



XL Insurance



Underground storage tank management: leak detection and integrity testing

An Environmental Risk Bulletin





Underground storage tanks (USTs) are widely used across the nation. Their types, sizes and uses vary from liquid fuels to chemicals to wastes. Nationwide, there are approximately 550,000 USTs that store petroleum or hazardous substances. Based on data from September 2019, the United States Environmental Protection Agency (USEPA) has estimated that only 68% of regulated USTs have met the most significant operational compliance requirements.

Although there has been a marked decrease in failure rates of USTs and reports of leaking USTs since enactment of USEPA’s UST regulations, according to industry statistics an approximate 1% to 1.5% of operating UST systems will fail in a given year. As UST systems age, corrosion, settling, and usage result in a higher risk for releases from tanks, piping and dispensers. Most older UST systems were replaced in 1989 concurrent with the full implementation of USEPA’s UST regulations. However, those new USTs are now >30 years old and past their original warranty period. These older systems now present a higher risk for component failure and product releases if not properly maintained, monitored and operated.

In the US, some states are attempting to address the risk from aging USTs by requiring upgrades or additional financial responsibility. This increased exposure from older UST systems has resulted in increased compliance requirements and decreased commercial financial assurance options. Insurance companies and lenders are less willing to provide a financial

assurance mechanism for USTs >30 years old. These factors have encouraged UST owners and operators to proactively upgrade old systems.

Effective leak detection and integrity testing procedures are the cornerstone of UST management programs. Without proper leak detection and/or integrity testing, tank failures have the potential to go undetected and can result in extensive remediation. Sites contaminated by leaking USTs also have the potential to result in costly bodily injury, property damage, and legal defense claims.

Understanding UST leak detection and integrity testing requirements applicable to your facility requires knowledge of UST regulations, tank construction and features, approved leak detection methods, and approved tank testing methods. This knowledge should be incorporated into a comprehensive UST management program that is implemented to minimize environmental risks.

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Federal and state regulations

To gain an understanding of the requirements of UST owners in selecting and maintaining leak detection and integrity testing systems, it is important to understand the regulatory requirements. Unfortunately, there is no single government regulation which governs all USTs. Most of the regulations concerning USTs are contained in USEPA's UST technical standards in 40 CFR Parts 280 and 281 and in individual state and territorial program standards in 40 CFR Parts 282.50 – 282.105.

UST systems are defined as “a tank and any underground piping connected to the tank that has at least 10% of its combined volume underground.” Tanks are typically regulated by their contents. In general, regulated USTs include those containing petroleum products and hazardous substances listed in 101(14) of CERCLA and listed in 40 CFR 302. Additionally, substances regulated by USEPA and listed in USTs may be regulated if they contain Resource Conservation and Recovery Act (RCRA) hazardous waste as characterized by USEPA in 40 CFR 261.

Exclusions to federal UST compliance requirements are provided in 40 CFR 280, including but not limited to:

- Tanks of 110 gallons or less capacity;
- Farm and residential tanks of 1,100 gallons or less holding motor fuel used for noncommercial purposes;
- Tanks storing heating oil used on the premises where it is stored;
- Tanks on or above the floor of underground areas such as basements or tunnels;
- Septic tanks and systems for collecting stormwater and wastewater;
- Flow-through process tanks; and
- Emergency spill and overfill tanks.

Although some USTs are unregulated, they still have the potential to release their contents to the environment if not managed properly. It is considered an industry best practice to develop a formal UST management program that includes unregulated USTs subject to periodic integrity testing.

All regulated USTs and piping must have corrosion protection for metallic components, spill protection, and overflow prevention. Other USEPA requirements include financial responsibility, recordkeeping, notification of releases, corrective action, and UST closure. Financial responsibility mechanisms are required for owners or operators of USTs containing petroleum products to ensure adequate funding or insurance is available for corrective action or closure. It is important to note that USTs containing hazardous substances are required to meet the same physical

requirements, but not the financial responsibility clause. States may be approved by USEPA to establish their own UST programs and manage compliance efforts. Currently, approximately 40 states are USEPA-approved to administer UST programs. This means that owners and operators of USTs in these states do not need to comply with two sets of regulations (state and federal) that may have some conflicts. Once their programs are approved, states have the lead role in UST program enforcement. In states without an approved program, USEPA works with state officials to coordinate UST enforcement actions.

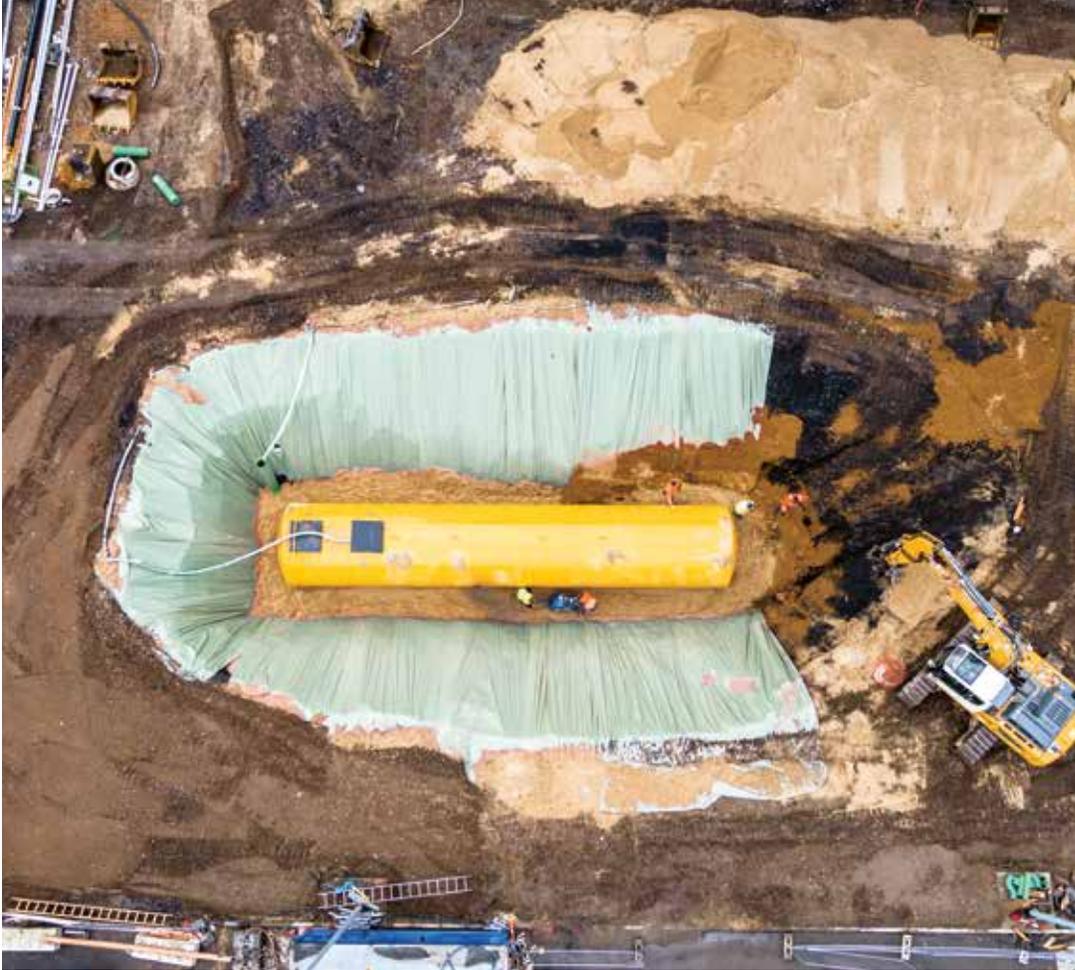
Industry codes and standards

It is also important to note the role of industry codes and standards with regard to UST construction, leak detection, and integrity testing. Federal UST regulations often require that industry codes and standards be followed where applicable, to ensure that UST systems work properly. For example, all UST systems must be designed, constructed, and protected from corrosion in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory. USEPA has also included the use of industry codes for other sections of the rule, such as upgrading, repairing, and closing USTs.

Industry codes and standards provide a means for improving methods, developing alternative methods, and updating standards for UST system management in a timely manner.

Examples of organizations and standards referenced by USEPA

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
NACE	National Association of Corrosion Engineers
NFPA	National Fire Protection Association
NLPA	National Leak Prevention Association
NWGLDE	National Work Group on Independent Leak Detection Evaluations



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It is critically important that all components of the tank system be well maintained.

Underground Storage Tank Act of 2005 (USTCA)

When Congress passed the Energy Policy Act of 2005, it included significant amendments to RCRA's UST requirements known as the Underground Storage Tank Compliance Act of 2005 (USTCA). These regulations were updated in 2015 and added new compliance requirements.

USTCA initially imposed provisions that had significant impacts on owners and operators of USTs as well as USEPA and states regulating USTs. This included:

- Requiring that states inspect all USTs at least every 3 years;
- Requiring that USEPA publish training guidelines for UST operators;
- Requiring UST facilities to have tank and piping secondary containment to protect groundwater, including new USTs located near potable public water supply systems;
- Providing evidence of manufacturer and installer financial responsibility (in each state receiving federal UST funding);
- Requiring states to establish UST installer certification/ licensing (for certain projects);
- Prohibiting use of MTBE in motor vehicle fuel no later than December 31, 2014 (in states electing to eliminate MTBE use);
- Requiring the establishment of UST recordkeeping systems and making them available to the public.

More recent USTCA revisions and requirements include, but are not limited to:

- Periodic operation and maintenance;
- Piping containment;
- Biofuel compatibility

Tanks themselves are made from a variety of materials including steel, clad steel, jacketed steel, and fiberglass. UST sizes typically range from a small 250 gallon tank up to a 20,000 gallon storage tank which can be 50 or 60 feet long. However, larger USTs are in use at some industrial facilities, but are typically field constructed tanks.

Tank features that assist in the prevention, identification, and release of tank contents include:

- Secondary containment outside of the tank to physically contain released materials;
- Level alarms to prevent tank overfills;
- Interstitial monitoring between the primary tank and/or piping wall and a secondary wall;
- Vapor recovery systems to prevent the atmospheric release of volatile emissions;
- Piping release detection including release alarms, shutoff devices, and flow restrictors.

It is critically important that all components of the tank system be well maintained. Many tank failures occur in the piping or dispensing systems where extensive use may cause stress and wear in joints, gaskets, etc.

Leak detection

For assessment purposes, USEPA considers USTs to fall into three main categories: operating, closed, and abandoned. All operating, regulated USTs are required to have leak detection. USEPA provides guidance for leak detection, tank testing, and monitoring on their website and in various guidance documents. Many state agencies provide guidance as well.

USEPA provides a summary of UST regulations and tank testing and monitoring methods in their 2015 updated version “Musts for USTs” publication and on their website <https://www.epa.gov/ust> (See “Preventing and Detecting Releases”).

USEPA does not endorse any particular leak detection method, but provides details on techniques that should meet environmental regulatory requirements when applied properly. USEPA also references the National Work Group on Leak Detection Evaluations (NWGLDE) (<http://www.nwglde.org>), which is comprised of USEPA and state UST regulators that independently evaluate leak detection methods for conformance to regulatory requirements.

Leak detection methods fall into four general categories:

Internal

Tank liquid level

External

Installed outside the tank system

Interstitial

Monitoring the area between UST and secondary containment

Piping

Line-leak detectors or integrity testing

USEPA outlines the following basic leak detection methods in 40 CFR 280:

- Automatic tank gauging
- Inventory control and tank tightness testing
- Manual tank gauging only
- Manual tank gauging and tank tightness testing
- Statistical inventory reconciliation
- Other methods (typically requiring agency approval)

The technology associated with these four general categories of leak detection and the various USEPA approved methods can be further subdivided into three broad categories:

Electronic Leak Detection (ELD)

Line Leak Detection (LLD)

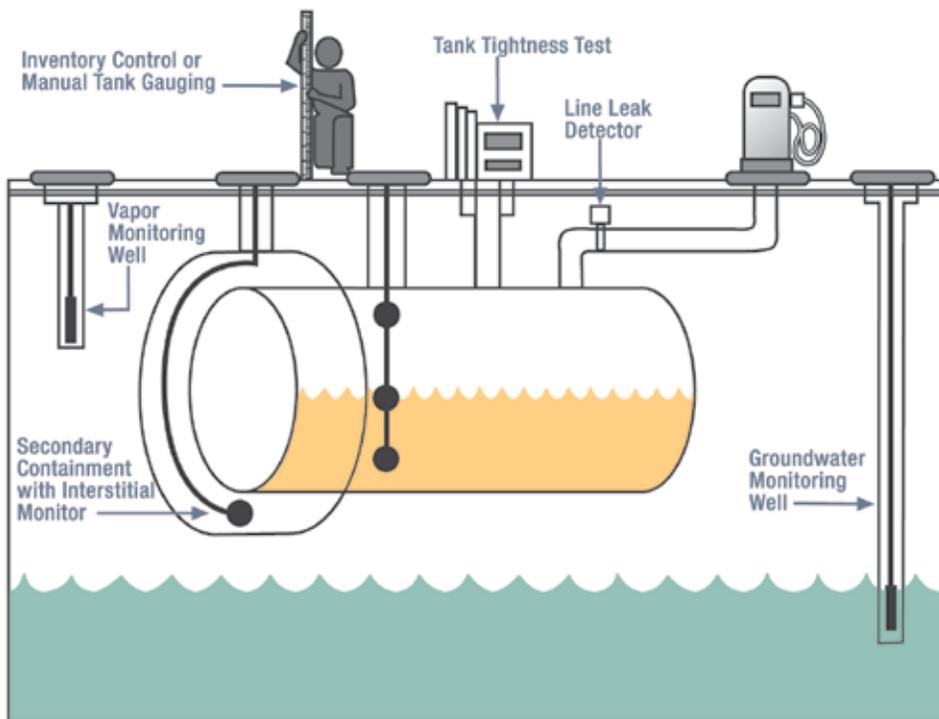
Mechanical Leak Detection (MLD)

ELD methods are used to detect changes in pressure or volume automatically. These units are often self-calibrating, making calculations of pressure and temperature unnecessary. The units are connected to electronic recording devices or computers to keep track of changes which could indicate a potential leak. ELDs are highly accurate and can detect very small leaks.

LLD is a variation of ELD, and uses similar technology and methods applied to UST piping and lines.

MLD is a general term for a large variety of testing methods, including those conducted externally to the UST system. Typically MLD consists of a sensor device that is located within the interstitial space between a tank and its secondary containment, or within an overflow area, or within the tank itself.

This generalized sketch of an UST system shows where sensors might be located inside a tank or the interstitial space. These sensors can vary in type and sensitivity and are generally linked to a computerized monitor that registers continuous or peak readings acceptable for small tanks (<2,000 gallons), and is used in conjunction with other methods such as inventory control and tank tightness testing.



Generalized Sketch of an UST System

Inventory control is a MLD method of continually comparing the product volume dispensed from a tank to the volume received over a set period of time. Discrepancies indicate that a leak is likely. This method also has low sensitivity—about 0.1 gallons per hour. It is used together with tank tightness testing and tank gauging.

USEPA does not endorse any particular leak detection method, but provides details on techniques that should meet environmental regulatory requirements when applied properly.

Tank tightness testing

Tank tightness testing is only required upon the installation of a new tank and when used in combination with inventory control methods for compliance with leak detection requirements as per 40 CFR 280. However, periodic tank tightness testing is considered a best management practice for unregulated/exempt USTs. This is typically the only definitive way to ascertain the integrity of an unregulated UST system that is not equipped with leak detection. The frequency of unregulated tank integrity testing depends on a company’s risk tolerance, but annual testing is a common benchmark for proactive tank owners.

Tightness testing protocols must meet certain sensitivities specified in 40 CFR 280 and/or as certified by NWGLDE. These methods consist of a variety of volumetric testing to determine leak rate or nonvolumetric testing that may include pressure (air) testing, hydrostatic (water) testing, ultrasonic (acoustic) testing, or colorimetric (dye/tracer) testing. A common volumetric tank tightness testing method is to observe a tank and its contents undisturbed for a period of at least 36 hours. A net decrease over time indicates a potential leak. It is important to take temperature and pressure considerations into the calculation, since these greatly affect volume readings. It should also be noted that overfill methods are far more accurate than partial fill methods. In overfill, the volume change is easier to gauge since the contents are measured in the fill neck of the tank. With the small diameter of the neck, a small volume change produces a relatively large depth change—thus making readings more accurate.

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UST management programs

Developing an operation and maintenance (O&M) plan is critical to maintaining and monitoring an UST system in accordance with regulations. More importantly, an O&M plan prevents releases and reduces impacts to human health and the environment.

Components of an effective O&M PLAN		
Description of the equipment located onsite (including release detection, spill and overfill protection, and corrosion protection)	Inspection procedures, including the frequency of inspections and required elements	Outline of response actions to be taken in the event of an identified or suspected release

An UST management program for larger companies with multiple locations should include a tank schedule for each site that outlines tank age, content, construction details, and monitoring requirements. An effective program should identify responsible parties and training requirements. A tracking system combined with an auditing program should be implemented to ensure ongoing regulatory requirements are met and best management practices are used. The USEPA website includes Resources for UST Owners and Operators to assist tank owners/operators with development of a management program (see Operating and Maintaining UST Systems).

Conclusion

The storage of material within underground tanks is convenient and allows for more efficient use of commercial space. It can also provide some fire prevention benefits when storing flammable materials. However, failure to manage risks associated with material stored in UST systems may result in severe impacts to human health and the environment.

Understanding UST leak detection, integrity testing requirements, and management practices is essential in preventing or minimizing bodily injury and property damage claims, remediation expenses, and legal defense expenses.

Tank owners should ensure leak detection compliance in accordance with federal and state requirements and utilize a proactive integrity testing programs for unregulated UST systems. A comprehensive UST management program must be implemented for all UST to ensure proper operations, maintenance, and emergency response.

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40 CFR Part 281: Approval of State Underground Storage Tank Programs.

40 CFR Part 282: Approved Underground Storage Tank Programs.

40 CFR Part 261: Identification and Listing of Hazardous Waste.



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