Leak Detection in UST Systems: Part 1 - Self-Inspection and Monitoring

It may appear that the leak detection business reached a peak with the 1998 regulations. However, the field is very active. Veeder Root's Dean Cheramie discusses trends in leak detection that will have an impact on the operation of UST systems.

This is the first of three articles by Veeder-Root's Dean Cheramie on current issues facing underground storage tank (UST) system operators as they work to comply with federal, state and local leak prevention and detection regulations. This first part deals with requirements and issues related to monitoring and inspection by UST system operators. Subsequent parts, scheduled for the May and July issues of PE&T, will deal with compliance issues at high-volume refueling facilities, and with expectations for vapor leak detection under vapor recovery requirements.
It seems a fairly straightforward question: Am I required to periodically inspect my automatic tank gauges (ATGs)? UST system owners are facing this question more often as regulatory agencies issue new guidelines and strengthen their enforcement programs. As simple as the question may seem, the answer requires careful consideration of today's ATG definition and of the federal, state and local requirements related to leak detection systems.

What is an ATG?
The term "automatic tank gauge" is defined by the US Environmental Protection Agency (EPA) as equipment that tests for loss of product that "can detect a 0.2 gallon per hour leak rate from any portion of the tank that routinely contains product" (40 CFR 280.43(d)). This narrow definition, established in the 1980s, applies to tank gauging consoles and the level-measurement probes installed in the tank to take product level and temperature readings.

However, in today's lingo, "ATG" can refer to any one of numerous devices or systems used in a wide range of environmental monitoring at UST sites, including groundwater monitoring, double-wall interstitial monitoring, pressurized line leak detection and dispenser pan monitoring. ATG's also supply the inventory measurements used in daily inventory control. The EPA regulations require monthly product inventory control to 1 percent of flow-through plus 130 gallons, and specify that the measuring equipment must be capable of measuring product level to the nearest one-eighth of an inch (40 CFR 280.43(a) and (a)(2)).

Self-inspection and monitoring requirements differ for various aspects of typical ATG systems. To complicate matters, federal, state and local rules can be significantly different for the same items.

Who sets the rules?

Both the federal regulations and most third-party certification organizations point to equipment manufacturers' instructions as the governing criteria for self-inspections and monitoring.

The 1988 EPA regulations state that "owners and operators of new and existing UST systems must provide a method, or combination of methods, of release detection that is installed, calibrated, operated, and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition" (40 CFR 280.40(a)(2)). This requirement applies to all release detection methods and covers tanks, piping, sumps, groundwater wells and other applications.

Federal publications providing guidance on implementing the regulations also point to manufacturers' instructions as the guiding authority. For examples, see Getting the Most Out of Your Automatic Tank Gauging System (EPA-510-F-98-011) and Reference Manual for Underground Storage Tank Inspectors (EPA 510-B-00-009).

Every third-party certification of ATG equipment contains essentially the following statement: "The performance estimates above are valid only when the vendor's instructions for installing and operating the ATGs are followed."

From the above, it would seem that following the manufacturers' instructions would always square you with the federal requirements for monitoring and inspecting leak detection equipment. But this is not quite true, because of the following.

The 1988 EPA regulations, in addition to the general requirement quoted above, set forth a specific requirement that applies only to automatic line leak detectors for pressurized piping systems. The regulations require that an annual test of the operation of the leak detector must be conducted in accordance with the manufacturer's requirements (40 CFR 280.44(a)). Tank gauging systems are often used in monitoring pressurized piping systems, and sometimes serve as the automatic line leak detectors. In these cases, following the manufacturers' instructions would be sufficient only if the testing was done at least once a year.

Getting a fix on the federal requirements for self-inspections and monitoring does not necessarily answer my opening question. This is because state and local requirements in your area may be significantly different. The federal EPA program allows such differences, provided that the state or local requirements and their enforcement are at least as stringent as they would be under the federal program. In other words, states and local jurisdictions have authority to mandate additional testing and inspection procedures.

State and local regulators want to see more frequent and effective inspections, not only to detect malfunctioning equipment, but also to improve education and identify users who are not completing and recording required monthly tests, and negligent users who purposely or inadvertently defeat systems. However, state regulations can be unclear or even silent on inspection requirements.

It is common for regulators, during on-site enforcement programs, to request procedures that may go beyond manufacturer and federal requirements. Their intent may be to detect negligence, evaluate tank owner understanding and compliance, or simply to establish a single procedure that can effectively evaluate any number of varied systems.

Some regulators, such as those in Florida and California, are also working to translate their enforcement programs into clear guidance on self-inspection requirements and are pursuing state and local regulation to help clarify and enforce new inspection standards.

So, minimum federal inspection requirements are based on manufacturers' instructions, which potentially can be less stringent than the requirements established or being established by state regulation and by the enforcement practices of state and regional enforcement teams.

What the manufacturers say

As indicated in the 1988 EPA regulations cited above, manufacturers instructions are to include routine maintenance and service checks for operability and running condition of the release detection system. And, for automatic line leak detectors, an annual test of the leak detector's operation must be conducted.

Release detection systems themselves, particularly electronic systems, are capable of carrying much of the burden of determining that they are working properly and that their tests are valid. Manufacturers design systems that require little or no intervention to validate the systems' test results.

Leak detection methods and systems are not infallible. Because of the intricacies of measuring tiny changes in volume and temperature, the EPA allows certification only of systems that meet minimum 95 percent probability of detection (Pd) and maximum 5 percent probability of false alarm (Pfa) requirements. Proper understanding is required to determine which portion of the UST system was, in fact, tested by the release detection method.

Owners of large tank populations and third party monitoring providers have experience managing large-scale UST compliance programs. Veeder-Root, for example, currently manages compliance programs for over 25,000 tanks using leak-detect results from automatic tank gauges, and for over 60,000 tanks using statistical inventory reconciliation (SIR). The tank gauges include models made by Veeder-Root and other manufacturers as well.

These programs are established on manufacturer recommendations, which in the case of Veeder-Root is regular evaluation of tank and line leak test results and sensor status, combined with close follow-up on sites that do not achieve acceptable results. I believe that, properly managed, these programs have proven to be highly effective as a means of confirming release detection performance and minimizing the time between releases and their detection.

Where mandated, on-site UST system inspections, especially those that include an evaluation of regular monthly tank and line leak test results, are helping to improve compliance rates. Problems

discovered in on-site inspections include disabled or defeated systems, improper set-up, failed equipment, missing test results, lack of education, and other problems. These problems are equally identifiable by a program of regular and proactive review of and follow-up on tank and line test results, either electronically or by collection of monthly ATG printouts.

Nonetheless it is likely that evolving state and local regulations will require more on-site inspections, as discussed in the next section.

Evolving state and local requirements

Regional, state and local initiatives are underway to revise or clarify on-site inspection requirements.

Most states, including New Jersey, Pennsylvania and South Dakota have affirmed in recent documents that regular review of leak test results is sufficient evidence of the proper operation of leak detection systems. For example, the Summer 2000 edition of Pennsylvania Department of Environmental Protection's publication, Storage Tank Monitor, states that:

"Every method of tank leak detection requires a record documenting that the method is working and that there are no indications of a release. The record is required to show at least a monthly check of the leak detection/method/equipment. In some cases, the equipment will produce a written record or printout that verifies a test was performed and the results were satisfactory."

EPA's Office of Underground Storage Tanks (OUST) initiated the National UST Operations and Maintenance (O&M) Manual Working Group, which received support from Alaska, Washington, Utah, New Mexico, South Carolina and Vermont. The Group released a useful manual, Operating and Maintaining Underground Storage Tank Systems.

Effective in March 2000, Alaska requires annual inspections by the owner and inspections every three years by a state-certified operations inspector. All such inspections include verification of monthly leak-detect results and maintenance of ATG's in accordance with manufacturer's requirements.

States generally cannot mandate third-party inspections without amending state regulations. It is not clear whether the other states in the Group will the Group's O&M manual or whether they will even consider third-party inspections.

The most aggressive inspection trend in state regulations appears to be in California, where the State Water Resources Control Board is proposing to mandate the following:

• Annual system certification by licensed and certified technicians

• Certification and re-certification requirements for third-party inspectors

• Detailed inspection by licensed technicians that include:
- Hands-on functional testing of leak detection components
- Inspection of sensor position in containment areas
- Visual inspection of tank probes for damage and residue build-up

At the writing of this article, the California proposed regulations were in the comment phase. It is important for equipment manufacturers to continue to provide input to the rulemaking process on behalf of themselves and the tank owners. These regulations could be in place as early as January 1, 2002.

While properly implemented programs based on regular evaluation of test results and close follow-up are effective, evolving local requirements will increasingly call for on-site or third-party inspections. Manufacturers should continue to develop instructions and training material that will help customers safely and efficiently comply with emerging inspection requirements.

Manufacturers have in the past been hesitant to provide this support, partially due to concern that any new information will be interpreted by regulators as new manufacturer recommendations. This potentially could lead, even without new state regulation, to unilateral enforcement of procedures which manufacturers feel are redundant.

But I believe that manufacturers can clearly state minimum operating standards for proper system operation and compliance with federal guidelines and, at the same time, describe procedures to be followed for safe and proper inspection when desired by owners or when mandated by local or state regulation.

Quantitative testing of line leak detectors

When ATG's are used for pressurized line leak detection, they typically displace the traditional mechanical leak detector, and generally provide 3 gph, 0.2 gph and 0.1 gph testing. While a 3 gph test is required at least once per hour, this test is typically performed before or after each dispensing cycle. Also required is a monthly 0.2 gph test or an annual 0.1 gph test. Unlike the provision for testing tanks, the option of annually testing pressurized piping systems did not expire in 1998.

While 3 gph tests are very quick, 0.2 gph and 0.1 gph precision tests of piping systems require a quiet period of up to several hours without dispensing, during which the pump may be cycled on and off several times to re-pressurize the line and evaluate thermal conditions.

Regulators are increasingly taking the position that the EPA-required annual test of the operation of automatic line leak detectors in accordance with the manufacturer's requirements is a functional test that must be performed via on on-site inspection.

Manufacturers, including Veeder-Root, have established a different position. Veeder-Root systems, for example, perform the required functional self-test as part of every 3 gph and precision test. It is not possible for defeated systems or systems not in control of pump operation to record regular test results. Therefore, evaluation of recently completed line leak test results meets the requirement for annual functional testing and confirms that systems have not been intentionally or inadvertently defeated.

Some counties and states are going further to require quantitative field testing of electronic line leak detectors, which requires that 3 gph and even 0.2 gph and 0.1 gph leaks are simulated on-site, to

confirm that the system detects the leak and shuts down the piping system as required. These field procedures create a number of potential trouble spots that need to be kept in mind as the tests are performed:

• **Test procedures:** The operation of electronic systems varies among manufacturers and even among models. The tests do not always run during pump start-up as they would with mechanical leak detectors. A test for a mechanical leak detector may not adequately exercise an electronic system. A test procedure for each model will be required.

• **Coordination:** Many electronic systems are monitored remotely by the customer or a designated third party. The quantitative test, by definition, produces an alarm that initiates a response by the monitoring center. Coordination with the remote monitoring party will be required. Documentation of the alarm "closures" will need to explain the inspection process.

• **Safety:** Quantitative testing requires unrestricted product flow through an orifice into a container, during part of which the submersible pump must remain on. Electronic systems control submersible pump operation and routinely turn the pump on at various intervals to perform leak detection functions. These intervals may change, depending on such site features as piping type and length. Clear procedures are required to ensure that the pump, which must be on to enable the test, cannot run while the test apparatus is being installed or when the container is not safely in place.

• **System operation:** Upon detecting the induced leak, the electronic system may disable the submersible pump. Different models have different procedures for confirming a no-leak condition and returning the pump to proper operation. Technicians will need specific post-test procedures for each model tested.

I do not recommend regular on-site quantitative testing of electronic line leak detection systems. However, I believe such testing will be mandated by a limited number of state and local jurisdictions. To help owner/operators comply, manufacturers should develop hardware, instructions and training material to help assure safe and proper quantitative testing of electronic line leak detection systems.

Testing containment sensors

Functional testing of sensors in containment areas (e.g., sumps and interstices of double-wall tanks) is also the focus of regulatory debate. Through the use of fail-safe sensors that allow systems to detect and "alert" sensor failure, manufacturers maintain that properly installed systems need little inspection, provided that sensor status is evaluated routinely, either remotely or through the collection of monthly system reports.

However, containment sensors can be rendered less effective if they are moved to different or higher locations within the containment area. Because these sensors sometimes are used as the sole or primary protection for tanks and piping, regulators are increasingly asking for routine inspection of sensor placement and operation.

Field inspection of double-wall tank sensors can present a particularly nasty problem. Sensors

installed into the narrow interstice of a double-wall tank often are installed before the tank is filled, because the interstitial space can be deformed and compressed when the tank is full. It may be possible to remove a sensor from the interstice of a full FRP tank for inspection by pulling on the installation cord. But it may be impossible to push the sensor back into proper position after the inspection, at least until the tank is partially emptied.

Outlook

In my view, release detection equipment manufacturers should continue to be responsible to their clients (tank owners) by identifying procedures that will provide a high level of assurance that the results achieved by the equipment are valid. The manufacturers should continue to promote routine evaluation of leak detection results, follow-up on missing or failed results and proper documentation of any events. Regulators, who have the responsibility for building enforcement programs, will continue to define additional processes for deterring non-compliance and negligence.

These objectives are not in conflict; rather they are complementary. Equipment manufacturers will define the procedures for properly evaluating compliance results.

States will determine if licensed technicians are required to carry out evaluations, or if additional procedures for detecting fraud or defeated systems are required. States will dictate more stringent inspection requirements for a variety of reasons. In these cases, it again becomes the manufacturer's responsibility to provide support and documentation for the safe and proper inspection of systems in accordance with state and local requirements.

From the UST owners' perspective, the responsibility for preventing and detecting leaks and complying with federal, state and local regulations will remain of utmost importance. In my view, the most important and effective action to affirm performance of on-site release detection systems is vigilant review of tank and line leak test results and sensor status, with follow-up on sites with alarms or sites that do not consistently report positive results. An effective program of record-keeping and follow-up will keep UST systems release detection compliance in most cases.

Marketers should be aware of local or state requirements for quantitative line leak testing, functional sensor testing, on-site inspection, or inspection by licensed and certified technicians. This information is available through local regulators or the state environmental agency web sites, which sometimes also provide inspection report forms. Qualified local service contractors are invaluable sources of insight into local requirements.

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