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Standard Guide for Three Methods of Assessing Buried Steel Tanks¹

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INTRODUCTION

The purpose of this guide is to provide three methods of inspecting and assessing buried steel tank(s) for corrosion damage and determining the suitability of these tanks prior to application of cathodic protection.

1. Scope

1.1 This guide covers procedures to be implemented prior to the application of cathodic protection for evaluating the suitability of a tank for upgrading by cathodic protection alone.

1.2 Three procedures are described and identified as Methods A, B, and C.

1.2.1 *Method A*—Noninvasive with primary emphasis on statistical and electrochemical analysis of external site environment corrosion data.

1.2.2 *Method B*—Invasive ultrasonic thickness testing with external corrosion evaluation.

1.2.3 *Method C*—Invasive permanently recorded visual inspection and evaluation including external corrosion assessment.

1.3 This guide presents the methodology and the procedures utilizing site and tank specific data for determining a tank's condition and the suitability for such tanks to be upgraded with cathodic protection.

1.4 While this guide provides minimum procedures for assessing a tank's condition, this guide does not provide minimum installation procedures or requirements for upgrades of the tank by cathodic protection.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appro-*

priate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The most recent version of the following documents should be consulted as references by those using this guide:

2.2 *ASTM Standards*:²

E114 Practice for Ultrasonic Pulse-Echo Straight-Beam Contact Testing

E797/E797M Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method

E1323 Guide for Evaluating Laboratory Measurement Practices and the Statistical Analysis of the Resulting Data

E1526 Practice for Evaluating the Performance of Release Detection Systems for Underground Storage Tank Systems (Withdrawn 2002)³

G51 Test Method for Measuring pH of Soil for Use in Corrosion Evaluations

G57 Test Method for Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

G193 Terminology and Acronyms Relating to Corrosion

2.3 *ASNT Standard*:⁴

ASNT SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing

¹ This guide is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.10 on Corrosion of Soils.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

- 2.4 *AMPP (formerly NACE International) Standards:*⁵
NACE SP0169 (formerly RP0169) Standard Practice – Control on External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0187 (formerly RP0187) Standard Practice – Design Considerations for Corrosion Control of Reinforcing Steel in Concrete
NACE SP0285 (formerly RP0285) Standard Practice – Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
- 2.5 *Environmental Protection Agency Methods:*⁶
EPA SW 846 Test Methods for Evaluating Solid Waste
EPA 371.1 Measurement of Sulfate Reducing Bacteria
- 2.6 *National Fire Protection Association (NFPA) Practice:*⁷
NFPA 329 Recommended Practice for Handling Underground Releases of Flammable and Combustible Liquids
- 2.7 *Underwriters Laboratories Standard:*⁸
UL 58 Steel Underground Tanks for Flammable and Combustible Liquids

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *buried, adj*—to be placed in the ground and covered with earth.

3.1.2 *cathodic protection, n*—an applied technique to prevent further corrosion of a metal surface by making that surface the cathode of an electrochemical cell. For example, a tank system can be cathodically protected through the application of either galvanic anodes or impressed current.

3.1.3 *corrosion specialist/cathodic protection specialist, n*—a competent person who by reason of knowledge of the physical sciences and the principles of engineering and mathematics, acquired by education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metallic piping systems and metallic tanks. Such persons are recommended to be registered professional engineers or persons recognized as corrosion specialists or cathodic protection specialists by NACE (AMPP), if their professional activities include suitable experiences in external corrosion control on buried or submerged metallic piping and tanks.

3.1.4 *corrosion technician, n*—a person possessing basic knowledge of corrosion and corrosion control, who is capable of performing routine, well defined work under the supervision of the corrosion specialist/cathodic protection specialist.

3.1.5 *invasive procedure, n*—a method of determining the corrosion status of a tank by assessing the tank from the inside

as part of the upgrade procedure. Further, for the purposes of this guide, it does not require manned entry into the tank. (See *non-invasive*.)

3.1.6 *limitations, n*—The user of this guide is encouraged to review any available third party verification information provided as part of the vendor selection process.

3.1.7 *noninvasive procedure, n*—a method of determining the corrosion status of a tank from the characteristics of its surroundings with minimal entry into the tank. Further, for the purposes of this guide, it does not require manned entry into the tank. (See *invasive*.)

3.1.8 *tank tightness test, n*—a method capable of detecting a 0.1 gal/h leak rate, while accounting for any applicable effects of thermal expansion or contraction of the product, of vapor pockets, of tank deformation, of evaporation or condensation, and of the location of the water table. The method should be capable of detecting a 0.1 gal/h leak rate with a probability of detection of at least 0.95 and a probability of false alarm of at most 0.05 or in accordance with NFPA 329.

3.1.9 *unconditional probability of corrosion failure, n*—the probability of corrosion failure which includes a determination of whether localized, pitting, or general corrosion is occurring.

3.1.10 *underground storage tank (UST), n*—any one or combination of tanks (including connected underground piping), the volume of which is 10 % or more beneath the surface of the ground.

3.1.11 *upgrade, n*—the addition to or retrofit of UST systems using approaches including, but not limited to, cathodic protection to improve the ability of a UST system to prevent a release.

3.1.12 *UST, n*—see underground storage tank (see 3.1.10).

3.1.13 *vendor provided information, n*—The user is referred to **Annex A1** for a specific form and format of information which should be provided by a vendor. This information consists of historic performance data on a method and is recommended as part of the guide.

4. Significance and Use

4.1 This guide provides three methods for determining the suitability of a buried steel tank to be upgraded with cathodic protection.

4.2 This guide may be used to assess any UST, including non-regulated USTs.

4.3 This guide provides three alternative methods but does not recommend any specific method or application. The responsibility for selection of a method rests with the user.

4.4 This guide has specific suggestions for vendor provided information which should be requested and reviewed by the user.

5. Permits, Plans and Tank Leak Testing

5.1 Prior to engaging in any activities relating to the alteration, repair, or upgrade of any UST system, all necessary authorities should be consulted to obtain any required permits.

5.2 *Tank Leak Testing:*

⁵ Available from AMPP International, 15835 Park Ten Pl., Houston, TX 77084, <http://www.ampp.org>.

⁶ Available from United States Environmental Protection Agency (EPA), Office of Underground Storage Tanks, William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, <http://www.epa.gov>.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101.

⁸ Available from Underwriters Laboratories (UL), UL Headquarters, 333 Pfingsten Road, Northbrook, IL, 60062, <http://www.ul.com>.