Standard Practice

Pipeline External Corrosion Direct Assessment Methodology

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 International 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 International assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official NACE International interpretations issued by NACE International in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this NACE International 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 International 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 International 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CAUTIONARY NOTICE: NACE International standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with NACE technical committee procedures. NACE International 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 International standards may receive current information on all standards and other NACE International publications by contacting the NACE International FirstService Department, 1440 South Creek Dr., Houston, TX 77084-4906 (telephone +1 281-228-6200).

Revised 2010-06-24
Reaffirmed 2008-03-20
Approved 2002-10-11
NACE International
1440 South Creek Dr.
Houston, Texas 77084-4906
+1 281-228-6200

ISBN 1-57590-156-0
© 2010, NACE International
An American National Standard
Approved December 3, 2010
Foreword

External corrosion direct assessment (ECDA) is a structured process that is intended to improve safety by assessing and reducing the impact of external corrosion on pipeline integrity. By identifying and addressing corrosion activity, repairing corrosion defects, and remediating the cause, ECDA proactively seeks to prevent external corrosion defects from growing to a size that is large enough to affect structural integrity.

ECDA as described in this standard practice is specifically intended to address buried onshore pipelines constructed from ferrous materials. Other methods of addressing external corrosion on onshore ferrous pipelines, such as pressure testing and in-line inspection (ILI), are not covered in this standard but are covered in other industry standards. Users of this standard must be familiar with all applicable pipeline safety regulations for the jurisdiction in which the pipeline operates. This includes all regulations requiring specific pipeline integrity assessment practices and programs. This standard is intended for use by pipeline operators and others who must manage pipeline integrity.

ECDA is a continuous improvement process. Through successive ECDA applications, a pipeline operator should be able to identify and address locations at which corrosion activity has occurred, is occurring, or may occur. One of the advantages of ECDA is that it can locate areas where defects could form in the future rather than only areas where defects have already formed.

Pipeline operators have historically managed external corrosion using some of the ECDA tools and techniques. Often, data from aboveground inspection tools have been used to locate areas that may be experiencing external corrosion. The ECDA process takes this practice several steps forward and integrates information on a pipeline’s physical characteristics and operating history (preassessment) with data from multiple field examinations (indirect inspection) and pipe surface evaluations (direct examination) to provide a more comprehensive integrity evaluation with respect to external corrosion (postassessment).

This standard was originally prepared in 2002 by Task Group (TG) 041, “Pipeline Direct Assessment Methodology.” It was reaffirmed in 2008 by Specific Technology Group (STG) 35, “Pipelines, Tanks, and Well Casings,” and revised in 2010 by TG 041. 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.
NACE International
Standard Practice

Pipeline External Corrosion Direct Assessment Methodology

Contents

1. General .......................................................................................................................... 1
2. Definitions ...................................................................................................................... 6
3. Preassessment .............................................................................................................. 9
4. Indirect Inspection ....................................................................................................... 18
5. Direct Examination ...................................................................................................... 23
6. Post Assessment ......................................................................................................... 30
7. ECDA Records ............................................................................................................ 36
References ........................................................................................................................ 38
Bibliography ...................................................................................................................... 39

Appendix A: Direct Examination—Data Collection Methods Before Coating Removal (Nonmandatory) ........................................................................................................... 40
Appendix B: Direct Examination—Coating Damage and Corrosion Depth Measurements (Nonmandatory) ........................................................................................................... 47
Appendix C: Postassessment—Corrosion Rate Estimation (Nonmandatory) .................. 50

FIGURES
Figure 1(a)—External Corrosion Direct Assessment Flowchart—Part 1 ...................... 4
Figure 1(b)—External Corrosion Direct Assessment Flowchart—Part 2 ...................... 5
Figure 2—Preassessment Step .................................................................................... 9
Figure 3—Example Selection of Indirect Inspection Tools ........................................... 17
Figure 4—Example Definitions of ECDA Regions ......................................................... 18
Figure 5—Indirect Inspection Step ............................................................................. 20
Figure 6—Direct Examination Step .......................................................................... 24
Figure 7—Postassessment Step .................................................................................. 32
Figure A1—Four-Pin Method with Voltmeter and Ammeter ...................................... 41
Figure A2—Four-Pin Method with Galvanometer ......................................................... 42
Figure A3—Pin Alignment Perpendicular to Pipe ....................................................... 43
Figure A4—Soil Box Resistivity .................................................................................. 44
Figure A5—Single-Probe Method ............................................................................. 45

TABLES
Table 1—ECDA Data Elements .................................................................................. 10
Table 2—ECDA Tool Selection Matrix ........................................................................ 16
Table 3—Example Severity Classification .................................................................... 22
Table 4—Example Prioritization of Indirect Inspection Indications .............................. 26
Section 1: General

1.1 Introduction

1.1.1 This standard covers the NACE external corrosion direct assessment (ECDA) process for buried onshore ferrous pipeline systems. This standard is intended to serve as a guide for applying the NACE ECDA process on typical pipeline systems.

1.1.2 This standard was written to provide flexibility for an operator to tailor the process to specific pipeline situations.

1.1.3 ECDA is a continuous improvement process. Through successive applications, ECDA should identify and address locations at which corrosion activity has occurred, is occurring, or may occur.

1.1.3.1 ECDA provides the advantage and benefit of locating areas where defects may form in the future rather than only areas where defects have already formed.

1.1.3.2 Comparing the results of successive ECDA applications is one method of evaluating ECDA effectiveness and demonstrating that confidence in the integrity of the pipeline is continuously improving.

1.1.4 ECDA was developed as a process for improving pipeline safety. Its primary purpose is preventing future external corrosion damage.

1.1.4.1 This standard assumes external corrosion is a threat to be evaluated. It can be used to establish a baseline from which future corrosion can be assessed for pipelines when external corrosion is not currently a significant threat.

1.1.5 ECDA as described in this standard is specifically intended to address buried onshore pipelines constructed from ferrous materials.

1.1.6 ECDA applications can include but are not limited to assessments of external corrosion on pipeline segments that:

1.1.6.1 Cannot be inspected using other inspection methods (such as ILI or pressure testing).

1.1.6.2 Have been inspected using other inspection methods as a method of managing future corrosion.

1.1.6.3 Have been inspected with another inspection method as a method of establishing a reassessment interval.

1.1.6.4 Have not been inspected using other inspection methods when managing future corrosion is of primary interest.

1.1.7 ECDA may detect other pipeline integrity threats, such as mechanical damage, stress corrosion cracking (SCC), and microbiologically influenced corrosion (MIC). When such threats are detected, additional assessments or inspections must be performed. The pipeline operator should use appropriate methods such as ASME(1) B31.4,(1) ASME B31.8,(2) ASME B31.8S,(3) and API(4) Std 1160(4) to address risks other than external corrosion.

(1) ASME International (ASME), Three Park Ave., New York, NY 10016-5990.
(2) American Petroleum Institute (API), 1220 L St. NW, Washington, DC 20005-4070.