# Recommended Practices for the Inspection and Maintenance of UST Systems

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# Recommended Practices for the Inspection and Maintenance of UST Systems

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- PEI/RP1400, *Recommended Practices for the Design and Installation of Fueling Systems for Emergency Generators, Stationary Diesel Engines and Oil Burner Systems*
- PEI/RP1500, *Recommended Practices for the Design, Installation, Operation and Maintenance of Compressed Natural Gas Vehicle Fueling Facilities*
- PEI/RP1600, *Recommended Practices for the Design, Construction, Installation, Operation and Maintenance of Liquefied Natural Gas/Liquefied Compressed Natural Gas Vehicle Fueling Facilities*
- PEI/RP1700, *Recommended Practices for the Closure of Underground Storage Tank and Shop-Fabricated Aboveground Storage Tank Systems*

# FOREWORD

These *Recommended Practices for the Inspection and Maintenance of UST Systems* have been prepared as an industry service by the Petroleum Equipment Institute. The text represents the consensus views of the PEI UST System Inspection & Maintenance Committee, comprised of the following members:

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# 1. INTRODUCTION

**1.1 Origin.** The Petroleum Equipment Institute (PEI) has produced this document as an industry service. The recommended practices described herein represent a synthesis of industry procedures, manufacturer recommendations and regulatory standards relating to underground storage system equipment. These practices are the consensus recommendations of the PEI Underground Storage Tank (UST) System Inspection and Maintenance Committee. The Committee is made up of representatives from petroleum marketing, equipment manufacturing, service and installation contracting companies, as well as regulatory agencies. In addition, the Committee has had the benefit of reasoned comments submitted by parties interested in the petroleum marketing equipment industry.

**1.2 Background.** Over the years, USTs have evolved from simple steel cylinders with a few piping connections to carefully engineered tanks with a number of electronically controlled, electrically operated and mechanically sophisticated components. For a modern underground storage system to operate successfully and safely, numerous components from a variety of manufacturers must be properly installed, inspected and maintained.

The increased sophistication of underground storage systems has largely resulted from two factors:

- greater awareness of the environmental contamination that can result from failures of these systems;
- increasingly large throughputs common at today's retail fuel outlets.

Because of these factors, it is no longer acceptable to simply bury a storage tank and forget it. Constant vigilance with regard to detecting leaks and anticipating operational problems are hallmarks of today's successful storage system operators.

> **NOTE:** The addition of ethanol to most of the nation's gasoline supply and the great reduction of sulfur in diesel fuels have produced substantial changes in the way these fuels interact with fuel storage systems. Phase separation of alcohol fuels, increased corrosion in many tank-top sumps associated with alcohol fuels, and increased corrosion within ultra-low sulfur diesel (ULSD) storage systems may necessitate more frequent and more extensive inspections than described in this recommended practice. Refer to Appendix B for a more detailed discussion of some of these issues.

**1.3 Purpose.** The purpose of this document is to provide a basic reference that consolidates information concerning the proper inspection and maintenance of underground storage system equipment. This information has been assembled from published and unpublished sources provided by equipment manufacturers, installers and end users. The intent is to provide guidance to facility



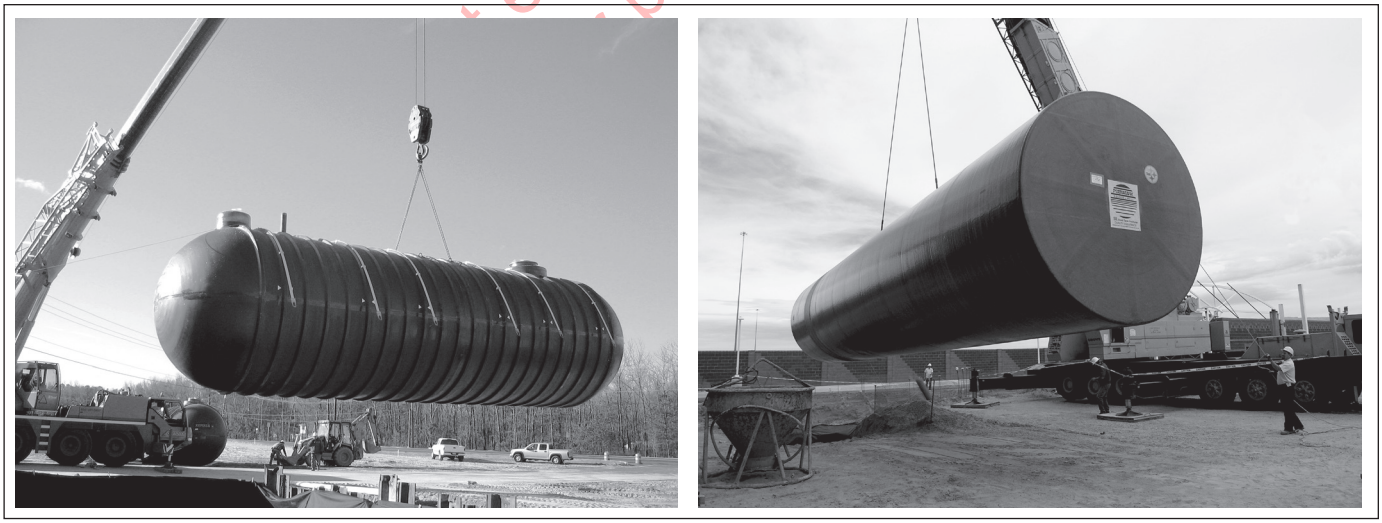

**FIGURE 1-1.** *Underground tanks are large cylinders typically made of fiberglass (left picture) or corrosion-protected steel (right picture) buried horizontally in the ground. Monitoring fuel storage systems to be sure that they function properly and do not leak is an important responsibility for everyone involved in operating and maintaining these systems.*

**FIGURE 1-2.** *Once tanks are installed and backfilled, many different types of equipment must be connected to the tank top. Ongoing inspection and maintenance of this equipment is essential to ensure the safe and efficient operation of the storage system.*

owners on how to properly inspect and maintain underground storage systems by describing recommended practices that:

- promote proper inspection, operation and maintenance of underground storage systems;
- enhance the longevity and trouble-free performance of UST equipment;
- promote fire prevention and storage system safety;
- promote protection of human health and the environment;
- promote regulatory compliance and reduce liability associated with the operation of underground storage systems;
- promote early identification of potential problems with equipment.

**1.4 Scope.** These recommended practices apply to USTs and associated equipment intended to store and dispense gasoline, diesel and related petroleum products at vehicle fueling facilities. The equipment covered includes all below-grade liquid and vapor handling components accessible from grade over or near the top of the storage tank and up to and including the shear valve at the fuel dispensers.

> **NOTE:** For monthly and annual inspection procedures applicable to pumps and fuel dispensers, please refer to PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment.*

While aspects of this document can be applied to marinas, aviation fueling facilities, isolated construction sites, farms, lube oil or heating oil storage systems and emergency generators, this document is not specifically intended for these types of operations.

These recommended practices do not apply to storage systems containing liquefied petroleum gases, liquefied natural gases or compressed natural gases.

This document is NOT intended to:

- provide interpretation of regulatory or legislative requirements related to underground storage system equipment;
- endorse or recommend particular materials, equipment, suppliers or manufacturers;
- prevent the development and implementation of new procedures, equipment or devices.

The description of specific procedures, equipment or devices in this document does not imply that such procedures, equipment or devices should always be used.

Although not a regulatory requirement, a more frequent inspection process that may be done is available in Appendix A-4. This periodic inspection may help the end user identify potential issues that need to be addressed prior to the monthly inspection.

**1.5 Sources.** The procedures outlined in this document constitute a synthesis of requirements and recommendations published by underground storage system equipment manufacturers, petroleum marketers and regulatory agencies. In instances where disparities or omissions existed in the available reference material, the PEI UST System Inspection and Maintenance Committee has included its own consensus recommendations based on practical experience in the installation, inspection and operation of underground storage system equipment.

**1.6 Use of Other PEI Recommended Practices.** There are many other aspects of fuel storage and dispensing systems that are not described in this document. Refer to the following PEI documents for additional recommended practices and procedures related to fuel storage systems:

- PEI/RP100, *Recommended Practices for Installation of Underground Liquid Storage Systems;*
- PEI/RP200, *Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling;*
- PEI/RP300, *Recommended Practices for Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites;*

- PEI/RP400, *Recommended Procedure for Testing Electrical Continuity of Fuel Dispensing Hanging Hardware;*
- PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment.*
- PEI/RP1000, *Recommended Practices for the Installation of Marina Fueling Systems.*
- PEI/RP1200, *Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment at UST Facilities.*

**1.7 Importance of Competent Personnel.** The onsite presence of knowledgeable and conscientious facility operators is key to the reliable and safe operation of underground storage system equipment. Operators should be trained to perform inspections, to safely identify existing and potential problems that may occur, and to know how to safely isolate problem equipment to protect the public and the environment.

Only properly trained individuals should maintain and repair underground storage system equipment that handles fuel or fuel vapors. Properly trained individuals should also maintain and repair electrical and electronic components of underground storage systems.

**1.8 Regulations.** The underground storage system components discussed in these recommended practices are manufactured in conformity with industry standards. In addition, some underground storage system components must meet requirements set forth by environmental, fire safety and/or other authorities having jurisdiction (AHJs). While the general requirements of regulatory authorities are similar, the specific requirements may vary from jurisdiction to jurisdiction. Consult with local authorities to determine applicable requirements.

**1.9 Relationship of these Recommended Practices to Federal UST Regulation.** The federal regulation that applies to UST systems storing petroleum was amended effective October 13, 2015. Many changes to the regulation were made, including requirements to periodically inspect and test certain components of UST systems. Section 40 CFR 280.36 of the federal regulation cites this recommended practices document as one that may be used to meet new walkthrough inspection requirements.

In many respects, the federal walkthrough inspection and testing requirements are less comprehensive than the inspection and testing practices contained in this document. After reviewing the walkthrough inspection requirements of the federal regulation, the PEI UST System Inspection and Maintenance Committee has decided that more frequent and comprehensive inspections of vehicle fueling UST systems than those specified in the federal rule are warranted. The recommended practices in this document include inspection and maintenance procedures the Committee believes to be important whether or not these procedures are included in the federal rule.

In a few cases, the 2015 federal UST rule contains walkthrough inspection and testing requirements that were not included in the 2008 edition of this document. Compliance with applicable regulations is a recommended industry practice, so the PEI UST System Inspection and Maintenance Committee has decided that RP900 will include all of the walkthrough inspection requirements described in the federal rule. It is the intent of the Committee that the recommended practices described in this document meet or exceed the walkthrough inspection requirements contained in the federal regulation. For a comparison of the recommended practices in this document and the requirements of the federal rule, refer to Table 3-1 in Chapter 3.

State and local authorities may have UST regulations that differ from the federal rule. The PEI UST System Inspection and Maintenance Committee has made no attempt to make this document consistent with state or local level regulation. Always consult state and local regulations to determine the requirements applicable to a specific UST facility.

# 2. DEFINITIONS

When used in this document, the terms listed below have the following meanings.

**2.1 American Suction.** A suction pumping system where the check valve is located close to the tank, typically either at the top of the tank (angle check valve) or at the bottom of the suction stub inside the tank (foot valve). Also known as "unsafe suction." Compare "Safe Suction."

**2.2 Appropriate Person.** The individual or organization designated by the facility owner or operator to receive notification of any problems or defects noted during any routine inspection procedure described in this recommended practice. It is the responsibility of the "appropriate person" to assess the nature of the problem or defect and initiate appropriate action.

**2.3 Authority Having Jurisdiction (AHJ).** An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation or a procedure.

**2.4 Automatic Tank Gauge (ATG).** An electronic device that consists of a probe that measures liquid level in a tank and a console that calculates liquid volume in an underground storage tank (UST). By monitoring the liquid level, the ATG can conduct leak tests of the underground tank. Accessory devices that monitor pressurized piping, interstitial spaces and containment sumps also can be connected to the ATG console.

**2.5 Bacon Bomb Sampler.** A fuel sampling device consisting of a closed cylinder with a valve mechanism protruding from the bottom end. The cylinder is lowered into a fuel tank using a small-diameter rope compatible with the fuel. When the valve mechanism at the bottom of the cylinder touches the tank bottom, the valve mechanism opens and fuel from near the bottom of the tank enters the cylinder. When the cylinder is raised, the valve automatically closes so that only fuel from the bottom of the tank is contained in the sampler.

**2.6 Ball Float Valve.** An overfill prevention device that operates by restricting the vent opening in a UST, thus limiting the flow of fuel into the tank.

**2.7 Biocide.** A chemical substance intended to destroy and/or control the growth of microorganisms found in fuel storage tanks.

**2.8 Cathodic Protection.** A method of protecting underground metal structures, such as steel tanks and piping, from corrosion. There are two basic types of cathodic protection:

- **Galvanic cathodic protection.** A method of corrosion protection that takes advantage of the properties of different metals to protect one metal (usually steel) from corrosion by directing the corrosion to another metal (usually zinc or magnesium, sometimes referred to as a "sacrificial anode").
- **Impressed-current cathodic protection.** A method of corrosion protection that uses a rectifier and buried anodes to provide an electric current that protects buried metal from corrosion.

**2.9 Class I, Division 1.** Part of a classification system used by the *National Electrical Code* published by the National Fire Protection Association (NFPA 70) to describe the fire or explosion hazard present in a specific area. A Class I, Division 1 area is a location where flammable gases, flammable liquid-produced vapors or combustible liquid-produced vapors:

- can exist at ignitable concentrations under normal operating conditions;
- may frequently exist at ignitable concentrations because of repair or maintenance operations or because of leakage;
- might be released in ignitable concentrations by the breakdown or faulty operation of equipment or processes that might also cause the simultaneous failure of electrical equipment.

For example, the area inside a fuel dispenser that contains product piping and most spaces beneath the access covers of a UST are Class I, Division 1 areas.

**2.10 Class I, Division 2.** Part of a classification system used by NFPA 70 to describe the fire or explosion hazard present in a specific area. A Class I, Division 2 area is a location where flammable gases, flammable liquid-produced vapors or combustible liquid-produced vapors may be present and the following types of circumstances exist:

- the gases, vapors or liquids are handled, processed or used but are normally confined within closed containers or closed systems from which they can escape only in the event of accidental rupture or breakdown of such containers or systems, or abnormal operation of equipment;
- ignitable concentrations of these gases, vapors or liquids are normally prevented by positive mechanical ventilation, but failure or abnormal operation of the ventilating equipment might create a hazardous condition;

- ignitable concentrations of these gases, vapors or liquids might occasionally flow from an adjacent Class I, Division 1 location unless prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

For example, an area within 18 inches above grade and within 10 feet horizontally of any edge of a submersible pump is a Class I, Division 2 location.

**2.11 Classified Area.** A general term for a location where fire or explosion hazards may exist due to the presence of flammable gases, flammable liquid-produced vapors or combustible liquid-produced vapors. Classified areas are described in national fire and electrical codes. For example, see the definitions for Class I, Division 1 and Class I, Division 2 in this chapter.

**2.12 Closed Double-Walled Piping System.** A double-walled piping system where the interstitial space around the piping is sealed off from the dispenser and submersible turbine pump (STP) sumps when the piping is in operation. This type of system is usually monitored by maintaining pressure or vacuum in the interstitial space of the piping. Compare "Open Double-Walled Piping System."

**2.13 Coaxial Vapor Recovery.** A Stage I vapor recovery method in which two hoses connected to a single adaptor fitting are used to transfer product and vapors between a truck and an underground tank. Within the fill riser, a drop tube that is narrower than the fill riser carries product into the tank while vapors travel in the space between the drop tube and the fill riser. The adaptor fitting attaches to the fill riser and separates the liquid and vapor flow paths. Also known as "single-point vapor recovery." Compare "Two-Point Vapor Recovery."

**2.14 Containment Sump.** A liquid-tight container that protects the environment by containing leaks and spills from piping, dispensers, pumps and related components. Containment sumps may be single-walled or double-walled. Typical locations include the top of a tank (fill sump or submersible turbine pump sump), underneath the dispenser (under-dispenser sump) or at other points in the piping run (transition or intermediate sump).

Besides containing leaks and spills, containment sumps may serve a variety of additional functions including:

- housing sensors that trigger alarms when liquid is detected in the sump;
- collecting and containing leakage from double-walled piping that drains into the sump;
- containing spills that may occur during maintenance activities associated with components within the sump;
- isolating components within the sump from the corrosive effects of subsurface moisture and soil;
- keeping groundwater away from the components within the sump in areas with a high water table.

Following are descriptions of specific types of containment sumps.

- **Dispenser Pan.** A shallow containment sump installed beneath a fuel dispenser designed to contain leaks and spills from dispenser components. Underground fuel piping enters the dispenser pan through the bottom of the pan.
- **Dispenser Sump.** A containment sump installed beneath a fuel dispenser designed to contain leaks and spills from dispenser components. A dispenser sump is deeper than a dispenser pan. Underground fuel piping enters the dispenser sump through the side walls of the sump. Also known as "under-dispenser containment" or "UDC."
- **Fill Sump.** A containment sump installed above an underground tank that houses the fill and Stage I vapor recovery risers. Other riser pipes, such as probe risers and water gauging and removal ports, may also be housed in fill sumps.
- **Submersible Turbine Pump (STP) Sump.** A containment sump installed above an underground tank that houses the top part of the STP. These sumps are also known as "turbine sumps" or "piping sumps." Other riser pipes, such as probe risers and water gauging and removal ports, also may be housed in STP sumps.
- **Transition Sump.** A containment sump installed in an underground piping run at points where joints are present in the piping. Transition sumps are commonly installed:
  - to provide access to below-grade valves;
  - to contain single-walled joints in a double-walled piping run;
  - where "T" or "Y" junctions occur in a piping run;
  - to contain repairs to piping;
  - where the slope of the piping changes;
  - where product piping from an aboveground tank goes underground;
  - where double-walled underground vent piping is connected to an aboveground vent riser.

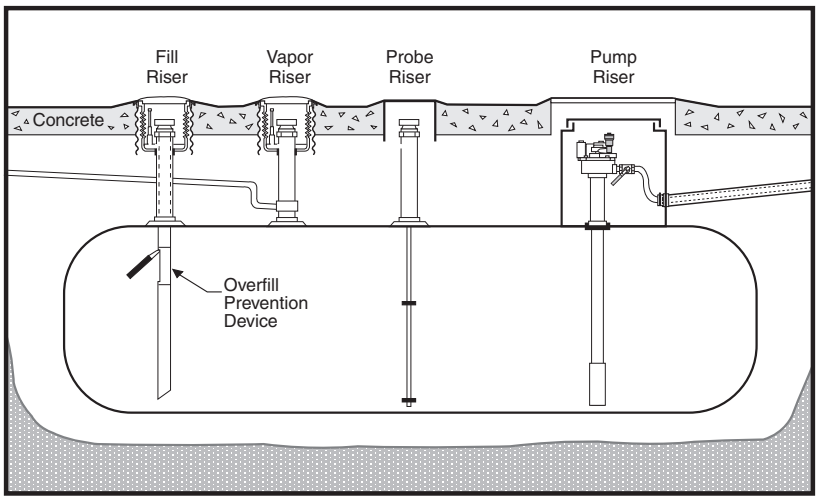


**FIGURE 2-1.** *A number of pipes called risers extend from the top of underground tanks to the ground surface. Risers serve a number of functions, including receiving fuel, venting vapors, and providing access for pumps and monitoring equipment.*

Transition sumps are also known as "intermediate sumps."

**2.15 Deflection Plate.** See "Striker Plate."

**2.16 Discriminating Sensor.** See "Sensor."

**2.17 Dispenser Pan.** See "Containment Sump."

**2.18 Dispenser Sump.** See "Containment Sump."

**2.19 Drop Tube.** A tube installed in the fill pipe of a UST that extends from the top of the fill pipe to within 4 to 6 inches of the bottom of the tank. The drop tube increases the delivery flow rate and reduces the volume of vapors generated during a delivery.

**2.20 Drop Tube Shutoff Valve.** A mechanism installed in a drop tube designed to prevent the overfill of a UST by shutting off product delivery when the tank is nearly full. Drop tube shutoff valves are frequently referred to as "flapper valves."

**2.21 Dry Break.** See "Vapor Recovery Adaptor."

**2.22 Emergency Shutoff Valve.** See "Shear Valve."

**2.23 Emergency Stop Switch.** A clearly identified switch that disconnects all power to submersible turbine pumps, fuel dispensers and related electrical equipment. The switch may be inside or outside of a building.

**2.24 European Suction.** See "Safe Suction."

**2.25 Fill Adaptor.** A permanent fitting at the top of the fill riser of an underground tank that allows a delivery hose to be quickly connected to the fill riser in a liquid-tight manner. Compare "Swivel Adaptor."

**2.26 Fill Cap.** A round, removable device that latches to the fill adaptor and is used to seal the fill-riser opening when a delivery is not in progress. See Figure 6-5.

**2.27 Flexible Connector.** A short braided metal hose assembly used to connect piping to a fuel dispenser, submersible pump or the vent opening in an underground tank. A typical flexible connector is about 2 feet in length and has an outer covering of braided stainless steel mesh.

**2.28 Fuel Dispenser.** A device that measures and transfers liquid fuel via pressure or suction from a storage system into a motor vehicle.

**2.29 Gauge Plate.** See "Striker Plate."

**2.30 Groundwater Monitoring (GWM).** A method of leak detection that works by monitoring for the presence of product floating on the water table in the environment outside of a storage tank or product piping. To be used for leak detection, the water table must always be within 20 feet of the ground surface.

**2.31 Hydrostatic Sensor.** See "Sensor."

**2.32 Intermediate Sump.** See "Containment Sump."

**2.33 Interstitial Monitoring.** A method of leak detection in which the area between the inner and outer walls of a double-walled storage system component is checked for the presence of liquid or a vacuum to determine if there is a leak. Interstitial monitoring can be used to detect leaks in double-walled tanks, double-walled piping, double-walled containment sumps and double-walled spill containment manholes.

**2.34 Interstitial Space.** The area between the inner and outer walls of a double-walled storage system component. Also known as the "interstice" or "annular space."

**2.35 Intrinsically Safe Circuit.** A circuit in which any spark or thermal effect is not capable of causing ignition of a mixture of flammable or combustible material under prescribed test conditions. In general, an intrinsically safe circuit is a low-energy electrical circuit that cannot generate enough heat or produce a spark large enough to ignite fuel vapors.

**2.36 Leak Detection.** Any procedure or equipment that can be used to determine whether an underground storage system is releasing product to the outside of the primary containment in an uncontrolled manner. Leak detection

methods include inventory control, tank and line testing, and interstitial monitoring. Leak detection is also known as "release detection."

**2.37 Line Leak Detector.** A device used to detect the presence of a leak in pressurized product piping connected to a UST system.

**2.38 Liquid Sensor.** See "Sensor."

**2.39 Lockout/Tagout.** Procedures designed to safeguard workers from exposure to electrical hazards, the unexpected start-up of machinery or the release of fuel while equipment is being serviced. This requires, in part, that a designated individual turns off and isolates the equipment from its energy source(s) before performing service or maintenance. The designated individual either locks or tags the breaker(s) or valve(s) and takes steps to verify that the equipment has been isolated effectively.

**2.40 Manhole.** An opening with a removable cover located in a concrete pad or pavement that allows access to below-grade equipment.

**2.41 Manway.** A 20-inch or larger diameter opening in a tank. The opening is usually sealed with a metal cover bolted to a flange around the manway opening. Manways allow a qualified individual to enter, inspect and maintain the interior of a UST.

**2.42 Microbe.** A very small organism able to survive in a fuel storage system.

**2.43 Monitoring Well.** A slotted pipe—typically made of polyvinyl chloride (PVC) plastic and positioned vertically in the ground—that is used to obtain groundwater samples in order to determine the extent of groundwater contamination.

**2.44 Observation Well.** A slotted pipe—typically made of PVC plastic and positioned vertically in an underground tank excavation—that permits an operator to determine whether there is a leak in the tank system by checking for the presence of product floating on the groundwater or product vapors in the subsurface.

**2.45 Open Double-Walled Piping System.** A double-walled piping system where the interstitial space of the piping is open to the dispenser and/or STP sumps. Leakage from the dispenser or the primary piping flows down the interstitial space of the piping to a low point, which is typically the STP sump. This type of system is usually monitored by installing a liquid or discriminating sensor in the STP sump. Compare "Closed Double-Walled Piping System."

**2.46 Overfill Alarm.** An outdoor audible and/or visual warning device that alerts a fuel delivery operator that a storage tank is nearly full and the delivery should be stopped.

**2.47 Penetration Fitting.** A fitting designed to provide a liquid-tight seal around piping or conduit that passes through the wall of a containment sump.

**2.48 Personal Protective Equipment (PPE).** Equipment designed to protect workers from workplace injuries or illnesses resulting from contact with chemical, physical, electrical, mechanical or other workplace hazards. Examples of PPE include safety shoes, hard hats, safety glasses, coveralls, gloves, high-visibility vests, hearing protection and respirators.

**2.49 Poppet.** A disk inside a Stage I vapor recovery adaptor (also known as a "dry break") that prevents the escape of vapors from the tank between the time when the vapor adaptor cap is removed and the delivery vehicle vapor hose is connected. See also "Vapor Recovery Adaptor."

**2.50 Pressure Sensor.** See "Sensor."

**2.51 Pressurized Pumping System.** A fuel delivery system that uses a submersible turbine pump located near the bottom of a storage tank to "push" fuel under pressure to one or more fuel dispensers. See also "Submersible Pump."

**2.52 Probe.** An electronic measuring device installed in an underground tank. Probes typically measure product level, water level and product temperature, and communicate this information to an ATG console.

**2.53 Product Sensor.** See "Sensor."

**2.54 Qualified Person.** An individual who has received appropriate training and can competently carry out specific duties with regard to a UST system. Two levels of qualified person are defined in these recommended practices:

- **Qualified Person.** An individual trained to visually identify and respond to identified problems and perform simple functions involving underground storage system equipment specified by the individual's employer. Refer to Section 3.5 of this document for a further description of a qualified person.
- **Qualified Technician.** An individual trained to evaluate, maintain and repair all aspects of underground storage system equipment. Refer to Section 3.5 of this document for a further description of a qualified technician.

**2.55 Riser.** A generic term for a vertical length of pipe in an underground storage system. Risers include:

- fill, vapor recovery, tank gauge and interstitial risers located on the top of the tank;
- fuel dispenser risers located beneath fuel dispensing equipment;
- vent risers that extend above grade to allow an underground tank to exhaust vapors or take in fresh air as necessary to maintain the tank at or near atmospheric pressure.

**2.56 Safe Suction.** A term used to describe a suction pumping system in which all of the following are true:

- there is only one check valve located immediately below the pump;
- the pump is at a higher elevation than the tank; and
- the piping slopes continuously back to the tank.

Suction pumping systems incorporating these features are "safe" because leaks in the piping will result in a loss of prime but not a release of product to the environment. Also known as "European suction." Compare "American suction."

**2.57 Safety Data Sheet (SDS).** Information supplied by a manufacturer and provided to individuals who use or come into contact with chemical substances. The SDS includes information on how to use, transport and store a chemical safely, as well as what to do in case of emergency.

**2.58 Schrader Valve.** A self-closing air valve used in the test boots of double-walled piping systems to allow the interstitial space of the piping to be pressurized and tested for leaks.

**2.59 Sensor.** An electronic device that can indicate a change in conditions by sending a signal to a remote monitoring console.

Following are descriptions of specific types of sensors:

- **Discriminating Sensor.** A sensor that can distinguish between fuel and water. The monitoring console will indicate different alarms depending on whether product or water is detected at the sensor location. Discriminating sensors are typically installed at the bottom of containment sumps and between the walls of double-walled tanks.
- **Hydrostatic Sensor.** The interstitial space of some double-walled fiberglass tanks and double-walled containment sumps is filled with liquid. A breach in the inner or outer wall of the tank or containment sump will result in a loss of this liquid. Hydrostatic sensors monitor the level of the liquid in the interstitial space and sound an alarm if the level of the liquid changes beyond certain limits.
- **Liquid Sensor.** A sensor that can detect the presence of liquid in normally dry locations. The monitoring console will indicate the same alarm regardless of whether water or fuel are detected at the sensor location. Liquid sensors are commonly installed at the bottom of containment sumps and in the interstitial spaces of double-walled tanks.
- **Pressure Sensor.** A sensor that detects a loss of pressure in the interstitial space of a double-walled tank, piping or double-walled containment sump. Pressure sensors are used in installations where the interstitial space is normally under a small amount of pressure. The loss of pressure could indicate a breach in the inner or outer wall of the double-walled tank, piping or double-walled containment sump.
- **Product Sensor.** A sensor that can detect the presence of fuel in normally dry locations. The sensor will alarm only if fuel is present. No alarm will sound if water is present. Product sensors are typically used in combination with a liquid sensor to produce a discriminating sensor.
- **Vacuum Sensor.** A sensor that detects a loss of vacuum in the interstitial space of a double-walled tank, piping or double-walled containment sump. Vacuum sensors are used in installations where the interstitial space is normally under a small amount of vacuum. The loss of vacuum could indicate a breach in the inner or outer wall of the double-walled tank, piping or double-walled containment sump.

**2.60 Shear Valve.** A mechanical device installed at the base of a fuel dispenser when the fuel supply piping operates under pressure. The valve is designed to automatically shut off the flow of fuel to the dispenser in the event of a severe impact to the fuel dispenser or a fire inside the fuel dispenser. This device is also known as a "crash valve," "impact valve" or "emergency shutoff valve."

**2.61 Soil Vapor Monitoring (SVM).** A method of leak detection that works by sensing the presence of hydrocarbon vapors in the subsurface environment outside of a storage tank or product piping.

**2.62 Spill Bucket.** See "Spill Containment Manhole."

**2.63 Spill Containment Manhole.** A liquid-tight container placed around the fill riser of a UST designed

to capture small spills that might occur when the delivery hose is disconnected. Spill containment manholes may include a drain valve to drain liquids into the tank or a small pump to remove liquids. Spill containment manholes are frequently referred to as "spill buckets."

**2.64 Stage I Vapor Recovery.** A system of piping and hoses designed to transfer gasoline vapors from an underground tank to a delivery truck as product is transferred from the truck to the tank. See also "Coaxial Vapor Recovery" and "Two-Point Vapor Recovery."

**2.65 Stage II Vapor Recovery.** A system of piping, hoses and nozzles designed to transfer gasoline vapors from a vehicle fuel tank to an underground tank as fuel is transferred from the underground tank to the vehicle.

**2.66 STP.** See "Submersible Turbine Pump."

**2.67 STP Sump.** See "Containment Sump."

**2.68 Strike Plate.** See "Striker Plate."

**2.69 Striker Plate.** A metal plate commonly installed at the bottom of steel and fiberglass underground tanks. Striker plates are positioned directly beneath a tank opening to protect against damage to the tank bottom caused by repeated dropping of the gauge stick. Also known as "strike plate," "wear plate," "gauge plate" or "deflection plate."

**2.70 Submersible Turbine Pump (STP).** A pumping unit located inside a UST designed to supply fuel to one or more fuel dispensers. The pump intake is positioned approximately 4 to 6 inches from the bottom of the tank, where it is submerged in the fuel. A submersible turbine pump may also be called a "submersible pump" or an "STP."

**2.71 Sump.** See "Containment Sump."

**2.72 Swivel Adaptor.** A fill or vapor adaptor that allows the top portion of the adaptor to rotate while the bottom portion is rigidly attached to the riser. Fill and vapor adaptors that do not swivel may become loosened or overtightened as the position of the hose is adjusted during a fuel delivery. Compare "Fill Adaptor" and "Vapor Recovery Adaptor."

**2.73 Tank Gauge Stick.** A long wooden stick with 1/8-inch markings clearly visible along its length. Tank gauge sticks are manually inserted in the fill pipe of an underground tank to measure the depth of product or water that is present in a tank. See Figures 7-4 and 7-5.

**2.74 Tank Pad.** The concrete area that is commonly found at grade level over the top of one or more underground tanks.

**2.75 Test Boot.** A donut or tube-shaped device made of flexible material that can be used to seal off the interstitial space in a double-walled piping system. With the test boot in place, the interstitial space of the piping can be isolated for integrity testing purposes.

**2.76 Transition Sump.** See "Containment Sump."

**2.77 Two-Point (Dual-Point) Vapor Recovery.** A Stage I vapor recovery method in which two hoses connected to two different risers are used to transfer product and vapors between a truck and an underground tank. One hose transfers fuel from the truck into the underground tank and the other hose transfers vapors from the underground tank into the truck. Compare "Coaxial Vapor Recovery."

**2.78 Unsafe Suction.** See "American Suction."

**2.79 Vacuum Sensor.** See "Sensor."

**2.80 Vapor Recovery Adaptor.** A special fitting installed at the top of a Stage I vapor recovery riser that connects to a fitting attached to the delivery truck's vapor hose. The vapor adaptor includes a poppet that is closed to prevent the escape of vapors unless the delivery fitting is attached. Also known as a "dry break."

**2.81 Vent Cap.** A device installed at the top of a storage tank vent pipe to prevent precipitation from entering the vent pipe while allowing air to freely enter and vapors to freely exit the vent pipe.

**2.82 Wear Plate.** See "Striker Plate."

# 3. UNDERGROUND STORAGE TANK (UST) SYSTEM INSPECTION

**3.1 General.** These recommended practices describe procedures to verify the function or condition of easily accessible components of underground storage systems located in the vicinity of the storage tank and at the fuel dispensers. These procedures are an important part of the proper operation of an underground storage system. This document is not intended to provide a complete guide to all aspects of underground storage system operation.

**3.2 Why Inspect?** Properly installed and maintained underground storage system equipment is durable and reliable. However, daily wear and tear, seasonal extremes of heat and cold, as well as exposure to the corrosive effects of soil, water and stored product, can degrade or damage storage system components causing product releases or equipment failure. The purpose of a storage system equipment inspection is to identify any noticeable deterioration or apparent malfunction in readily visible underground storage tank (UST) components. Readily visible components are present beneath grade level access covers located over or near the top of the UST and at the fuel dispensers. Periodic inspections are recommended to help protect the public, facility employees and the environment from the hazards posed by the release of flammable or combustible liquids and exposure to toxic motor fuels.

The inspection procedures outlined in these recommended practices are based on the consensus opinion of the PEI UST System Inspection and Maintenance Committee. Equipment manufacturers and distributors, other trade associations, authorities having jurisdiction (AHJs) and owners of underground storage systems may establish their own inspection procedures. Some storage system components must be inspected according to requirements established by environmental, fire safety and other AHJs. The specific inspection requirements can vary from jurisdiction to jurisdiction. Consult with local AHJs to identify applicable requirements.

**3.3 What to Inspect.** In general, routine inspection procedures should focus on storage system components that operate in difficult environments, have moving parts or are subject to abuse. Other factors to consider when determining what to inspect include the abilities of the person performing the inspection and the ease with which a component can be inspected.

**3.4 When to Inspect.** The monthly and annual inspection procedures contained in these recommended practices represent the consensus opinion of the PEI UST System Inspection and Maintenance Committee. Other factors affecting the frequency of inspection could include monthly throughput, climatic conditions, sensitivity of the environment adjacent to the storage system, applicable environmental rules and regulations, manufacturer recommendations, experience with component performance, corrosion or other extenuating circumstances.

The frequency of scheduled inspections may be determined by regulations, by the manufacturer of the equipment or by the equipment owner. If different sources have different requirements, follow the most stringent requirements.

> **NOTE:** Table 3-1 provides a quick means of comparing the inspection tasks and inspection frequencies required by federal regulation and those recommended by this document. Tables 3-2 and 3-3 provide references to sections in this document and the federal rule where each inspection task is described.

Although not a regulatory requirement, a more frequent inspection process that may be done is available in Appendix A-4. This periodic inspection may help the end user identify potential issues that need to be addressed prior to the monthly inspection.

**3.5 Who Should Inspect?** Assign inspection responsibilities only to personnel who are properly trained and qualified to conduct the inspection. The individual performing the inspection should have an understanding of the functionality of equipment onsite and understand why it is required to be inspected. Training should include safety and emergency first-aid procedures. Repeat training as needed to refresh and reinforce the content of the training. Additional training may also be required to update personnel on changes to equipment for which they are responsible or changes in regulatory requirements. Use the following guidelines when assigning inspection duties to personnel.

- **Qualified Person.** A qualified person is trained to complete the monthly checklist presented in this document, evaluate problems and perform simple functions involving underground storage system equipment specified by the qualified person's employer. Examples of such functions may include, but are not necessarily limited to:
  - knowing the method(s) of leak detection in use at any facility for which the qualified person is responsible;

| RP900 Recommended Practices Compared With Federal Rule Requirements | | | |
|---|---|---|---|
| **Component/Task** | **Monthly** | **Annual** | **Every 3 Years** |
| Automatic Tank Gauge | PEI/EPA | PEI/EPA | |
| Check for Water in Tank | PEI/EPA | | |
| Complete Daily Checklist and Compare to Previously Completed Daily Checklists | PEI | | |
| Complete Monthly Checklist and Compare to Previously Completed Monthly Checklists | | PEI | |
| Containment Sumps | PEI | PEI/EPA | PEI/EPA |
| Drop Tube | PEI | PEI | |
| Electronic Line Leak Detector | PEI/EPA | PEI/EPA | |
| Fill Cover | PEI | | |
| Fill Cap | PEI/EPA | | |
| Fill Pipe | PEI/EPA | | |
| Fuel Dispensers | | PEI | |
| Galvanic Corrosion Protection | | | PEI/EPA |
| Gauge Stick | PEI | EPA | |
| Grade Level Covers | PEI | | |
| Groundwater/Soil Vapor Monitoring | PEI/EPA | PEI/EPA | |
| Groundwater Bailer | PEI | EPA | |
| Impressed Current Corrosion Protection | PEI/EPA | PEI | PEI/EPA |
| Inventory Control | PEI/EPA | | |
| Leak Detection Monitor | PEI/EPA | PEI/EPA | |
| Leak Detection Sensor | | PEI/EPA | |
| Manual Interstitial Monitoring | PEI/EPA | | |
| Mechanical Line Leak Detector | PEI | PEI/EPA | |
| Observation Wells | PEI | | |
| Operator Training | PEI | | |
| Overfill Prevention | | PEI | EPA |
| Piping Tightness Test | | PEI/EPA | |
| Site Diagram | | PEI | |
| Spill Containment Manhole | PEI/EPA | | PEI/EPA |
| Spill Kit | PEI | | |
| Stage I Vapor Recovery | PEI | PEI | |
| Stage II Vapor Recovery | | PEI | |
| Statistical Inventory Reconciliation | PEI/EPA | PEI | |
| Submersible Turbine Pump | | PEI/EPA | |
| Suction Pump | | PEI | |
| Tank Lining | | PEI | EPA |
| Tank Pad and Pavement | | PEI | |
| Tank Tightness Test | | PEI | |
| Tank Vents | PEI | | |
| Unmonitored Dispensers | PEI | | |
| Unmonitored Submersible Pumps | PEI | | |

**Table 3-1.** *This table is intended to compare the general types of inspection and testing tasks contained in PEI RP900 and the federal EPA storage system regulations. In each cell of the table where the acronym "PEI" appears, RP900 contains an inspection or maintenance task related to the UST component listed to the left at the frequency indicated at the top of the column. Likewise, each cell of the table where the acronym "EPA" appears indicates that the federal rules describe an inspection or testing task related to the UST component on the left at the frequency indicated at the top of the column. Refer to Table 3-2 for citations to the sections in RP900 and Table 3-3 for citations to the federal rule where the exact requirements relative to each UST component can be found.*

| Citations to RP900 Recommended Practices | | | |
|---|---|---|---|
| **Component/Task** | **Monthly** | **Annual** | **Every 3 Years** |
| Automatic Tank Gauge | 6.5.1 | 7.8, 8.11.1 | |
| Check for Water in Tank | 6.6.6 | | |
| Complete Monthly Checklist and Compare to Previously Completed Monthly Checklists | | 7.4 | |
| Containment Sumps | 6.5.8 | 7.6 | 7.6.18, 7.6.19 |
| Drop Tube | 6.6.4 | 7.9.1 | |
| Electronic Line Leak Detector | 6.5.3 | 7.6.12, 7.6.13, 7.6.14, 7.11.3.3 | |
| Fill Cover | 6.6.2 | | |
| Fill Cap | A-4.5.3.1 | | |
| Fill Pipe | A-4.5.3 | | |
| Fuel Dispensers | | 7.5 | |
| Galvanic Corrosion Protection | | | 7.12.1 |
| Gauge Stick | 6.6.5 | | |
| Grade Level Covers | 6.6.2 | | |
| Groundwater/Soil Vapor Monitoring | 6.5.6 | 7.11.7, 7.11.8 | |
| Groundwater Bailer | 6.5.6.1 | | |
| Impressed Current Corrosion Protection | 6.9.1 | 7.12.2.2 | 7.12.2.1 |
| Inventory Control | 6.5.5 | | |
| Leak Detection Monitor | 6.5.2 | 7.11.2 | |
| Leak Detection Sensor | | 7.7.1 | |
| Manual Interstitial Monitoring | 6.5.7, 6.5.8 | | |
| Mechanical Line Leak Detector | A-4.4.3 | 7.6.11 | |
| Observation Wells | 6.8.1 | | |
| Operator Training | 6.4 | | |
| Overfill Prevention | | 7.10 | |
| Piping Tightness Test | | 7.11.3 | |
| Site Diagram | | 7.13.5 | |
| Spill Containment Manhole | 6.6.3 | | 7.9.3, 7.9.4 |
| Spill Kit | 6.6.1 | | |
| Stage I Vapor Recovery | 6.7 | 7.9.2, 7.13.3 | |
| Stage II Vapor Recovery | | 7.6.16, 7.13.2, 7.13.4 | |
| Statistical Inventory Reconciliation | 6.5.4 | 7.11.6 | |
| Submersible Turbine Pump | | 7.6.17 | |
| Suction Pump | | 7.11.4 | |
| Tank Lining | | 7.12.3 | |
| Tank Pad and Pavement | | 7.13.1 | |
| Tank Tightness Test | | 7.11.5 | |
| Tank Vents | 6.6.7 | | |
| Unmonitored Dispensers | 6.10 | | |
| Unmonitored Submersible Pumps | 6.10 | | |

**TABLE 3-2.** *This table is intended to allow the reader to easily locate the section of RP900 that describes specific inspection or maintenance tasks for each of the storage system components listed.*

| Citations to Federal Rule Regulations (40 CFR 280) | | | |
|---|---|---|---|
| **Component/Task** | **Monthly** | **Annual** | **Every 3 Years** |
| Automatic Tank Gauge | 280.36 | 280.40 | |
| Check for Water in Tank | 280.43 | | |
| Complete Monthly Checklist and Compare to Previously Completed Monthly Checklists | | | |
| Containment Sumps | | 280.36 | 280.35 |
| Drop Tube | | | |
| Electronic Line Leak Detector | 280.36 | 280.40, 280.44 | |
| Fill Cover | | | |
| Fill Cap | 280.36 | | |
| Fill Pipe | 280.36 | | |
| Fuel Dispensers | | | |
| Galvanic Corrosion Protection | | | 280.31 |
| Gauge Stick | | 280.36 | |
| Grade Level Covers | | | |
| Groundwater/Soil Vapor Monitoring | 280.36 | 280.40 | |
| Groundwater Bailer | | 280.36 | |
| Impressed Current Corrosion Protection | 280.31* | | 280.31 |
| Inventory Control | 280.36, 280.43 | | |
| Leak Detection Monitor | 280.36 | 280.40 | |
| Leak Detection Sensor | | 280.40 | |
| Manual Interstitial Monitoring | 280.36 | | |
| Mechanical Line Leak Detector | | 280.40, 280.44 | |
| Observation Wells | | | |
| Operator Training | | | |
| Overfill Prevention | | | 280.35 |
| Piping Tightness Test | | 280.41 | |
| Site Diagram | | | |
| Spill Containment Manhole | 280.36 | | 280.35 |
| Spill Kit | | | |
| Stage I Vapor Recovery | | | ** |
| Stage II Vapor Recovery | | | |
| Statistical Inventory Reconciliation | 280.36, 280.43 | | |
| Submersible Turbine Pump | | 280.36 | |
| Suction Pump | | | |
| Tank Lining | | | 280.21*** |
| Tank Pad and Pavement | | | |
| Tank Tightness Test | | | |
| Tank Vents | | | |
| Unmonitored Dispensers | | | |
| Unmonitored Submersible Pumps | | | |

* *EPA requires that the rectifier be checked every 60 days.*

** *Federal regulations concerning Stage I vapor recovery are contained in 40 CFR 63 Subpart CCCCCC.*

*** *EPA requires that the tank lining be inspected every 5 years.*

**TABLE 3-3.** *This table is intended to allow the reader to easily locate the section in the EPA regulations that describes specific inspection or testing tasks for each of the storage system components listed. For simplicity, only a partial citation is given in the table. The full citation for each reference is preceded by "40 CFR."For example: 40 CFR 280.35, 40 CFR 280.36, etc.*

- reviewing monthly leak detection results;
- evaluating the condition of fill and vapor caps.

- **Qualified Technician.** A qualified technician is trained to complete the monthly and annual checklists contained in this document. In addition, a qualified technician is trained to inspect, test, evaluate and maintain various components of underground storage system equipment that could release product or vapors or cause such a release to remain undetected. Where applicable, a qualified technician has received appropriate certification or licensing from regulatory bodies, as well as certification from the manufacturer for the specific equipment being serviced. A qualified technician also has received training related to all safety checks that should be performed when returning storage system equipment to service.

  A qualified technician has access to all of the tools and equipment required to perform these duties in a safe and professional manner and has received all of the necessary safety training and information required to safely and competently execute these duties.

**3.5.1 Relationship of Class A, B and C Operators to Qualified Persons and Qualified Technicians.** Federal regulation requires that state UST regulatory agencies establish standards for training Class A, B and C UST operators. The recommended practices in this document define two levels of qualification for personnel responsible for inspecting and maintaining UST systems.

**NOTE:** While the PEI UST System Inspection and Maintenance Committee fully supports the goal of the federal regulation to promote UST operator competency, the Committee did not attempt to mold the levels of qualifications described in this document to fit the operator training categories of the federal regulation.

The qualification levels described in this document are based solely on the relevant training that an individual has received. The classification levels defined in the federal rule are based primarily on job functions.

The Class A operator in the federal regulation is the person ultimately responsible for the proper operation of the UST. The Class A operator may assign properly trained personnel to complete the monthly and annual inspections described in this document or, if properly trained, the Class A operator can perform these inspections.

The Class B operator in the federal regulation is the person who is responsible for the day-to-day operation of the UST. With proper training, the Class B operator may function as a qualified person, but it is by no means necessary that the functions of the Class B operator and the qualified person be performed by the same individual.

The Class C operator in the federal regulation is the person responsible for addressing emergency situations. Typically, there is no overlap between the duties of the Class C operator as defined in regulation and those of a qualified person as defined in this document.

AHJs are encouraged to consider these recommended practices in establishing the inspection requirements for the USTs in their jurisdictions, but they must keep in mind that the levels of qualification described in this document do not correspond to the classes of UST operators defined in federal regulation.

**3.6 How to Inspect.** Inspection procedures should be clearly described in writing and inspection personnel should be trained on how to carry out the inspection. Document the inspection using an appropriate checklist. See Appendix A of this document for sample checklists. A checklist will provide:

- consistency in the execution of the procedure among different personnel;
- consistency in the execution of the procedure over time;
- a reminder of all the items that must be inspected;
- a means of documenting that the procedure has been performed;
- a means of documenting who performed the inspection.

Checklists need not be paper-based. Checklist applications running on portable electronic devices can be used to record the results of the inspection.

Any checklist should clearly and concisely describe each item to be inspected and what features indicate that a problem may be present. Written inspection procedures, which are a separate document from the checklist, should provide additional explanatory or background information that help the checklist user understand how to complete the checklist. The inspection procedures

should also provide guidance on how to respond when specific problems are identified during the inspection.

Management personnel should establish a review procedure to verify that problems identified in the inspection have been addressed. For example, the person completing the monthly checklist should review the monthly checklists completed during the previous month to verify that they have been properly completed and that any deficiencies have been addressed. Likewise, the person completing the annual checklist should review the monthly checklists for the prior year to verify that they have been properly completed and that any deficiencies have been addressed.

**3.7 Inspection Safety.** Vehicular traffic can pose a safety hazard when performing the inspections. Staying alert at all times is critical for inspection personnel. Personnel can also be exposed to flammable, combustible, and toxic liquids and vapors. Proper PPE should always be utilized. Chapter 5 details other potential safety hazards and precautions associated with routine underground storage tank inspections.

# 4. DOCUMENTATION

**4.1 General.** This chapter describes the documentation required to satisfy the inspection procedures of these recommended practices. Other compliance documentation may be required by environmental, fire-safety or other authorities having jurisdiction (AHJs).

**4.2 Record Location and Retention.** Maintain underground storage system inspection and maintenance records at the facility where the equipment is located, an off-site location specified by the owner, or the location specified by environmental, fire safety or other AHJs. Records may also be maintained electronically. Retain records for the length of time specified by the owner or as required by environmental, fire safety or other AHJs, whichever is longer.

**4.3 Inspection Documentation.** Use paper or electronic inspection checklists to document that underground storage systems have been inspected at the recommended intervals.

**4.4 Maintenance Documentation.** Maintain records of all underground storage system equipment maintenance, repairs, calibration and testing. Records may include:

- name of the qualified technician who performed the work;
- name of the company that performed the work;
- date;
- nature of the activity;
- results of any testing conducted;
- model and serial number of any replacement components installed.

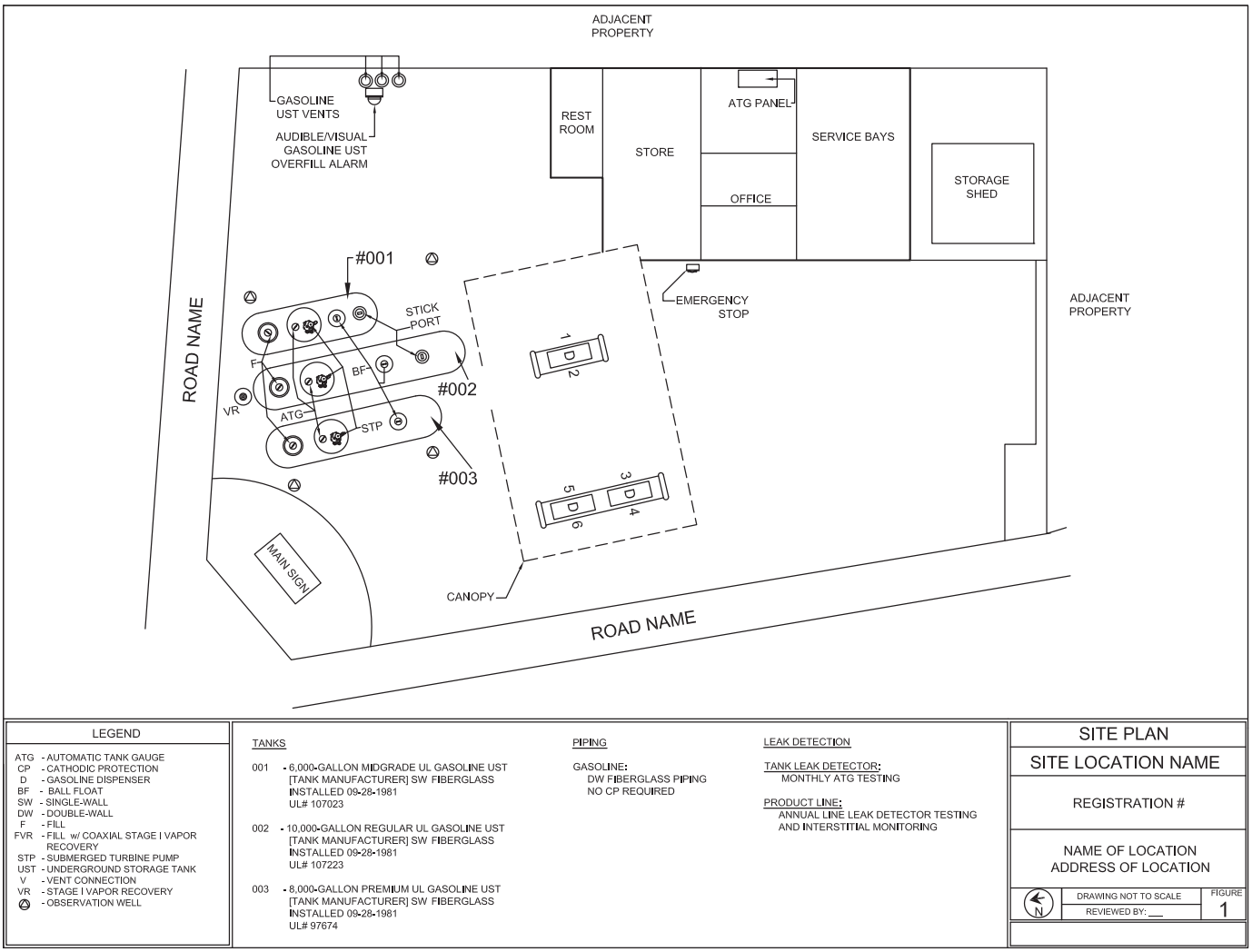


**FIGURE 4-1.** *A detailed and accurate site information diagram provides a concise summary of the equipment present at a location. This information can be very useful when conducting inspection and maintenance tasks.*

**4.5 Site Information.** To assist in completing inspection checklists, identifying tanks and providing site documentation, complete a site information sheet. The site information sheet should include a site diagram with basic tank and piping information, and the methods of leak detection in use at the site. Assign tank numbers on the site information sheet and use them consistently when completing the monthly and annual checklists. See Figure 4-1 for an example of a completed site information sheet. See Appendix A-3 for an example of a form that can be used to record site information.

**4.6 Class A, B and C Training Documentation.** Owners and operators must train personnel according to the requirements for Class A, B and C operators provided by the AHJ. Keep records documenting the training of all currently designated Class A, B and C operators with the required information and for length of time specified by the AHJ.

# 5. SAFETY

**⚠ WARNING**

**FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS COULD RESULT IN PROPERTY DAMAGE, INJURY OR DEATH.**

**5.1 General.** This chapter is intended to provide a general overview of some of the safety issues that should be considered when underground storage systems are inspected, maintained and repaired. This chapter is NOT intended to provide safety training for personnel involved in the inspection, maintenance or repair of underground storage systems. Refer to Appendix C for references to related safety publications.

Underground storage system inspection, maintenance and repair activities are performed in an environment where a variety of hazards may be present. Potential hazards include:

- vehicular traffic;
- flammable and combustible liquids;
- toxic liquids and vapors;
- dangerous voltages;
- confined spaces;
- pinching hazards;
- slip, trip and fall hazards.

Additional physical and chemical hazards unique to a facility or situation also may be present.

Taking appropriate safety precautions should be the first step prior to conducting any underground storage system equipment inspection or maintenance activity.

Only properly trained individuals should inspect, maintain or repair underground storage system equipment. These individuals are responsible not only for their own safety but also for the safety of facility employees, customers, the general public and any other personnel in the work area.

**5.2 Responsibility.** It is the responsibility of the facility owner, operator and service provider to ensure that only individuals who are properly trained inspect, maintain or repair underground storage systems. It is the responsibility of the trained individuals conducting the underground storage system inspection, maintenance or repair to evaluate the hazards of a specific activity at a specific location, and to use their best judgment and established procedures in determining the safety precautions and practices that should be implemented. Employers are responsible for providing appropriate safety training and equipment to their employees.

**5.3 Personal Protective Equipment (PPE).** Wear appropriate clothing and PPE when inspecting and maintaining underground storage systems to provide protection against the various hazards that may be present.

It is the responsibility of the employer to provide employees with detailed guidance regarding the PPE required for specific tasks that each person is expected to perform.

> **NOTE:** Refer to OSHA 29 CFR 1910, Subpart I and ANSI Standard 107 for guidance in determining appropriate PPE.

**5.4 Vehicle Hazards.** Vehicles pose one of the more serious and common hazards in the vicinity of the tank pad and especially around the fuel dispensers. Drivers are often distracted and inattentive when approaching fueling locations or maneuvering around the site and may not take appropriate notice of personnel conducting inspections or performing maintenance activities.

At a minimum, persons conducting inspections or maintenance in areas where traffic may be present should wear enhanced-visibility safety vests or brightly colored safety shirts. Garments that meet Class 2 requirements of ANSI Standard 107 are recommended.

In the tank pad and fuel dispenser areas, use vehicles, safety cones, barricades or barrier tape to isolate the work area, as appropriate. In general, the most secure method of isolating a work area is to park a service vehicle so that it prevents other vehicles from entering the work area. Take care not to place tools, equipment, manhole covers or sump lids outside the barricaded area.

Do not remove safety equipment until all work is completed.

**5.5 Chemical Hazards.** Liquid petroleum fuels are complex mixtures of chemicals, many of which are hazardous, toxic or both. Before working in the vicinity of a fuel storage system, workers should read and understand the relevant Safety Data Sheets (SDS) and receive appropriate first-aid training. Appropriate PPE should be worn to minimize the potential for exposure to chemical hazards.

**⚠ WARNING**

**HEALTH HAZARD**

- FAILURE TO USE CAUTION MAY CAUSE SERIOUS INJURY, ILLNESS OR DEATH.
- MOTOR FUEL CAN BE HARMFUL OR FATAL IF SWALLOWED.
- AVOID BREATHING VAPORS.
- KEEP FUEL AWAY FROM SKIN AND EYES BY WEARING APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT.

Following are some basic guidelines regarding liquid petroleum fuel exposure.

- Do not clean hands with petroleum fuels. Wear appropriate chemical-resistant gloves when performing activities that may result in contact with fuel. Petroleum fuel spilled on the skin may cause a rash or other trauma. Immediately wash the exposed area thoroughly with soap and rinse with clean water.
- Petroleum fuels can burn eye tissue or cause loss of sight. If fuel comes in contact with eye tissue, flush eyes with clean water for approximately 15 minutes and then immediately seek medical attention.
- Take appropriate precautions to minimize inhalation of petroleum fuel vapors. Ensure that the work area is well ventilated before beginning any activities that may release fuel vapors. Inhalation of petroleum fuel vapors may cause personal injury or death.
- The ingestion of petroleum fuels may cause unconsciousness and burns to internal organs. Do not induce vomiting. If petroleum fuels are swallowed, seek medical attention immediately.

**5.6 Fire and Explosion Hazards.** Gasoline and other Class I liquids generate flammable vapors that when mixed with air are easily ignited. Special caution is required in situations where Class I liquids are present in an open container or spilled on the ground, or when working in or around enclosed spaces where Class I liquids or vapors may be present.

At a minimum, observe the following precautions when working in any area where product vapors may be present.

- Eliminate all sources of ignition. Open flames from matches or cigarette lighters, or burning cigarettes, cigars or pipes can ignite fuel vapors and should never be allowed in the vicinity of underground storage system equipment.

**⚠ WARNING**

**FIRE HAZARD**

- EXTINGUISH ALL SMOKING MATERIALS AND OPEN FLAMES.
- DO NOT START OR RUN VEHICLES OR OPERATE ELECTRIC POWER TOOLS IN CLASSIFIED AREAS.
- DO NOT WEAR CLOTHING OR FOOTWEAR THAT CAN GENERATE STATIC CHARGES.
- DISCHARGE PERSONAL STATIC BY TOUCHING A GROUNDED METALLIC OBJECT BEFORE ENTERING A CLASSIFIED AREA.
- REMOVE ANY STORAGE SYSTEM COMPONENT FROM SERVICE THAT IS LEAKING FUEL OR VAPOR.

- Sparks from vehicle, generator or other ignition systems, starting or using battery or AC-powered tools not approved for use in hazardous locations, and devices such as ordinary work lights or flashlights can also ignite fuel vapors. Use only tools or equipment approved for use in hazardous locations when working in areas where fuel vapors may be present.
- Static electricity generated by friction on articles of clothing or vehicle upholstery can cause a spark sufficient to ignite fuel vapors. Wear clothing that does not accumulate static charges. Discharge static electricity by touching a metallic object well outside any area where flammable vapors may be present.

Personnel working in an area where vapors may be present should be familiar with the location and operation of appropriate fire extinguishers and/or fire suppression systems at the facility before beginning any underground storage system inspection or maintenance tasks.

**⚠ WARNING**

**NEVER PERMIT STORAGE SYSTEM EQUIPMENT THAT IS LEAKING FUEL OR VAPOR TO REMAIN IN SERVICE. IF A LEAK IS DISCOVERED, DEACTIVATE THE EQUIPMENT AND NOTIFY APPROPRIATE PERSONNEL.**

**5.7 Electrical Hazards.** Improperly installed, worn or unprotected electrical equipment can create fire, explosion or electrical shock hazards. Pump, sensor, liquid level monitoring and all other equipment wiring should


**FIGURE 5-1.** *The emergency stop switch immediately cuts off power to all fuel dispensing equipment. All employees and service personnel should know where this switch is located and under what circumstances to use it.*

conform to applicable electrical code requirements, particularly with regard to classified areas, and the specifications of the equipment manufacturer.

In general, wiring located below grade in the area of the tank top or beneath fuel dispensers must meet the electrical code requirements for a Class I, Division 1 location. Wiring that powers high-current components (e.g., a submersible pump or solenoid valve) must be enclosed in threaded, rigid metal conduit. Electrical conduit can provide a pathway for flammable vapors to migrate from the tank pad or fuel dispenser areas to a building. To prevent vapor migration, electrical codes require the installation of seal-off fittings in conduit just before it exits a Class I, Division 1 location, such as an access manhole or containment sump. After all of the wiring has been installed in a conduit, a sealing compound should be poured into the seal-off fitting to block the passage of vapors through the conduit. Do not disturb this sealing compound during subsequent maintenance or repair of the underground storage system equipment.

Many sensors and liquid level monitoring devices contain "intrinsically safe circuits." This wiring is not required to be enclosed in conduit because these circuits do not carry enough electrical energy to generate a spark or produce enough heat to ignite fuel vapors.

Any activity or procedure requiring access to electrical or electronic components of the underground storage system requires complete electrical shutoff of all circuits within that component by trained personnel. Use the appropriate circuit breaker or switch at the facility power panel to remove power to individual pumps, fuel dispensers or other devices. Qualified individuals must understand and comply with lockout/tagout requirements to ensure safety while servicing equipment. Refer to company procedures and applicable codes and regulations (e.g., OSHA Standard 29 CFR 1910.147) for further description of lockout/tagout requirements.

**⚠ WARNING**

**FIRE AND SPILL HAZARD**

- **STOP BUTTONS ON THE POINT-OF-SALE CONSOLE DO NOT SHUT OFF ALL POWER TO THE DISPENSERS AND/OR SUBMERSIBLE PUMPS.**
- **IN AN EMERGENCY, ACTIVATE THE EMERGENCY STOP SWITCH.**

In an emergency, use an emergency stop switch to turn off ALL power to the fuel dispensing system. All facility employees and service technicians should know the location of the emergency stop switch(es).

**WARNING: The "Stop," "All Stop" and "Pump Stop" buttons on the point-of-sale (POS) console will deauthorize the fuel dispenser but will NOT shut off electrical power to the pump/dispenser. These buttons DO NOT remove AC power and DO NOT always stop product flow.**

Improperly grounded equipment may cause injury or death and can damage electronic equipment. Consult applicable electrical codes and manufacturer instructions to determine specific grounding requirements, including the use of ground fault interrupters.

**5.8 Personnel Hazards.** Untrained or inattentive personnel present at a facility may cause significant hazards. Customers operating vehicles, or facility managers or operators who reenergize electrical circuits that have been turned off, can create hazards that must be anticipated and addressed. Use traffic barriers, warning signage, PPE, lockout/tagout procedures for equipment, and fuel shutoff valves as necessary to ensure safety during underground storage system inspection and maintenance activities.

Always advise personnel in charge of the facility and POS systems of what work is to be done. Periodically monitor the work area and surroundings for any potential hazards while conducting inspection and maintenance activities, and immediately stop work if hazards are observed.

**5.9 Confined Space Entry.** Containment sumps may be large enough to present hazards associated with confined space entry. Refer to OSHA 29 CFR 1910.146 for further guidance on confined space entry procedures.

**5.10 Responding to Fuel Spills.** Fuel spills can occur during underground storage system equipment maintenance activities. Follow the spill response procedures specified by the facility owner or your employer.

Take precautions to avoid igniting spilled fuel. Immediately evacuate people from the area and verify that there are no open flames or other ignition sources in the area of the spill. Do not allow vehicles to be started in the area.

It is advisable to have a "spill kit" readily available. Contents of this kit may include, but are not limited to, fuel-absorbent material, absorbent pads, an absorbent boom, fuel-resistant gloves, fuel-resistant plastic bags, caution tape, a scoop or shovel and a broom. Do not use the same broom used to clean up spills to sweep inside the facility. Do not store contaminated materials inside an occupied building. Handle and dispose of used absorbent materials according to instructions provided by the owner or operator of the facility.

The owner, operator or other person designated by the owner should report any spills or discharges to the appropriate authority as required by law.

# 6. MONTHLY UST SYSTEM INSPECTION CHECKLIST

**6.1 General.** This chapter is designed to help you complete the "Monthly Underground Storage System Inspection Checklist" presented in Appendix A-1. If you need help in completing the monthly checklist, refer to the appropriate section in this chapter for additional description of the checklist item.

**NOTE:** For monthly inspection procedures applicable to fuel dispensing equipment, refer to PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment.*

**NOTE:** The section numbers printed in the PEI/RP900 column of the monthly checklist in Appendix A-1 match the section numbers in this chapter. Sections of the text that directly relate to items on the checklist begin with the words "Checklist Item" followed by the words describing each item on the monthly checklist printed in bold.

**NOTE:** Not all inspection items listed in the monthly inspection checklist in Appendix A-1 will be present at all UST facilities. The checklist in Appendix A-1 may be modified by a qualified person or other person designated by the UST owner so that only those items that are present at a given facility are included. This allows the checklist to be tailored to a specific facility through the removal of irrelevant items. For example, a facility that does not have monitoring wells could remove the groundwater monitoring and soil vapor monitoring item from the checklist. Do not remove a checklist item simply because it is too burdensome.

**6.2 Purpose.** This chapter and the associated checklist describe a routine visual inspection procedure for external underground storage system components. This inspection procedure should be:

- conducted by a qualified person (see Section 3.5);
- repeated on a monthly basis;
- properly recorded using a paper or electronic checklist (see Appendix A-1 for an example of a paper checklist);
- documented by retaining the completed inspection checklist for the length of time specified by the owner or the authority having jurisdiction (AHJ).

**NOTE:** Although not a regulatory requirement, a more frequent inspection process that may be done is available in Appendix A4. This periodic inspection may help the end user identify potential issues that need to be addressed prior to the monthly inspection.

**6.3 Preparation.** Inform facility personnel that the underground storage system inspection procedure is about to take place. Use appropriate personal protective equipment (PPE) and take appropriate safety precautions. Refer to Chapter 5 of these recommended practices for further information concerning how to safely conduct an underground storage system equipment inspection.

Identify the "appropriate person" who is to be notified if any problems or defects are discovered during the inspection. Check to be sure that the name and contact information for this person's organization are included in the top section of the checklist. The inspection procedure and checklist will have little value if problems that are identified are not communicated to the personnel responsible for correcting them.

In the monthly checklist procedure described below, the Qualified Person is consistently instructed to "notify the appropriate person" if a problem is discovered. The employer should instruct the Qualified Person of the notification method that should be used to notify the appropriate person.

When completing the monthly checklist, individual tanks are assigned numbers to identify them. A site information sheet (see Section 4.5) should be completed by a knowledgeable person to help identify the tank location, features such as the fill pipe, and the numbering scheme to be used to identify the tanks. Be sure to use the tank numbers contained on the site information sheet to identify the tanks on the monthly inspection checklist. See Figure 4-1 for a sample site information sheet and Appendix A-3 for a blank form.

**6.4 ✓ Checklist Item: Review Site Training Documents.** Review records of Class C operator training that have occurred during the month. Verify that all appropriate personnel have received Class C training and training documentation is available for review. Notify the appropriate person(s) if any of these records are inaccurate, missing or if there are personnel who need to be trained.

**6.5 Leak Detection Recordkeeping.** The purpose of leak detection is to provide early warning of the possibility of a leak from any portion of the underground storage system that routinely contains product. Leak detection recordkeeping provides documentation that leak detection requirements have been met. As a general rule, regulations require that an underground storage system (tanks and piping) be evaluated for leaks on a monthly basis.

There are a number of different methods of leak detection. Consult with the facility owner to determine which of the methods of leak detection listed on the monthly checklist are applicable to your facility. Circle the applicable leak detection method(s) on the checklist and complete the items on the checklist that relate to the method(s) of leak detection that you have circled. If the methods of leak detection that are not applicable to your facility have been deleted (see Section 6.1), complete all of the leak detection items listed on the checklist.

**NOTE:** In many jurisdictions, leak detection records may also be kept at corporate headquarters or electronically. Follow the tank owner's policies and procedures for obtaining and storing these records.

MAGI OIL
73 BELL STREET
PORTLAND, ME 04103
207-774-9260

V15.nn

05-06-07 09:15:00

LEAK TEST FOR TANK 2
FINISHED. PASSED 0.2
GPH LEAK TEST

05-06-07 09:15:00
PRODUCT LEVEL 28.02 "
% VOLUME: 54 %
TEMPERATURE 67.18 ºF
CALCULATED RATE OF
CHANGE: 0.01

(VOLUME IS DECREASING.)

**FIGURE 6-1.** *Test reports printed out by automatic tank gauges (ATGs) must be kept on hand to document compliance with leak detection requirements.*

**6.5.1 Automatic Tank Gauge (ATG).** An ATG can perform a variety of functions. The tank testing function monitors the product level in a tank to determine if there is a leak. If an ATG is conducting tank testing for leak detection, monthly documentation showing that a leak test has been performed and passed is required. Check the following items on a monthly basis.

**6.5.1.1 ✓ Checklist Item: Passing tank test report printed and properly filed.** Check the equipment manual or consult with the equipment manufacturer, the equipment installer or the facility owner to determine how to print the tank test report. If the test report indicates that a

MAGI OIL
77 OCEAN AVENUE
PORTLAND, ME 04101

V15.nn

05-24-07 09:15:00

LEAK SENSOR
STATUS REPORT:

CHANNEL 1 IMO
REG NL SUMP
WATER
05-23-07 06:08:35

CHANNEL 2 IMO
REG NL INTER
NORMAL

CHANNEL 3 IMO
DIESEL SUMP
NORMAL

CHANNEL 4 IMO
DISP 1-2
NORMAL

**FIGURE 6-2.** *Facilities using interstitial monitoring of secondary containment for leak detection should document the status of leak detection sensors each month to demonstrate compliance with regulatory requirements. This report indicates that water is present in the regular no-lead sump. Report the presence of water in any sump to the appropriate person.*

test has failed or is inconclusive, notify the appropriate person and follow the facility owner's policies and procedures concerning the discovery of a possible leak. If the ATG does not include a printer, complete a manual log documenting that a passing test was conducted on a monthly basis.

**6.5.2 Continuous Interstitial Monitoring (CIM).** If an ATG or other electronic monitoring device is being used for interstitial monitoring, monthly documentation showing that the sensing devices are functioning and are not in alarm is required. This leak detection method may be used for tanks and/or piping. Check the following items on a monthly basis.

**6.5.2.1 ✓ Checklist Item: Sensor status report printed and properly filed.** If the tank gauge or other electronic monitoring device includes a printer, check the equipment manual or consult with the equipment manufacturer, the equipment installer or the facility owner to determine what leak sensor status report is required and how to print it. If the sensor status report indicates that a sensor is in alarm, notify the appropriate person and follow the facility owner's policies and procedures concerning the discovery of a possible leak. If the sensor status report indicates that a sensor is not operating properly, notify the appropriate person. If any sensors are currently in alarm, or had been in alarm during the prior month, perform an inspection of the sump or containment area to determine if any fuel or water is present and if there is any active leak. If the ATG or electronic monitoring device does not include a printer, complete a manual log documenting that the sensor status was checked on a monthly basis.

**6.5.3 Monthly Piping Leak Test (MPLT).** Some ATG consoles may be equipped with an electronic line leak detector (ELLD) to test the product piping for leaks. If this is the case, monthly documentation showing the piping leak test results must be kept. Stand-alone devices that test product piping are also available. Some of these do not include a printer. Check the following items on a monthly basis.

**6.5.3.1 ✓ Checklist Item: Passing piping leak test report printed/documented and properly filed.** Consult the equipment manual, the equipment manufacturer, the equipment installer or the facility owner to determine what test report is required and how to print it. If the piping testing equipment does not include a printer, keep a log documenting that a leak test was conducted on a monthly basis. If the piping testing device indicates that a test has failed, notify the appropriate person and follow the facility owner's policies and procedures concerning the discovery of a possible leak. If there are no piping leak test results, notify the appropriate person.

**6.5.4 Statistical Inventory Reconciliation (SIR).** When SIR is used for leak detection, inventory records are analyzed using statistical techniques. For SIR to be used as a leak detection method, inventory data must be carefully gathered, promptly analyzed and results promptly communicated to the facility. This leak detection method may be used for tanks. Another method must be used for piping. Check the following items on a monthly basis.

**6.5.4.1 ✓ Checklist Item: Last month's SIR results passed and available for inspection.** The SIR analysis for the previous month must be filed and available for inspection. If a SIR result indicates that a tank has failed, notify the appropriate person and follow the facility owner's policies and procedures concerning the discovery of a possible leak. If the SIR results are inconclusive for any tank, notify the appropriate person.

**NOTE:** According to Federal guidelines, a leak must be identified within 30 days when using SIR for compliance with leak detection requirements. If a SIR vendor requires 30 days of inventory data plus another 5 days to do the analysis and return the results to the facility, then this is a period of 35 days which is not consistent with Federal guidelines. Consult with the SIR vendor if the number of days of inventory data plus the number of days required to receive the results of the analysis is greater than 30.

**NOTE:** An "inconclusive" SIR result indicates that leak detection has not been conducted for that month and is a violation of Federal leak detection regulations. The storage system owner should consult with the SIR provider on how to eliminate inconclusive SIR results.

**6.5.5 Inventory Control (IC).** If a facility is using daily inventory and monthly reconciliation as a leak detection method, at the end of each month a qualified person must compare the total monthly inventory overage or shortage to the total monthly throughput. This is called the monthly leak check or reconciliation result. Check the following items on a monthly basis.

**6.5.5.1 ✓ Checklist Item: Inventory reconciled and within the company or regulatory standard.** The monthly reconciliation result should be a relatively small percentage of the sales for the month. If the monthly reconciliation result exceeds company or local regulatory standards, notify the appropriate person.

**NOTE:** A number of different standards are used by regulatory agencies or set by corporate policy regarding the allowable inventory overages or shortages before a problem is suspected. Be sure to determine and use the reconciliation standard in effect for the facility being inspected.

**NOTE:** The U.S. Environmental Protection Agency publication *Doing Inventory Control Right For Underground Storage Tanks* provides detailed guidance on how to perform inventory control. Note that this document may be used for general guidance on how to conduct inventory control, but local regulations may contain requirements that differ from what is described in this document. Refer to Appendix C for information on how to obtain this publication.

**6.5.6 Manual Groundwater Monitoring (GWM) or Soil Vapor Monitoring (SVM).** GWM and SVM are leak detection techniques that monitor the environment outside of the storage system to determine if a leak is present. This leak detection method may be used for tanks and/or piping.

- GWM is only allowable and effective where the water table is always less than 20 feet from the ground surface. To check for leaks, a bailer is lowered into a monitoring or observation well and a sample of groundwater is visually inspected. Because traditional petroleum fuels and water don't readily mix and fuels are less dense than water, leaked fuel will float as a separate layer on top of the groundwater. If for any reason the monitoring or observation well contains no groundwater, another leak detection method must be used.
- SVM is only effective where the soils readily allow the movement of fuel vapors. To check for leaks, a device that can detect fuel vapors is used to sample the air that is present in the pore spaces of the soil. Typically, the soil vapor sample is taken using a monitoring or observation well.

**6.5.6.1 ✓ Checklist Item: Groundwater bailer in good condition.** If groundwater monitoring is used for leak detection, inspect the bailer before using it to sample groundwater. Check the following items:

- the string is securely attached to the top of the bailer;
- the string is long enough to reach the level of the water table in the well;
- the ball at the bottom of the bailer moves freely;
- there are no cracks or other defects in the body of the bailer that would allow liquid to leak out.

If the string is not securely attached, the string is not long enough, the ball does not move freely, there are cracks or other defects in the body of the bailer or the bailer is not serviceable for any other reason, notify the appropriate person.

**6.5.6.2 ✓ Checklist Item: Wells sampled and results pass.** For both GWM and SVM, a logbook documenting that the groundwater or soil vapor was checked for evidence of leaks on a monthly basis is needed. The results of the inspection must be recorded and kept on file. If product is found floating on the groundwater or if soil vapor levels are high, notify the appropriate person

and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**6.5.7 Manual Interstitial Monitoring for Tanks (MIMT).** The space between the walls of double-walled tanks is known as the interstitial space. On some tanks, this space can be checked manually for the presence of liquid, a change in liquid level or a loss of vacuum to meet leak detection requirements. For steel tanks, checking the bottom of the interstitial space for the presence of liquid is straightforward and can be done with a wooden tank gauge stick. (See Section 6.5.7.1.) There are several manual monitoring methods for fiberglass tanks that involve checking for liquids. Two of these methods are described in the following paragraphs. Both steel and fiberglass tanks can be monitored for a loss of vacuum between the walls of the tank using a vacuum gauge. (See Section 6.5.7.4.) For all of these leak detection methods, follow manufacturer instructions for method-specific procedures.

Two leak detection methods are routinely used on fiberglass tanks. These are commonly called "dry" and "wet" or "hydrostatic."

- For fiberglass tanks with a dry leak detection system, monthly checking of the bottom of the tank for leaks can be done by looking for the presence of liquid at the bottom of the interstitial space using a flexible dipstick. The procedure for manually monitoring fiberglass tanks with a "dry" monitoring system is described in Section 6.5.7.2 below.
- For fiberglass tanks with "wet" or "hydrostatic" leak detection systems, accessing the bottom of the interstitial space is not required. Because the interstitial space is completely filled with a leak detection liquid, all that is required is to verify that the level of the leak detection fluid in a reservoir at the top of the tank has not changed substantially. The procedure for manually monitoring fiberglass tanks with a "wet" monitoring system is described in Section 6.5.7.3 below.

**☑6.5.7.1 Checklist Item: Steel tank—Interstitial space checked and found dry.** For steel tanks, the interstitial space can be checked using a wooden tank gauge stick. Remove the grade-level cover and the cap sealing the opening of the interstitial space. Insert the tank gauge stick until it touches the bottom of the interstitial space. This should be at about the same depth as the bottom of the tank. Remove the stick and inspect the bottom to see if it is dry or wet. If the bottom of the tank gauge stick is dry, record the results in a log sheet and file the log sheet. If the bottom of the stick is wet, record the results in a log sheet, notify the appropriate person, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**☑6.5.7.2 Checklist Item: Fiberglass tank—Interstitial space checked and found dry.** Remove the grade-level cover and the cap sealing the opening of the interstitial space. Grasp the handle of the flexible rod that is beneath the cap and pull the flexible rod all the way out of the ground. There should be a strip of cloth at the end of the rod. Inspect the cloth to see if it is wet or dry and re-insert the rod into the interstitial space. If the cloth is dry, record the results in a log sheet and file the log sheet. If the cloth is wet, record the results in a log sheet, notify the appropriate person, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**☑6.5.7.3 Checklist Item: Fiberglass tank—Level of monitoring fluid within normal range.** Fiberglass tanks that have a "wet" or "hydrostatic" monitoring system can be checked with a tank gauge stick. Insert the tank gauge stick into the interstitial riser and lower it until it stops. This should be when the bottom of the stick is at about the level of the top of the tank. Remove the tank gauge stick and measure the depth of the liquid. Record this depth on a log sheet and file the log sheet. The depth of liquid will vary somewhat depending on the level of product in the tank, but it should remain within a fairly small range over time. If the liquid depth is outside of the normal range, notify the appropriate person. (See note below.)

**NOTE:** The level of the liquid in a hydrostatic monitoring system will vary with the amount of product in the tank. The level of the monitoring liquid will increase when the tank is

full and decrease when the tank is relatively empty. Establish the normal range of variation of the liquid level by recording the liquid level when the tank is nearly full and again when the tank is nearly empty. Once the normal range of the depth of the monitoring liquid has been established, the monthly liquid measurement can be compared to the upper and lower limits of this range to establish whether there may be a problem.

✓**6.5.7.4 Checklist Item: For steel and fiberglass tanks, vacuum level is within tolerances.** If the tank interstitial space is monitored using a vacuum gauge, read the gauge and record the vacuum level on the checklist in the space provided. Compare this reading to the vacuum gauge readings recorded for the last 3 months. If the level has changed more than what is allowed by the owner's procedures, notify the appropriate person.

**6.5.8 Manual Interstitial Monitoring for Piping (MIMP).** Double-walled piping typically is sloped downward to a containment sump on the top of the tank, usually the submersible turbine pump (STP) sump. A visual inspection of this sump on a monthly basis can be used for piping leak detection. Typically, this process involves removing a grade-level cover, removing a sump lid and inspecting the sump for the presence of product or water.

✓**6.5.8.1 Checklist Item: Containment sump (STP and/or remote fill sump) inspected and no liquid found.** Remove the grade-level cover. It may be necessary to remove bolts which fasten the cover. Carefully remove the sump lid, which may also be fastened with bolts or various fittings. Many sump lids include a gasket to keep rain and groundwater out. Take care not to damage the gasket when removing and reinstalling the lid. Visually inspect the sump for the presence of product or water. If any amount of product or water is present in the sump, notify the appropriate person and follow the facility owner's policies and procedures concerning the discovery of a possible leak. Replace the sump lid, being sure to carefully replace any gaskets present between the sump rim and the cover to keep water out. Replace the grade-level cover and reinstall any bolts that were removed.

**NOTE:** Opening tank-top containment sumps typically involves removing large, heavy covers and removing lids that are fastened in various ways to make them water tight. These sumps are also frequently located in areas where vehicles are present. Inspection of tank-top containment sumps is hazardous and may compromise the integrity of these sumps. For these reasons, only properly trained, properly equipped and physically able personnel should inspect tank-top containment sumps.

**6.6 All Tanks.** The checklist items in this section apply to all tanks, whether fiberglass or steel and whether they are single-walled or double-walled.

✓**6.6.1 Checklist Item: All components of the spill kit are present and in good condition.** The spill kit (see Section 5.10) should include a list of all the components that should be present. Check to be sure that all the spill kit components are present and in good condition and that appropriate amounts of expendable items such as absorbent material and plastic bags are present. If any components are broken or missing, or additional expendable materials are needed, notify the appropriate person.

**6.6.2 Grade-Level Covers.** On the tank pad over the top of the tank there will be a number of round or square covers that allow access to various components of the underground storage system. Check the following items on a monthly basis.

✓**6.6.2.1 Checklist Item: All covers present, in good condition, seated firmly on the correct tank** . All grade-level covers should be in good condition and seated firmly in place. The cover should not rest on the piping below the cover. If you find a cover missing, not fitting properly, cracked, broken or not on the correct tank, notify the appropriate person.

**6.6.3 Spill Containment Manhole Drain Valve.** Some spill containment manholes are equipped with a valve designed to drain any spilled fuel into the tank. Other spill containment manholes have a small pump that can be used to remove liquids. If the spill containment manhole is equipped with

a drain valve mechanism, it is important that this valve be in good condition, otherwise water can enter the tank. Check the following items on a monthly basis.

**✓6.6.3.1 Checklist Item: Drain valve in spill containment manhole in good condition** Inspect the drain mechanism to verify that it is in good condition. The handle should not be bent or broken off and the drain mechanism should operate freely. If the handle is broken or the drain mechanism does not operate freely, notify the appropriate person.

**✓6.6.3.2 Checklist Item: Interstitial space of double-walled containment manhole is dry.** Some spill containment manholes are double-walled with an interstitial space. Most of these include a simple visual method of determining whether there is liquid between the walls of the containment manhole. Methods range from small dipsticks that can be inserted into the interstitial space to dials that register the liquid level to colored gauges that indicate the presence of liquid by a color change visible though a special observation port.

If the spill containment manhole is double-walled and includes a method of visually determining the presence of liquid in the interstitial space, verify that no liquid is present. If the monitoring device indicates the presence of liquid in the interstitial space, notify the appropriate person.

**6.6.4 Drop Tube.** Most gasoline tanks have a tube installed inside the fill pipe that extends nearly to the bottom of the tank. This tube may be essentially the same diameter as the fill pipe (standard drop tube) or it may have a smaller diameter, creating a ring-shaped space between the fill pipe and the drop tube (coaxial drop tube). Check the following items on a monthly basis.

**✓6.6.4.1 Checklist Item: Standard drop tube smooth, no ragged edges, in good condition.** Remove the fill cap and inspect the drop tube. The tube should be smooth with no visible ragged edges and free of obstructions. If the top edge of the drop tube is visible, notify the appropriate person.

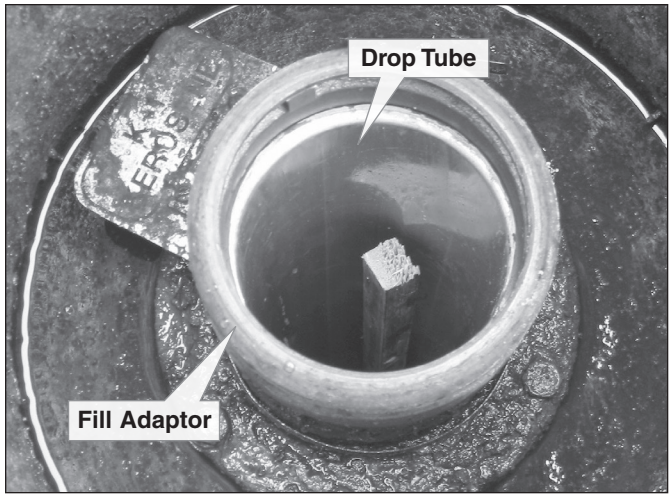


**FIGURE 6-3.** *Drop tubes inside fill pipes accelerate the rate of fuel delivery and minimize vapor generation. Drop tubes are typically made of aluminum, should be smooth, and the top of the drop tube should be just below the fill adaptor. See Figure A4-3 for an example of a coaxial drop tube. There should be no obstructions (such as broken gauge sticks) inside the fill pipe. Notify the appropriate person if an obstruction is found.*

**✓6.6.4.2 Checklist Item: Top edge of coaxial drop tube smooth, round, slightly below the top edge of the fill pipe.** The top edge of a coaxial drop tube will be visible. This edge should be smooth and round and should be only slightly below the top of the fill pipe. Visually inspect the top of the drop tube. If the drop tube is not at the proper level in the fill pipe or if the top edge of the coaxial drop tube is not smooth and round, notify the appropriate person.

**6.6.5 Tank Gauge Stick.** Even though a facility may have an ATG, a tank gauge stick should be available to verify the tank gauge readings, take inventory measurements if the tank gauge is not working and check for the presence of water. Check the following items on a monthly basis.

**✓6.6.5.1 Checklist Item: Tank gauge stick can be clearly read, is not warped or broken** Check the tank gauge stick to be sure the markings can be clearly read and that the stick is not warped or broken. There should be a plastic button on the bottom of the stick. If the tank gauge stick markings are faded, the stick is warped or broken, or the plastic button is missing, notify the appropriate person.

**FIGURE 6-4.** *Verify that the numbers on the gauge stick are clear and easy to read and that the gauge stick is not warped or broken.*

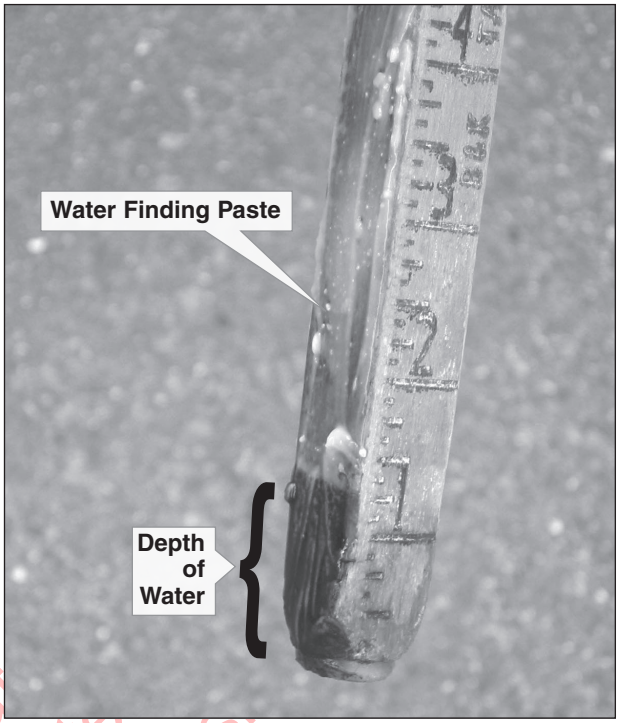


**FIGURE 6-5.** *Water paste applied to a gauge stick will change color if water is present. Minimizing the amount of water in a tank is important to maintain fuel quality for all fuels and is critically important for fuels containing alcohol. Numbers on gauge sticks should be clear and easy to read.*

**6.6.6 Check for Water.** Water in underground tanks can affect fuel quality and promote microbial growth resulting in corrosion of metal components in underground storage systems. Check the following item on a monthly basis.

✓**6.6.6.1 Checklist Item: No water present in the tank.** Check for water in a tank using an ATG or a tank gauge stick and water-finding paste. If a tank gauge stick is used, store the stick in a dry location to prevent the false indication of water in the tank because the tank gauge stick is wet or damp. To check for water, remove the grade-level cover and the cap from the fill pipe or the water gauging port if a water gauging port is present. If the tank contains gasoline blended with alcohol, use water-finding paste intended for use with alcohol fuels. Apply water-finding paste to the bottom few inches of a tank gauge stick and lower the stick to the bottom of the tank. Let the stick rest at the bottom of the tank for the amount of time recommended by the manufacturer of the water-finding paste. Remove the stick and inspect the bottom for a change in the color of the water paste that indicates water is present. If any amount of water in the tank is detected with the gauge stick or the ATG, notify the appropriate person.

**NOTE:** Refer to Appendix B for more information about water in storage systems.

**6.6.7 Tank Vents.** Tank vents are typically vertical steel piping extending at least 12 feet above the surrounding ground level. Vents pipes may be attached to the side of a building, free standing or located inside the canopy columns. Check the following item on a monthly basis.

✓**6.6.7.1 Checklist Item: Vent cap present, vent pipe solidly supported and vertical** The tops of vent pipes are fitted with a cap to prevent precipitation from entering the tank. Verify that a vent cap is present at the top of the vent pipe and that the vent pipes are solidly supported and vertical. If the vent cap is missing or the vent pipe is damaged or not properly supported, notify the appropriate person.

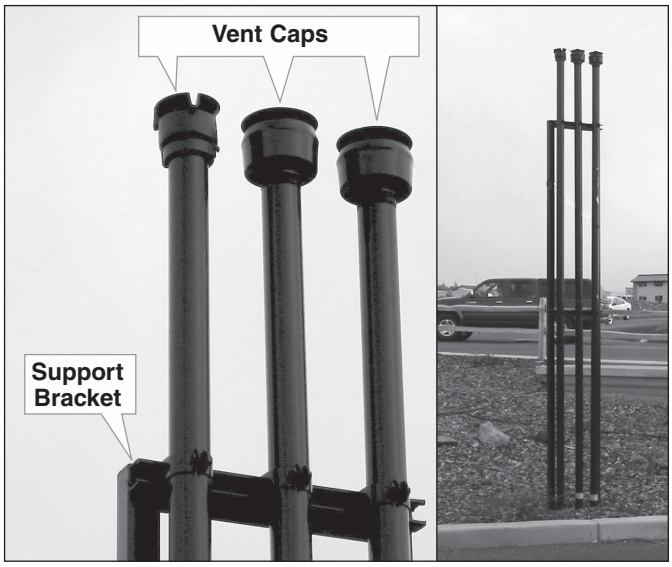


**FIGURE 6-6.** *Vent pipes allow underground tanks to breathe and keep tanks at atmospheric pressure. Vents should be vertical and solidly supported. Vent caps on the tops of vent pipes keep precipitation out.*

**6.7 Stage I Vapor Recovery.** Stage I vapor recovery equipment provides a path for gasoline vapors in the underground tank to travel back to the delivery truck during a delivery. There are two types of Stage I vapor recovery: coaxial and two point. In coaxial Stage I vapor recovery, the drop tube is a smaller diameter than the fill pipe, so that fuel can flow down the drop tube while vapors can flow up around the space between the drop tube and the fill pipe. A special fitting attaches to the fill pipe that channels the vapors through a hose back to the delivery truck. In two-point Stage I vapor recovery, there is a separate vapor riser, usually close to the fill riser, through which vapors flow.

**6.7.1 Two-Point (Dual-Point) Vapor Recovery.** In two-point Stage I vapor recovery there is a second grade-level cover, colored orange, within a few feet of the fill cover. Beneath the cover is an orange-colored cap at the top of the Stage I vapor recovery riser. Most often, there is dirt or gravel around the Stage I riser, but in some cases, the Stage I riser is installed within a spill containment manhole, just like the fill pipe. Check the following items on a monthly basis.

☑ **6.7.1.1 Checklist Item: Cover present, colored orange, seated firmly at grade, not broken, cracked or chipped.** If the facility is equipped with two-point Stage I vapor recovery, verify that the grade-level cover is present, painted or colored orange, in good condition and seated firmly. The cover should not rest on the piping below the cover. If the Stage I grade-level cover is missing, broken, cracked or damaged, or not colored orange, notify the appropriate person.

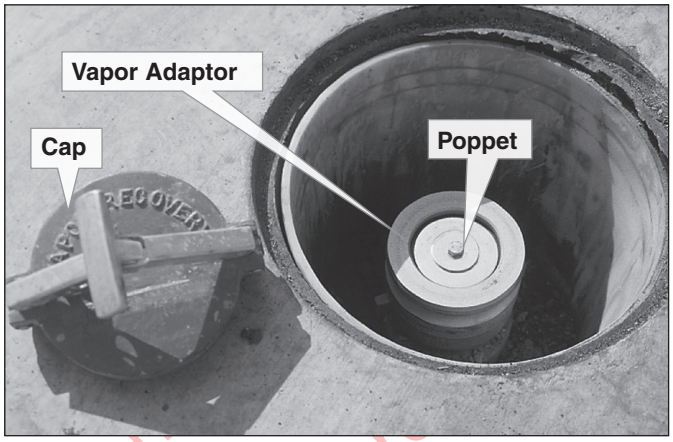


**FIGURE 6-7.** *When two-point vapor recovery is installed, an orange cap is used to cover the vapor adaptor fitting. The poppet at the center of the vapor adaptor should seal tightly to keep vapors from escaping, even when the cap is off.*

☑ **6.7.1.2 Checklist Item: If spill containment manhole is present, no dirt, trash, water or product.** Dirt and debris in a containment manhole can interfere with proper operation of the drain mechanism. Water or product in the manhole must be removed to maintain the capacity of the manhole. Notify the appropriate person or follow the facility owner's policies and procedures for handling dirt, trash and liquids found in spill containment manholes.

☑ **6.7.1.3 Checklist Item: If spill containment manhole is present, no cracks, bulges or holes.** Spill containment manholes must be liquid-tight. Any defects in the sides or bottom of the spill containment manhole that could allow liquids to drain out must be repaired or the spill bucket replaced. Visually inspect the inside of the spill containment manhole for cracks, bulges or holes. If any defects are found, notify the appropriate person.

☑ **6.7.1.4 Checklist Item: Vapor recovery cap in good condition, seals tightly.** There should be an orange vapor recovery

cap, similar to a fill cap, beneath the grade-level cover. Verify that the vapor recovery cap is in good condition and that the latch mechanism seals the cap tightly to the vapor recovery adaptor. Remove the vapor recovery cap and look on the underside of the cap for a gasket or an O-ring. If you find the vapor recovery cap broken, loose, or missing, or if the gasket or O-ring is missing, notify the appropriate person.

✓**6.7.1.5 Checklist Item: Poppet of vapor recovery adaptor seals tightly.** Remove the vapor recovery cap. Beneath the cap is the vapor recovery adaptor, also known as a "dry break." In the center of the vapor recovery adaptor is a spring-operated valve (poppet) that should be closed to prevent the escape of vapors. There should be no vapors escaping from around the valve when it is closed. If the disk does not seal tightly, notify the appropriate person.

**NOTE:** Vapor recovery fittings are sometimes propped open with small sticks, stones, screwdrivers or other objects. This is dangerous because it can allow flammable vapors to escape from the underground tank. If you discover that the vapor recovery poppet has been propped open, notify the appropriate person.

**NOTE:** Local AHJs may have different requirements for inspecting Stage I vapor recovery adaptors.

**6.8 Observation and Monitoring Wells.** Observation wells are small diameter, vertical pipes installed below ground usually in the corners of a tank excavation. Monitoring wells are similar to observation wells except that they are located outside the tank excavation area. Pipes used to construct observation and monitoring wells have very fine slots in them that allow water and vapors to enter but keep backfill and soil out. They are used to detect contamination when GWM or SVM is used for leak detection.

**6.8.1 Identification of Observation and Monitoring Wells.** Many tanks that routinely use other methods of leak detection have observation wells that can be used to confirm the presence of a leak or monitoring wells that can be used to measure the progress of contamination removal efforts. However, if observation and monitoring wells are not properly labeled, secured and sealed, they can serve as a pathway for surface spills to contaminate the subsurface. It is very important that observation and monitoring wells be properly labeled and secured, even if they are not being used for routine leak detection. Check the following item on a monthly basis.

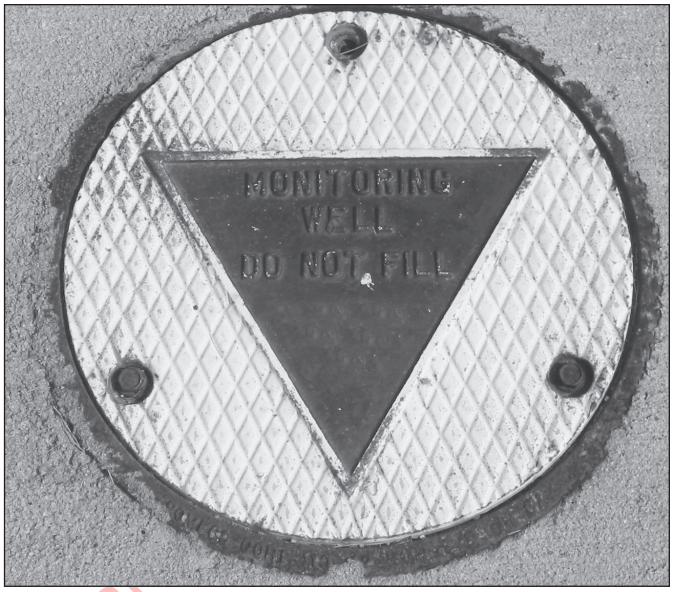


**FIGURE 6-8.** *Observation and monitoring wells should be identified using a cover that includes a black triangle on a white background. Bolts in the cover help to prevent unauthorized access to the well.*

✓**6.8.1.1 Checklist Item: Observation well cover is properly identified and secured.** The industry standard symbol for an observation well is a black triangle on a white background. If your facility has grade-level covers located near the corners of the tank pad that do not have this symbol, notify appropriate personnel to determine whether these covers are observation wells and, if they are, to have them properly identified. If the observation well covers are properly marked, check to see whether they are secured, either by requiring a wrench or other tool to remove the cover or by having a padlock on the observation well cap beneath the grade-level cover. If the well covers or well caps are not secured, notify the appropriate person.

**NOTE:** In some jurisdictions, different color schemes may be used to identify observation and monitoring wells.

**6.9 Corrosion Protection.** Steel tanks and piping that routinely contain product must have corrosion protection. Corrosion protection can be accomplished with thick coatings, galvanic cathodic protection or impressed-current cathodic protection.

**6.9.1 Impressed-Current Cathodic Protection.** If steel tanks or piping are present, determine which type of corrosion protection is being used by asking the owner, a facility manager or a service technician who is familiar with the location. If impressed-current corrosion protection is being used, do the following.

☑ **6.9.1.1 Checklist Item: Record volt and amp readings, readings consistent with previous months.** If impressed-current cathodic protection is used, there will be a device called a rectifier installed, usually near the electrical panel for the facility. The rectifier usually includes one or two meters that indicate the voltage and amperage output of the rectifier. These readings should be recorded in a log each month. The readings should be approximately the same as they were when the system was first installed and should remain constant from month to month. If there is a significant change in either the voltage or the amperage readings, notify the appropriate person.

☑ **6.9.1.2 Checklist Item: Record hour meter reading (if present). Reading increases by about 700 hours each month.** Some rectifiers include an hour meter that records the total number of hours the rectifier has been on. If an hour meter is present, this reading should be recorded in the log as well. The reading on this meter should increase by about 700 hours a month. If this reading is not changing or is changing much less than 700 hours a month, notify the appropriate person.

**NOTE:** Federal and many state regulations specify that rectifier readings be taken every 60 days. The PEI UST System Inspection and Maintenance Committee recommends that these readings be made every 30 days.

**6.10 Inspecting Unmonitored Dispensers and STPs.** Fuel leaks from dispenser components and submersible pumps are common and may not be detected by typical leak detection techniques. For dispensers and STPs equipped with containment sumps and sensors to detect releases, such leaks are readily detected and corrected. For dispensers and STPs that are not equipped with containment sumps or that have containment sumps but are not monitored with sensors, conduct monthly visual inspections to detect leaks. Use the following procedures to check unmonitored dispensers and STPs for leaks.

**6.10.1 Accessing Dispenser Components.** To access storage system components located inside and beneath the fuel dispenser cabinet, first secure the area around the dispenser before attempting to access the dispenser components, then unlock and carefully remove the lower dispenser door panels on each side of the fuel dispenser cabinet. Set the dispenser door panels aside in a location where they are secure and out of the way of the inspection, as well as local vehicle- and foot-traffic patterns. Allow any vapors present inside the fuel dispenser cabinet to dissipate before proceeding with the inspection.

☑ **6.10.1.1 Checklist Item: All dispenser components are clean and dry.** Check to see if any fuel dispenser component, whether above or below the shear valve, is wet with fuel, if dripping fuel is present, or any fuel is present below the dispenser. If a leak is observed, close the shear valve if the leak is above the shear valve, or take the appropriate submersible pump(s) out of service if the leak is below the shear valve. Replace the fuel dispenser door panels, take the fuel dispenser out of service, notify the appropriate person immediately, and follow the facility owner's policies and procedures concerning the discovery of a possible leak. Dispensers should also be free of debris which may potentially obstruct the sensor's functionality.

**6.10.2 Accessing STPs.** To access STPs, secure the area around the STP access manhole to prevent traffic from entering. Remove the grade-level covers using appropriate tools and lifting techniques. The STP access manhole may qualify as a confined space, so do not enter the access opening.

☑ **6.10.2.1 Checklist Item: No fuel detected in STP access manhole.** Visually check the submersible pump manifold,

piping connections, and any other product containing components that might be present for moisture that might indicate a leak. Water often condenses on these components, so do not assume that any moisture present is fuel. If fuel is suspected, apply fuel detecting paste on the end of a yardstick or similar probe and check to see whether the paste changes color when it comes in contact with the moisture. If fuel is detected, take the STP out of service, notify the appropriate person immediately, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**NOTE:** Opening access manholes typically involves removing large, heavy covers that are frequently located in areas where vehicles are present. For these reasons, only properly trained, properly equipped and physically able personnel should inspect access manholes.

# 7. ANNUAL UST SYSTEM INSPECTION CHECKLIST

**7.1 General.** This chapter is designed to help you complete the "Annual Underground Storage System Inspection Checklist," presented in Appendix A-2. If you need help in completing the checklist, refer to the appropriate section in this chapter for an additional description of the checklist item.

Testing and verification procedures described in this chapter can be part of a "hands-on" inspection where test procedures are performed during the inspection. The inspection can also be "hands-off," where documentation is reviewed showing that all the procedures described in this chapter have been completed in the appropriate time frame.

**NOTE:** For annual inspection procedures applicable to fuel dispensing equipment, refer to PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment.*

**NOTE:** The section numbers printed in the PEI/RP900 column of the annual checklist match the section numbers in this chapter. The words describing each item on the annual checklist are printed at the beginning of the sections that follow.

**NOTE:** Not all inspection items listed in the annual inspection checklist in Appendix A-2 will be present at all UST facilities. The checklist in Appendix A-2 may be modified by a qualified technician or other person designated by the UST owner so that only those items that are present at a given facility are included. This allows the checklist to be tailored to a specific facility through the removal of irrelevant items. For example, if a storage system is constructed entirely of fiberglass, the corrosion protection items can be removed from the checklist. Do not remove a checklist item simply because it is too burdensome.

**NOTE:** There are numerous references throughout this chapter to PEI/RP1200, *Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment at UST Facilities.* In this chapter, this document will be referred to simply as "PEI/RP1200."

**7.2 Purpose.** This chapter and the associated checklist describe routine testing and verification procedures to be conducted on an annual basis for easily accessible underground storage system components. This inspection procedure should be:

- conducted by a qualified technician;
- in addition to the procedures described in the monthly checklists;
- properly recorded using a paper or electronic checklist (see Appendix A-2 for example of paper checklist);
- documented by retaining the completed inspection checklist for the length of time specified by the UST owner or the authority having jurisdiction (AHJ).

**7.3 Preparation.** Inform facility personnel that the underground storage system inspection procedure is about to take place. Facility personnel should be informed that individual components and perhaps the entire site will be shut down at various times during the inspection procedure. Use appropriate personal protective equipment (PPE) and take appropriate safety precautions (see Chapter 5 for safety information).

Identify the "appropriate person" who is to be notified if any problems or defects are discovered during the inspection. Check to be sure that the name and contact information for this person's organization are included in the top section of the checklist. The inspection procedure and checklist will have little value if problems that are identified are not communicated to the personnel responsible for correcting them.

In the annual checklist procedure described below, the qualified technician is consistently instructed to "notify the appropriate person" if a problem is discovered. The employer should instruct the qualified technician of the notification method that should be used to notify the appropriate person.

In some cases, the qualified technician may be authorized to repair or correct certain problems that may be discovered. If this is the case, the qualified technician should receive clear instructions describing the type(s) of problems that may be repaired or corrected.

When completing the annual checklist, individual tanks are assigned numbers to identify them. A site information sheet should be completed by a knowledgeable person

**⚠ CAUTION**

**THE ANNUAL UNDERGROUND STORAGE SYSTEM EQUIPMENT CHECKLIST IS INTENDED FOR USE BY KNOWLEDGEABLE, TRAINED, PROFESSIONAL TECHNICIANS.**

to help identify the tank locations and the numbering scheme to be used to identify the tanks. Be sure to use the tank numbers contained on the site information sheet to identify the tanks on the annual inspection checklist. See Figure 4-1 for a sample site information sheet and Appendix A-3 for a blank site information form.

**7.4 Verification and Review of Monthly Inspections.** As part of the annual inspection, the qualified technician should complete the monthly checklist. The qualified technician should then verify the inspection results noted on the most recent monthly checklist, as well as review the monthly inspection checklists for the previous year for accuracy and completeness. The qualified technician should confirm that the monthly inspections have been conducted and documented properly and determine whether deficiencies that have been noted have been corrected.

✓**7.4.1 Checklist Item: Complete monthly checklist and compare to previously completed monthly checklists.** Any outstanding problems should be noted on the monthly inspection checklist completed by the qualified technician. Submit this monthly inspection checklist to the appropriate person together with the annual inspection checklist.

✓**7.4.2 Checklist Item: Monthly inspections reviewed and found adequate.** After completing a monthly checklist according to Chapter 7 of these recommended practices, the qualified technician should review the last year of monthly checklists completed by facility personnel. If problems have been overlooked during the monthly inspection, point these out to the person(s) responsible for the monthly inspections so that future inspections can be improved. If monthly inspection checklists completed by facility personnel are missing, incomplete or improperly completed, record these deficiencies on the annual checklist and notify the appropriate person.

**7.5 Initial Fuel Dispenser Inspection.** Fuel leaks from dispenser components and spills from maintenance activities can occur within dispenser cabinets. Fuel that accumulates in dispenser sumps can present a significant fire hazard. The first thing to establish during a fuel dispenser inspection is that there are no leaks or uncontained product present. To protect persons who may be using adjacent dispensers, it is important to identify and address safety hazards immediately at the start of the inspection.

**NOTE:** Except for the initial fuel dispenser inspection described in this Section, the inspection procedures described in this Recommended Practice are limited to the shear valve and items below the shear valve. Refer to PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment,* for inspection procedures applicable to fuel dispenser components above the shear valve.

To access storage system components located beneath the fuel dispenser cabinet, unlock and carefully remove the lower dispenser door panels on each side of the fuel dispenser cabinet. Set the dispenser door panels aside in a location where they are secure and out of the way of the inspection, as well as local vehicle- and foot-traffic patterns. Allow any vapors present inside the fuel dispenser cabinet to dissipate before proceeding with the inspection.

✓**7.5.1 Checklist Item: All dispenser components are clean and dry.** Check to see if any fuel dispenser component, whether above or below the shear valve, is wet with fuel or if dripping fuel is present. If a leak is observed, close the shear valve if the leak is above the shear valve, or take the appropriate submersible pump(s) out of service if the leak is below the shear valve. Discontinue the inspection of this fuel dispenser, replace the fuel dispenser door panels, take the fuel dispenser out of service, notify the appropriate person immediately, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

✓**7.5.2 Checklist Item: If dispenser sump is present, sump is dry.** If a dispenser sump is present, look in the bottom of the sump to see if there is any liquid. If the sump is deep, it may be necessary to use an explosion-proof light to see the bottom of the sump. If liquid is present, apply water and product paste on opposite sides of a short stick to determine whether water or product or both are present in the sump. Follow the appropriate action(s) listed below.

- If only water is present, notify the appropriate person.

- If any product is present identify the source of the leak, close the shear valve if the leak is above the shear valve, or take the appropriate submersible pump(s) out of service if the leak is below the shear valve.

In all cases where product is present in the sump, replace the fuel dispenser door panels, notify the appropriate person immediately, take the fuel dispenser out of service, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**7.6 Identifying the Steps Required for an Annual Dispenser, STP and Containment Sump Inspection.** Refer to Table 7-1 to identify which of the inspection steps in this section need to be completed for the type(s) of UST components present at the facility. The top row of Table 7-1 lists dispensers, STPs and the various types of below-grade sumps that may be present at typical USTs. The column beneath each heading indicates with an "X" the checklist items in this Section that apply to each type of dispenser, STP and containment sump. To complete the UST inspection, follow the instructions in the sections below that are applicable to each dispenser, STP and containment sump present at the facility.

**STP, Dispenser and Containment Sump Inspection Steps**

| Section | STP No Sump | STP SW* Sump | STP DW** Sump | Dispenser No Sump | Dispenser SW Sump | Dispenser DW Sump | Transition Sump SW | Transition Sump DW | Fill Sump SW | Fill Sump DW |
|---|---|---|---|---|---|---|---|---|---|---|
| 7.6.1 | X | X | X | X | X | X | X | X | X | X |
| 7.6.2 | X | X | X | X | X | X | X | X | X | X |
| 7.6.3 | X | X | X | | | | | | X | X |
| 7.6.4 | | X | X | | X | X | X | X | X | X |
| 7.6.5 | X | X | X | X | X | X | X | X | X | X |
| 7.6.6 | | X | X | | X | X | X | X | X | X |
| 7.6.7 | | X | X | | X | X | X | X | X | X |
| 7.6.8 | X | X | X | X | X | X | X | X | X | X |
| 7.6.9 | X | X | X | X | X | X | X | X | X | X |
| 7.6.10 | X | X | X | | | | | | | |
| 7.6.11 | X | X | X | | | | | | | |
| 7.6.12 | X | X | X | | | | | | | |
| 7.6.13 | X | X | X | | | | | | | |
| 7.6.14 | X | X | X | | | | | | | |
| 7.6.15 | | | | X | X | X | | | | |
| 7.6.16 | | | | X | X | X | | | | |
| 7.6.17 | X | | | X | | | | | | |
| 7.6.18 | | X | | | X | | X | | X | |
| 7.6.19 | | | X | | | X | | X | | X |
| 7.6.20 | | X | X | | | | X | X | X | X |
| 7.6.21 | | | | | X | X | | | | |
| 7.6.22 | | X | X | | X | X | X | X | X | X |
| 7.6.23 | | X | X | | | | X | X | X | X |
| 7.6.24 | X | X | X | | | | X | X | X | X |

*Single-Walled ** Double-Walled

**TABLE 7-1.** *The top row of this Table lists dispensers, STPs and the various types of below-grade sumps that may be present at typical USTs. The column beneath each heading indicates with an "X" the checklist items in Section 7.6 that apply to each type of dispenser, STP and containment sump. To complete the UST inspection, follow the instructions in the sections listed in the left column that are applicable to each dispenser, STP and containment sump present at the facility.*

**✓7.6.1 Checklist Item: Visible piping and fittings show no signs of leaking.** Visually check the piping, piping connections, and any other product containing components that might be present for moisture that might indicate a leak. Water often condenses on these components, so do not assume that any moisture present is fuel. If fuel is suspected, apply product-detecting paste on the end of a yardstick or similar probe and check to see whether the paste changes color when it comes in contact with the moisture. If fuel is detected, take the applicable product out of service, notify the appropriate person immediately, and follow the facility owner's policies and procedures concerning the discovery of a possible leak.

**NOTE:** Because of the close proximity of the public, product in dispenser sumps can be especially hazardous. If liquid is found in a dispenser sump, be sure to follow the procedures outlined in Section 7.5.2.

**✓7.6.2 Checklist Item: Piping in good condition.** Visually inspect piping for kinking, sponginess, elongation, cracking, discoloration, corrosion or any other signs of deterioration. If any evidence of deterioration is found, notify the appropriate person.

**✓7.6.3 Checklist Item: Excessive corrosion not present.** Severe corrosion may be observed on metallic tank top components, especially if the UST stores gasoline blended with ethanol (see text box and Figure 7-1). If excessive corrosion is present, notify the appropriate person.

**FIGURE 7-1.** *Corrosion may form a thick, rough layer on metallic components located above tanks containing ethanol-blended gasoline. This type of corrosion is caused by microbes that feed on ethanol and produce acid that is responsible for the corrosion.*

### Ethanol-Blended Gasoline and Corrosion in Containment Sumps and Manholes

Since shortly after the widespread introduction of gasoline blended with ethanol, corrosion with unusual characteristics has been noted in some tank-top containment sumps and access manholes, especially around submersible turbine pumps (see Figure 7-1).The corrosion forms a thick, rough coating on virtually all metallic components in the sump except stainless steel, and the corrosion on copper components has a turquoise color.

This type of corrosion is caused by microbes that feed on ethanol and produce acid that is responsible for the corrosion. Ethanol may be present in the containment sump or manhole as a result of product spills due to maintenance activities or small amounts of product in liquid or vapor form escaping from the storage system. Once outside the storage system, subsurface moisture absorbs the ethanol, forming a mixture of ethanol and water that is ideal for microbial growth.

Most tank-top metal components are robust, and widespread failure of storage system equipment from this type of corrosion has not been reported to date. How this form of corrosion will affect the integrity and performance of storage system components in the long term is not known.

Tank owners who wish to limit this form of corrosion should insist that maintenance personnel be very diligent in preventing spills and cleaning up any spills that may occur. Other actions that can limit this form of corrosion include checking for liquid or vapors that may be escaping from:

- manway cover gaskets;
- ATG caps that do not seal properly;
- ATG caps that have leaky grommets around the probe wire;
- threaded connections; and
- any other component from which very small amounts of liquid or vapor may escape from the storage system into the containment sump or manhole.

**✓7.6.4 Checklist Item: Any water or product removed and disposed of properly.** If there is water or product in the containment sump, conduct a careful visual inspection of the sump, all penetration fittings and the sump lid to determine the likely source of the liquid. Notify the appropriate

person of the presence and amount of liquid in the sump and whether a likely source has been identified.

**NOTE:** Some environmental, fire-safety or other AHJs may require reporting of the presence of liquid in containment sumps.

☑ **7.6.5 Checklist Item: Dispenser, STP and containment sumps free of trash and debris.** Check beneath dispensers, around STPs and inside containment sumps for the presence of trash or debris. Look for used filters beneath dispensers. Remove any filters and trash and as much debris as is feasible and dispose of properly. If trash or debris is present but cannot be easily removed, notify the appropriate person. If filters are found, notify the appropriate person.

☑ **7.6.6 Checklist Item: Sump is free of cracks, holes, bulges or other defects.** Visually inspect the sump for cracks, holes, bulges or other defects in the sides or bottom. If there are any defects in the sump, notify the appropriate person.

☑ **7.6.7 Checklist Item: Penetration fittings intact and secured.** Visually inspect all sump-penetration fittings for tears, cracks or other signs of deterioration. Press gently on flexible fittings with a stick or similar probe to flex the rubber so if cracks are present they will be more apparent. Use an explosion proof light to improve visibility if necessary. Check if any hose clamps sealing the penetration fittings need to be tightened. If any defects are found, notify the appropriate person.

☑ **7.6.8 Checklist Item: Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition.** Check external surfaces of electrical junction boxes and conduit for excessive corrosion or other damage. If wiring is present that is not inside conduit, verify that this wiring is connected to an intrinsically safe device and is in good condition. If junction boxes or conduit are in poor condition, notify the appropriate person. If wiring is present that should be inside a conduit but is not, or if intrinsically safe wiring is damaged, frayed or not in good condition, notify the appropriate person.

☑ **7.6.9 Checklist Item: Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications.** Check the visible portion of each flexible connector and verify that it is not twisted, kinked or bent beyond manufacturer specifications. Check the braided outer covering of the flex connector for broken or frayed strands. If a flex connector is frayed, twisted, kinked or bent beyond manufacturer specifications, notify the appropriate person.

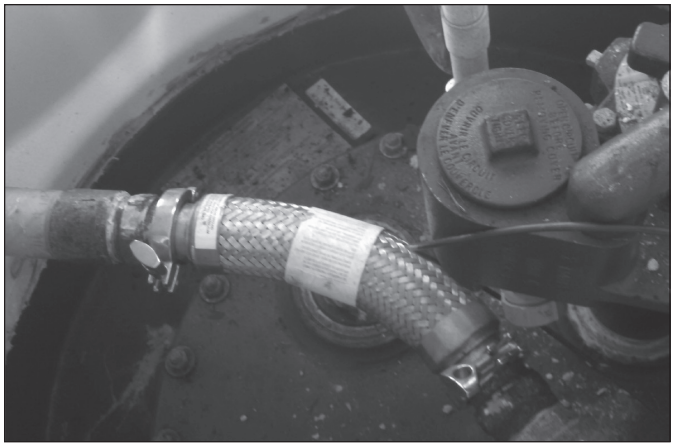

**FIGURE 7-2.** *A properly installed flexible connector should bend smoothly without kinks or twists. The bend radius must not exceed manufacturer specifications.*

☑ **7.6.10 Checklist Item: Mechanical line leak detector (MLLD) properly vented, vent tube not kinked or twisted, vent tube fittings intact and tightened.** If a MLLD is present, verify that the vent tube is connected at both ends to appropriate locations and that the vent tube fittings are intact and tightened. Verify that the vent tube is not kinked or twisted. If the vent tube is not properly connected or is kinked or twisted, notify the appropriate person.

☑ **7.6.11 Checklist Item: MLLD passes 3.0 gallons per hour (gph) test.** If a MLLD is installed, test the leak detector's ability to detect 3.0 gph leaks in accordance with PEI/RP1200, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If no test results are available or if the most recent test failed, notify the appropriate person.

☑ **7.6.12 Checklist Item: Electronic line leak detector (ELLD) passes 3.0 gph test.** If an ELLD is installed, test the leak detector's ability to detect 3.0 gph leaks in accordance with PEI/RP1200, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If no test results are available or if the most recent test failed, notify the appropriate person.

☑ **7.6.13 Checklist Item: ELLD passes 0.2 gph test.** If an ELLD is used to meet monthly leak detection requirements for the piping, test the leak detector's ability to detect 0.2 gph leaks in accordance with PEI/RP1200, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If no test results are available or if the most recent test failed, notify the appropriate person.

☑ **7.6.14 Checklist Item: ELLD passes 0.1 gph test.** If an ELLD is used to meet annual leak detection requirements for the piping, test the leak detector's ability to detect 0.1 gph leaks in accordance with PEI/RP1200, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If no test results for the ELLD are available, or if the most recent test failed, notify the appropriate person.

☑ **7.6.15 Checklist Item: Shear valves operate freely and close completely.** If product is dispensed using a submersible pump, test the operation of each shear valve in accordance with PEI/RP1200, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If any shear valves fail the test, remove the product associated with the valve from service and notify the appropriate person. If shear valves have not been tested in the last 12 months, notify the appropriate person.

☑ **7.6.16 Checklist Item: Stage II piping functional or else capped and sealed at an elevation lower than the fuel dispenser island.** If present, verify that Stage II vapor recovery piping is either in service or else equipped with a vapor tight cap at a level that is below the top surface of the fuel dispenser island. If inactive vapor piping is not properly capped, notify the appropriate person.

**NOTE:** Some facilities have Stage II piping that has been installed but is not being used or has been abandoned because Stage II vapor recovery is no longer required. Unused or abandoned piping must be securely capped to prevent the escape of vapors. Refer to PEI/RP300, *Recommended Practices for Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites* for recommended procedures for abandoning Stage II vapor recovery piping.

☑ **7.6.17 Checklist Item: Submersible pump head, flex connector(s) and other metallic product piping are not in contact with soil or water or are cathodically protected.** The submersible pump head should be exposed and not in contact with soil or water. Make sure that any flexible connectors present are not in contact with soil or water unless they are protected from corrosion by a moisture-proof covering that is in good condition, a water-tight boot or a cathodic protection system. If the submersible pump head is in contact with soil or water and is not protected by a cathodic protection system, notify the appropriate person. If flexible connector(s) or any other metallic product piping are in contact with soil or water and are not protected from corrosion by a moisture-proof covering or a cathodic protection system, notify the appropriate person.

☑ **7.6.18 Checklist Item: Single-walled sump tested for integrity every 3 years.** Single-walled containment sumps must be tested every 3 years to be sure they are liquid tight. Either test the single-walled sump(s) in accordance with PEI/RP1200, or verify that testing has been completed in the last 36 months. Record the date of the test on the checklist. If the sump failed the test or passing test documentation is not available, notify the appropriate person. If a test of single-walled containment sumps is due within the next 12 months, notify the appropriate person.

**NOTE:** Only containment sumps used for leak detection and enclosing product piping require testing. If a method other than interstitial monitoring is used for leak detection or the piping in the sump is not product piping (e.g., a transition sump containing only vent piping), then the containment sump does not need to be tested for tightness.

**NOTE:** Periodic tightness testing of single-walled containment sumps is a new requirement in the 2015 amendments to the federal tank regulations. The date by which the first tightness test must be completed is different in different jurisdictions. Consult the AHJ to determine when the first tightness test of single-walled containment sumps must be completed.

**✓7.6.19 Checklist Item: If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years.** If the integrity of a double-walled containment sump is not continuously monitored using a sensor (see Section 7.7.1) or not visually inspected annually (see Section 7.7.6), it must be tightness tested every 3 years. If periodic tightness testing is required, test the double-walled sump in accordance with PEI/RP1200, or verify that testing has been completed in the last 36 months. Record the date of the test on the checklist. If the sump failed the test or passing test documentation is not available, notify the appropriate person. If a test of double-walled containment sumps is due within the next 12 months, notify the appropriate person.

**✓7.6.20 Checklist Item: Piping interstitial space open to the STP or fill containment sump (open double-walled piping system only).** If an open-type double-walled piping system is installed, verify that the interstitial space of the piping is open so that liquid can flow from the piping interstitial space into the STP or fill containment sump. Test boots and test donuts may be left in their test positions if the Schrader valve sealing pin is unscrewed and removed and the Schrader valve stem is pointed downward. See Figure 7-4. If the test boot has no Schrader valve, verify that the test boot opening is pointed downward and there are no extension tubes or caps attached to the test boot opening that would prevent even a small amount of leaked fuel from flowing readily into the containment sump.

If an open-type double-walled piping system is installed and leaked product from the piping interstitial space cannot readily flow into the containment sump, notify the appropriate person.

**✓7.6.21 Checklist Item: Piping interstitial space open to the dispenser sump or dispenser pan (open double-walled piping system only).** If an open-type double-walled piping system is installed, verify that the interstitial space of the piping is open to the dispenser sump or dispenser pan so that liquid can readily flow from the sump into the piping interstitial space. If an open-type double-walled piping system is installed and leaked product cannot readily flow from the dispenser sump or dispenser pan into the interstitial space of the piping, notify the appropriate person.

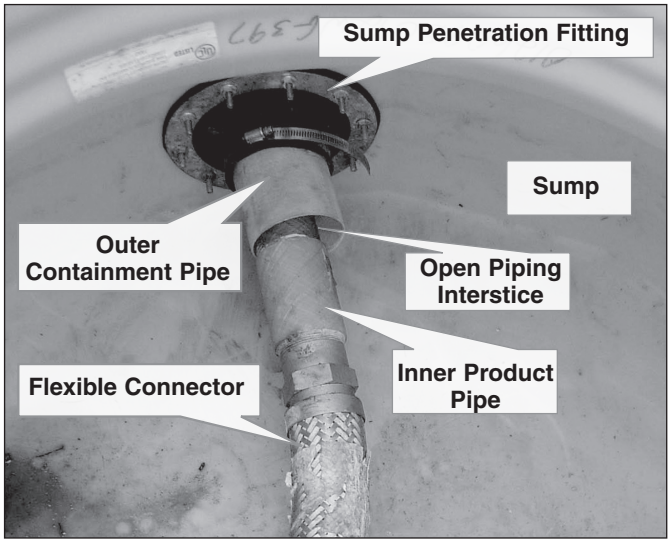


**FIGURE 7-3.** *If the piping interstice is monitored using an "open" system, any liquid leaked from the piping must be free to flow into a sump where the liquid can be detected by a sensor. Verify that the interstice of the piping is open to the sump.*

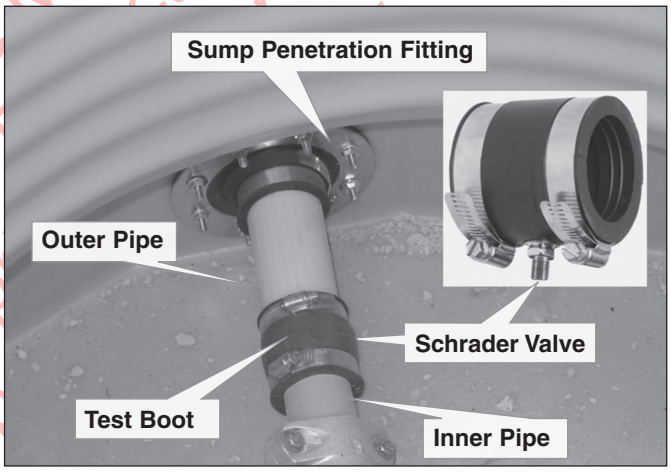


**FIGURE 7-4.** *Test boots can be left in place as long as fuel leaks from the piping can readily flow into the sump. In this case, the poppet has been removed from the Schrader valve and the test boot is oriented so that the Schrader valve points downward.*

**✓7.6.22 Checklist Item: Piping interstitial space closed to the sumps at both ends of the piping (closed double-walled piping system only).** If a closed-type double-walled piping system is installed, verify that the interstitial space of the piping is sealed so that liquid cannot readily flow from the interstitial space of the piping into an STP or fill sump, or from a dispenser sump or dispenser pan into the piping interstitial space. If a closed-type double-walled piping system is installed but the interstitial space of the piping is

not sealed off from the containment sumps at both ends of the piping, notify the appropriate person.

**✓7.6.23 Checklist Item: Sump lid, gasket and seals present and in good condition.** Check the condition of the sump lid. It should be in good condition, free of cracks, with all seals and gaskets present, and without tears or breaks. If there are any defects in the sump lid, seals or gaskets, notify the appropriate person.

**✓7.6.24 Checklist Item: Manhole cover at grade in good condition, does not touch sump cover, all bolts present, handles and lift mechanism in good condition (as applicable).** Check the manhole cover to be sure that it fits securely, it is in good condition, and there is clearance between the manhole cover and the sump cover or below-grade equipment. If there are bolts missing from the cover, or handles intended for lifting the cover have broken off or are in poor condition, notify the appropriate person. If the manhole cover does not fit properly or if there is not sufficient clearance between the manhole cover and the sump cover or below-grade equipment, notify the appropriate person. If the manhole cover includes a spring mechanism to assist in opening the cover, check to see that it is operating properly. If the mechanism is not operating properly, notify the appropriate person.

**7.7 Identifying the steps required for a leak detection device inspection.** Refer to Table 7-2 to identify which of the inspection steps in this Section need to be completed for the type(s) of leak detection devices present at the facility. The top row of Table 7-2 lists the various types of leak detection devices that may be present at typical USTs. The column beneath each type of device indicates with an "X" the checklist items in this Section that may apply to each type of leak detection device. To complete the leak detection device inspection, follow the instructions in the sections below that are applicable to each type of leak detection device present at the facility.

**✓7.7.1 Checklist Item: Sensor tested and functional.** Test the sensor according to the procedures described in PEI/RP1200 or manufacturer instructions that are applicable to the type of sensor present, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If no passing sensor test results completed in the last 12 months are available or if a sensor tested during the inspection failed, notify the appropriate person.

**✓7.7.2 Checklist Item: Alarm sounds when pressure or vacuum is released.** If a closed-type double-walled piping system or a double-walled containment sump using a pressure or vacuum leak detection system is present, test the operation of the leak detection system in accordance with manufacturer instructions, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If the leak detection system has not passed a test in the last 12 months or if the leak detection system failed the test conducted during the inspection, notify the appropriate person.



**Leak Detection Device Inspection Steps**

| Section | Liquid Sensor | Discriminating Sensor | Hydrostatic Sensor | Vacuum/ Pressure Sensor | Visually Monitored Double-Walled Sump | Dispenser Pan Float Mechanism |
|---|---|---|---|---|---|---|
| 7.7.1 | X | X | X | X | | X |
| 7.7.2 | | | | X | | |
| 7.7.3 | X | X | | | | |
| 7.7.4 | X | X | | | | |
| 7.7.5 | | | X | | | |
| 7.7.6 | | | | | X | |
| 7.7.7 | | | | X | | |
| 7.7.8 | | | | | | X |

**TABLE 7-2.** *The top row of this table lists the various types of leak detection devices that may be present at typical USTs. The column beneath each type of device indicates with an "X" the checklist items in Section 7.7 that may apply to each type of leak detection device. To complete the leak detection device inspection, follow the instructions in the sections listed in the left column that are applicable to each type of leak detection device present at the facility.*

**FIGURE 7-5.** *Verify that sump sensors are mounted vertically and in contact with the bottom of the sump. Test the operation of the sensor to verify that it is functional.*

**7.7.3 Checklist Item: (Containment sump or pan sensor only) Liquid or discriminating sensor properly mounted at the bottom of the containment sump or pan.** If the sump or pan has a flat bottom, verify that the liquid or discriminating sensor is securely mounted in contact with the bottom of the containment sump or pan. If the tank shell forms the bottom of the sump, there will be two low points in the containment sump. The liquid or discriminating sensor should be securely mounted in the low part of the sump nearest the point where the product piping enters the sump. If the sensor relies on a float switch to trigger an alarm, the sensor must be mounted vertically. If the sensor is not properly positioned, notify the appropriate person.

**7.7.4 Checklist Item: (Double-walled tank sensor only) Liquid or discriminating sensor properly mounted at the bottom of double-walled tank.** If the double-walled tank is steel, verify that the sensor is installed at the bottom of the vertical monitoring riser. If the double-walled tank is fiberglass, verify that the sensor is installed at the bottom of the tank interstitial space. If the sensor is not properly positioned, notify the appropriate person.

**7.7.5 Checklist Item: Hydrostatic sensor properly positioned.** Hydrostatic sensors installed in double-walled tanks should rest at the bottom of the tank reservoir. Hydrostatic sensors installed in double-walled sumps should be mounted according to sump manufacturer instructions. If the sensor is not properly positioned, notify the appropriate person.

**7.7.6 Checklist Item (visually monitored sumps): Leak detection device is within recommended limits.** If local regulations allow, double-walled containment sumps can be monitored visually. Verify that the reading on the vacuum or pressure gauge, or level of hydrostatic monitoring fluid in the sump reservoir is within the limits recommended by the manufacturer of the sump. If the vacuum, pressure or level of hydrostatic monitoring fluid is not within the limits recommended by the manufacturer, notify the appropriate person.

**NOTE:** The integrity of double-walled sumps must be checked at least annually or else the sump must be tightness tested every 3 years. See Section 7.6.19.

**7.7.7 Checklist Item: Entire interstitial space under pressure or vacuum (closed double-walled piping system only).** If a closed-type double-walled piping system is present, test the entire interstice to determine whether pressure or vacuum is maintained in accordance with piping manufacturer instructions, or verify that testing has been completed in the last 12 months. Record the date of the test on the checklist. If the piping system failed the most recent test or if no test results are available, notify the appropriate person.

**7.7.8 Checklist Item: Dispenser pan float mechanism free to move and properly adjusted.** Some fuel dispenser pans are equipped with a float mechanism that is linked with a chain to the trip arm of the shear valve so that the presence of liquid will close the shear valve. If this type of float mechanism is present, test the float mechanism in accordance with manufacturer instructions, or verify that testing has been completed in the last 12 months. Record the date of the passing test on the checklist. If no passing test results are available or if the float mechanism is tested during the inspection and fails, notify the appropriate person.

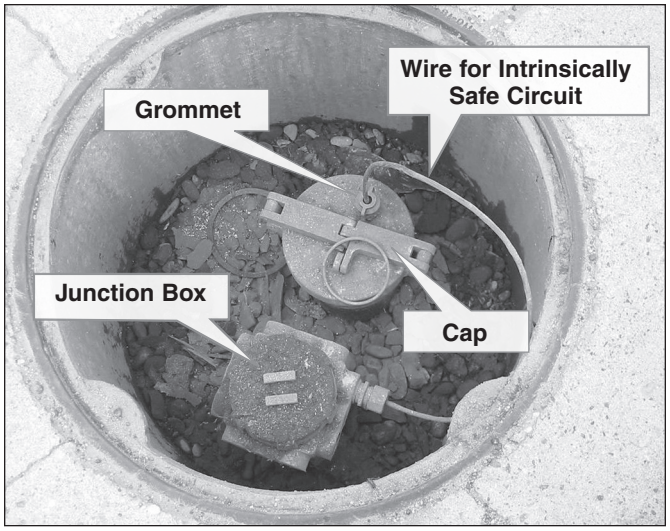


**FIGURE 7-6.** *The cap of the ATG probe should be in good condition and seal tightly. The grommet around the probe wire as it passes through the cap should be tight to prevent the escape of vapors. Because the ATG probe uses an intrinsically safe circuit, the probe wire does not need to be enclosed in conduit. The electrical junction box should be in good condition and liquid-tight to prevent moisture from affecting the connections inside the box.*

**7.8 Automatic Tank Gauge (ATG) Manhole.** Storage tanks equipped with an ATG will typically have a grade-level manhole cover to access the tank level-sensing probe. The probe riser may also be located within a STP or fill sump. Check the ATG manhole in the following manner.

✓**7.8.1 Checklist Item: Cap in good condition, seals tightly, hole sealed where probe wire goes through.** Check to be sure the cap on the probe riser is in good condition, seals tightly to the riser and that the hole where the probe wire goes through the cap is sealed as well. If the cap is in poor condition, the cap does not seal tightly on the riser or the probe wire does not seal tightly where it goes through the cap, notify the appropriate person.

✓**7.8.2 Checklist Item: Wire splices sealed and wire in good condition.** Wire splices between the ATG probe wire and the wire running to the facility should be within a seal pack or similar device to keep moisture out of the connection. If the splice is not enclosed in a junction box, verify that the probe wire is in good condition and that wire splices are sealed according to ATG manufacturer instructions. If the probe wire is not in good condition or if the splice is not according to manufacturer instructions, notify the appropriate person.

✓**7.8.3 Checklist Item: Junction box has cover, not corroded; intrinsically safe wiring in good condition.** Check external surfaces of the electrical junction box and conduit for excessive corrosion or other damage. If wiring is present that is not inside conduit, check that this wiring is in good condition. If junction boxes or conduit are in poor condition, notify the appropriate person. If intrinsically safe wiring is damaged, frayed or not in good condition, notify the appropriate person.

✓**7.8.4 Checklist Item: No exposed wires.** Some ATG probe wires are direct-buried in shallow saw cuts in the pavement and sealed with caulk. If any of these wires become exposed at the surface, they can be damaged and interfere with the operation of the probe. Inspect the pavement in the vicinity of the ATG manhole for evidence of saw cuts. If saw cuts are present, inspect them for exposed wires. If any exposed wires are present, notify the appropriate person.

✓**7.8.5 Checklist Item: Probe and floats in good condition, both floats present and move freely (magnetostrictive probe).** For magnetostrictive probes, follow the procedures described in PEI/RP1200 to evaluate the condition of the probe and floats, or verify that these procedures have been conducted within the last 12 months. Record the date of the ATG probe inspection on the checklist. If no inspection results are available, or if problems are identified with the probe or the floats, notify the appropriate person.

✓**7.8.6 Checklist Item: Verify functionality of ATG probe.** Follow the procedures described in PEI/RP1200 to evaluate the functionality of the probe, or verify that these procedures have been conducted within the last 12 months. Record the date of the ATG probe functionality inspection on the checklist. If no functionality inspection results are available or if problems are identified with the function of the probe, notify the appropriate person.

✓**7.8.7 Checklist Item: ATG Manhole cover in good condition.** Check the ATG manhole cover to be sure it fits securely and is in good condition. If the cover does not fit securely or is in poor condition, notify the appropriate person.

**☑7.8.8 Checklist Item: Adequate clearance between ATG grade-level cover and below-grade components.** Improper tank backfill procedures may result in settlement of the concrete pad over the tank. This can cause the grade-level cover over the ATG probe riser to rest on the ATG probe cap, the electrical junction box, or other subsurface components. Contact between the grade-level cover and subsurface components, especially the ATG probe wire and ATG cap, can damage these components. If the grade-level cover touches any subsurface components, notify the appropriate person.

**7.9 Fill Area.** The following checklist items are located in the area around the fill opening of an underground tank.

**☑7.9.1 Checklist Item: Drop tube extends to within 6 inches of the tank bottom (if no flow diffuser present).** Verify that the drop tube is within 6 inches of the bottom of the tank. The lower end of a drop tube is typically cut at an angle. The 6-inch measurement is from the bottom of the tank to the highest point on the lower end of the drop tube. If the drop tube is too short, notify the appropriate person.

**NOTE:** Some drop tubes may be equipped with flow-diffuser devices at the lower end. These diffusers rest on the bottom of the tank and the 6-inch measurement from the bottom of the tank does not apply.

**☑7.9.2 Checklist Item: Poppet of Stage I vapor recovery adaptor (also known as a "dry break") moves freely, seals tightly.** Remove the vapor recovery cap. Beneath the cap is a spring-operated valve (poppet) that should be closed to prevent the escape of vapors. Briefly press down on the disk in the middle of the vapor recovery adaptor to open the valve. Avoid exposure to fuel vapors that may escape when the poppet is pressed. Release the disk and observe that the valve quickly closes. There should be no vapors escaping from around the valve when it is closed. If the disk does not move freely or seal tightly, notify the appropriate person.

**NOTE:** Vapor recovery fittings are sometimes propped open with small sticks, stones, screwdrivers or other objects. This is dangerous because it can allow flammable vapors to escape from the underground tank. If you discover that the vapor recovery poppet has been propped open, notify the appropriate person.

**NOTE:** AHJs may have different requirements for inspecting Stage I vapor recovery adaptors.

**☑7.9.3 Checklist Item: Single-walled spill containment manhole tightness tested within the last 3 years.** Single-walled spill containment manholes must be tested every 3 years to be sure they are liquid tight. Test single-walled spill containment manholes according to the procedures in PEI/RP1200, or verify that testing has been completed in the last 36 months. Record the date of the test on the checklist. If no test results are available or if the most recent test failed, notify the appropriate person. If a test of single-walled spill containment manholes is due within the next 12 months, notify the appropriate person.

**NOTE:** Periodic tightness testing of single-wall spill containment manholes is a new requirement in the 2015 amendments to the federal tank regulations. The date by which the first tightness test must be completed is different in different states. Consult the AHJ to determine the date by which the first tightness test of single-walled spill containment manholes must be completed.

**☑7.9.4 Checklist Item: Double-walled spill containment manhole tightness tested within the last 3 years OR inspected monthly.** Double-walled spill containment manholes must be tested every 3 years to be sure they are liquid tight UNLESS they are inspected on a monthly basis (see Section 6.6.3.2). Test double-walled spill containment manholes according to the procedures in PEI/RP1200, or verify that testing has been completed in the last 36 months. Record the date of the test on the checklist. If no test results are available or if the most recent test failed, notify the appropriate person. If a test of double-walled spill containment manholes is due within the next 12 months, notify the appropriate person.

**NOTE:** Periodic tightness testing or monthly inspection of double-walled spill containment manholes is a new requirement in the 2015 amendments to the federal tank regulations.

The date by which the first tightness test must be completed or when periodic inspections must begin is different in different states. Consult the AHJ to determine the date by which the first tightness test of double-walled spill containment manholes must be completed or periodic inspections must begin.

**7.10 Overfill Prevention.** There are three types of commonly installed overfill prevention devices. Typically, only one type of overfill device is required.

**7.10.1 Drop Tube Shutoff.** If a tank has a drop tube shutoff valve (often called a flapper valve) installed, check the shutoff valve in the following manner.

✓**7.10.1.1 Checklist Item: Drop tube shutoff valve passes inspection.** Evaluate the drop tube shutoff valve according to the procedures in PEI/RP1200 or verify that the shutoff valve has been evaluated in the last 12 months. Record the date of the evaluation on the checklist. If no evaluation results are available or if the most recent evaluation failed, notify the appropriate person.

✓**7.10.1.2 Checklist Item: For drop tube shutoff valves in diesel tanks, excessive corrosion not present.** Corrosion on the moving parts of drop tube shutoff valves may interfere with the operation of the valve. Refer to Appendix B for a discussion of the likely causes and possible approaches to reducing this corrosion. If excessive corrosion is present on the drop tube shutoff valve, notify the appropriate person.

**7.10.2 Ball Float Valve.** If a ball float valve is used for overfill prevention, check the ball float valve in the following manner.

**NOTE:** It is the intent of the 2015 amendments to the federal UST regulations to phase out the use of ball floats as overfill prevention devices. Ball float valves may not be used for overfill prevention on storage systems installed after the regulations go into effect. In addition, if a ball float fails the inspection after the effective date of the regulations, it may not be replaced or repaired. A drop tube shutoff device or an overfill alarm must be used instead. The effective date of the regulations will be different in different states. Check with the AHJ to determine the effective date of the regulations.

✓**7.10.2.1 Checklist Item: Ball float can be removed and inspected.** The ball float valve should be able to be removed using an extractor fitting so that it can be inspected. If the ball float valve cannot be removed and inspected, notify the appropriate person.

✓**7.10.2.2 Checklist Item: Ball float valve passes inspection.** Evaluate the ball float valve according to the procedures in PEI/RP1200, or verify that the ball float valve has been evaluated in the last 12 months. Record the date of the evaluation on the checklist. If no evaluation results are available or if the most recent evaluation failed, notify the appropriate person.

✓**7.10.2.3 Checklist Item: For ball float valves in diesel tanks, excessive corrosion not present.** Corrosion on the cage or tube of a ball float valve may interfere with the operation of the valve. Refer to Appendix B for a discussion of the likely causes and possible approaches to reducing this corrosion. If excessive corrosion is present on the ball float valve, notify the appropriate person.

**7.10.3 Overfill Alarm.** Check the overfill alarm in the following manner.

✓**7.10.3.1 Checklist Item: Overfill alarm passes inspection.** Evaluate the overfill alarm according to the procedures in PEI/RP1200, or verify that the overfill alarm has been evaluated in the last 12 months. Record the date of the evaluation on the checklist. If no evaluation results are available or if the most recent evaluation failed, notify the appropriate person.

**7.11 Leak Detection.** Routine leak detection is required on all active motor fuel storage systems. It is important to verify that leak detection equipment installed is operational and that there are no active warnings or alarms. Leak detection inspection for USTs using secondary containment with interstitial monitoring is

covered in Sections 7.6 and 7.7 of this chapter. Inspection of all other methods of leak detection is described in this Section. Consult with the owner to determine which method of leak detection is being used to meet leak detection requirements. If multiple leak detection methods are in use, verify that all methods are operating properly. Any leak detection method in use that indicates a possible release must be investigated.

**7.11.1 ATG Console.** ATGs can be used to meet regulatory requirements for leak detection in a variety of ways, including:

- the tank gauge can run periodic or continuous tests of the liquid level in the tank to see if there is a leak;
- if an electronic line leak detector is installed, the tank gauge can monitor the piping to detect 3.0, 0.2 and 0.1 gph leaks;
- if the tank is double-walled, the tank gauge can monitor a sensor in the tank interstitial space;
- if there are containment sumps at the facility, the tank gauge can monitor sensors in these locations;
- if there are sensors installed in observation wells, the tank gauge can be used to monitor for the presence of product in groundwater or increases in product soil vapor levels.

Regardless of the leak detection method used by the ATG, it is important to verify that the chosen leak detection method is working properly. Check ATG leak detection in the following manner.

☑ **7.11.1.1 Checklist Item: ATG passes annual inspection.** Evaluate the ATG according to the procedures in PEI/RP1200 or verify that the ATG has been evaluated in the last 12 months. Record the date of the evaluation on the checklist. If no evaluation results are available or if the most recent evaluation of the ATG failed, notify the appropriate person.

☑ **7.11.1.2 Checklist Item: Console has no active warnings or alarms.** Verify that the console has no active warnings or alarms regarding leak detection or proper functioning of the tank gauge. If any of these types of alarms are present, notify the appropriate person.

**NOTE:** If a leak-related alarm is present, notify the appropriate person immediately.

☑ **7.11.1.3 Checklist Item: Alarm history shows no recurring leak alarms.** Review the alarm history and verify that there are no leak-related alarms. If failed tank or line tests or sensor alarms are occurring repeatedly, check to be sure that the tank gauge is properly programmed and discuss the alarms with facility personnel to determine why they are occurring. If sensor alarms are due to water intrusion into sumps, notify the appropriate person. If there is no apparent explanation for failed tests, notify the appropriate person that the failed tests must be investigated.

**NOTE:** Small leaks can be a cause of intermittent failure of tank or line tests. Do not ignore failed tests.

☑ **7.11.1.4 Checklist Item: Verify in-tank leak detection tests are being completed (if used for leak detection).** If the tank gauge is conducting in-tank testing to meet leak detection requirements, verify that the tank gauge has been completing these tests and that the results are passing. If tests are not passing, are inconclusive or are not being conducted, notify the appropriate person.

☑ **7.11.1.5 Checklist Item: Verify correct setup parameters for electronic line leak detector (if present).** If electronic line leak detectors are installed, verify the line leak detector setup parameters according to the procedures in PEI/RP1200, or verify that these parameters have been evaluated in the last 12 months. Record the date of the verification on the checklist. If no verification results are available or if the line leak detector setup parameters are not correct, notify the appropriate person.

☑ **7.11.1.6 Checklist Item: Verify piping leak detection tests are being completed (if used for leak detection).** If the tank gauge is equipped with an electronic line leak detector that con-

ducts piping testing to meet leak detection requirements, verify that these tests have been completed and that the results are passing. If tests are not passing, are inconclusive or are not being conducted, notify the appropriate person.

**7.11.2 Electronic Leak Detection Monitor.** If a facility is equipped with a leak detection monitor that does *not* include a tank gauging function, use the following procedure to verify the operation of the monitor.

**☑7.11.2.1 Checklist Item: Leak monitoring console is operational and has no active warnings or alarms.** Verify that the console is operational and that there are no active warnings or alarms regarding leak detection or proper functioning of the leak monitor. Consult manufacturer instructions to determine if there are any specific inspection requirements. If any alarms are present or the monitor is not operating properly, notify the appropriate person.

**NOTE:** If a leak-related alarm is present, notify the appropriate person immediately.

**7.11.3 Line Tightness Testing.** Line tightness testing conducted annually for pressurized piping and every 3 years for American suction piping is another method that can be used for meeting piping leak detection requirements. If line tightness testing is used for leak detection at a facility, check the following.

**☑7.11.3.1 Checklist Item: If pressurized piping has been tested in the last year, review the results and verify that the test passed.** If the pressurized piping has been tested within the last 12 months, review the test results and verify that the piping passed the test. Record the date of the test on the checklist. If a piping test is due, notify the appropriate person.

**☑7.11.3.2 Checklist Item: If suction piping has been tested within the last 3 years, review the results and verify that the test passed.** If the suction piping has been tested within the last 36 months, review the test results and verify that the piping passed the test. Record the date of the test on the checklist. If a piping test is due in the next 12 months, notify the appropriate person.

**☑7.11.3.3 Checklist Item: ELLD has conducted a 0.1 gph test in the last year.** If an ELLD is used to meet annual leak detection requirements for the piping, verify that the ELLD has successfully completed a 0.1 gph leak test of the piping within the last 12 months. Record the date of the leak test on the checklist. If no ELLD leak test results for the piping are available, or if the most recent test failed, notify the appropriate person.

**7.11.4 Safe Suction Systems (also called European suction.)** Suction pumping systems with a single check valve located immediately below the pump do not need to conduct any additional leak detection. The following three checklist items must be present for this type of construction to qualify as leak detection.

**☑7.11.4.1 Checklist Item: Below-grade piping operates at less than atmospheric pressure.** The pump must be located higher than the tank. This should be true at most underground tank facilities but may not be true at marinas or in hilly terrain where the pump can be at a lower elevation than the tank. If the pump is located below the top of the tank, notify the appropriate person.

**☑7.11.4.2 Checklist Item: Below-grade piping slopes continuously back to the tank.** Consult site plans, blueprints or photographs taken at the time of construction to determine whether the piping was designed to slope continuously back to the tank. In some cases, it may be necessary to use professional judgment to determine the slope of the piping. If the piping does not appear to slope continuously back to the tank, notify the appropriate person.

**☑7.11.4.3 Checklist Item: There is only one check valve, and it is located as close as practicable to the suction pump.** There must not be a foot valve at the bottom of the suction stub or a check valve at the top of the tank. The only check valve present must be located as close as

practicable to the suction pump. If more than one check valve is present in the suction piping, notify the appropriate person.

**7.11.5 Tank Tightness Testing.** Tank tightness testing every 5 years may be used in conjunction with inventory control for tank leak detection purposes for tanks that are 10 years old or less.

**NOTE:** This is a test of the primary tank, NOT a test of the integrity of the interstitial space of a double-walled tank.

**NOTE:** Check with the AHJ as to the applicability of this method of leak detection. Many states require that interstitial monitoring be used for leak detection on all tanks installed after a certain date.

☑ **7.11.5.1 Checklist Item: Tank is 10 years old or less.** This method of leak detection may not be used on tanks that are older than 10 years. If the tank installation date is 11 years or more in the past, notify the appropriate person.

☑ **7.11.5.2 Checklist Item: If a tank test has been conducted within the last 5 years, review the results and verify that the test passed.** If the tank has been tested within the last 60 months, review the test results and verify that the tank passed the test. Record the date of the test on the checklist. If a tank test is due within the next 12 months, notify the appropriate person.

**7.11.6 Statistical Inventory Reconciliation (SIR).** SIR is a method of leak detection that applies statistical techniques to inventory data to evaluate whether a leak may be present in a tank or piping.

☑ **7.11.6.1 Checklist Item: SIR results for the previous 12 months are "pass."** If the storage system is using SIR for leak detection, review the last 12 months of SIR results and verify that results for all storage systems are present and that the results "pass." There should be no "fail" or "inconclusive" results. If any SIR results for the previous 12 months are missing or indicate "fail," or "inconclusive," notify the appropriate person.

**NOTE:** According to federal guidelines, a leak must be identified within 30 days when using SIR for compliance with leak detection requirements. If a SIR vendor requires 30 days of inventory data plus another 5 days to do the analysis and return the results to the facility, then this is a period of 35 days, which is not consistent with federal guidelines. Consult with the SIR vendor if the number of days of inventory data plus the number of days required to receive the results of the analysis is greater than 30.

**NOTE:** An inconclusive SIR result indicates that leak detection has not been conducted for that month and is a violation of federal leak detection regulations. The storage system owner should consult with the SIR provider on how to eliminate inconclusive SIR results.

**NOTE:** Some AHJs have additional requirements when SIR is used for leak detection.

**7.11.7 Continuous Soil Vapor Monitoring (SVM).** Continuous SVM is a leak detection technique that uses a sensor to monitor the product vapor level in the environment around a storage system to determine if a leak is present.

☑ **7.11.7.1 Checklist Item: Sensing device tested.** If a permanently installed soil vapor sensor is used for leak detection, test the sensor according to the procedures in PEI/RP1200, or verify that the sensor has been tested in the last 12 months. Record the date of the test on the checklist. If no test results are available or if the most recent test of the soil vapor sensor failed, notify the appropriate person.

**7.11.8 Continuous Groundwater Monitoring (GWM).** Continuous GWM is a leak detection technique that uses a sensor in an observation well to monitor for the presence of liquid product floating on the water table. Check the sensor in the following manner.

☑ **7.11.8.1 Checklist Item: Sensing device tested.** If a permanently installed groundwater sensor is used for leak detection, test the sensor according to the pro-

cedures in PEI/RP1200, or verify that the sensor has been tested in the last 12 months. Record the date of the test on the checklist. If no test results are available or if the most recent test of the groundwater sensor failed, notify the appropriate person.

**7.12 Corrosion Protection.** If a facility is using cathodic protection to protect any buried metal component from corrosion, the cathodic protection system should be tested to verify that it is meeting an accepted criterion for cathodic protection.

**7.12.1 Galvanic Cathodic Protection.** Galvanic cathodic protection uses coatings, sacrificial anodes and electrical isolation to protect metallic tanks and product piping from external corrosion. The AHJ may require cathodic protection on additional storage system components. Check galvanic cathodic protection systems in the following manner.

✓**7.12.1.1 Checklist Item: Verify that cathodic protection testing of all metallic components in contact with soil or water has been conducted within the past 3 years and the test passed.** Confirm that cathodic protection testing has been conducted within the past 3 years or the time frame required by the AHJ. Record the date of the testing on the checklist. Notify the appropriate person if any of the following conditions exist:

- cathodic protection testing has not been conducted;
- cathodically protected components were omitted from the cathodic protection testing (e.g., flex connectors);
- the cathodic protection test shows failing results; or
- the cathodic protection test results are not clearly stated.

**NOTE:** Federal rules specify that cathodic protection systems be tested every 3 years, but a number of AHJs require cathodic protection testing on a more frequent basis. In some jurisdictions, the AHJ may allow less frequent testing of cathodic protection systems on double-walled steel tanks. Check with the AHJ to determine the required frequency of cathodic protection testing.

**7.12.2 Impressed-Current Cathodic Protection.** Impressed-current cathodic protection uses a rectifier and anodes to protect metallic tanks and piping from external corrosion. Check impressed-current cathodic protection in the following manner.

✓**7.12.2.1 Checklist Item: Verify that cathodic protection testing has been conducted within the past 3 years and the test passed.** Confirm that cathodic protection testing has been conducted within the past 3 years or the time frame required by the AHJ. Record the date of the testing on the checklist. If cathodic protection testing has not been conducted, the cathodic protection test shows failing results, or the results are not clearly stated, notify the appropriate person.

✓**7.12.2.2 Checklist Item: No exposed wires.** Many impressed-current cathodic protection systems use wires buried in shallow saw cuts in the pavement. If any of these wires are exposed, they can be damaged, which will cause the impressed-current system to fail to operate as designed. Inspect the pavement in the vicinity of the tanks and piping runs for evidence of saw cuts. If saw cuts are present, inspect them for exposed wires. If any exposed wires are present, notify the appropriate person.

**7.12.3 Internal Tank Lining.** Internal tank lining is a corrosion protection measure that uses a thick coating applied to the inside of the tank to provide protection against corrosion. Check internal tank lining in the following manner.

✓**7.12.3.1 Checklist Item: Lining inspected as required and in good condition.** If a storage tank has been internally lined, verify that a qualified contractor has inspected the lining in the time frame required by the AHJ. Record the date of the inspection on the checklist. If the lining has not been inspected as required, the lining inspection shows failing results or the results of the lining inspection are not clearly stated, notify the appropriate person.

**NOTE:** Regulations typically require that tank linings be inspected ten years after installation and every 5 years thereafter.

**7.13 Miscellaneous Inspection Items.** Following are several items that should be inspected if present at a facility.

**7.13.1 Condition of Tank Pad and Surrounding Pavement.** Serious cracking of the concrete pad over the tanks or settling of asphalt pavement, especially around the edges of the tank pad, may be a sign of a potential problem with underground storage system integrity. Further investigation may be warranted. Check the tank pad and pavement in the following manner.

☑ **7.13.1.1 Checklist Item: Concrete or asphalt over or near tanks is level, no significant cracks.** If the tank pad concrete has cracked significantly or the asphalt adjacent to the tank pad has settled substantially, notify the appropriate person.

**7.13.2 Stage II Liquid Collection Points.** Some facilities equipped with Stage II vapor recovery where the vapor piping could not be installed with a continuous slope from the fuel dispenser to the tank field have a liquid collection point (also known as drop-out tank, condensate trap or vapor pot) in the vapor piping run. A small-diameter tube from the submersible pump suction port is typically used to remove product from this liquid collection point. It is important to verify that no significant amount of liquid is accumulating in the liquid collection point. Check liquid collection points in the following manner.

☑ **7.13.2.1 Checklist Item: Cap in good condition, fits tightly, little or no liquid in bottom.** If a facility is equipped with a liquid collection point, make sure the cap is in good condition and fits tightly and that there is little or no liquid gasoline at the bottom. If the cap does not seal tightly or there is a significant amount of liquid in the bottom of the liquid collection point, notify the appropriate person.

**7.13.3 Stage I Vapor Recovery Testing.** Stage I vapor recovery equipment captures fuel vapors from USTs during fuel deliveries and channels the vapors to the tank truck delivering the fuel. In most jurisdictions, Stage I equipment must be tested periodically to establish that it is working properly and the UST is reasonably vapor tight.

☑ **7.13.3.1 Checklist Item: Verify that Stage I testing has been conducted and test results are passing.** Confirm that Stage I vapor recovery testing has been conducted. The type of tests and the testing frequency vary among different jurisdictions. Check with the AHJ to determine what tests are required and how often they must be conducted. Record the date of the test on the checklist. If Stage I testing has not been conducted, the Stage I testing shows failing results or the results are not clearly stated, notify the appropriate person.

**NOTE:** Stage I vapor recovery may not be required at low-throughput facilities. Check with the AHJ to determine which facilities are required to have Stage I vapor recovery.

**7.13.4 Stage II Vapor Recovery Testing.** Stage II vapor recovery equipment captures fuel vapors from automobile tanks during refueling and channels the vapors to the underground tanks. In most jurisdictions, Stage II equipment must be tested periodically to establish that it is working properly.

☑ **7.13.4.1 Checklist Item: Verify that Stage II testing has been conducted and test results are passing.** Confirm that Stage II vapor recovery testing has been conducted. The type of tests and the testing frequency vary among different jurisdictions, so check with the AHJ to determine what tests are required and how often they must be conducted. Record the date of the test on the checklist. If Stage II testing has not been conducted, the Stage II testing shows failing results or the results are not clearly stated, notify the appropriate person.

**NOTE:** Some facilities have Stage II piping that has been installed but is not being used or has been abandoned because Stage II vapor recovery is no longer required. Unused or abandoned piping must be securely capped

to prevent the escape of vapors (see Section 7.6.16). Refer to PEI RP300, *Recommended Practices for Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites* for recommended procedures for abandoning Stage II vapor recovery piping.

**7.13.5 Checking the Site Diagram.** Over time, changes may be made in the types of products stored, hardware configurations, leak detection techniques and other storage system components described on the site diagram. For the diagram to remain useful, the diagram must be kept current so that it accurately depicts the site conditions.

✓**7.13.5.1 Checklist Item: Site diagram accurately reflects the site conditions.** Review the site diagram to verify that the storage systems and associated equipment present at the facility are shown on the diagram. Note any changes on the diagram itself or on the annual inspection checklist. If a site diagram is not available, create a site sketch and attach it to the inspection checklist. (See Appendix A-3 for a sample form.)

# APPENDIX A: CHECKLISTS

Appendix A (pages 53 – 72) contains the following checklists:

- Appendix A-1: Sample Form for Monthly Underground Storage System Inspection Checklist
- Appendix A-2: Sample Form for Annual Underground Storage System Inspection Checklist
  Sample Form for Annual Submersible Turbine Pump Inspection Checklist
  Sample Form for Annual Dispenser Inspection Checklist
  Sample Form for Annual Leak Detection Device Inspection Checklist
  Sample Form for Annual Fill Containment Sump Inspection
  Sample Form for Annual Transition Sump Inspection Checklist
  Sample Form for Annual "Other" Sump Inspection Checklist
- Appendix A-3: Sample Site Plan Form
- Appendix A-4: Sample Form for an Optional Periodic Underground Storage Tank System Inspection Checklist

## APPENDIX A-1: SAMPLE FORM FOR MONTHLY UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST – Page 1

*Go to www.pei.org/RP900 for an electronic version of this form.*

### MONTHLY UST SYSTEM INSPECTION CHECKLIST

| Facility ID# | Facility Name/Address | Qualified Person Signature | Date |
|---|---|---|---|
| | | | |

If any problem is found, contact: _____ Contact information: _____

| Category | Description | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|
| Operator Training | Review site training documents | 6.4 | | | | | |
| **Leak Detection Recordkeeping** | **Circle method of tank leak detection: ATG, CIM, SIR, IC, GWM, SVM, MIMT**<br>**Circle method of piping leak detection: CIM, MPLT, SIR, GWM, SVM, MIMP** | 6.5 | | | | | |
| Automatic Tank Gauge (ATG) | Passing tank test report printed and properly filed | 6.5.1.1 | | | | | |
| Continuous Interstitial Monitoring (CIM) | Sensor status report printed and properly filed | 6.5.2.1 | | | | | |
| Monthly Piping Leak Test (MPLT) | Passing piping leak test report printed/documented and properly filed | 6.5.3.1 | | | | | |
| Statistical Inventory Reconciliation (SIR) | Last month's SIR results passed and available for inspection | 6.5.4.1 | | | | | |
| Inventory Control (IC) | Inventory reconciled and within the company or regulatory standard | 6.5.5.1 | | | | | |
| Manual Groundwater Monitoring (GWM) | Groundwater bailer in good condition | 6.5.6.1 | | | | | |
| Manual Groundwater (GWM) or Soil Vapor Monitoring (SVM) | Wells sampled and results pass | 6.5.6.2 | | | | | |
| Manual Interstitial Monitoring for Tanks (MIMT) | Steel tank: interstitial space checked and found dry | 6.5.7.1 | | | | | |
| | Fiberglass tank: interstitial space checked and found dry | 6.5.7.2 | | | | | |
| | Fiberglass tank: level of monitoring fluid within normal range | 6.5.7.3 | | | | | |
| | For steel and fiberglass tanks, vacuum level is within tolerances<br>Tnk 1 vac: Tnk 2 vac: Tnk 3 vac: Tnk 4 vac: | 6.5.7.4 | | | | | |
| Manual Interstitial Monitoring for Piping (MIMP) | Containment sump (STP and/or remote fill sump) inspected and no liquid found | 6.5.8.1 | | | | | |
| **All Tanks** | | 6.6 | | | | | |
| Spill Kit | All components of the spill kit are present and in good condition | 6.6.1 | | | | | |
| Grade-Level Covers | All covers present, in good condition, seated firmly on the correct tank | 6.6.2.1 | | | | | |
| Spill Containment Manhole | Drain valve in spill containment manhole in good condition | 6.6.3.1 | | | | | |
| | Interstitial space of double-walled containment manhole is dry | 6.6.3.2 | | | | | |

## APPENDIX A-1: SAMPLE FORM FOR MONTHLY UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST – Page 2

*Go to www.pei.org/RP900 for an electronic version of this form.*

| Category | Description | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|
| Drop Tube | Standard drop tube smooth, no ragged edges, in good condition | 6.6.4.1 | | | | | |
| | Top edge of coaxial drop tube smooth, round, slightly below the top edge of the fill pipe | 6.6.4.2 | | | | | |
| Tank Gauge Stick | Tank gauge stick can be clearly read, is not warped or broken | 6.6.5.1 | | | | | |
| Check for Water | No water present in the tank | 6.6.6.1 | | | | | |
| Tank Vents | Vent cap present, vent pipe solidly supported and vertical | 6.6.7.1 | | | | | |
| **Stage I Vapor Recovery** | | 6.7 | | | | | |
| Two-Point (Dual-Point) Vapor Recovery | Cover present, colored orange, seated firmly at grade, not broken, cracked or chipped | 6.7.1.1 | | | | | |
| | If spill containment manhole is present, no dirt, trash, water or product | 6.7.1.2 | | | | | |
| | If spill containment manhole is present, no cracks, bulges or holes | 6.7.1.3 | | | | | |
| | Vapor recovery cap in good condition, seals tightly | 6.7.1.4 | | | | | |
| | Poppet of vapor recovery adaptor seals tightly | 6.7.1.5 | | | | | |
| **Observation and Monitoring Wells** | | 6.8 | | | | | |
| | Observation well cover is properly identified and secured | 6.8.1.1 | | | | | |
| **Corrosion Protection** | | 6.9 | | | | | |
| Impressed-Current Cathodic Protection | Record volt and amp readings, readings consistent with previous months | 6.9.1.1 | | | | | |
| | Record hour meter reading (if present); Reading increases by about 700 hours each month | 6.9.1.2 | | | | | |
| **Unmonitored Dispensers and Submersible Turbine Pumps (STPs)** | | 6.10 | | | | | |
| Unmonitored Dispensers | All dispenser components are clean and dry | 6.10.1.1 | | | | | |
| Unmonitored STPs | No fuel detected in STP access manhole | 6.10.2.1 | | | | | |

**DESCRIBE ANY DEFICIENCIES HERE:**

Instructions: Mark each tank where no problem is observed with a checkmark: √ If certain equipment is not required and / or not present, mark checklist in the N/A column. If a defect is found, mark the checklist with an "X," describe the problem in the "DEFICIENCIES" section, and notify the appropriate person. Refer to the section listed in the "PEI/RP900" column for additional information. Refer to PEI RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment,* for inspection procedures that apply to fuel dispensing equipment.

## APPENDIX A-2: SAMPLE FORM FOR ANNUAL UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST – Page 1

*Go to www.pei.org/RP900 for an electronic version of this form.*

### ANNUAL UST SYSTEM INSPECTION CHECKLIST

| Facility ID# | Facility Name/Address | Qualified Technician Signature | Date |
|---|---|---|---|
| | | | |

| If any problem is found, contact: | | Contact information: | |
|---|---|---|---|

| Category | Description | | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|---|
| Monthly Inspections | Complete monthly checklist and compare to previously completed monthly checklists | | 7.4.1 | | | | | |
| | Monthly inspections reviewed and found adequate | | 7.4.2 | | | | | |
| **ATG Manhole** | | | 7.8 | | | | | |
| ATG Manhole | Cap in good condition, seals tightly, hole sealed where probe wire goes through | | 7.8.1 | | | | | |
| | Wire splices sealed and wire in good condition | | 7.8.2 | | | | | |
| | Junction box has cover, not corroded; intrinsically safe wiring in good condition | | 7.8.3 | | | | | |
| | No exposed wires | | 7.8.4 | | | | | |
| | Probe and floats in good condition, both floats present and move freely (mag probe) | TEST DATE: | 7.8.5 | | | | | |
| | Verify functionality of ATG probe | TEST DATE: | 7.8.6 | | | | | |
| | Manhole cover in good condition | | 7.8.7 | | | | | |
| | Adequate clearance between ATG grade-level cover and below-grade components | | 7.8.8 | | | | | |
| **Fill Area** | | | 7.9 | | | | | |
| Drop Tube | Drop tube extends to within 6 inches of the tank bottom (if no flow diffuser present) | | 7.9.1 | | | | | |
| Vapor Recovery Adaptor | Poppet of Stage I vapor recovery adaptor (also known as a “dry break”) moves freely, seals tightly | | 7.9.2 | | | | | |
| Single-Walled Spill Containment Manhole | Single-walled spill containment manhole tightness tested within last 3 years | TEST DATE: | 7.9.3 | | | | | |
| Double-Walled Spill Containment Manhole | Double-walled spill containment manhole tightness tested within last 3 years OR inspected monthly | TEST DATE: | 7.9.4 | | | | | |
| **Overfill Prevention** | | | 7.10 | | | | | |
| Drop Tube Shutoff (Flapper Valve) | Drop tube shutoff valve passes inspection | EVALUATION DATE: | 7.10.1.1 | | | | | |
| | For drop tube shutoff valves in diesel tanks, excessive corrosion not present | | 7.10.1.2 | | | | | |

## APPENDIX A-2: SAMPLE FORM FOR ANNUAL UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST – Page 2

*Go to www.pei.org/RP900 for an electronic version of this form.*

| Category | Description | | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|---|
| Ball Float Valve | Ball float can be removed and inspected | | 7.10.2.1 | | | | | |
| | Ball float valve passes inspection | EVALUATION DATE: | 7.10.2.2 | | | | | |
| | For ball float valves in diesel tanks, excessive corrosion not present | | 7.10.2.3 | | | | | |
| Overfill Alarm | Overfill alarm passes inspection | EVALUATION DATE: | 7.10.3.1 | | | | | |
| **Leak Detection** | | | 7.11 | | | | | |
| ATG Console | ATG passes annual inspection | EVALUATION DATE: | 7.11.1.1 | | | | | |
| | Console has no active warnings or alarms | | 7.11.1.2 | | | | | |
| | Alarm history shows no recurring leak alarms | | 7.11.1.3 | | | | | |
| | Verify in-tank leak detection tests are being completed (if used for leak detection) | | 7.11.1.4 | | | | | |
| | Verify correct set-up parameters for electronic line leak detector (if present) | VERIFICATION DATE: | 7.11.1.5 | | | | | |
| | Verify piping leak detection tests are being completed (if used for leak detection) | | 7.11.1.6 | | | | | |
| Electronic Leak Detection Monitor | Leak monitoring console is operational and has no active warnings or alarms | | 7.11.2.1 | | | | | |
| Line Tightness Testing | If pressurized piping has been tested in the last year, review the results and verify that the test passed | TEST DATE: | 7.11.3.1 | | | | | |
| | If suction piping has been tested within the last 3 years, review the results and verify that the test passed | TEST DATE: | 7.11.3.2 | | | | | |
| | ELLD has conducted a 0.1 gph test in the last year | TEST DATE: | 7.11.3.3 | | | | | |
| Under Pump Check Valve (Suction Pump) | Below-grade piping operates at less than atmospheric pressure | | 7.11.4.1 | | | | | |
| | Below-grade piping slopes continuously back to the tank | | 7.11.4.2 | | | | | |
| | There is only one check valve, and it is located as close as practicable to the suction pump | | 7.11.4.3 | | | | | |
| Tank Tightness Testing | Tank is 10 years old or less | | 7.11.5.1 | | | | | |
| | If a tank test has been conducted within the last 5 years, review the results and verify that the test passed | TEST DATE: | 7.11.5.2 | | | | | |
| Statistical Inventory Reconciliation (SIR) | SIR results for the previous 12 months are "pass" | | 7.11.6.1 | | | | | |

## APPENDIX A-2 SAMPLE FORM FOR ANNUAL UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST – Page 3

*Go to www.pei.org/RP900 for an electronic version of this form.*

| Category | Description | | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|---|
| Continuous Soil Vapor Monitoring | Sensing device tested | TEST DATE: | 7.11.7.1 | | | | | |
| Continuous Ground-water Monitoring | Sensing device tested | TEST DATE: | 7.11.8.1 | | | | | |
| **Corrosion Protection** | | | 7.12 | | | | | |
| Galvanic Cathodic Protection | Verify that cathodic protection testing of all metallic components in contact with soil or water has been conducted within the past 3 years and the test passed | TEST DATE: | 7.12.1.1 | | | | | |
| Impressed Current Cathodic Protection | Verify that cathodic protection testing has been conducted within the past 3 years and the test passed | TEST DATE: | 7.12.2.1 | | | | | |
| | No exposed wires | | 7.12.2.2 | | | | | |
| Tank Lining | Lining inspected as required and in good condition | TEST DATE: | 7.12.3.1 | | | | | |
| **Miscellaneous Inspection Items** | | | 7.13 | | | | | |
| Tank Pad & Pavement | Concrete or asphalt over or near tanks is level, no significant cracks | | 7.13.1.1 | | | | | |
| Stage II Liquid Collection Points | Cap in good condition, fits tightly, little or no liquid in bottom | | 7.13.2.1 | | | | | |
| Stage I Testing | Verify that Stage I testing has been conducted and test results are passing | TEST DATE: | 7.13.3.1 | | | | | |
| Stage II Testing | Verify that Stage II testing has been conducted and test results are passing | TEST DATE: | 7.13.4.1 | | | | | |
| Site Diagram | Site diagram accurately reflects the site conditions | | 7.13.5.1 | | | | | |

**DESCRIBE ANY DEFICIENCIES HERE:**

Instructions: Mark each tank where no problem is observed with a checkmark: √ If certain equipment is not required and / or not present, mark checklist in the N/A column. If a defect is found, mark the checklist with an "X," describe the problem in the "DEFICIENCIES" section, and notify the appropriate person. Refer to the section listed in the "PEI/RP900" column for additional information. Refer to PEI RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment*, for inspection procedures that apply to fuel dispensing equipment.

## APPENDIX A-2: SAMPLE FORM FOR ANNUAL STP INSPECTION CHECKLIST – Page 1

*Go to www.pei.org/RP900 for an electronic version of this form.*

| ID#: | ANNUAL STP INSPECTION CHECKLIST | | | | | | | Date: |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | | **PEI/RP900** | **N/A** | **Tank 1** | **Tank 2** | **Tank 3** | **Tank 4** |
| **Submersible Turbine Pump (STP)** | | | | | | | | |
| All STP | Visible piping and fittings show no signs of leaking | | 7.6.1 | | | | | |
| | Piping in good condition | | 7.6.2 | | | | | |
| | Excessive corrosion not present | | 7.6.3 | | | | | |
| | Sump free of trash and debris | | 7.6.5 | | | | | |
| | Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition | | 7.6.8 | | | | | |
| | Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications | | 7.6.9 | | | | | |
| | Mechanical line leak detector properly vented, vent tube not kinked or twisted, vent tube fittings intact and tightened | | 7.6.10 | | | | | |
| | Mechanical line leak detector passes 3.0 gallons per hour (gph) test | TEST DATE: | 7.6.11 | | | | | |
| | Electronic line leak detector (ELLD) passes 3.0 gph test | TEST DATE: | 7.6.12 | | | | | |
| | ELLD passes 0.2 gph test | TEST DATE: | 7.6.13 | | | | | |
| | ELLD passes 0.1 gph test | TEST DATE: | 7.6.14 | | | | | |
| | Manhole cover at grade in good condition, does not touch sump cover, all bolts present, handles and lift mechanism in good condition (as applicable) | | 7.6.24 | | | | | |
| STP: No Containment Sump | Submersible pump head, flex connector(s) and other metallic product piping are not in contact with soil or water or are cathodically protected | | 7.6.17 | | | | | |
| STP: In Containment Sump | Any water or product removed and disposed of properly | | 7.6.4 | | | | | |
| | Sump is free of cracks, holes, bulges or other defects | | 7.6.6 | | | | | |
| | Penetration fittings intact and secured | | 7.6.7 | | | | | |
| | Piping interstitial space open to the STP sump (open double-walled piping system only) | | 7.6.20 | | | | | |
| | Piping interstitial space closed to the STP sump (closed double-walled piping system only) | | 7.6.22 | | | | | |
| | Sump lid, gasket and seals present and in good condition | | 7.6.23 | | | | | |
| STP: In Single-Walled Containment Sump | Single-walled sump tested for integrity every 3 years | TEST DATE: | 7.6.18 | | | | | |

## APPENDIX A-2: SAMPLE FORM FOR ANNUAL STP INSPECTION CHECKLIST – Page 2

***Go to www.pei.org/RP900 for an electronic version of this form.***

| Category | Description | | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|---|
| STP: In Double-Walled Containment Sump | If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years | TEST DATE: | 7.6.19 | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-2: SAMPLE FORM FOR ANNUAL DISPENSER INSPECTION CHECKLIST

*Go to www.pei.org/RP900 for an electronic version of this form.*

| ID#: | ANNUAL DISPENSER INSPECTION CHECKLIST | | | | | | | Date: |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | **PEI/RP900** | **N/A** | **Disp 1** | **Disp 2** | **Disp 3** | **Disp 4** | |
| **Initial Fuel Dispenser Inspection** | | 7.5 | | | | | | |
| All Dispensers | All dispenser components are clean and dry | 7.5.1 | | | | | | |
| | If dispenser sump is present, sump is dry | 7.5.2 | | | | | | |
| **Fuel Dispenser Inspection** | | 7.6 | | | | | | |
| All Dispensers | Visible piping and fittings show no signs of leaking | 7.6.1 | | | | | | |
| | Piping in good condition | 7.6.2 | | | | | | |
| | Dispenser containment sump free of trash and debris | 7.6.5 | | | | | | |
| | Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition | 7.6.8 | | | | | | |
| | Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications | 7.6.9 | | | | | | |
| | Shear valves operate freely and close completely — TEST DATE: | 7.6.15 | | | | | | |
| | Stage II piping functional or else capped and sealed at an elevation lower than the fuel dispenser island | 7.6.16 | | | | | | |
| Dispensers Without Sumps | Flex connectors and other metallic product piping are not in contact with soil or water or are cathodically protected | 7.6.17 | | | | | | |
| Dispensers With Sumps | Any water or product removed and disposed of properly | 7.6.4 | | | | | | |
| | Sump free of cracks, holes, bulges, or other defects | 7.6.6 | | | | | | |
| | Penetration fittings intact and secured | 7.6.7 | | | | | | |
| | Piping interstitial space open to the dispenser sump or dispenser pan (open double-walled piping system only) | 7.6.21 | | | | | | |
| | Piping interstitial space closed to the dispenser sump (closed double-walled piping system only) | 7.6.22 | | | | | | |
| Dispensers With Single-Walled Sumps | Single-walled sump tested for integrity every 3 years — TEST DATE: | 7.6.18 | | | | | | |
| Dispensers With Double-Walled Sumps | If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years — TEST DATE: | 7.6.19 | | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-2: SAMPLE FORM FOR ANNUAL LEAK DEVICE INSPECTION CHECKLIST

***Go to www.pei.org/RP900 for an electronic version of this form.***

| ID#: | ANNUAL LEAK DETECTION DEVICE INSPECTION CHECKLIST | | | | | | | Date: |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | | **PEI/RP900** | **N/A** | **Tank 1** | **Tank 2** | **Tank 3** | **Tank 4** |
| **Leak Detection Device. Describe location (e.g., interstitial, STP, fill, dispenser) on this row:** | | | 7.7 | | | | | |
| Liquid Sensor | Sensor tested and functional | TEST DATE: | 7.7.1 | | | | | |
| | Sensor properly mounted at the bottom of the containment sump or pan (containment sump or pan sensor only) | | 7.7.3 | | | | | |
| | Sensor properly mounted at the bottom of double-walled tank (double-walled tank sensor only) | | 7.7.4 | | | | | |
| Discriminating Sensor | Sensor tested and functional | TEST DATE: | 7.7.1 | | | | | |
| | Sensor properly mounted at the bottom of the containment sump or pan (containment sump or pan sensor only) | | 7.7.3 | | | | | |
| | Sensor properly mounted at the bottom of double-walled tank (double-walled tank sensor only) | | 7.7.4 | | | | | |
| Hydrostatic Sensor | Sensor tested and functional | TEST DATE: | 7.7.1 | | | | | |
| | Hydrostatic sensor properly positioned | | 7.7.5 | | | | | |
| Vacuum/Pressure Sensor | Sensor tested and functional | TEST DATE: | 7.7.1 | | | | | |
| | Alarm sounds when pressure or vacuum is released | TEST DATE: | 7.7.2 | | | | | |
| | Entire interstitial space under pressure or vacuum (closed double-walled piping system only) | TEST DATE: | 7.7.7 | | | | | |
| Visually Monitored Double-Walled Sump | Leak detection device is within recommended limits | | 7.7.6 | | | | | |
| Dispenser Pan Float Mechanism | Sensor tested and functional | TEST DATE: | 7.7.1 | | | | | |
| | Dispenser pan float mechanism free to move and properly adjusted | TEST DATE: | 7.7.8 | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-2: SAMPLE FORM FOR ANNUAL FILL CONTAINMENT SUMP INSPECTION CHECKLIST

***Go to www.pei.org/RP900 for an electronic version of this form.***

| ID#: | ANNUAL FILL CONTAINMENT SUMP INSPECTION CHECKLIST | | | | | | | Date: |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | | **PEI/RP900** | **N/A** | **Tank 1** | **Tank 2** | **Tank 3** | **Tank 4** |
| **Fill Sump** | | | 7.6 | | | | | |
| Fill Containment Sump | Any water or product removed and disposed of properly | | 7.6.4 | | | | | |
| | Visible piping and fittings show no signs of leaking | | 7.6.1 | | | | | |
| | Piping in good condition | | 7.6.2 | | | | | |
| | Excessive corrosion not present | | 7.6.3 | | | | | |
| | Sump free of trash and debris | | 7.6.5 | | | | | |
| | Sump is free of cracks, holes, bulges or other defects | | 7.6.6 | | | | | |
| | Penetration fittings intact and secured | | 7.6.7 | | | | | |
| | Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition | | 7.6.8 | | | | | |
| | Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications | | 7.6.9 | | | | | |
| | Piping interstitial space open to the fill sump (open double-walled piping system only) | | 7.6.20 | | | | | |
| | Piping interstitial space closed to the fill sump (closed double-walled piping system only) | | 7.6.22 | | | | | |
| | Sump lid, gasket and seals present and in good condition | | 7.6.23 | | | | | |
| | Manhole cover at grade in good condition, does not touch sump cover, all bolts present, handles and lift mechanism in good condition (as applicable) | | 7.6.24 | | | | | |
| Single-Walled Fill Sump | Single-walled sump tested for integrity every 3 years | TEST DATE: | 7.6.18 | | | | | |
| Double-Walled Fill Sump | If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years | TEST DATE: | 7.6.19 | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-2: SAMPLE FORM FOR ANNUAL TRANSITION SUMP INSPECTION CHECKLIST

*Go to www.pei.org/RP900 for an electronic version of this form.*

| ID#: | ANNUAL TRANSITION SUMP INSPECTION CHE7KLIST | | | Date: | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | | **PEI/RP900** | **N/A** | **Tank 1** | **Tank 2** | **Tank 3** | **Tank 4** |
| **Transition Sump** | | | 7.6 | | | | | |
| Transition Sump | Any water or product removed and disposed of properly | | 7.6.4 | | | | | |
| | Visible piping and fittings show no signs of leaking | | 7.6.1 | | | | | |
| | Piping in good condition | | 7.6.2 | | | | | |
| | Sump free of trash and debris | | 7.6.5 | | | | | |
| | Sump is free of cracks, holes, bulges, or other defects | | 7.6.6 | | | | | |
| | Penetration fittings intact and secured | | 7.6.7 | | | | | |
| | Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition | | 7.6.8 | | | | | |
| | Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications | | 7.6.9 | | | | | |
| | Piping interstitial space open to the transition sump (open double-walled piping system only) | | 7.6.20 | | | | | |
| | Piping interstitial space closed to the transition sump (closed double-walled piping system only) | | 7.6.22 | | | | | |
| | Sump lid, gasket and seals present and in good condition | | 7.6.23 | | | | | |
| | Manhole cover at grade in good condition, does not touch sump cover, all bolts present, handles and lift mechanism in good condition (as applicable) | | 7.6.23 | | | | | |
| Single-Walled Transition Sump | Single-walled sump tested for integrity every 3 years | TEST DATE: | 7.6.18 | | | | | |
| Double-Walled Transition Sump | If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years | TEST DATE: | 7.6.19 | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-2: SAMPLE FORM "OTHER" SUMP INSPECTION CHECKLIST

*Go to www.pei.org/RP900 for an electronic version of this form.*

| ID#: | ANNUAL "OTHER" SUMP INSPECTION CHECKLIST | | | Date: | | | | |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Description** | | **PEI/RP900** | **N/A** | **Tank 1** | **Tank 2** | **Tank 3** | **Tank 4** |
| **Other Sump. Describe location or function (e.g., suction piping, tank manhole) on this row:** | | | 7.6 | | | | | |
| Other Sump | Any water or product removed and disposed of properly | | 7.6.4 | | | | | |
| | Visible piping and fittings show no signs of leaking | | 7.6.1 | | | | | |
| | Piping in good condition | | 7.6.2 | | | | | |
| | Sump free of trash and debris | | 7.6.5 | | | | | |
| | Sump is free of cracks, holes, bulges, or other defects | | 7.6.6 | | | | | |
| | Penetration fittings intact and secured | | 7.6.7 | | | | | |
| | Junction box(es) have covers, not corroded; conduit and intrinsically safe wiring in good condition | | 7.6.8 | | | | | |
| | Flexible connectors not frayed, twisted, kinked or bent beyond manufacturer specifications | | 7.6.9 | | | | | |
| | Piping interstitial space open to the sump (open double-walled piping system only) | | 7.6.20 | | | | | |
| | Piping interstitial space closed to the sump (closed double-walled piping system only) | | 7.6.22 | | | | | |
| | Sump lid, gasket and seals present and in good condition | | 7.6.23 | | | | | |
| | Manhole cover at grade in good condition, does not touch sump cover, all bolts present, handles and lift mechanism in good condition (as applicable) | | 7.6.24 | | | | | |
| Single-Walled Other Sump | Single-walled sump tested for integrity every 3 years | TEST DATE: | 7.6.18 | | | | | |
| Double-Walled Other Sump | If not continuously monitored or inspected annually, double-walled sump tightness tested every 3 years | TEST DATE: | 7.6.19 | | | | | |
| **DESCRIBE ANY DEFICIENCIES HERE:** | | | | | | | | |
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## APPENDIX A-3: SAMPLE SITE PLAN FORM

*Go to www.pei.org/RP900 for an electronic version of this form.*



| Legend | Tanks | Piping | Leak Detection | Site Plan | |
|---|---|---|---|---|---|
| ATG - automatic tank gauge<br>CP - cathodic protection<br>D - dispenser<br>I - interstitial access<br>SW - single wall<br>DW - double wall<br>F - fill<br>STP - submerged turbine pump<br>UST - underground storage tank<br>V - vent connection<br>VR - Stage I vapor recovery<br>▽ - observation well | | | | Facility Name: | |
| | | | | Address: | |
| | | | | Registration #: | |
| | | | | Drawn by: | Date: |

See Figure 4-1 for an example of a completed form. Having ready access to accurate storage system information is very important to the proper operation of underground storage systems.

# APPENDIX A-4: OPTIONAL PERIODIC UST SYSTEM INSPECTION CHECKLIST

**A-4.1 General.** A good practice to follow but is not required is to complete a periodic review of a sites refueling equipment on a regular basis. Appendix A-4 is designed to help you complete an optional "Periodic Underground Storage System Inspection Checklist. The period checklist may be completed each day that a facility is in operation. Refer to the appropriate section in this appendix for additional descriptions of the checklist items.

**NOTE:** For periodic inspection procedures applicable to fuel dispensing equipment, refer to PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment.*

**NOTE:** Not all inspection items listed in the periodic inspection checklist in Appendix A-4 will be present at all UST facilities. The checklist in Appendix A-4 may be modified by a qualified person or other person designated by the UST owner so that only those items that are present at a given facility are included. This allows the checklist to be tailored to a specific facility through the removal of irrelevant items. For example, a facility that has electronic line leak detectors could remove the mechanical line leak detector item from the checklist. Do not remove a checklist item simply because it is too burdensome.

**A-4.2 Purpose.** This appendix and the associated checklist describe a routine visual inspection procedure for external underground storage system components. This inspection procedure should be:

- conducted by a person that has been trained to complete the Daily Inspection;
- properly recorded using a paper or electronic checklist (see Appendix A-4 for an example of a paper checklist);
- documented by retaining the completed inspection checklist for the length of time specified by the owner.

**A-4.3 Preparation.** Inform facility personnel that the underground storage system inspection procedure is about to take place. Use appropriate personal protective equipment (PPE) and take appropriate safety precautions. Refer to Chapter 5 of these recommended practices for further information concerning how to safely conduct an underground storage system equipment inspection.

Identify the appropriate person who is to be notified if any problems or defects are discovered during the inspection. Check to be sure that the name and contact information for this person's organization are included in the top section of the checklist. The inspection procedure and checklist will have little value if problems that are identified are not communicated to the personnel responsible for correcting them.

In the periodic checklist procedure described below, the qualified person is consistently instructed to "notify the appropriate person" if a problem is discovered. The employer should instruct the qualified person of the notification method that should be used to notify the appropriate person.

When completing the periodic checklist, individual tanks are assigned numbers to identify them. A site information sheet (see Section 4.5) should be completed by a knowledgeable person to help identify the tank location, features such as the fill pipe, and the numbering scheme to be used to identify the tanks. Be sure to use the tank numbers contained on the site information sheet to identify the tanks on the daily inspection checklist. See Figure 4-1 for a sample site information sheet and Appendix A-3 for a blank form.

**A-4.4 Leak Detection.** Even carefully installed storage systems constructed of up-to-date materials can develop leaks that result in safety hazards and environmental contamination. It is important to maintain vigilance against leaks in storage systems by verifying that leak detection equipment is functioning properly, leak detection procedures are carefully carried out, and the response to any alarms is quick and appropriate.

**A-4.4.1 Automatic Tank Gauge.** (ATG) Many facilities are equipped with an ATG that measures the height and calculates the volume of product in each underground tank. Very often, ATGs also perform a leak detection function by monitoring the liquid level in the storage tank. Sensors connected to ATGs also may be used for interstitial monitoring or to monitor the ground water or soil vapor outside of

a storage system. If the facility is equipped with an ATG, it is very important to check the ATG to verify that no alarms or warnings are present and that it is operating properly. Check the following items on a periodic basis.

**☑A-4.4.1.1 Checklist Item: The power is on.** Usually, the tank gauge console has a power indicator (typically a green light). Check to be sure this light is on. If there is no power indicator light, check the display or other operating feature to be sure there is power to the console. If the light is not on or power to the console cannot be verified, notify the appropriate person.

**☑A-4.4.1.2 Checklist Item: No warning or alarm lights are blinking or lit.** If you see any warning or alarm light lit or blinking or if there is an audible alarm beeping, do not ignore the alarm. Notify the appropriate person and follow the facility owner's policies and procedures for responding to the alarm.

**☑A-4.4.1.3 Checklist Item: There is a liquid measurement for each tank and the reading appears accurate.** Follow manufacturer instructions to view or print the liquid level in each tank that is connected to the ATG. If the liquid level information for one or more of the tanks is not available, notify the appropriate person. If the information does not appear to be reasonable, verify the liquid level with a tank gauge stick. If the tank gauge reading is substantially different from the tank gauge stick reading, notify the appropriate person.

**☑A-4.4.1.4 Checklist Item: The printer has paper and is in working condition.** Most tank gauge consoles are equipped with a printer that prints on a roll of paper similar to a cash register tape. If there is a printer, confirm that the paper is properly installed and that the printer is in working order by reviewing a recent printout or pressing the appropriate buttons to print a short report. If the printer is out of paper, install a new roll if you are qualified to do this or notify the appropriate person to perform this task. If the printer is not working properly, notify the appropriate person.

**NOTE:** Some ATGs are connected to a printer that is separate from the tank gauge console.


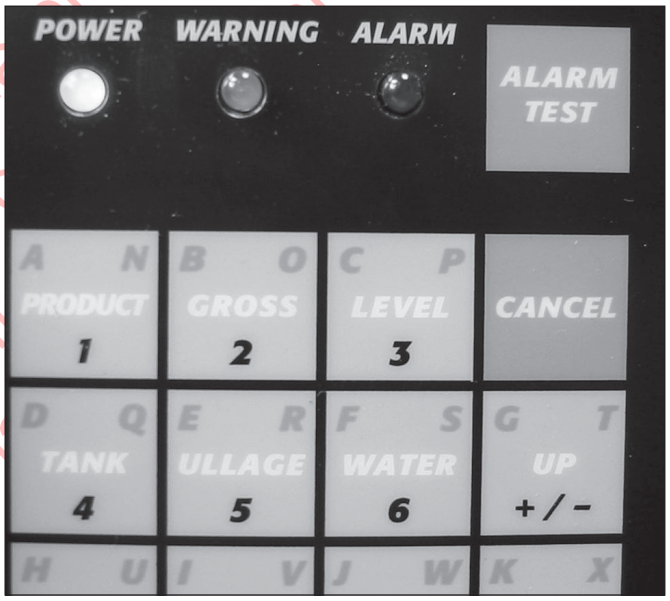


**FIGURE A4-1.** *The periodic inspection of automatic tank gauges (ATGs) and electronic leak detection monitors should verify the power is on and any warning or alarm indicators are off. Warning or alarm indicators that are on should be attended to immediately.*

**A-4.4.2 Electronic Leak Detection Monitor.** Some facilities have a leak detection monitor that performs leak detection functions such as interstitial monitoring or monitoring the groundwater or soil vapor outside the storage system, but does not provide product inventory information. If a leak detection monitor is present, it is very important to check it to make sure that there are no alarms or warnings present and that it is operating properly. Check the following items on a periodic basis.

☑**A-4.4.2.1 Checklist Item: The power is on.** Usually, the leak detection monitor has a power indicator (typically a green light). Check to be sure this light is on if it is present. If there is no power indicator light, check the display or other operating feature to be sure there is power to the console. If the light is not on or power to the console cannot be verified, notify the appropriate person.

☑**A-4.4.2.2 Checklist Item: No warning or alarm lights are blinking or lit.** If you see any warning or alarm light lit or blinking or if there is an audible alarm sounding, do not ignore the alarm. Notify the appropriate person and follow the facility owner's policies and procedures for responding to the alarm.

**A-4.4.3 Mechanical Line Leak Detector.** Line leak detectors are very important devices because they provide prompt warning of large leaks in pressurized pumping systems commonly used with underground storage systems. Mechanical line leak detectors indicate that a leak is present by slowing down the flow of product. As a result, some customers will likely complain that it is taking a long time to fuel their vehicles. There are other possible reasons for slow flow of product, but a slow flow condition should always be investigated. Check the following on a periodic basis.

☑**A-4.4.3.1 Checklist Item: No customers have complained about slow flow.** If a facility has mechanical line leak detectors, check with the store personnel who deal directly with the customers who are buying fuel to determine whether there have been any customer complaints of slow flow from any of the dispensing nozzles. If slow flow is a problem with one of the products being dispensed, notify the appropriate person to have the problem investigated immediately.

☑**A-4.4.3.2 Checklist Item: Inventory records are reconciled daily and daily variance is within the guidelines set by the facility owner.** Verify that all of the required information has been recorded (i.e., gallons sold, gallons delivered and gallons in the tank for each product). Reconcile the data by calculating the daily variance (the difference between the amount of product calculated to be in a tank and the amount actually present in a tank based on a physical measurement). If the daily variance is significantly larger than normal, check your calculations and the inventory data to be sure they are correct. If the data is correct, pay special attention to the inventory for the next few days. If the variances exceed guidelines, notify the appropriate personnel.

**NOTE:** These guidelines for inventory control apply when facility personnel are responsible for gathering and reviewing inventory control data.

**A-4.4.4 Daily Inventory.** Inventory control records are a valuable product management and leak detection tool. To maximize effectiveness, accurate inventory information must be gathered and reconciled daily. Check the following items on a periodic basis.

**NOTE:** Inventory control procedures are described in the U.S. Environmental Protection Agency document *Doing Inventory Control Right for Underground Storage Tanks.* Note that this document may be used for general guidance on how to conduct inventory control, but local regulations may contain requirements that differ from what is described in this document. Refer to Appendix C for information on how to obtain this document.

**A-4.5 Tank Fill Area.** The area around the tank fill pipe is an area of concern because small fuel spills during deliveries are commonplace at many facilities. The spill containment manhole is intended to collect small spills of fuel that occur when a transport driver disconnects the delivery hose. Periodic inspections of the spill containment manhole help ensure that this device will function as designed.

**A-4.5.1 Fill Cover.** The fill cover is the grade-level lid that protects the fill pipe from vehicle traffic and usually channels precipitation away from the spill containment manhole. If the fill cover or the rim around it is broken or damaged, water can enter the spill containment manhole located beneath the cover. Check the following items on a periodic basis.

☑**A-4.5.1.1 Checklist Item: Fill cover present, not broken or damaged.** Verify that

the grade-level cover over the fill pipe is present and in good condition and does not touch the fill cap beneath it. If the fill cover or rim is broken or damaged, notify the appropriate person. If the fill cover is designed to contain a gasket, verify that the gasket is present and in good condition. If the gasket is found to be damaged or missing, notify the appropriate person.

☑**A-4.5.1.2 Checklist Item: Fill covers are identified by color and located on the correct tank.** Delivery drivers frequently rely on colored fill covers to identify the grade and type of fuel in a tank. The American Petroleum Institute (API) has produced an industry standard color code (API 1637) that is recommended to identify the product contained in a UST. Labels placed inside the containment manhole indicating the grade of fuel in the tank may be used in addition to the colored cover. Verify that the fill covers are properly identified by color and are located on the correct tank.

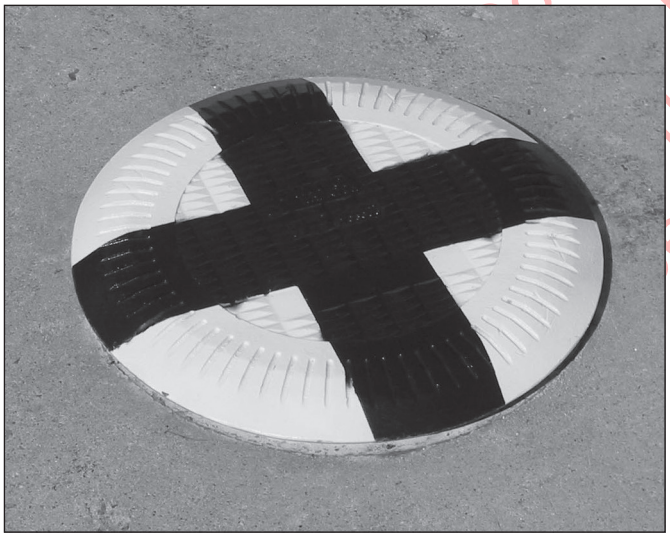

**FIGURE A4-2.** *Fill covers should be in good condition, identified by color and located on the correct tank.*

**NOTE:** Refer to Appendix C for a reference to the API recommended practice for color-code identification of fill pipes.

**A-4.5.2 Spill Containment Manhole.** The spill containment manhole (frequently referred to as a "spill bucket") is intended to catch small spills of product that may occur when the delivery hose is disconnected from the fill pipe. If this spilled product is not dealt with in a timely manner, it may become contaminated and unsuitable for draining into the underground tank. Fuel in spill containment manholes can also present a fire hazard.


**FIGURE A4-3.** *Spill containment manholes should be clean and dry. Drain mechanisms should be in good condition. The rim of coaxial drop tubes should be smooth and round.*

Water also frequently enters spill containment manholes. If this water subsequently enters the tank, fuel quality can be affected. In cold climates, the water can freeze and make fuel deliveries difficult. In addition, spill containment manholes may deteriorate and leak so that they no longer serve their intended purpose. For these reasons, spill containment manholes should be inspected on a periodic basis. Check the following items on a periodic basis.

☑**A-4.5.2.1 Checklist Item: No dirt, trash, water or product in the spill containment manhole.** Dirt and debris in a containment manhole can interfere with proper operation of the drain mechanism. Water or product in the manhole must be removed to maintain the capacity of the manhole. Notify the appropriate person or follow the tank owner's policies and procedures for handling dirt, trash and liquids found in spill containment manholes.

**WARNING: Do not use any type of blower, vacuum or other electricalor gasoline-operated device to remove dirt, debris,**

**liquids or vapors from spill containment manholes unless the device is listed for use in classified areas.**

**☑A-4.5.2.2 Checklist Item: No cracks, bulges or holes in the spill containment manhole.** Spill containment manholes must be liquid-tight. Any defects in the sides or bottom of the spill containment manhole that could allow liquids to drain out must be repaired or the spill bucket replaced. Visually inspect the inside of the spill containment manhole for cracks, bulges or holes. If any defects are found, notify the appropriate person.

**☑A-4.5.2.3 Checklist Item: Below-grade containment manhole properly latched (if present).** Some spill containment manholes, known as "below-grade" manholes, have two covers: a grade-level cover that is typically flat and level with the surrounding grade and a below-grade cover that includes a latch mechanism to seal the manhole from water infiltration. If a below-grade containment manhole is present, check to be sure that the latch mechanism is in good condition and that the below-grade cover is securely latched. If the latch mechanism does not work properly, notify the appropriate person.

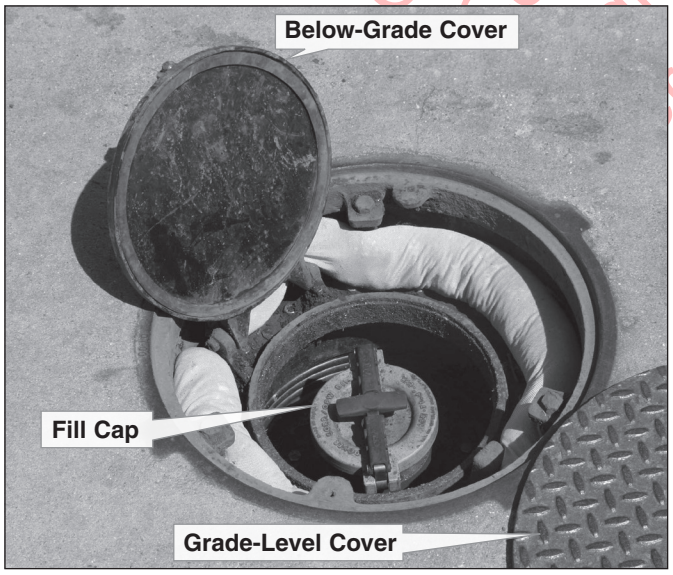


**FIGURE A4-4.** *Below grade containment manholes around the fill pipe should be surrounded by a "sock" containing oil absorbent material to help prevent fuel spills from reaching the environment.*

**☑A-4.5.2.4 Checklist Item: Below-grade containment manhole contains oil-absorbent material.** Soil or backfill is generally exposed between the ring in which the grade-level cover sits and the lid of the below-grade containment manhole. This exposed soil or backfill provides a pathway for spilled fuel to enter the environment. A tube or "sock" of special oil-absorbent material should be located around the lid of the below-grade manhole cover to soak up any fuel before it can escape into the environment. This absorbent material is designed so that it absorbs oil but not water. Rags or paper towels are not appropriate absorbent materials. Check to see that this special oil-absorbent material is in place around the below-grade spill containment manhole and that it is dry. If the absorbent material is not present or is wet with fuel, notify the appropriate person.

**A-4.5.3 Fill Pipe.** The fill pipe is the opening through which fuel is delivered into the underground tank. It is typically 4 inches in diameter and is fitted with a cap that clamps tightly onto the fill adaptor. The fill cap must seal tightly to the fill pipe to prevent the escape of fuel vapors. Check the following items on a periodic basis.

**☑A-4.5.3.1 Checklist Item: Fill cap in good condition, seals tightly.** Verify that the fill cap is in good condition and that the latch mechanism seals the cap tightly to the fill adaptor. Remove the fill cap and

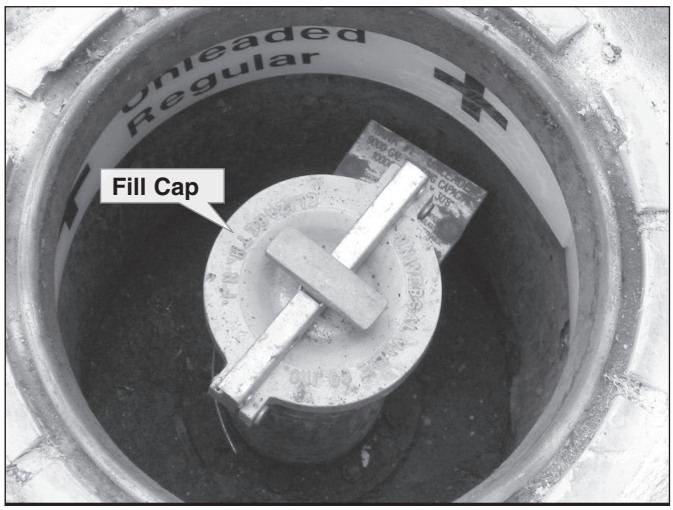


**FIGURE A4-5.** *Fill caps should be in good condition and seat tightly on the fill pipe to prevent the escape of vapors.*

look on the underside of the cap for a gasket or an O-ring. If you find the fill cap broken, loose or missing, or if the gasket or O-ring are missing, notify the appropriate person.

☑**A-4.5.3.2 Checklist Item: No obstruction inside the fill pipe.** Look down the fill pipe to make sure there is nothing obstructing the fill opening. If an overfill prevention device is installed in the drop tube, you may be able to see a narrowing of the drop tube about 3 to 4 feet from the top of the fill pipe. This is normal. If you see any foreign objects (e.g., a tank gauge stick) in the fill pipe, this may be an indication that the overfill prevention device is not working properly. Notify the appropriate person immediately.

# APPENDIX A-4: SAMPLE FORM FOR AN OPTIONAL PERIODIC UNDERGROUND STORAGE SYSTEM INSPECTION CHECKLIST

***Go to www.pei.org/RP900 for an electronic version of this form.***

## OPTIONAL PERIODIC UST SYSTEM INSPECTION CHECKLIST

| Facility ID# | Facility Name/Address | Qualified Person Signature | Date |
|---|---|---|---|
| | | | |

| If any problem is found, contact: | | Contact information: | |
|---|---|---|---|

| Category | Description | PEI/RP900 | N/A | Tank 1 | Tank 2 | Tank 3 | Tank 4 |
|---|---|---|---|---|---|---|---|
| **Leak Detection** | | A-4.4 | | | | | |
| Automatic Tank Gauge (ATG) | The power is on | A-4.4.4.1 | | | | | |
| | There are no warning or alarm lights blinking or lit | A-4.4.1.2 | | | | | |
| | There is a liquid measurement for each tank and the reading appears accurate | A-4.4.1.3 | | | | | |
| | The printer has paper and is in working condition | A-4.4.1.4 | | | | | |
| Electronic Leak Detection Monitor | The power is on | A-4.4.2.1 | | | | | |
| | There are no warning or alarm lights blinking or lit | A-4.4.2.2 | | | | | |
| Mechanical Line Leak Detector | No customers have complained about slow flow | A-4.3.3.1 | | | | | |
| Daily Inventory | Inventory records are reconciled daily and daily variance is within the guidelines set by the facility owner | A-4.3.2 | | | | | |
| **Tank Fill Area** | | A-4.5 | | | | | |
| Fill Cover | Fill cover present, not broken or damaged | A-4.5.1.1 | | | | | |
| | Fill covers are identified by color and located on the correct tank | A-4.5.1.2 | | | | | |
| Spill Containment Manhole (Spill Bucket) | No dirt, trash, water or product in the spill containment manhole | A-4.5.2.1 | | | | | |
| | No cracks, bulges or holes in the spill containment manhole | A-4.5.2.2 | | | | | |
| | Below-grade containment manhole properly latched (if present) | A-4.5.2.3 | | | | | |
| | Below-grade containment manhole contains oil-absorbent material | A-4.5.2.4 | | | | | |
| Fill Pipe | Fill cap in good condition, seals tightly | A-4.5.3.1 | | | | | |
| | No obstruction inside the fill pipe | A-4.5.3.2 | | | | | |

**DESCRIBE ANY DEFICIENCIES HERE:**

**Instructions:** Mark each tank where no problem is observed with a checkmark: √ If certain equipment is not required and / or not present, mark checklist in the N/A column. If a defect is found, mark the checklist with an "X," describe the problem in the "DEFICIENCIES" section and notify the appropriate person. Refer to the section listed in the "PEI/RP900" column for additional information. Refer to PEI RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment,* for inspection procedures that apply to fuel dispensing equipment.

# APPENDIX B: WATER MANAGEMENT IN STORAGE SYSTEMS

**NOTE:** This Appendix reflects the current knowledge and recommendations of the PEI UST System Inspection and Maintenance Committee. Research on many of the issues discussed in this Appendix, especially with regard to diesel fuel, is ongoing.

**B-1. Water Management Is an Important Issue in Storage Systems.** Ever since motor fuel has been stored in underground storage tanks (USTs), water has been a concern for tank owners because of the potential to pump water into customers' cars and the resulting automobile repair bills and bad publicity. Another important reason to manage the water in fuel storage systems is fuel quality. Water accelerates degradation of the fuel, creating sludge and other particulates. Both gasoline and diesel engine manufacturers are placing more emphasis on cleaner fuel standards to protect engine performance.

As of 2016, about 97 percent of the gasoline sold in the United States contains ethanol, with a blend of 10 percent ethanol and 90 percent gasoline (commonly known as E10) being by far the most common mixture. Because of the presence of ethanol in gasoline, water in gasoline storage systems now presents additional concerns. Water dissolves in E10 gasoline much more readily than in non-ethanol gasoline. When the water content of E10 gasoline reaches about 0.5 percent, much of the ethanol in the gasoline mixes with the water and settles to the bottom of the tank. If this ethanol/water mixture is pumped into vehicles, they may stall.

Keeping water out of diesel fuel has always been important, but in recent years water management in diesel fuel storage systems has become increasingly critical. Since 2007, severe corrosion in many metallic components of diesel fuel storage systems has been commonly observed. Microbial activity is strongly suspected of producing this severe corrosion, and water is necessary to support microbial activity. This phenomenon is still being studied to establish the cause of the corrosion.

The current, commonly accepted standard of 1 inch of water in a UST as the point when water should be removed is inadequate for today's fuels. While zero water is the ideal, maintaining this level of water in USTs may not be achievable in all cases. Small quantities of water in ethanol-blended fuels will likely be absorbed by the ethanol and generally eliminate any water bottoms in these tanks. Diesel fuel often contains water-absorbing biodiesel in small amounts, but diesel tanks may more commonly accumulate water bottoms because this mix does not absorb as much water as ethanol-gasoline blends.

**B-2. How Water Enters USTs.** Water may enter an underground tank through a variety of pathways, including:

- Holes or cracks in the UST system, such as leaky tank-top fittings, spill containment manhole drains, fill or Stage I caps with missing gaskets, or loose automatic tank gauge (ATG) caps;
- Water also may be delivered with a load of fuel if storage practices at a terminal or bulk plant supplying the fuel are not adequate, or if transport vehicles have not been properly maintained;
- Ballast water may not be completely removed when a new tank is installed;
- Condensation from warm fuel being loaded into a cooler tank or from warm, humid air from vents displacing fuel vapors during dispensing operations.

**B-3. Water Detection Challenges.** Detecting small amounts of water in underground storage tanks is difficult. Most tank owners rely on ATGs to detect water, but a half-inch of water must usually be present before the ATG registers any amount of water. If a gauge stick and water finding paste are used to detect water the first quarter inch of water may not be detected because of the thickness of the striker plate in the tank and the plastic button on the bottom of the gauge stick.

Striker plates, unevenness along the tank bottom and tank tilt are some of the reasons that tanks should be checked for water in multiple locations. Water, sludge and/or slime, and particulates may be pushed away from the fill opening because of turbulence that occurs during fuel deliveries. If possible, periodically check for water at openings other than the fill opening, such as the ATG opening.

In addition to ATGs and gauge sticks, other methods that may provide more accurate results can be utilized to check for the presence of water. A "bacon bomb sam-

pler" can be used to retrieve a sample of liquid from the tank bottom at any available tank opening. Vacuum sampling devices using flexible tubing can be used to obtain samples from locations that are not directly below a tank opening. Samples can then be analyzed for the presence of water or microbial activity. Remote video inspection equipment also may be utilized to inspect for the presence of water, either on the tank bottom or as condensation on the tank walls above the fuel level.

**B-4. Water Removal Challenges.** Removing water and particulates in USTs to the level required to maintain fuel stability and to forestall the growth of microbes in diesel and prevent phase separation in E10 gasoline is challenging. Water has traditionally been removed from USTs by inserting a small-diameter pipe in the fill opening and pumping it out. While this approach is good because it can be used on a routine basis to quickly remove water bottoms, it may not remove water from areas away from the fill pipe.

Companies that offer tank cleaning or fuel polishing services have special equipment that can travel along the tank bottom and remove water and sludge/slime/particulates along the entire length of the tank. This is the type of equipment that is currently capable of removing most of the water and sludge/slime/particulates along the tank bottom.

**B-5. Water Issues Specific to E10 Gasoline.** Ethanol gasoline can absorb more water than non-ethanol gasoline. However, when the water content of E10 gasoline reaches about 0.5 percent (e.g., 25 gallons of water in 5,000 gallons of fuel) the water and much of the ethanol mixed into the gasoline will separate out and settle to the bottom of the tank. This phenomenon is called "phase separation." The amount of water that will cause phase separation varies with the temperature of the fuel. The colder the fuel, the less water it takes for the ethanol to separate from the gasoline. The 0.5 percent value is for fuel at about 60° F. Mixing of the water and the E10 gasoline is usually required for the ethanol to separate from the gasoline. When phase separation occurs in E10 gasoline, the remaining gasoline (without the water/ethanol layer) most likely will not meet federal or state fuel quality regulatory requirements, such as volatility and octane.

**B-6. What Are the Indications That Water Is Present in USTs Storing Ethanol-Blended Gasoline?** Typical indicators of water in E10 storage systems include the following.

- Water paste applied to a gauge stick changes color.
- The ATG indicates that water is present.
- Strainers and water sensing filters installed in dispensers are replaced frequently because they are clogging.
- Cloudy or hazy fuel is present, especially near the bottom of the tank.
- If a fuel density measuring float is installed on an ATG probe, the measured density of the fuel increases.
- A sample of the fuel is tested and does not meet American Society of Testing Materials (ASTM) standard D4814, *Standard Specification for Automotive Spark-Ignition Engine Fuel.*
- Recently fueled vehicles stall out.
- Unusual or more frequent equipment failures occur.

**B-7. Strategies for Ethanol-Blended Gasoline.** Owners and operators of tanks storing ethanol-blended gasoline may consider the following strategies to prevent and detect water intrusion.

- To prevent water entry into the UST:
  - Spill bucket drain valves can introduce water into tanks. Ensure drain valves are properly maintained. Do not drain water from spill buckets into tanks.
  - Be sure all tank-top riser caps are liquid-tight.
  - If necessary, slope pavement away from any tank-top openings.
- To detect water entry into the UST:
  - Use water-sensing filters in dispensers.
  - Routinely check for water with a gauge stick and water paste designed for use in ethanol fuels. Check for water in as many locations along the length of the tank as possible.
  - Install special floats on ATG probes that will detect phase separation or changes in fuel density.

**B-8. Water Issues Specific to Diesel.** Water issues specific to diesel arise primarily from corrosion promoted by microbial growth. Microbially influenced corrosion involves the production of acids that can corrode metallic components in the storage system, both above and below the fuel level in the tank and in the piping system.

**B-9. What Are the Indications That Water is Present in Tanks Storing Diesel?** Typical indicators of water in diesel storage systems include the following.

- Water paste applied to a gauge stick changes color.

- The ATG indicates that water is present.
- Filters require frequent replacement due to clogging. Inspect used filters for the presence of particulates that indicate corrosion or slimy deposits that indicate microbial growth.
- Cloudy, hazy or discolored fuel is present, especially near the bottom of the tank.
- A sample of the fuel is tested and does not meet ASTM standard D975, *Standard Specification for Diesel Fuel Oils.*
- Corrosion of metallic components inside USTs is present. Check for moderate to severe corrosion of the inside of ATG or other easily accessible risers. If removing equipment such as ball float valves, drop tube overfill prevention devices, STPs or any other metallic components, take the opportunity to inspect for corrosion.
- More frequent replacement of mechanical line leak detectors, drop tube overfill prevention devices, shear valves and STP components is required. Corrosion and particulates interfering with moving parts can contribute to the premature failure of these components.

**B-10. Strategies for Diesel.** Owners and operators of tanks storing diesel fuel may consider the following strategies to prevent water intrusion.

- To prevent water entry into the UST:
  - Spill bucket drain valves can introduce water into tanks. Ensure drain valves are properly maintained. Do not drain water from spill buckets into tanks.
  - Be sure all tank-top riser caps are liquid-tight.
  - If necessary, slope pavement away from any tank top openings.
- To detect water entry into the UST:
  - Consider using water-sensing filters in dispensers.
  - Routinely check for water with a gauge stick and water paste. Check for water in as many locations along the length of the tank as possible.
- To manage water that may be present in the UST:
  - Monitor tank-bottom conditions by taking fuel samples from near the bottom of the tank. Also collect water samples if water is found. Test the water and fuel samples for the presence of microbes. If microbial colonies are detected, consider treating with biocides. Consult with fuel quality specialists to establish a monitoring and treatment program to limit microbial growth and potential corrosion.
  - If water and/or microbial colonies are detected, have the tank bottom and the fuel itself cleaned.

# APPENDIX C
# PUBLICATION REFERENCE

Many of the recommendations contained in this publication have been derived from the standards and recommended practices of other industry organizations. Listed below are the names, addresses, telephone numbers and websites of selected industry organizations, followed by the titles of their publications, which have some relation to this document.

**■ AMERICAN NATIONAL STANDARDS INSTITUTE**
25 West 43rd Street, 4th Floor, New York, NY 10036. (212) 642-4900. www.webstore.ansi.org

ANSI/ISEA 107-2020, *American National Standard for High-Visibility Safety Apparel*, 2015.

**■ AMERICAN PETROLEUM INSTITUTE**
200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571. (202) 682-8000. www.api.org

American Petroleum Institute, RP 1632, *Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems*.

American Petroleum Institute, RP 1637, *Using the API Color-Symbol System to Identify Equipment, Vehicles, and Transfer Points for Petroleum Fuels and Related Products at Dispensing and Storage Facilities and Distribution Terminals*.

American Petroleum Institute, RP 1639, *Owner/Operator's Guide to Operation and Maintenance of Vapor Recovery Systems at Gasoline Dispensing Facilities*.

American Petroleum Institute, RP 1640, *Product Quality in Light Product Storage and Handling Operations*.

American Petroleum Institute, RP 1646, *Safe Work Practices for Contractors Working at Retail Petroleum/Convenience*.

American Petroleum Institute, RP 2005, *Service Station Safety*.

**■ ASTM INTERNATIONAL**
100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. (877) 909-2786. www.astm.org

ASTM Standard D975, *Standard Specification for Diesel Fuel*.

ASTM Standard D4814, *Standard Specification for Automotive Spark-Ignition Engine Fuel*.

ASTM Standard D6469, *Standard Guide for Microbial Contamination in Fuels and Fuel Systems*.

**■ BATTELLE MEMORIAL INSTITUTE**
505 King Avenue, Columbus, OH 43201. (800) 201-2011. www.battelle.org

Battelle Memorial Institute, *Corrosion in Systems Storing and Dispensing Ultra Low Sulfur Diesel (ULSD), Hypotheses Investigation,* September 5, 2012.

**■ COORDINATING RESEARCH COUNCIL**
5755 North Point Parkway, Suite 265, Alpharetta, GA 30022. (678) 795-0506. www.crcao.org

Coordinating Research Council Report No. 667, *Diesel Fuel Storage and Handling Guide,* September 2014.

Coordinating Research Council Report No. 672, *Preventive Maintenance Guide for Diesel Storage and Dispensing Systems*, July 2016.

**■ INTERNATIONAL CODE COUNCIL**
Publications, 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795. (888) 422-7233. www.iccsafe.org

International Code Council, *International Fire Code*.

**■ NATIONAL FIRE PROTECTION ASSOCIATION**
1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02169-7471. (888) 344-3555. www.nfpa.org

National Fire Protection Association, NFPA 30, *Flammable and Combustible Liquids Code*.

National Fire Protection Association, NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*.

National Fire Protection Association, NFPA 70, *National Electrical Code*.

**■ PETROLEUM EQUIPMENT INSTITUTE,**
P.O. Box 2380, Tulsa, OK 74101-2380. (918) 494-9696. www.pei.org

Petroleum Equipment Institute, RP100, *Recommended Practices for Installation of Underground Liquid Storage Systems*.

Petroleum Equipment Institute, RP300, *Recommended Practices for Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites*.

Petroleum Equipment Institute, RP500. *Recommended Practices for Inspection and, Maintenance of Motor Fuel Dispensing Equipment*.

Petroleum Equipment Institute, RP1200, *Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment at UST Facilities.*

■ **RENEWABLE FUELS ASSOCIATION**
425 3rd Street, SW Suite 1150, Washington, DC 20024, (202) 289-3835, www.ethanolrfa.org

Renewable Fuels Association, *E15 Retailer Handbook*.

■ **STI/SPFA**
944 Donata Court, Lake Zurich, IL 60047. (847) 438-8265. www.steeltank.com

Steel Tank Institute, R111, *Storage Tank Maintenance Standard*, March 2016.

■ **UNDERWRITERS LABORATORIES INC.**
333 Pfingsten Road, Northbrook, IL 60062-2096. (847) 272-8800. www.ul.com

Underwriters Laboratories, Standard 567, *Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas*, Ninth Edition, 2003.

Underwriters Laboratories, Standard 971, *Nonmetallic Underground Piping for Flammable Liquids*.

Underwriters Laboratories, Standard 971A, *Metallic Underground Fuel Pipe*.

■ **U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION,**
200 North Constitution Avenue NW, Room N3626, Washington, DC 20210. (800) 321-6742. www.osha.gov

Occupational Safety and Health Administration, Title 29, Code of Federal Regulations (CFR), Part 1910, *Occupational Safety and Health Standards*.

■ **U.S. ENVIRONMENTAL PROTECTION AGENCY,**
1200 Pennsylvania Avenue, NW, Washington, DC 20460. (202) 272-0167. www.epa.gov

U.S. Environmental Protection Agency, EPA 510-B-93-004, *Doing Inventory Control Right for Underground Storage Tank Systems*, November 1993.

U.S. Environmental Protection Agency, EPA 510-K-16-001, *Operating and Maintaining Underground Storage Tank Systems*, February 2016.

U.S. Environmental Protection Agency, EPA 510-R-16-001, *Investigation of Corrosion-Influencing Factors In Underground Storage Tanks With Diesel Service*, July, 2016.

U.S. Environmental Protection Agency, Title 40, Code of Federal Regulations (CFR), Part 280, *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*.

U.S. Environmental Protection Agency, Title 40 Code of Federal Regulations (CFR), Part 63, Subpart CCCCCC, *National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities*.

U.S. Environmental Protection Agency, *Summary of Regulations Controlling Air Emissions from Gasoline Dispensing Facilities,* January 2011.

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