



RISK BULLETIN

UNDERGROUND STORAGE TANK MANAGEMENT

LEAK DETECTION AND INTEGRITY TESTING

INTRODUCTION

Underground storage tanks (USTs) are widely used across the nation. Their types and usage vary dramatically from storage of fuel to explosive gases. It has been estimated that there are more than 660,000 operating USTs regulated by USEPA and state agencies. Of these tanks, USEPA has estimated that approximately 35% are not in operational compliance with both release detection and release prevention 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 USTs will fail in a given year.

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 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.

UST REGULATIONS

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 Part 281 and individual state and territorial program standards in 40 CFR Part 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, USTs may be regulated if they contain 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:

- farm and residential tanks of 1,100 gallons or less holding motor fuel used for non-commercial 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 unregulated, these tanks have the potential to release their contents to the environment if not managed properly. As such, it is considered an industry best practice to develop a formal tank management program for these tanks including 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 UST programs and manage compliance efforts.

Currently, more than 30 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 be conflicting. 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.

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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 include:

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

Emerging Regulations and Requirements

The Energy Policy Act of 2005 included significant amendments to Subtitle I of RCRA known as the Underground Storage Tank Compliance Act of 2005 (USTCA). USTCA compliance became effective in 2007 and imposed provisions that were expected to have significant impacts on owners and operators of USTs and USEPA and States regulating USTs including:

- 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), and

- requiring the establishment of UST recordkeeping systems and making them available to the public.

TANK CONSTRUCTION AND FEATURES

UST systems consist of a number of key components in addition to the tank itself. These components include, the tank, piping, pumps, dispensers, overfill protection, leak detection, access ports, vents, and corrosion protection. Depending upon tank usage, there may be other components as well. Most of the tank system components are potential leak sources, and must be maintained and treated as critical system parts. UST systems may also be comprised of external components such as groundwater or vapor monitoring systems installed nearby to meet leak detection regulatory requirements.

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 weighing about 3,000 pounds up to a 20,000 gallon storage tank which can be 50 or 60 feet long and weigh in excess of 75,000 pounds. Tank features which 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.

In USEPA's basic tank testing handbook (<http://www.epa.gov/swerust1/index.htm>) there are dozens of methods listed for testing and monitoring. USEPA does not endorse any particular method, but provides details on techniques they believe will 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

“ Leak detection methods fall into four general categories: internal, external, interstitial and piping.”

evaluate leak detection methods for conformance to regulatory requirements.

Leak detection methods fall into four general categories: internal (tank liquid level measurements), external (installed outside the tank system), interstitial (monitoring area between UST and

secondary containment) and piping (line-leak detectors or integrity testing). USEPA outlines the following basic leak detection methods in 40 CFR 280:

- Automatic tank gauging
- Interstitial monitoring
- Groundwater monitoring
- Vapor monitoring
- Inventory control and tank tightness testing
- Manual tank gauging only
- Manual tank gauging and tank tightness testing
- Statistical inventory reconciliation and
- Other methods (typically require agency approval)

As noted, these methods and various other methods used alone or in combination are acceptable for regulatory compliance.

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) and 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 external 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 a UST system shows where a sensor might be located. This sensor can vary in type and sensitivity and is generally linked to a computerized monitor that registers continuous or peak readings.

Another commonly used MLD method relies on a gauging stick calibrated to tank specifications. This method is not sensitive enough to detect small leaks, is generally acceptable for small tanks (<2,000 gallons), and is used in conjunction with other methods such as inventory control and tank tightness testing.

Inventory control is a MLD method comprised of continually comparing the product volume dispensed from a tank to the volume received over

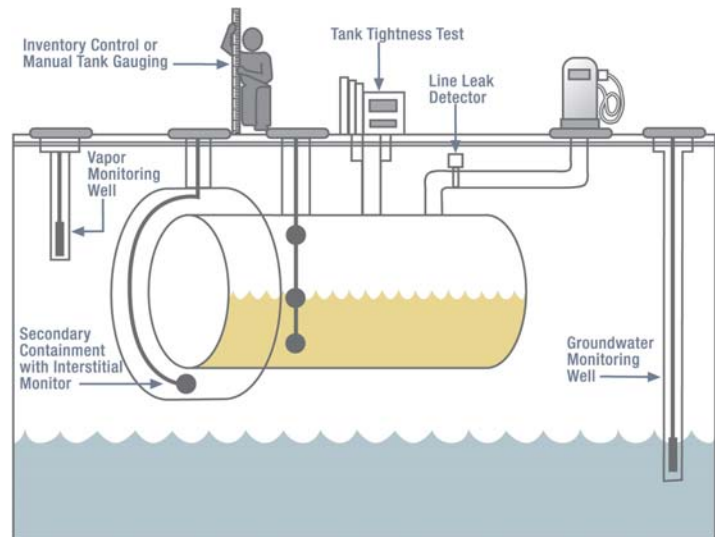
a set period of time. Discrepancies indicate that a leak is likely. This method also has low sensitivity – about 0.1 gallons per hour. It is used together with tank tightness testing and tank gauging.

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.



Generalized Sketch of a UST System

UST MANAGEMENT PROGRAMS

Developing an operation and maintenance (O&M) plan is critical to maintaining and monitoring an UST system in accordance with regulations and most importantly, a program that prevents releases and reduces impacts to human health and the environment. An effective plan includes: a 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; and an 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 and best management practices are fulfilled.

USEPA has developed a guide entitled "Operating and Maintaining Underground

Storage Tank Systems” to assist tank owners with development of a management program (<http://www.epa.gov/oust/pubs/ommanual.htm>).

CONCLUSION

The storage of material within underground tanks is convenient and allows for more efficient use of commercial space. 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, implement a proactive integrity testing program for unregulated UST systems, and implement comprehensive UST Management Programs that ensure proper operations, maintenance and emergency response.

REFERENCES

1. USEPA list of UST publications with executive summaries — <http://www.epa.gov/swrust1/pubs/>
2. ISONet – Engineering and Safety On-Line – Liability: Underground Storage Tanks, LB-50-40. <http://info.iso.com/>
3. 40 CFR Part 280 Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
4. 40 CFR Part 281 Approval of State Underground Storage Tank Programs
5. 40 CFR Part 282 Approved Underground Storage Tank Programs
6. 40 CFR Part 261 Identification and Listing of Hazardous Waste

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