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Standard Guide for Environmental Management of Underground Storage Tank Systems Storing ~~Hazardous~~Regulated Substances ~~or Petroleum~~[1]

This standard is issued under the fixed designation E2681; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This guide provides an overview of environmental practices for design, installation, ~~operation and maintenance, and~~ operation, maintenance including scheduled inspections and periodic equipment testing, and when necessary, and corrective action for underground tank systems used for storage of ~~hazardous substances and petroleum products.~~ regulated substances. The training for, and application of these practices should serve to prevent accidental releases of petroleum or ~~hazardous substances~~ regulated from underground storage tank systems and to facilitate effective detection and response when and if such releases do occur. The guide is intended for use by tank system owners and operators and other persons concerned with practices for prevention and control of environmental releases and remediation of affected environmental media. The guide provides an overview of environmentally sound management practices, identifying key management considerations and referring the user to other related ASTM standards and industry guidelines for more detailed information. Regulatory requirements related to underground storage tank systems may vary by regulatory jurisdiction. This guide provides recommendations to comply with the requirements of 40 CFR Part 280. The user must review the regulations of the implementing agency to determine if it has more stringent regulatory requirements. All personal safety considerations are not addressed in this guide, and it is the responsibility of the user to identify relevant safety and health protection practices and regulations related to tank system management. Caution is warranted due to the flammable or combustible property of some materials stored in underground storage tanks. Fire codes should be followed.

1. Scope

1.1 The framework discussed in this guide is limited to facilities with underground storage tanks (USTs) storing ~~hazardous~~regulated substances ~~or petroleum~~ at ambient temperature and atmospheric pressure. This guide is not intended to provide detailed technical specifications for implementation of the approaches described in this document, nor to be used as an enforcement tool, but rather to identify the important information used for environmental management of underground tank systems. The term "must" is used where United States federal requirements apply. References to ASTM standards and other industry guidelines have been provided to address implementation of the approaches discussed in this guide. Many states and some local agencies have adopted ~~UST~~ rules that place additional responsibilities on the owners/operators of UST systems. Refer to state and local regulations that may contain additional requirements. It is not possible to identify all considerations or combinations of conditions pertinent to a unique underground storage tank system.

[1] This guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.01 on Storage Tanks.

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1.2 This guide addresses principal considerations related to the prevention of, and response ~~for~~to environmental releases from tank systems and is organized in the sections listed below:

~~Section 1:~~	~~Scope~~
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~~Section 2:~~	~~Lists relevant ASTM Standards and other industry or regulatory guidance documents~~
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~~Section 3:~~	~~Defines the key terminology used in this guide~~
Section 3:	Defines the key terminology used in this guide
~~Section 4:~~	~~Describes the significance and use of this guide~~
Section 4:	Describes the significance and use of this guide
~~Section 5:~~	~~Tank System Design and Installation~~
Section 5:	Tank System Design and Installation
~~Section 6:~~	~~Preventive Maintenance and Inspection Plan~~
Section 6:	Preventive Maintenance and Inspection Plan
~~Section 7:~~	~~Fueling Procedure~~
Section 7:	Fueling Procedure
Section 8:	Dispensing Activities
Section 9:	Release Response Plan
~~Section 8:~~	~~Corrective Action for Affected Environmental Media~~
Section 10:	Corrective Action for Affected Environmental Media
~~Section 9:~~	~~Tank System Closure~~
Section 11:	Tank System Closure
~~Section 10:~~	~~Tank Management Practice Education and Training~~
Section 12:	UST Management Practice and Operator Training
~~Appendix X1:~~	~~Recurring Release Detection and Cathodic Protection Requirements (Quick Glance) is intended to be a quick reference guide for monitoring information~~
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Related Material:	Documents related to environmental management of underground storage tanks

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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 appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use. Some specific hazards statements are given in Section ~~7~~7 on Hazards.*

1.5 *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 *ASTM Standards:*[2]

D5745 Guide for Developing and Implementing Short-Term Measures or Early Actions for Site Remediation

E1739 Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites

~~E1912 Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases (Withdrawn 2013)~~[3]

E1990 Guide for Performing Evaluations of Underground Storage Tank Systems for Operational Conformance with 40 CFR, Part 280 Regulations

E2081 Guide for Risk-Based Corrective Action

E2616 Guide for Remedy Selection Integrating Risk-Based Corrective Action and Non-Risk Considerations

2.2 *American Petroleum Institute (API) Standards:*[3]

API RP 1007 Loading and Unloading of MC-306 and DOT-406 Cargo Tank Motor Vehicles

API RP 1604 Closure of Used Underground Petroleum Storage Tanks

API RP 1615 Installation of Underground Petroleum Storage Systems

API RP 1621 Bulk Liquid Stock Control at Retail Outlets

API RP 1626 Storage and Handling of Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Filling Stations

API Publication 1628 Guide to the Assessment and Remediation of Underground Petroleum Releases

API Publication 1629 Guide for Assessing and Remediating Petroleum Hydrocarbons in Soils

[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] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.

API RP 1632 Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems
API Publication 4509 Design, Construction, Operation, Maintenance and Inspection of Terminal and Tank Facilities

2.3 *Underwriters Laboratory (UL) Standards*[4]

UL 58 Standard for Steel Underground Tanks for Flammable and Combustible Liquids
UL 87A Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends With Nominal Ethanol Concentrations Up To 85 Percent (E0 - E85)
UL 971 Standard for Nonmetallic Underground Piping for Flammable Liquids
UL 1316 Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures
UL 1746 Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks

2.4 *National Association of Corrosion Engineers (NACE) Standards*[5]

NACE RP0285 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE Corrosion Data Survey Metals and Nonmetals Sections. Hamner, N.E. (ed.), 1975

2.5 *National Fire Protection Association (NFPA) Standards:*[6]

NFPA 30 Flammable and Combustibles Liquids Code
NFPA 30A Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 326 Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair
NFPA 385 Standard for Tank Vehicles for Flammable and Combustible Liquids

2.6 *Petroleum Equipment Institute (PEI) Standards:*[7]

PEI RP100 Recommended Practice for Installation of Underground Liquid Storage Systems
PEI RP900 Recommended Practices for the Inspection and Maintenance of UST Systems

2.7 *Steel Tank Institute (STI) Standards:*[8]

STI-P3 System for External Corrosion Protection of Underground Steel Storage Tanks
STI F841-01 Standard for Dual Wall Underground Steel Storage Tanks
STI ACT-100 External Corrosion Protection of FRP Composite Steel Underground Storage Tanks
STI ACT-100-U External Corrosion Protection of Composite Steel Underground Storage Tanks
STI Document "Keeping Water Out of Your Storage System"
STI F922 PERMATANK (trademarked) Double Wall Steel-Fiberglass Underground Storage Tank

2.8 *United States Environmental Protection Agency (US EPA) Standards:*[9]

EPA/510-B-93-005 USEPA Manual Tank Gauging for Small Underground Storage Tanks
EPA ~~510-B-05-002~~510-K-16-001 USEPA Operating and Maintaining Underground Storage Tank Systems—Practical Help and Checklists
EPA/510-R-05-001 USEPA UST Systems: Inspecting and Maintaining Sumps and Spill Buckets—Practical Help and Checklist
Title 40 CFR 280 Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

3. Terminology

3.1 *Definitions:*

3.1.1 *ancillary ~~equipment—~~equipment, n—*any devices that are used to distribute, meter, or control the flow of ~~petroleum substances or hazardous substances~~ regulated substances into or out of an UST, including, but not limited to, piping, fittings, flanges, valves, and pumps.

3.1.2 *cathodic protection ~~tester—~~tester, n—*a person who can demonstrate an understanding of the principles and measurements of all common types of cathodic protection systems as applied to buried or submerged metal piping and tank systems; at a minimum, such persons must have education and experience in soil resistivity, stray current, structure-to-soil potential, and component electrical isolation measurements of buried metal piping and tank systems.

3.1.3 *corrective ~~action—~~action, v—*the sequence of actions performed in response to a release that include site assessment and investigation, response actions, interim remedial action, remedial action, operation and maintenance of remediation equipment, monitoring of progress, and termination of the remedial action.

[4] Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, http://www.ul.com.
[5] Available from NACE International (NACE), 1440 South Creek Dr., Houston, TX 77084-4906, http://www.nace.org.
[6] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.
[7] Available from Petroleum Equipment Institute (PEI), P.O. Box 2380, Tulsa, OK 74101–2380, http://www.pei.org.
[8] Available from Steel Tank Institute (STI), 944 Donata Ct., Lake Zurich, IL 60047, http://www.steeltank.com.
[9] Available from United States Environmental Protection Agency (EPA), Ariel Rios Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20004, http://www.epa.gov.

3.1.4 *gasoline dispensing ~~facilities—~~facilities, n—*also known as a filling station and service station, means any stationary facility which dispenses gasoline into the fuel tank of a motor vehicle.

3.1.5 *hazardous ~~substance—~~substance, n—*any substance defined or listed in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), §101(14), (42 U.S.C. §9601(14), and which is not regulated as a hazardous waste under the Solid Waste Disposal Act, Subtitle C, (42 U.S.C. §6921, et seq.).

3.1.5.1 *Discussion—*
A hazardous substance does not include petroleum product or crude oil. This definition is modeled on 40 CFR §280.12.

3.1.6 *hazardous substance UST ~~system—~~system, n—*an UST system that contains a hazardous substance defined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), §101(14), (42 U.S.C. §9601(14) (but not including any substance regulated as a hazardous waste under the Solid Waste Disposal Act, Subtitle C, (42 U.S.C. §6921 et seq.)) or any mixture of such substances and petroleum, and which is not a petroleum UST system.

3.1.6.1 *Discussion—*
This guide is not applicable to USTs subject to regulation under the Atomic Energy Act.

3.1.7 *implementing agency, n—*Environmental Protection Agency (EPA), or, in the case of a State with program approval (or pursuant to a memorandum of agreement with EPA), the designated State or Local agency responsible for carrying out the UST program.

3.1.7.1 *Discussion—*
The EPA is the implementing agency on tribal land.

3.1.8 *~~maintenance—~~maintenance, n—*the normal operational upkeep to prevent an UST system from releasing product.

3.1.9 *motor ~~fuels—~~fuels, n—*petroleum or a petroleum-based substance that is motor gasoline, aviation gasoline, No. 1 or No. 2 diesel fuel, or any grade of gasohol and is typically used in the operation of a motor engine.

3.1.9.1 *Discussion—*
This definition applies to blended petroleum motor fuels such as biodiesel and ethanol blends that contain more than a de minimis amount of petroleum or petroleum-based substance.

3.1.10 *~~operator—~~operator, n—*any person in control of, or having responsibility for, the daily operation of the UST system. The Underground Storage Tank Compliance Act of 2005 further characterizes three operator classes, A, B, and C.

3.1.10.1 *operator, Class ~~A—~~A, n—*an individual whose primary responsibility is to operate and maintain the underground storage tank system.

3.1.10.1 *Discussion—*
This could include managing resources and personnel—such as establishing work assignments—to achieve and maintain compliance with regulatory requirements.

3.1.10.2 *operator, Class ~~B—~~B, n—*implements the day-to-day aspects of operating, maintaining, and record keeping for underground storage tanks at one or more facilities.

3.1.10.3 *operator, Class ~~C—~~C, n—*an employee who, generally, is the first line of response to events indicating emergency conditions.

~~3.1.9.1 *Discussion—*~~
~~This individual is responsible for responding to alarms or other indications of emergencies caused by spills or releases from underground storage tank systems. This individual notifies the Class B or Class A operator and appropriate emergency responders when necessary. Not all employees of the facility are necessarily Class C operators.~~

3.1.10.4 *Discussion—*
This individual is responsible for responding to alarms or other indications of emergencies caused by spills or releases from underground storage tank systems. This individual notifies the Class B or Class A operator and appropriate emergency responders when necessary. Not all employees of the facility are necessarily Class C operators.

3.1.11 *~~overfill—~~overfill, n—*a release that occurs when an UST system is filled beyond its capacity, thereby resulting in a discharge of a regulated substance to the surface or subsurface environment.

3.1.12 *~~owner—~~owner, n—*means any person who owns an UST system used for storage, use, or dispensing of regulated substances.

3.1.13 *petroleum substance*—includes crude oil or any fraction thereof that is liquid at standard conditions of temperature and pressure. ~~The term includes petroleum-based substances comprised of a complex blend of hydrocarbons derived from crude oil through processes of separation, conversion, upgrading, and finishing, (for example, motor fuels, aviation gasoline, gas-turbine fuel oils, illuminating oils, distillate fuel oils, residual fuel oils, jet fuels, lubricants, petroleum solvents, used oils).~~

3.1.13.1 *Discussion*—
The term includes petroleum-based substances comprised of a complex blend of hydrocarbons derived from crude oil through processes of separation, conversion, upgrading, and finishing, (for example, motor fuels, aviation gasoline, gas-turbine fuel oils, illuminating oils, distillate fuel oils, residual fuel oils, jet fuels, lubricants, petroleum solvents, used oils).

3.1.14 *petroleum UST ~~system~~system, n*—an underground storage tank system that contains a petroleum substance or a mixture of petroleum substances with de minimis quantities of other regulated substances.

3.1.14.1 *Discussion*—
Such systems include those containing motor fuels, jet fuels, distillate fuel oils, residual fuel oils, lubricants, petroleum solvents, and used oils.

3.1.15 *~~piping~~piping, n*—all underground pipes in an UST system, including valves, elbows, joints, flanges, flexible connectors, and other fittings attached to a tank system through which regulated substances flow, or in which regulated substances are contained or stored.

3.1.16 *pressurized ~~piping~~piping, n*—product or delivery piping in a UST system that typically operates at greater than atmospheric pressure.

3.1.17 *regulated ~~substance~~substance, n*—a hazardous substance as defined in 3.1.5, a petroleum substance as defined in ~~3.1.12~~3.1.13, and any mixture of two or more hazardous substances and/or petroleum substances; this definition is considered to be equivalent to the definition in 40 CFR §280.12.

3.1.18 *~~release~~release, n*—any spilling, leaking, emitting, discharging, escaping, leaching, or disposing from a tank system into groundwater, surface water, or soils.

3.1.19 *release ~~detection~~detection, n*—determining whether a release of a regulated substance has occurred from the UST system into the environment or into the interstitial space between the UST system and its secondary barrier or secondary containment around it.

3.1.20 *~~repair~~repair, v*—the restoration, renovation, or mending of a damaged or malfunctioning UST system component.

3.1.21 *replaced tank, n*—this means to remove a tank and install another tank.

3.1.22 *replaced piping, n*—this means to remove 50 percent or more of piping, excluding connectors, connected to a single tank and install other piping.

3.1.22.1 *Discussion*—
For tanks with multiple piping runs, replaced piping applies independently to each piping run.

3.1.23 *secondary containment or secondarily contained, n*—a release prevention and release detection system for a tank or piping utilizing an inner and outer barrier with an interstitial space that is monitored for leaks.

3.1.23.1 *Discussion*—
This term includes containment sumps when used for interstitial monitoring of piping.

3.1.24 *~~spill~~spill, n*—a release of a regulated substance which results during the filling, placement, removal, or transfer of regulated substances to, or from, a UST system.

3.1.25 *standard conditions of temperature and ~~pressure~~pressure, n*—a temperature of ~~60°F~~60 °F and an atmospheric pressure of 14.7 psi absolute.

3.1.26 *suction ~~piping—~~piping, n—*product or delivery piping in an UST system that typically operates below atmospheric pressure and transfers fluids from the storage tank as a result of low pressure of the suction side of a pump.

3.1.27 *suspected release, n—*released product discovered at or near the UST site; observed unusual operating conditions, such as apparent loss of product; or results from a release detection method that indicates a release.

3.1.27.1 *Discussion—*

Suspected release does not include situations where a method or equipment is found to be defective, is immediately corrected, and then indicates no release.

3.1.28 *tank ~~system—~~system, n—*a tank system consists of the UST; all associated underground piping and ancillary equipment; spill and overfill prevention equipment; release detection equipment; corrosion protection system; secondary containment equipment (as applicable); and all other related systems and equipment.

3.1.29 *underground storage tank ~~(UST)—~~(UST), n—*any one or combination of underground tanks and any connecting underground pipes used to contain an accumulation of regulated substances, the volume of which, including the volume of the connecting underground pipes, is 10 % or more beneath the surface of the ground.

3.1.29.1 *Discussion—*

This term does not include any of the devices, equipment and facilities excluded from the definition of underground storage tank in 40 CFR §280.12 or are listed in 40 CFR ~~§§280.10(b), (c)~~ §§280.10(b) & ~~(d)~~(c) as not subject to regulation in whole or in part under 40 CFR §280.12.

3.1.30 *~~upgrading—~~upgrading, v—*the addition, improvement, retrofitting, or renovation of an existing UST system with equipment or components as required to meet the corrosion protection, spill and overfill prevention, and release detection requirements.

4. Significance and Use

4.1 Environmentally sound management of underground storage tank systems involves a broad range of preventative maintenance activities directed toward preventing accidental releases of ~~petroleum or hazardous~~ regulated substances, and effectively detecting and responding to such releases when, and if, they do occur. Numerous technical guidelines are presently available addressing specific procedures for release prevention and response for underground tank systems, including guidelines for tank system design, ~~installation~~ installation, operation and maintenance, leak ~~detection and~~ detection, spill control, periodic equipment inspections, corrective action for affected environmental media, tank system closure, and ~~personnel~~operator training. This guide presents an overview, identifying key management considerations and referring the user to other related ASTM standards and industry guidelines for more detailed information.

4.2 *Tank System Design and Installation—*The first step in environmentally sound management of tank systems is to design and install the tank system so as to minimize the potential for release of ~~petroleum or hazardous~~ regulated substances to the environment. This guide addresses key considerations related to the types of tank systems to be used, compatibility of regulated substances to construction materials, types of spill containment and overfill prevention devices, corrosion protection, leak detection proper installation practices, and system ~~inspection and maintenance.~~operation.

4.3 *Preventative ~~Maintenance and Inspection Plan—~~Maintenance—*Even for properly designed and installed tank systems, practical measures are needed to detect and terminate leaks and respond to releases in a timely manner so as to minimize regulated substance losses and associated environmental effects. This guide reviews general considerations including release detection measures, possible indicators of a release, appropriate record-keeping procedures, ~~leak detection system inspection and maintenance, and~~ tank system inspection, equipment testing, response planning and release control measures. Some preventative maintenance activities are recommended while others are mandated by state or federal regulations. This guide addresses federally mandated activities

4.4 *Inspections—*Inspections are a critical component of a sound UST management plan. Both third-party professional and operator inspections can identify potential risks associated with component compromise and operational issues that may increase the risk of an uncontained release. Some inspections are required by regulatory requirements. The scope, frequency and necessary qualifications to perform required inspections vary by jurisdiction. This guide outlines the scope and schedule of federally required walkthrough inspections.

4.5 *Equipment Testing*—Testing can confirm the functional status of various UST components. Some UST equipment and components must be tested in accordance with federal regulations. Spill prevention equipment and containment sumps used for interstitial monitoring of piping must be tested at least once every three years. Electronic and mechanical release detection components must be tested annually. Cathodic protection systems must be tested within six months of installation, then at least every three years and within six months of any repair activity. This guide outlines the scope and schedule of federally required equipment testing.

4.6 *Fueling Procedure*—Careful loading, unloading, and dispensing of liquids to and from underground storage tanks is the most important day-to-day activity to ensure proper handling of liquids and prevention of releases. This guide is developed to addresses UST system management. Dispensers and dispensing activities may be sources of releases but are not considered a component of the UST system and are not include in the regulatory requirements addressed by this guide.

4.7 *Corrective Action for Affected Environmental Media*—Following discovery and control of a release ~~of petroleum or a hazardous~~ regulated substance from an underground tank system, corrective actions may be required for affected soil and groundwater as needed to protect human health, safety, and environmental resources. This guide reviews a risk-based process for investigation, evaluation, and remediation of affected environmental media consistent with the guidelines provided in ~~the~~ Guide E2081.

4.8 *Tank System Closure*—If it is determined that an underground tank system will no longer be used ~~for~~ to store regulated substances, the system must be taken out of service, either temporarily or permanently, and, when appropriate, decommissioned and removed in a manner that minimizes the potential for future releases or safety hazards. This guide reviews the general procedures for properly removing tank systems from service, as well as the options for tank system closure by means of tank excavation and backfill placement or in-place closure methods.

4.9 *Tank Management Practice Education, and Operator Training*—Personnel training is a key element of successful environmental management of UST systems. It is important that persons involved in the installation, operation, or maintenance of tank systems understand the release prevention, appropriate leak detection, and response procedures. This guide outlines the scope and schedule of several key training areas that may be appropriate depending on individual job assignments, including: tank system installation and maintenance; general measures for release prevention; leak detection equipment operation and maintenance; release control and emergency response measures; and regulated substance and waste handling measures. This guide outlines the scope of federally mandated operator training.

4.10 *Recognized Practice*—Some federally mandated testing and inspection requirements can be satisfied by following a practice developed by a nationally recognized association or independent testing laboratory such as provided in 40 CFR §280.35(a)(1)(ii)(B) and 40 CFR §280.40(a)(3). Many such practices are referenced in this guide. Not all practices developed by nationally recognized associations or independent testing laboratories are accepted by the USEPA or the implementing agency. To determine if a practice satisfies the federal requirements, the owner or operator should consult with the implementing agency.

5. UST System Design and Installation

5.1 *Objectives*—The first step in environmental management of a tank system is to design and install the tank system to minimize the potential for release of petroleum or hazardous substances into the environment. This involves careful planning and an understanding of the importance for proper installation of the appropriate type of tank for the application, ~~the~~ compatibility of the materials in the system, ~~the~~ with the substance to be stored, the types of spill containment and overfill devices, and a comprehensive plan for system ~~maintenance~~operation and ~~inspection.~~maintenance. Consider options available in the design that can affect the use and maintenance of the tank, such as manways, striker plates, and other options. Tanks, piping, and appurtenances ~~should generally~~ must be installed according to the manufactures' instructions. All tanks should be tested prior to installation to verify the tank was not damaged during shipment. UST systems and system components should only be installed by qualified persons authorized by the manufacturer to install the equipment.

5.2 *Certification of Installation*—All owners and operators of new UST systems must certify in the Notification for Underground Storage Tanks (EPA Form 7530-1) compliance with the following requirements:

5.2.1 Installation of ~~tanks and piping~~the UST system under 40 CFR §280.20(e);

5.2.2 Cathodic protection of steel tanks and piping under 40 CFR §§280.20 (a) and (b);

5.2.3 Release detection under 40 CFR §§280.41 and 280.42.

5.2.4 All owners and operators of new UST systems must require that the installer certifies in the notification form that the methods used to install the ~~tanks and piping~~the UST system comply with the requirements in 40 CFR §280.20(d).

5.2.5 *System Design and Installation*—~~Check for state~~ Qualifications for installers vary by regulatory jurisdiction. Many states require licensing or certification. Check with the implementing agency for specific qualification requirements.

5.2.6 *General Requirements*—UST systems installed after April 11, 2016 must be secondarily contained and must use interstitial monitoring as the primary leak detection method.

5.3 *Material Compatibility:* Federal regulations require that UST systems be compatible with the substance stored. Incompatibility between regulated substances stored and UST system materials can result in equipment or components such as tanks, piping, gaskets, or seals becoming brittle, elongated, thinner, or swollen when compared with their condition when first installed. When this occurs, the UST system may fail to contain the regulated substance resulting in a release to the environment and possible failure to detect the release.

5.3.1 Construction materials must include materials that provide protection against corrosion or are resistant to corrosion. ~~All~~ Tank systems including tanks, lines, fittings, and associated piping must be constructed of, or lined with, materials compatible with the substance stored. Incompatibility of materials could result in the structural deterioration of the ~~vessel or piping~~ tank piping, or other system components and potentially cause a release of ~~product~~ regulated substance into the environment. Use approved or listed corrosion-resistant materials or systems as indicated in NFPA 30 and NFPA 30A. API RP 1626 provides information on the storage of ethanol systems. UL 87A applies to tank systems with ethanol blends.

NOTE 1—The tank system includes ancillary equipment.

5.3.2 A recommended source of material compatibility data is the NACE Corrosion Data Survey, Metals and Nonmetals Section.

NOTE 2—The owner/operator may want to obtain an opinion from an independent third-party technical expert on the material compatibility, and obtain a certificate of compatibility, attesting the materials used for modifications, repairs, or upgrades made to the existing UST system are compatible with the material stored and dispensed.

5.3.3 *Biofuel Compatibility*—Chemical and physical properties of ethanol and biodiesel blends may make them more aggressive to certain UST system materials than petroleum, therefore it is important that all UST system components in contact with ethanol or biodiesel blends are materially compatible with that fuel. Owners storing ethanol-blended fuels greater than 10 percent ethanol or biodiesel-blended fuels greater than 20 percent biodiesel must document that all system components are compatible with the substance stored in compliance with 40 CFR 280.32. Components that must be compatible include tank or internal tank lining; piping; sealants (including pipe dope and thread sealant); line leak detector; flexible connectors; drop tube; spill and overfill prevention equipment; submersible turbine pump and components, fittings, gaskets, O-rings, bushings and couplings; containment sumps (including submersible turbine sumps and under dispenser containment); penetration boots; release detection floats, sensors, and probes; fill and riser caps; and product shear valve.

5.4 *Construction Materials for Tanks:*

5.4.1 There are three classes (metal, nonmetal, composite) of tanks for storing ~~petroleum and/or hazardous materials.~~ regulated substances. Each tank may have different and/or better applications in certain situations. The benefits and features of a tank system for a particular site can be evaluated by a licensed professional engineer or other competent person. The tank owner has the responsibility of determining the appropriate tank for their application. Criteria a tank owner should use to determine an appropriate type of tank for use include, but are not limited to:

5.4.1.1 ~~Material~~ Regulated substance that will be stored in the tank.

5.4.1.2 Soil type/corrosiveness of the soil.

5.4.1.3 Hydrogeology (depth to water table, high permeability of geologic subgrade, proximity to water wells, amount of precipitation/climatic conditions).

5.4.1.4 Geologic hazards (seismically induced liquefaction; landslides; active faulting; strong ground-motion).

5.4.2 *Fiberglass Reinforced Plastic Tanks (FRP):*

5.4.2.1 The fiberglass reinforced plastic tank is manufactured from thermosetting resin reinforced with chopped or strand fiberglass. FRP tanks are considered to be resistant to exterior corrosion due to contact with the soil. FRP tanks are relatively lighter than steel tanks, but are typically a bit longer due to dome end caps. These tanks are manufactured to UL ~~1316.~~ 1316 requirements. These tanks meet the corrosion protection requirements as outlined under UST tank rules (40 CFR §280.20(a)(1)). These tanks are available as single, double, or triple wall tanks. FRP tanks can be purchased with multiple compartments. FRP tanks with interstitial spaces can be monitored with liquid brine solution (useful in high water table applications), dry area sensors, or vacuum.

5.4.2.2 UL 1316 provides options for testing FRP tanks to a broad spectrum of transportation fuels including all blends of ethanol. As with all tanks, it is necessary to check the compatibility of the ~~product~~ regulated substance being stored with the particular resin used by the tank manufacturer. FRP tanks are tolerant of the presence of normal water bottoms found in product tanks.

5.4.2.3 In addition to contacting the manufacturers of such containers, further information on FRP tanks can be obtained from the Fiberglass Tank and ~~Piping~~Pipe Institute.

5.4.3 *Steel Tanks:*

5.4.3.1 An underground steel storage tank consists of a single-wall, or double-wall, carbon steel tank with one of a variety of external corrosion protection systems. Steel tanks are generally constructed to UL 58 requirements. Steel tanks are available with multiple compartments. UL 1746 addresses external corrosion protection system for the steel tank. These tanks are compatible with most petroleum products. It is important to determine the possible external and internal corrosion mechanisms and provide corrosion protection against the expected corrosion mechanisms. Steel tanks can be affected by internal microbial corrosion (MIC). Steel tanks can also be affected if water is allowed to accumulate inside the tank unless internally coated or unless they have internal cathodic protection. See Note 3. A double-wall steel tank affords the advantage of an interstitial space between the two steel walls that has the capability of being monitored to detect a breach between the primary and secondary tank walls. STI F841-01 describes this construction.

NOTE 3—All tank systems, including FRP, and all fuels can be impacted by microbiological activities.

5.4.3.2 STI-P3 covers a method of underground exterior corrosion control for steel tanks. The method combines three basic corrosion control approaches. Namely, these are: (*1*) protective coating to minimize metal exposure to the soil, (*2*) cathodic protection using galvanic anodes to protect any exposed metal and to electrically isolate the UST from stray current corrosion, and (*3*) isolation devices to limit the area to be cathodically protected.

5.4.4 *Composite Clad Steel Tanks:*

5.4.4.1 Composite clad steel underground storage tanks are generally a UL 58 and UL 1746 listed steel tank with a thick nonmetallic laminate such as fiberglass or urethane applied to the tank exterior which provides a significant di-electric barrier between the steel tank and the electrically conductive solution, that is, electrolyte. The following specifications are two types of these tanks:

5.4.4.2 STI ACT-100, FRP Composite Steel Underground Storage Tank, which consists of an FRP laminate to eliminate metal-to-soil exposure.

5.4.4.3 STI ACT-100-U, Clad Composite Steel Underground Storage Tank, which includes a urethane cladding to eliminate metal-to-soil exposure.

5.4.5 *Jacketed Steel Tanks:*

5.4.5.1 This tank design utilizes an inner UL 58 steel tank within an outer nonmetallic jacket (such as FRP) that is typically UL 1746 listed. STI F922 describes one type of this construction.

5.4.5.2 The outer nonmetallic tank jacket provides corrosion resistance and secondary containment. There is a polyester film/mesh standoff between the tanks and a factory installed vacuum gauge to monitor the interstitial space between the tanks. The resulting tank has the strength of a steel tank with the corrosion resistance of a nonmetallic tank.

5.5 *Spill and Overfill Prevention and Control*—Spill and overfill containment devices are designed to prevent releases of regulated substances that occur during the filling of the UST system due to spills and overfills. ~~Petroleum and/or hazardous~~ Regulated substance UST systems, where more than 25 gallons of product will be transferred at any one time, must meet the minimum requirements of 40 CFR §280.20(c), EPA/510-R-05-001, and any additional regulations required by the ~~state the UST system is located in.~~implementing agency.

5.5.1 *General Requirements:*

5.5.1.1 The design of the spill and overfill prevention for the UST system must ~~be done such that~~ allow the system ~~can~~to be operated properly. ~~Some elements within the design can have options for providing the tank system requirements.~~ The general operational requirements that must be considered for spill and overfill prevention are:

(1) All spill and overfill containment equipment are to be designed to prevent release of regulated substances to the environment when the tank system is being filled.

(2) Prior to regulated substances being transferred and deposited into a UST system, the available volume in the tank is to be verified to ensure that this volume is greater than the volume of the regulated substance to be transferred into the tank.

(3) During the entire time that the regulated substance is being transferred into the UST system, the owner/operator must ensure that the transfer operation is monitored constantly to prevent overfilling and spilling.

(4) All spill and overfill prevention devices are to be maintained in good operating condition, and the devices are to be inspected and serviced in accordance with federal requirements and the manufacturer's specifications.

(5) The transfers of regulated substances to or from an UST system are to be in accordance ~~to nationally accepted codes or standards practice.~~with a nationally recognized standard or code of practice. Refer to API RP 1007.

5.5.2 *Spill Prevention Equipment:*

5.5.2.1 *Containment*—The fill pipe of the tank is either equipped with an attached spill ~~container~~ container, sometimes referred to as a spill bucket or catchment basin, or is enclosed in a liquid-tight manway, riser, or sump.

(1) The spill containment device is to be equipped with a liquid-tight lid or cover designed to minimize the entrance of any surface water, groundwater, or other foreign substances into the device. Spill containment devices must be clean and empty prior to transfer operation so that they are capable of holding any drips or spills that may occur when the transfer hose is disconnected from the fill pipe.

(2) Manufacturers may equip the spill container with either a drain or a spark-free pump to remove liquids. The drain allows any spilled product to be drained into the tank. However, any water or other fluids or sediment that have accumulated within the spill container should be removed and disposed of properly. Spill containers are also available with a secondary container with monitor sensors.

(3) Spill containment device must be tested once every three years for proper operation unless the device is double walled with periodic monitoring of the integrity of both walls of the device.

5.5.2.2 *Tight-fill Fitting*—The fill pipe of the tank is to be equipped with a tight-fill fitting, or similar device that provides a liquid-tight seal during the transfer of regulated substances into the tank.

5.5.3 *Types of Overfill Protection Devices:*

5.5.3.1 *Automatic Flow Restrictor*—A device that restricts the flow of regulated substances into the tank when the liquid level in the tank reaches a preset level which is no higher than the 95 % capacity level for the tank or at 30 minutes prior to overfilling, provided that such flow restricting device also alerts the person responsible for the delivery when such preset level is reached.

5.5.3.2 ~~*Automatic Flow Restrictor—*~~*Pipe Ball Float Valve (or flow vent valve)—*~~A device that restricts the flow of regulated substances into the tank when the liquid level in the tank reaches a preset level which is no higher than the 95 % capacity level for the tank or at 30 minutes prior to overfilling, provided that such flow restricting device also alerts the person responsible for the delivery when such preset level is reached.~~This device is a form of flow restrictor which consists of a hollow aluminum ball inside of a wire cage directly beneath the vent pipe opening inside the UST. As product rises toward the top of the tank, the ball floats up and closes the vent pipe, which slows the fuel coming into the tank. Ball float valves should not be used if the tank receives pressurized deliveries, uses suction piping, or uses single point (coaxial) stage I vapor recovery.

~~*(1) Pipe Ball Float Valve (or flow vent valve)*—This device is a form of flow restrictor which consists of a hollow aluminum ball inside of a wire cage directly beneath the vent pipe opening inside the UST. As product rises toward the top of the tank, the ball floats up and closes the vent pipe, which slows the fuel coming into the tank. Ball float valves should not be used if the tank receives pressurized deliveries, uses suction piping, or uses single point (coaxial) stage I vapor recovery.~~

5.5.3.3 *Automatic Tank Gauge High Level Alarm*—The automatic tank gauge can be set to sound an alarm audible to the fuel transfer operator when the tank is 90 % full or is within one minute of being overfilled. The fuel transfer operator can then shut off the fuel, thereby preventing an overfill. The alarm should be located in an area where the fuel transfer operator can hear or see it to be effective.

5.5.3.4 *Automatic Shut-Off*—A device that shuts-off the flow of regulated substances into the tank when the liquid level in the tank reaches a preset level, which is no higher than the 95 % capacity level for the tank or before any of the fittings located on top of the tank are exposed to product. One example of an automatic shutoff device is a drop tube flapper valve which is installed on a drop tube in the fill pipe. A float rises as the tank is being filled. As the fuel nears the top of the tank, the valve closes and prevents liquid from coming into the UST.

5.5.4 *Overfill prevention equipment inspection*—Overfill prevention equipment must be inspected for proper operation at least once every three years according to requirements developed by the manufacturer, a code of practice developed by a nationally recognized association or independent testing laboratory or requirements determined by the state or implementing agency to be no less protective than those developed by the manufacturer or in the code of practice.

5.6 *Corrosion Protection of Tank System*—Tank and piping components that are in contact with the ground and routinely contain product must be protected from corrosion in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory. If not properly protected, all metal components, including storage tanks, piping, connectors, and ~~so forth,~~ other metallic components, can deteriorate and permit leakage. Corrosion can be minimized with proper design ~~and/or~~ and use of cathodic protection or the use of nonmetallic materials.

5.6.1 *General Requirements:*

5.6.1.1 *Existing UST Systems (those where installation began on or before December 22, 1988)*—Existing tanks must ~~be~~ have been upgraded with cathodic protection or internal lining and ~~existing~~associated piping must ~~be~~ have been upgraded with cathodic protection or meet the new UST system requirements in 5.6.1.2.

5.6.1.2 *New UST Systems (those where installation began after December 22, 1998)*—Generally, new tanks must be constructed of fiberglass reinforced plastic, or be coated and cathodically protected steel, or be steel clad with a noncorrodible material or be steel jacketed with a noncorrodible material. New piping must generally be constructed of coated and cathodically protected steel, or fiberglass reinforced plastic, or flexible plastic.

NOTE 4—UL 971 is typically utilized to meet this requirement for nonmetallic piping.

5.6.2 *Types of Corrosion Protection:*

5.6.2.1 *Galvanic Anodes*—In these systems, sacrificial anodes are attached to a coated steel UST to provide corrosion protection. Like its name implies, sacrificial anodes sacrifice or deplete in favor of the steel allowing the steel protection from corrosion.

5.6.2.2 *Impressed Current*—These systems use direct current to combat rust and decay that affect metal. Current is supplied by an integral component of the system, a rectifier.

5.6.2.3 *Cathodic Protection Inspections, Testing and Record Keeping:*

(1) All cathodic protection systems must be tested within six months of installation, then at least every three years, and within six months of any repair activity by a cathodic protection tester to ensure that the cathodic protection system is operating properly. The criteria used to determine if cathodic protection is adequate must be in accordance with a code of practice developed by a nationally recognized organization (for example, NACE, ~~API, and so forth),~~ API), such as API RP 1632. Owners and operators must keep records of the last two tests and have a qualified professional fix any problems discovered during testing.
~~See Note 5.~~

NOTE 5—NACE RP0285 is a widely recognized standard and is written into the federal regulations for determining adequate cathodic protection.

(2) Impressed current cathodic protection systems must be inspected at least once every 60 days to make sure the equipment is running properly. Owners and operators may perform this inspection. Owners and operators must keep records of the last three inspections and have a qualified professional fix any problems discovered during the inspection. See Note 5.

~~NOTE 5—NACE RP0285 is a widely recognized standard and is written into the federal regulations for determining adequate cathodic protection.~~

5.6.2.4 *Internal Lining*—A method of corrosion protection for existing tanks (those where installation began on or before December 22, 1988) where the tank is inspected, prepared, and internally lined with a noncorrodible material. Tanks installed after December 22, 1988 may not use this method to meet the corrosion protection requirements.

5.6.3 *Records for Corrosion Protection:*

5.6.3.1 There are a number of records that must be kept related to corrosion protection. They are as follows:

(1) Records must be maintained for testing that must be accomplished within the following time periods: within the first six months of installation; every three years afterwards; and within six months after an UST system repair. Impressed current systems must be inspected every 60 days to ensure proper operation. Several references are provided in Section 2.

(2) Records of galvanic cathodic protection systems require determining whether the cathodic protection is adequate according to criteria established by a code of practice. This test needs to be conducted within six months of installation; and at least every three years after the previous test; and within six months after any repairs to your UST system. Make sure the professional tester is qualified to perform the test and follows a standard code of practice to determine that test criteria are adequate. Retention of the results of at least the last two tests is required.

(3) Records for internally-lined tanks. All upgraded tanks that have been internally lined to meet corrosion protection requirements should have records that show the lining was installed prior to December 22, 1998. Tanks using internal lining as the only method of corrosion protection must be inspected in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory within ten years of lining and then every five years thereafter. The inspection must determine that the tank is structurally sound and that the lining is still performing according to original design specifications. Lined tanks that fail the inspection may be repaired according to a code of practice developed by a nationally recognized association or independent testing laboratory. Owners and operators should keep a record of the most recent lining inspection. See EPA 510-B-05-002.

(4) Records of repairs. All records of repairs to either the cathodic protection system or the internal tank lining must be kept for the life of the UST system.

5.7 *Structural Protection and Proper Installation of Tank System:*

5.7.1 Proper installation of the UST system is the foundation for the successful operation of a facility, including proper choice of equipment and materials necessary to ensure long-term system operation and integrity.

5.7.2 The keys to the successful operation of a UST system, in order to prevent a release or other safety issues associated with storing flammable and combustible liquids, are:

5.7.2.1 Sound design of installation, including proper choice of equipment and materials necessary to ensure long-term system operation and integrity.

5.7.2.2 Proper installation which can decrease the potential for storage leaks and failures.

5.7.2.3 A set of sound operating procedures for the installation ~~contractor.~~professional. Careful planning and a set of operating procedures for the installation ~~contractor~~professional at the installation or upgrade phase of construction can minimize product loss, minimize maintenance costs, minimize future installation costs, increase product quality, and increase profits. For additional information on proper installation of underground storage tanks see the installation instructions provided by the tank manufacturer, STI's various instructions that are part of their specifications API RP 1615 and PEI RP100. Owners and operators are required to indicate on the notification form which method is used for ensuring proper installation was used and to obtain the installers certification that the installation was properly performed. Additional information on certification of installation is described in 40 CFR §§280.20 (d) and (e).

5.8 *Piping and Piping Systems*—Piping material construction includes: steel, FRP, single or double walled, or flexible double-walled. The double walled pipe system design can include sensors for use in leak detection. Use approved or listed corrosion-resistant materials or systems as indicated in API 1626, NFPA 30, and NFPA 30A. UL 87A applies to tank systems with ethanol blends. UL 971 addresses safety of nonmetallic underground piping