
Figure A2: Example Inclination Profile, Gas Flowing South to North .....................30
Figure A3: Example Inclination Profile, Gas Flowing North to South ....................31
Figure B1: Illustration of ICDA Region Definitions ..................................................32
Section 1: General

1.1 Introduction

1.1.1 This standard covers the NACE internal corrosion direct assessment (ICDA) process for normally dry natural gas pipeline systems. This standard is intended to serve as a guide for applying the NACE DG-ICDA process on natural gas pipeline systems that meet the feasibility requirements of Paragraph 3.3 of this standard.

1.1.2 The primary purposes of the DG-ICDA method are to enhance the assessment of internal corrosion in natural gas pipelines, and to ensure pipeline integrity.

1.1.3 DG-ICDA was developed for natural gas pipelines that normally carry dry gas, but may suffer from infrequent short-term upsets of liquid water. This standard does not address water vapor condensation. Because of this, DG-ICDA is not applicable to wet gathering and producing pipelines, storage fields or other pipelines where water vapor condensation occurs at distinct locations or throughout the length of the pipeline. Where water condensation occurs or is expected to occur, then assessment should be carried out in accordance with NACE SP0110, Wet Gas Internal Corrosion Direct Assessment Methodology for Pipelines.

1.1.4 One benefit of the DG-ICDA approach is that an assessment can be performed on a pipe segment for which alternative methods (e.g., in-line inspection (ILI), hydrostatic testing, etc.) may not be practical.

1.1.5 The basis of DG-ICDA for gas lines is a detailed examination of locations along a pipeline where water or other electrolyte first accumulates, allowing inferences to be made about the integrity of the remaining downstream length of pipe.

1.1.6 If the locations along a length of pipe that are most likely to accumulate water have not corroded, other locations less likely to accumulate water are unlikely to have suffered corrosion when operating under the same conditions.

1.1.7 Identifying areas in which internal corrosion (or the potential for future internal corrosion) exists, and conversely, where internal corrosion is unlikely, may also be incorporated into corrosion integrity and risk management plans.

1.1.8 In the process of applying DG-ICDA, other pipeline integrity threats, such as external corrosion, mechanical damage, stress corrosion cracking (SCC), etc., may be detected. When such threats are detected, additional assessments or inspections must be performed. The pipeline operator should utilize appropriate methods to address risks other than internal corrosion, such as those described in NACE standards, ASME(1) B31.8, API(2) 1160, ANSI(3)/API 579, and BS(4) 7910, international standards, and other documents.

1.1.9 The DG-ICDA methodology assesses the likelihood of internal corrosion and includes existing methods of examination available to a pipeline operator to determine whether internal corrosion is actually present, or may occur.

1.1.10 DG-ICDA uses flow modeling results and provides a framework to utilize those methods.

1.1.11 DG-ICDA has limitations, and not all pipelines can be successfully as-