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

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INTRODUCTION

This guide provides an overview of environmental practices for design, installation, operation and maintenance, and corrective action for underground tank systems used for storage of hazardous substances and petroleum products. The training and application of these practices should serve to prevent accidental releases of petroleum or hazardous substances 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. 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 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.

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

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

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

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

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

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 USEPA Operating and Maintaining Underground Storage Tank Systems—Practical Help and Checklists

[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.

[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.

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

3.1.2 *cathodic protection tester*—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*—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.

3.1.4 *gasoline dispensing facilities*—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*—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*—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.

3.1.7 *maintenance*—the normal operational upkeep to prevent an UST system from releasing product.

3.1.8 *motor fuels*—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.

3.1.8.1 *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.

3.1.9 *operator*—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.

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

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

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

3.1.9.3 *operator, Class C*—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 *overfill*—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.

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

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

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

3.1.14 *piping*—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.

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

3.1.16 *regulated substance*—a hazardous substance as defined in 3.1.5, a petroleum substance as defined in 3.1.12, 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.

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

3.1.18 *release detection*—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.

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

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

3.1.21 *standard conditions of temperature and pressure*—a temperature of 60°F and an atmospheric pressure of 14.7 psi absolute.

3.1.22 *suction piping*—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.

3.1.23 *tank system*—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.

3.1.24 *underground storage tank (UST)*—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.

3.1.24.1 *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) & (d) as not subject to regulation in whole or in part under 40 CFR §280.12.

3.1.25 *upgrading*—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 activities directed toward preventing accidental releases of petroleum or hazardous 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 and maintenance, leak detection and spill control, corrective action for affected environmental media, tank system closure, and personnel 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 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, proper installation practices, and system inspection and maintenance.

4.3 *Preventative Maintenance and Inspection Plan*—Even for properly designed and installed tank systems, practical measures are needed to detect and terminate releases in a timely manner so as to minimize regulated substance losses and associated environmental effects. This guide reviews general release detection measures, possible indicators of a release, appropriate record-keeping procedures, leak detection system inspection and maintenance, and response planning and release control measures.

4.4 *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.

4.5 *Corrective Action for Affected Environmental Media*—Following discovery and control of a release of petroleum or a hazardous 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.

4.6 *Tank System Closure*—If it is determined that an underground tank system will no longer be used for 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.

4.7 *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.

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 types of spill containment and overfill devices, and a comprehensive plan for system maintenance and inspection. 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 be installed according to the manufactures' instructions. All tanks should be tested prior to installation to verify the tank was not damaged during shipment.

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 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 comply with the requirements in 40 CFR §280.20(d).

5.2.5 *System Design and Installation*—Check for state specific qualification requirements.

5.3 *Material Compatibility:*

5.3.1 Construction materials must include materials that provide protection against corrosion or are resistant to corrosion. All 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 and potentially cause a release of product 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 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.

5.4 *Construction Materials for Tanks:*

5.4.1 There are three classes (metal, nonmetal, composite) of tanks for storing petroleum and/or hazardous materials. 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 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. 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 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 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 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.

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 the system can 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 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.

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 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.

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.

(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.

5.5.3.2 *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.

5.5.3.3 *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.

5.6 *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, can deteriorate and permit leakage. Corrosion can be minimized with proper design and/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 upgraded with cathodic protection or internal lining and existing piping must be 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), 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.

(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.

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. Careful planning and a set of operating procedures for the installation contractor 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.

5.8.1 Pressurized piping systems must be designed to have devices that automatically shut off or restrict flow or have an alarm that indicates a leak.

5.8.2 For suction piping systems, the type of design can affect the type of leak detection. A type of suction piping that does not require leak detection is described in 6.6.3.8(2)(a).

5.9 Gasoline dispensing facilities have emission limitations and management practices required by U.S. National Emission Standards described in 40 CFR §63.11115 that can affect the design of a tank system.

6. Preventive Maintenance and Inspection Plan

6.1 *General Considerations:*

6.1.1 A preventive maintenance and inspection plan provides a comprehensive indication of those items that are both required and recommended to be performed in order to ensure effective performance from the UST system. Each UST facility is a somewhat unique entity. Therefore, based upon the site-specific UST design being used, maintenance and inspection requirements can vary widely between facilities. Establishing a useful plan requires a detailed analysis of the numerous components of an individual UST system.

6.1.2 Establishing a sound plan may entail reviewing all owner's manuals or contacting manufacturers to provide detailed lists of checks to be performed on spill and overfill devices, corrosion protection systems, and leak detection components, which comprise a total UST system.

6.1.3 The plan does not necessarily require formulation of a lengthy document. A comprehensive checklist should be sufficient to address concerns with items of the UST system that need to be routinely checked.

6.1.4 For example, checking the proper maintenance and inspection activities should include how water that has accumulated in a tank or the spill bucket is properly disposed of. Another example is to assure the amount of product in a tank is sufficient to run the required leak test using an automatic tank gauge, if equipped. If it is intended that the tank be manually gauged to gather data for any applicable method (for example, Statistical Inventory Control, manual tank gauging, or inventory control) make sure that the manual gauge (stick) can measure not only to one-eighth of an inch but to the level of product over the full range of the tanks height; if it can't, then the stick should be replaced.

6.1.5 Resources that will help are Guide E1990, U.S. EPA's EPA/510-R-05-001, and PEI RP900. The information provided in these references helps the system owners and operators identify and understand the operation and maintenance procedures for a UST system to help avoid a release resulting in cleanup costs and liability concerns. These references also assist with providing guidance for developing and maintaining records of operating and maintenance activities.

6.2 *Release Prevention Practices*—The specific operating practices and equipment designed to prevent an environmental release (for example, tank design and installation features, overfill protection, secondary containment, leak detection, spill response, and so forth) can vary with each location. Operating personnel should understand the importance of release prevention, the proper handling of hazardous substances and petroleum stored or handled on the site. Respective training is outlined in Section 10.

6.3 *Maintenance:*

6.3.1 A tank manager must be informed on the procedures required to properly evaluate and maintain the tank system. The Environmental Protection Agency, as well as Guide E1990, has checklists to help evaluate underground storage tank systems according to the requirements of EPA's regulations (40 CFR Part 280). Check with the state and local agencies for additional UST requirements.

6.3.2 Those performing periodic checks on corrosion protection and leak detection systems require specific training.

6.3.3 A comprehensive plan for routine system maintenance and inspection is not only environmentally sound, but a good business practice. It has the potential to save the owner/operator thousands of dollars and lessen the possibility of liability by preventing an unwanted release.

6.3.4 Proper tank maintenance helps assure the stored substances do not become contaminated by water infiltration. Water in a steel tank can also result in internal corrosion and therefore should be controlled. See STI document, "Keeping Water Out of Your Storage System."

6.4 *Overfill Prevention*—In addition to the installation and maintenance of approved devices to prevent overfills, procedures designed to lessen the likelihood of an overfill must be followed. A checklist of overfill prevention measures for before, during, and after filling an underground storage tank is provided in EPA 510-B-05-002. Additional information is available in API RP 1621.

6.5 *Release Control*—While release prevention is the cornerstone of any tank system installation, it is essential to have processes and mechanisms in place in the event a release occurs. The goal is to reliably detect a release from the tank system, respond to terminate the release, and control impacts should one occur. These processes and mechanisms include release detection, a response plan, and a system maintenance and inspection program.

6.6 *Release Detection*—Release detection provides a means to determine if a release has occurred from any portion of the tank system that routinely contains product. The release detection system should be capable of detecting a release in sufficient time to minimize damages to the environment and minimize the extent of corrective action required. Detection time should be as short as possible in order to afford sufficient capability to notify the appropriate state UST program office.

6.6.1 *General Requirements of Release Detection*—At least every 30 days, release detection methods for UST systems must be able to determine whether or not a tank and piping are leaking. Release detection must be installed, calibrated, operated, and maintained according to the manufacturer's instructions. Never ignore leak detection alarms or failed leak detection tests. Treat alarms and failed tests as a possible release until otherwise confirmed according to the method used. The release detection method employed for a UST must meet specific performance requirements. The options for consideration of release detection in an UST system are outlined in 40 CFR Part 280, subpart D, for a state approved program in 40 CFR §281.33, and in Guide E1990. These include:

6.6.1.1 Automatic tank gauging systems for tanks,

6.6.1.2 Manual Tank Gauging for tanks less than 2000 gallons,

6.6.1.3 Inventory control and tank tightness testing,

6.6.1.4 Vapor monitoring for tanks and piping,

6.6.1.5 Groundwater monitoring for tanks and piping,

6.6.1.6 Secondary containment with interstitial monitoring for tanks and piping,

6.6.1.7 Piping systems,

(1) Pressurized Piping—Automatic line leak detectors (electronic or mechanical) and annual inspections and line tests for pressurized piping.

(2) Suction Piping—Loss of pump prime may indicate a leak.

6.6.1.8 Statistical inventory reconciliation for tanks and piping and release detection records, and

6.6.1.9 Other methods approved by the regulatory authority. Some regulatory authorities require double wall interstitial monitoring. When installed and operated according to manufacturer's specifications, secondary containment with interstitial monitoring meets the federal detection requirements for piping.

6.6.2 *Release Detection Record-Keeping for USTs*—Release detection records are required by federal regulations to be maintained by all owners/operators of petroleum UST systems. Keep all applicable records of calibration, maintenance, and repair of release detection equipment for at least one year. Keep all performance claims supplied by the installer, vendor, or manufacturer for at least five years. Detailed records of monthly or periodic release detection activities must be kept on file for a minimum of one year at the facility or other secure location. Detailed records should include the following:

6.6.2.1 *Automatic Tank Gauging Systems*—Maintain records that may include printouts from the system showing monthly monitoring.

6.6.2.2 *Manual Tank Gauging Systems for Tanks Less Than 2000 Gallons*—Manual tank gauging is an option for tanks 2000 gallons or less. For tanks between 1001 to 2000 gallons, the last record of an annual tank tightness test is needed. The U.S. EPA's EPA/510-B-93-005 explains what has to be done for keeping records of manual tank gauging.

6.6.2.3 *Inventory Control and Tank Tightness Testing*—Record the volume of product put into the tank and removed from the tank each day that the tank is operating. Keep a monthly record to show the added or subtracted changes to the tank system, and compare the value to 1.0 % of flow-through plus 130 gallons to determine if your system is leaking.

6.6.2.4 *Vapor Monitoring for Tanks and Piping*—In addition to recording monthly monitoring activity, the site assessment should be available to show the vapor monitoring system is acceptable for use at its location.

6.6.2.5 *Groundwater Monitoring for Tanks and Piping*—Like vapor monitoring, a record of monthly monitoring needs to be kept as well as the site assessment showing that the monitoring system is acceptable for use at its location.

6.6.2.6 *Secondary Containment with Interstitial Monitoring for Tanks and Piping*—Like all other methods of release detection, a record showing that the containment area has been monitored on a monthly basis is required.

6.6.2.7 Piping systems should be installed according to API 1615 or PEI RP100.

(1) Pressurized Piping Systems—Two forms of release detection are required for pressurized piping so two records must be maintained. The first record is the annual test of the automatic line leak detector. The second record depends on whether you are using a monthly monitoring method like vapor monitoring, ground water monitoring, interstitial monitoring, or some other method allowed by the state you are in. In this case, keep a record of monitoring the system based on the method used, or you will need to have a record of an annual line tightness test.

(2) Suction Piping Systems—You will need to have a record of a line tightness test done every three years or show a record of monthly monitoring activity using either vapor monitoring, groundwater monitoring, interstitial monitoring, or some other method allowed by the state that you are in. No release detection is required only if it can be verified that you have a safe suction piping system with the following characteristics.

(a) Only one check valve per line located directly below the dispenser;

(b) Piping sloping back to the tank; and

(c) System must operate below atmospheric pressure.

6.6.2.8 Other methods not identified here may be used, but must be approved by the regulatory authority.

6.6.2.9 Statistical inventory reconciliation for tanks and piping. Keep the records of investigations conducted as a result of any monthly monitoring activity showing "pass," "inconclusive," or "fail" for at least one year. EPA considers an "inclusive" as not meeting the requirements of release detection.

6.6.3 *Indications of a Release*—A release might be identified by visual observation of a spill or other indications. It is imperative that immediate action be taken to determine whether an actual release has occurred. Upon determining that a release has taken place, a release report is required to be filed with the appropriate UST implementing agency and may also be required under the terms for financial responsibility. Commonly accepted methods used to fulfill the monthly monitoring requirement include the following:

6.6.3.1 *Automatic Tank Gauging (ATG) Systems*—ATGs use monitors permanently installed in the tank. These monitors are linked electronically to a nearby control device to provide information on product level and temperature. The gauging system can automatically calculate the changes in product volume that can indicate a leaking tank. The water detection capability of ATG's which rely on buoyancy-based floats may be unreliable in tanks storing ethanol-blended fuels, leading to potential problems with leak detection. Only those water/phase-separation detection and leak detection systems specifically designed for and approved for use with the type of fuel being stored should be installed. This includes acceptable measurement accuracy as well as construction material compatibility with the substances stored. This is an issue which has not been entirely resolved for higher ethanol blends. ATGs at filling stations for up to 10 % ethanol volume are in use now.

6.6.3.2 *Manual Tank Gauging*—Manual tank gauging can be used only on tanks 2000 gallons or smaller. This method is not acceptable for use on tanks larger than 2000 gallons or on piping. This method requires taking the tank out of service for at least 36 h each week to take measurements of the tank's contents. Tanks 1000 gallons or less can use this method alone. Tanks from 1001 to 2000 gallons can use this method only when it is combined with periodic tank tightness testing and only for ten years after installing a new UST or upgrading an UST with corrosion protection. After ten years of installation, these UST's must use another leak detection method identified in 6.6.1.

6.6.3.3 *Inventory Control and Tank Tightness Testing*—This is a combination of two methods. This combined method can only be used temporarily. Tank tightness testing requires periodic tests conducted by vendors who temporarily install special equipment that tests the soundness of the tank. Tank tightness testing must be used in combination with inventory control. Inventory control is an ongoing accounting system, like a checkbook, kept by the UST owner or operator to detect leaks. Inventory control requires taking daily accurate measurements of the tank's contents and performing monthly calculations to prove that the system is not leaking. Tank tightness testing and inventory control can be used only for ten years after installing a new UST or upgrading the UST with corrosion protection. After ten years, these UST's must use one of the leak detection methods listed in 6.6.1.

6.6.3.4 *Vapor Monitoring*—Vapor monitors sense and measure product vapor in the soil around the tank and piping to determine the presence of a leak. This method requires installation of carefully placed monitoring wells. Vapor monitoring can be performed periodically using manual devices or continuously using permanently installed equipment.

6.6.3.5 *Groundwater Monitoring*—Groundwater monitoring devices sense the presence of liquid product floating on the groundwater. This method requires installation of monitoring wells at strategic locations in the ground near the tank and along the piping runs. To discover if leaked product has reached groundwater, these wells can be checked periodically by hand or continuously with permanently installed equipment. This method is effective only at sites where groundwater is within 20 ft of the surface.

6.6.3.6 *Secondary Containment and Interstitial Monitoring*—This method involves placing a barrier between the UST and the environment. The barrier provides "secondary" containment and can be a vault, liner, or the outer wall of a double-walled structure. Interstitial monitoring methods range from a simple dipstick to automated vapor or liquid sensors permanently installed in the system. All USTs holding hazardous substances (not petroleum) that were installed after December 22, 1988 must use this method. Secondary containment with interstitial monitoring represents a means of not only detecting a release but preventing that release from entering the environment as well.

6.6.3.7 Statistical inventory reconciliation (SIR) SIR uses sophisticated computer software to determine whether a tank system is leaking. The computer conducts a statistical analysis of inventory, delivery, and dispensing data collected over a period of time and provided by the operator to a vendor.

6.6.3.8 *Piping Systems:*

(1) Pressurized Piping—Pressurized piping must meet the following requirements:

(a) The piping must have devices that automatically shut off or restrict flow or have an alarm that indicates a leak. Conduct an annual tightness test of the piping or use one of the following monthly methods,

(b) Interstitial monitoring,

(c) Vapor monitoring,

(d) Groundwater monitoring,

(e) Statistical inventory reconciliation.

(2) Suction Piping—If the UST has suction piping, the leak detection requirements will depend on the type of suction piping

(a) One type of suction piping does not require leak detection if it has the following characteristics which must be readily determinable: Below-grade piping operating at less than atmospheric pressure is sloped so that the contents of the piping will drain back into the storage tank if the suction is released. Only one check valve is included in each suction line

and is located directly below the suction pump. Suction piping that does not exactly match the characteristics noted above must have leak detection, either monthly monitoring (using one of the monthly methods noted above for use on pressurized piping) or tightness testing of the piping every three years. More information on leak detection for underground piping is available from the USEPA and from other sources listed within the references.

6.6.4 *Release Response Plan:*

6.6.4.1 The release response plans describes the processes and procedures to address a release from a storage tank system at the facility. The response plan should describe the equipment in place or available for a release response and the personnel trained and available to conduct the release response. The response plan may be a consolidated contingency plan.

6.6.4.2 The release response plan(s) should include a description of the

(1) Prevention methodologies and equipment in place at the facility to prevent or contain a release from the tank system and during deliveries or distribution of petroleum or hazardous substances from the tank system.

(2) Prediction of the potential impacts of a release from the tank system including:

(a) Direction of fluid movement.

(b) Rate of flow.

(c) Total quantity of product which could be discharged.

(d) Establishment and prioritization of early action objectives to address the predicted potential impacts.

(e) Installation of containment and/or diversionary structures, if appropriate.

(f) Training requirements for facility personnel.

(g) Record keeping for releases.

6.7 Standards for gasoline dispensing facilities include initial and three year periodic testing and monitoring requirements for a vapor balance system used to control vapor emissions according to 40 CFR §63.11120.

7. Fueling Procedure

7.1 *Placing, Storing and Dispensing of Petroleum and/or Hazardous Substances*—The placing, storing, and dispensing of petroleum and/or hazardous substances must be in accordance with applicable federal, state, and local standards. The Underground Storage Tank Compliance Act of 2005 prohibits deposit of petroleum and/or hazardous substances into an underground storage tank that EPA or a state determines is subject to a fuel delivery, deposit or acceptance prohibition.

7.1.1 *Red Tag Program*—Delivery prohibition programs that physically identify USTs that are ineligible to receive product. The mechanisms are usually red tags, but the mechanisms and their colors can vary by state. The mechanisms are generally attached to the fill pipes of ineligible tanks. If an UST does not have a red tag, then the deliverer can assume that the tank is compliant and eligible for delivery.

NOTE 6—The regulatory agency (if such exists) may not have the manpower to install physical indicator(s) (that is, red tags) or, the operator may have removed the physical indicator. Although not generally required, the supplier/distributor may verify with the applicable regulatory agency if a UST facility is eligible to receive the product.

7.1.2 *Green Tag Program*—Delivery prohibition programs that physically identify USTs that are eligible to receive product. The mechanisms are usually green tags or permits, but the mechanisms and their colors can vary by state. The mechanisms are generally affixed to the fill pipes of eligible USTs or otherwise conspicuously displayed at the UST facility. If a green tag or permit is present, then the deliverer can assume the tank is compliant and eligible for delivery. An implementing agency prohibits deliveries by removing the tag or permit.

7.1.3 States and territories that do not have a red-tag or green-tag delivery prohibition program only have UST registration requirements. Those states' and territories' registration requirements are generally connected with registration fees and not tied to compliance with UST regulations. A small number of these states and territories can prohibit owners and operators from receiving deliveries through administrative orders.

7.2 *Loading, Unloading, and Dispensing:*

7.2.1 Qualified operators must understand the properties of the substance stored, delivered to, and dispensed from the tank. This is important for the ability to recognize what is being released, special handling, and appropriate emergency response. Such information must be provided with the shipping papers associated with the substance while in transportation, to include loading and unloading from a cargo tank to and from a UST. Safety data sheets must also include this information for facility employees.

7.2.2 Federal underground storage tank regulations (40 CFR §280.30) describe actions that UST owners and operators should take to prevent accidental spills and overfills. Other common applicable federal regulations are:

7.2.2.1 29 CFR §1910.1200 "Hazard Communication,"

7.2.2.2 29 CFR §1910.120 "Emergency Response,"

7.2.2.3 40 CFR §63.11111 NESHAP "Source Category: Gasoline Dispensing Facility,"

7.2.2.4 49 CFR §172 "Hazardous Materials Transportation,"

7.2.2.5 49 CFR §177.834(i) "Attendance Requirements,"

7.2.3 Identify the proper contents for the tank. Identify the proper fill opening for the tank intended to service. Make sure the volume available in the tank is greater than the volume of product to be transferred to the tank before beginning a delivery to the UST.

7.3 *Driver Attendance:*

7.3.1 The cargo tank delivery truck must never be left unattended while fuel is being transferred. It's important to monitor the transfer operation constantly to prevent overfilling and spilling. The attendant must be awake, have an unobstructed view of the cargo tank that is unloading to the UST, and be within 25 ft of the cargo tank.

7.3.2 Additional information about proper filling procedures may be found in NFPA 385.

7.3.3 Further guidance on spill and overfill prevention appears in API 1621.

7.3.4 API Recommended Practice 1007.

7.3.5 NFPA 30 and NFPA 30A.

7.4 *Retail:*

7.4.1 Refer to operational requirements specified in NFPA 30A.

7.4.2 Filling station underground storage tank owners and operators should inform the public with appropriate warning signs. Local codes may have additional posting requirements.

7.4.3 Have an emergency response plan to deal with fueling mishaps. Fuel attendants should have fire response training. Motor fuel delivery truck drivers should have training for how their function should respond to an UST emergency during a delivery.

7.5 *Release Prevention Practices*—The delivery personnel should verify the appropriate tank contents and the available capacity of a tank before beginning the transfer process. Flow indicators on transfer pipes or hoses are useful to determine if the contents of a cargo tank has been completely delivered to the UST. The delivery personnel should know how to properly work with the type of overfill prevention device installed.

7.6 *Release Control and Emergency Response:*

7.6.1 In accordance with the site's regulated substance management plan, and/or contingency plan, each employee of a facility should be trained in the appropriate steps to initiate emergency response procedures for the facility. Emergency response procedures should include activities to be taken by each employee or classification of employee and emergency contact information.

7.6.2 *Activities to Minimize the Extent of a Release*—If a release were to occur, a quick and effective response will minimize the impact of the release and the extent and timing of corrective action. This could also greatly reduce the cost of any corrective action and decrease the potential for a negative financial impact from corrective action and/or litigation.

8. Corrective Action for Affected Environmental Media

8.1 The goal of corrective action is to ensure that concentrations of chemical(s) of concern in environmental media (for example, soil, soil vapor, ground water, air) is within acceptable levels and to satisfy regulatory obligations. Corrective action may be necessary if a release is identified during the environmental investigation or if a release were to occur at an operating property. When corrective action is required, it should be conducted as an iterative process based on a site conceptual exposure model with information or data collection as the core or common thread for the corrective action process. Key steps in the corrective action process are summarized below.

8.2 *Control and Emergency Response*—Emergency actions for response to an UST leak are site-specific in nature; however the objectives of these actions are common to all sites usually depend on site-specific conditions. The key steps involve control of the release; control of fire, explosion, and acute exposure hazards; and minimization/mitigation of spill migration to soil, groundwater, surface water, or other media. Short term, or early action remedies are described in Guide D5745.

8.3 *Site Assessment*—Characterize affected soil, groundwater, surface water, and sediment; identify applicable receptors, and potential constituent transport mechanisms as needed to support risk-based site evaluation. Appropriate methods for site assessment are described in Guides E1912, E1739, and E2081, API 1628, API 1629, API 4509, and EPA publications.

8.4 *Conceptual Model/Pathway Screening*—Define applicable risk concerns based on the evaluation of contaminated areas (that is, sources), transport mechanism and locations where exposure to contamination may occur (that is, receptors).

8.5 *Risk Assessment*—Determine the potential for adverse impacts to human health or ecological resources based on a site-specific evaluation of contaminant toxicity and the potential for exposure based on applicable transport mechanisms and receptors. Based on the results of this risk assessment, develop site-specific remedial action levels that are protective for human health and ecological resources. Methods for risk-based corrective action are described in Guides E1739 and E2081. Remediation standards for chemicals of concern may have been developed for each environmental media in some areas. These standards are considered to be protective of human health and the environment, and the attainment of these standards may preclude the need for a risk assessment and the development of site-specific remedial action levels.

8.6 *Remedy Selection*—Select a site management strategy based on nature and immediacy of anticipated impacts, current and future land use, and site-specific soil, groundwater, and surface water conditions. See Guide E2616.

8.6.1 Site conditions such as driveway access and the location of other hazardous operations (for example, propane filling) should be considered to help avoid interrupting otherwise normal operations.

8.7 *Management of Remediation Wastes*—Remediation activities can generate both hazardous and non-hazardous wastes. These wastes should not be commingled and require management in accordance with all applicable laws and regulations. Disposal facilities and transporters should be properly permitted and licensed.

9. Tank System Closure

9.1 Once it has been determined that a tank system will no longer be used for regulated substances, the system must be taken out of service and in many cases the tank system should be removed. Procedures for taking tank systems out of service and removing tank systems are described in API 1604 and NFPA 326.

9.2 *Temporarily Out of Service:*

9.2.1 Temporarily out of service assumes that the tanks system is to be brought back into service in the near future; typically within one year.

9.2.2 To take a tank system temporarily out of service, piping should be drained in to the tank and the petroleum or hazardous substance should be removed from the tank to the maximum extent practicable. As a safety precaution, validating the pipe has drained back to the tank can be important when flexible pipe is found without a consistent slope. Piping should be disconnected and capped where accessible. Openings in the tanks should be plugged with the exception of the vent.

Electrical service should be disconnected to pumps and other electrical equipment associated with the tanks system.

NOTE 7—If installed, the impressed current cathodic protection must remain in operation as described in 5.6.2.3(2).

9.3 *Permanently Out of Service:*

9.3.1 Tank systems that are intended to remain permanently out of service should be removed. However, if a tank system is not going to be removed then the tank system including the piping should be cleaned by removing all remaining petroleum or hazardous substances and any sludge or residues.

9.3.2 Once the tank system has been cleaned, all openings should be permanently plugged and access to the tank system should be restricted.

9.4 *Decommissioning and Removal of UST System:*

9.4.1 A tank excavation assessment (TEA) may be beneficial as part of a UST removal or replacement. The purpose of the TEA is to document on site environmental conditions discovered as part of a UST removal or replacement and is generally required by UST regulations.

9.4.2 The following three basic issues can be addressed by performing a TEA.

9.4.2.1 The potential for and general extent of concentrations of chemical(s) of concern can be estimated.

9.4.2.2 Handling, storage, and disposal or remedial options for soil, vapors, and water generated during the tank system removal can be identified.

9.4.2.3 Both short-term and long-term remedial action options can be identified.

9.4.3 The TEA generally involves sampling soil and ground water in the area of the UST system that is being removed to determine if a release has occurred. This typically will involve soil sampling under the tank system based on site-specific conditions and along the sidewalls where lateral migration has occurred. Additional sampling and analysis may be appropriate in hydrogeologically sensitive areas to document that no further action is required. Examples include potable water supplies (public and private wells) and geologic subgrade with high transmissivity for contaminant migration (karst terrain, glacial deposits, highly fractured bedrock, permeable alluvium, and colluvium).

9.4.4 Soil and groundwater samples identified for analysis should be analyzed for chemical(s) of concern. The regulatory agency may require additional or other analyses. If concentrations of chemical(s) of concern are identified in the samples, it may need to be reported to the regulatory agency as a release.

9.4.5 *Recordkeeping*—Permanent records of the closure assessment activities should be kept.

10. UST Management Practice and Operator Training

10.1 Training programs provide a person with a familiarity of the provisions for their work and knowledge of specific requirements applicable to the functions performed. UST owners and operators should contact their state or local agency that implements the UST program to obtain state-specific and site-specific requirements, if any, that pertain to training and their UST system.

10.2 Tank managers might be able to hire or use independent contractors to install, check, test, verify, and control the tank system activity. Tank managers should ensure personnel are qualified to carry out their functions and assigned tasks. The primary areas for training related to underground storage tank systems include.

10.2.1 Installation,

10.2.2 Corrosion Protection,

10.2.3 Overfill Protection,

10.2.4 Release Detection,

10.2.5 Record Keeping,

10.2.6 Financial Responsibility,

10.2.7 Spill Protection—loading, unloading, dispensing (API Recommended Practice 1007),

10.2.8 Emergency Response and Corrective Action,

10.2.9 Closure Procedures,

10.2.10 Preventative Inspections and Maintenance.

10.3 Use a trained professional having education and experience for performing the functions of:

10.3.1 Cathodic protection tester,

10.3.2 Corrosion expert,

10.3.3 Tank tightness test,

10.3.4 Pipe tightness test.

10.4 *Design and Installation Training*—Training should cover the design and installation of the overall UST systems and the specific design of the facility being operated. While not always required, the installer should be certified by the tank and piping manufacturers; or is certified or licensed by the implementing agency; or the installation has been inspected and certified by a registered professional engineer with education and experience in UST system installation.

10.5 *Maintenance Training*—Training should include specific maintenance procedures for the facility being operated. The Environmental Protection Agency, as well as Guide E1990, has checklists to help evaluate underground storage tank systems according to the requirements of 40 CFR Part 280. Check with the state and local agencies for additional UST requirements. Those performing periodic checks on corrosion protection systems require specific training. Those performing periodic checks on leak detection systems require specific training.

10.6 *Regulated Substance and Waste Handling Procedures*—All employees should be familiar with and trained in the proper storage and disposal of remediation wastes generated on the site, when employees are permitted to enter the remediation site.

10.7 Guidelines were developed for states to establish training requirements associated with as a result of the Underground Storage Tank Compliance Act of 2005. Three classes of UST operators were established to assist states in identifying responsible individuals and the general terms for their required training.

10.7.1 *Class A Operator*—The Class A operator has a primary responsibility to operate and maintain the underground storage tank system. The Class A operator's responsibilities include managing resources and personnel, such as establishing work assignments, to achieve and maintain compliance

with regulatory requirements. In general, this individual focuses on the broader aspects of the statutory and regulatory requirements and standards necessary to operate and maintain the underground storage tank system (that is, 40 CFR Part 280 or requirements of a state underground storage tank program approved by EPA).

10.7.1.1 For examples of the Class A operator function, this individual typically ensures that appropriate individual(s):

(1) Properly operate and maintain the underground storage tank system.

(2) Maintain appropriate records.

(3) Are trained to operate and maintain the underground storage tank system and keep records.

(4) Properly respond to emergencies caused by releases or spills from underground storage tank systems at the facility.

(5) Make financial responsibility documents available to the underground storage tank implementing agency as required.

10.7.1.2 At a minimum, the Class A operator must be trained in the following:

10.7.1.3 A general knowledge of underground storage tank system requirements for making informed decisions regarding compliance, and ensure appropriate individuals are fulfilling operation, maintenance, and recordkeeping requirements of 40 CFR Part 280 or other requirements of a state UST program regarding:

(1) Spill prevention,
(2) Overfill prevention,
(3) Release detection,
(4) Corrosion protection,
(5) Emergency response,
(6) Product compatibility,
(7) Financial responsibility documentation requirements,
(8) Notification requirements,
(9) Release and suspected release reporting,
(10) Temporary and permanent closure requirements, and
(11) Operator training requirements.

10.7.2 *Class B Operator*—A Class B operator implements applicable underground storage tank regulatory requirements and standards (that is, 40 CFR Part 280 or requirements of a state underground storage tank program approved by EPA) in the field. This individual implements day-to-day aspects of operating, maintaining, and recordkeeping for underground storage tanks at one or more facilities.

10.7.2.1 For examples of the Class B operator function, this individual typically monitors, maintains, and ensures:

(1) Release detection method, recordkeeping, and reporting requirements are met;

(2) Release prevention equipment, recordkeeping, and reporting requirements are met;

(3) All relevant equipment complies with performance standards;

(4) Appropriate individuals are trained to properly respond to emergencies caused by releases or spills from underground storage tank systems at the facility.

10.7.2.2 Compared with training for the Class A operator, training for the Class B operator will provide a more in-depth understanding of operation and maintenance aspects, but may cover a more narrow breadth of applicable regulatory requirements. states may require either site-specific operator training, which is focused only on equipment used at the underground storage tank facility, or broader training regarding regulatory requirements. At a minimum, Class B operator training should encompass the following:

(1) Components of underground storage tank systems;

(2) Materials of underground storage tank system components;

(3) Methods of release detection and release prevention applied to underground storage tank components;

(4) Operation and maintenance requirements of 40 CFR Part 280 or requirements of a state underground storage tank program that apply to underground storage tank systems and include:

(a) Spill prevention,
(b) Overfill prevention,
(c) Release detection,
(d) Corrosion protection,
(e) Emergency response,
(f) Product compatibility,
(g) Product compatibility,
(h) Class C operator training requirements.

10.7.3 *Class C Operator*—The Class C operator is an employee and is, generally, the first line of response to events indicating emergency conditions. 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. This individual typically controls or monitors the dispensing or sale of regulated substances, or is responsible for initial response to alarms or releases.

10.7.3.1 The Class C operator is an employee and is, generally, the first line of response to events indicating emergency conditions. 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. This individual typically controls or monitors the dispensing or sale of regulated substances, or is responsible for initial response to alarms or releases.

10.7.4 *Operator Retraining*—All persons that are subject to the operator training requirements are required to repeat the applicable training if the tank for which they have primary daily on-site management responsibilities is determined to be out of compliance. Retraining should be done when the original training is considered ineffective or obsolete based on performance deficiencies or changes in equipment or procedures. There may also be periodic recurrent training required by a state program.

11. Keywords

11.1 Energy Policy Act of 2005; operator training; petroleum UST; tank system; underground storage tank

APPENDIX

(Nonmandatory Information)

X1. MONITORING INFORMATION

X1.1 See Table X1.1.

TABLE X1.1 Recurring Release Detection and Cathodic Protection Requirements

	Daily	Weekly	Monthly	Bi-Monthly	Each Year	3 years	5 years	10 Years
Tank Stick Readings	X							
Inventory Totalizer Reading			X					
Inventory Control Reconciliation			X					
Automatic Tank Gauge			X					
Vapor Monitoring			X					
Manual Tank Gauging[A]		X	X					
Statistical Inventory Reconciliation			X					
Groundwater Monitoring			X					
Pressurized Line Test					X			
Conventional Line Suction Test						X		
Tank Tightness Test							X	
Galvanic and Impressed Current Cathodic Protection System Test						X		
Impressed Current C.P. Rectifier Reading (amp)				X				
First Internal Tank Lining Inspection								X
Subsequent Tank Lining Inspection							X	

[A] See 6.6.3.2.

RELATED MATERIAL

ASTM Guide D5880 for Subsurface Flow and Transport Modeling
ASTM Practice E1527 for Environmental Site Assessments: Phase I Environmental Site Assessment Process
ASTM Practice E1528 for Limited Environmental Due Diligence: Transaction Screen Process
ASTM Practice E1903 for Environmental Site Assessments: Phase II Environmental Site Assessment Process
ASTM Guide E1943 for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites
ASTM Guide E2018 for Property Condition Assessments: Baseline Property Condition Assessment Process
ASTM Guide E2026 for Seismic Risk Assessment of Buildings
ASTM Guide E2091 for Use of Activity and Use Limitations, Including Institutional and Engineering Controls
ASTM Guide G158 for Three Methods of Assessing Buried Steel
API RP 1627 Storage and Handling of Gasoline-Methanol/ Cosolvent Blends at Distribution Terminals and Service Stations
API Publication 1628C Optimization of Hydrocarbon Recovery
API Publication 1628E Operation and Maintenance Considerations for Hydrocarbon Remediation Systems
API RP 1631 Interior Lining and Periodic Inspection of Underground Storage Tanks
API RP 1635 Recommended Practice for Underground Petroleum Storage Systems at Marketing and Distribution Facilities
API Standard 2610 Design, Construction, Operation, Maintenance and Inspection of Terminal and Tank Facilities
UL 567 Standard for Emergency Breakaway Fittings, Swivel Connectors, and Pipe-Connection Fittings for Petroleum Products and LP-Gas
NACE RP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE Corrosion Data Survey Nonmetals Section, Fifth Edition
NACE Corrosion Data Survey Online (CORSUR—Corrosion Survey Database)
NFPA 70 National Electrical Code
PEI RP500 Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment
STI R831 Optional Recommended Practice for Control of Localized CorrosionWithin Underground Steel Petroleum Storage Tanks
STI RP R011 Recommended Practice for Anchoring of Steel Underground Storage Tanks
STI R892 Recommended Practice for Corrosion Protection of Underground Piping Networks Associated with Liquid Storage and Dispensing Systems
EPA-510-R-07-005 Energy Policy Act of 2005, Title XV, Subtitle B (Underground Storage Tank Compliance Act) Grant Guidelines To States For Implementing The Operator Training Provision Of The Energy Policy Act Of 2005
EPA/510-R-96-001 USEPA How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites: A Guide for State Regulators
EPA/510-B-97-007 USEPA Straight Talk on Tanks—Leak Detection Methods for Petroleum Underground Storage Tanks and Piping
Title 40 CFR 63 Subpart CCCCCC National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Category: Gasoline Dispensing Facilities
Title 40 CFR 281 Approval of State Underground Storage Tank Programs
Title 29 CFR 1910.120 Emergency Response
Title 29 CFR 1910.1200 Hazard Communication
Title 49 CFR Subchapter C Subpart G Emergency Response Information
Title 49 CFR Subchapter C Subpart H Training
Title 49 CFR 177.834(i) Attendance Requirements