Secondary Containment and Interstitial Monitoring

Standardized Inspection Manual

Technical Chapter 3.4

Tennessee Department of Environment & Conservation

Division of Underground Storage Tanks

Rules Effective October 13, 2018

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

TECHNICAL CHAPTER 3.4

SECONDARY CONTAINMENT AND INTERSTITIAL MONITORING

EFFECTIVE DATE - October 13, 2020 - TBD

DISCLAIMER

This document is guidance only and does not affect legal rights or obligations. Agency decisions in any particular case will be made applying applicable laws and regulations to the specific facts. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

PURPOSE

The purpose of this technical chapter is to assist Division of Underground Storage Tanks (Division) staff in understanding the regulatory requirements for the installation, operation, release detection, and recordkeeping requirements for underground storage tank (UST) systems that are secondarily contained and are monitored using interstitial monitoring.

This technical chapter contains the current policy of the Division based on the statute and regulations governing the Tennessee Petroleum Underground Storage Tank program. This document supersedes all previously published versions. The most current version of this technical chapter will be posted and always available on the Division's website.

AUTHORITY

All rules referred to in this technical chapter are contained in Chapter 0400-18-01 and are available on the Division of Underground Storage Tanks website at https://www.tn.gov/environment/program-areas/ust-underground-storage-tanks/ust/act-rules-and-policies.html.

APPLICABILITY

This document provides technical and specific industry knowledge regarding the installation, inspection, and operation of interstitial monitoring (IM) devices for UST systems. The document also provides specific information related to monthly monitoring requirements for secondarily contained UST systems. Continuous interstitial monitoring is required on all secondarily contained UST systems installed on or after July 24, 2007. [1] If IM is chosen as the primary release detection method for use on secondarily contained UST systems installed prior to July 24, 2007, the requirements in the release detection portion of this document must be implemented for those systems also.

[1] Required by Rules 0400-18-01-.02(1)(c), .02(2)(a)2., .02(2)(b)2. .04(3)(d)1. and .04(4)(c)1

Each device utilized for interstitial monitoring must be evaluated by a third party and subsequently listed by the National Work Group on Leak Detection Evaluations (NWGLDE).[2] All IM devices must be third-party certified to test for leaks at 0.2 gph on a monthly basis, with a 95% probability of detection, with no more than a 5% probability of false alarm.[3] The NWGLDE evaluations list may be accessed at www.nwglde.org.

INTRODUCTION

The use of IM as a release detection method for petroleum underground storage tank systems (tanks and piping) involves two elements. First, secondary containment is installed outside the portion of the tank and/or piping routinely containing petroleum. An example of secondary containment for piping is a 3-inch pipe constructed around the outside of a 2-inch pipe. The 2-inch pipe delivers fuel from the tank to the dispenser and is considered the primary (inner) pipe. The 3-inch pipe is the secondary (outer) pipe and is the barrier which allows liquids to flow to a location where a sensor is located. The area between the primary and secondary walls of the tank/piping is referred to as the interstice, annular area, or interstitial space.

The purpose of the secondary containment system is to prevent the release from entering the surrounding environment and allow it to be detected by the monitoring system. The outer wall must also divert any liquids which accumulate in the interstice to the lowest point in the secondary containment system. For product piping, the lowest point is typically a tank top sump or dispenser sump. For tanks, this location is typically the bottom of the tank in the interstitial space.

In addition, a monitoring system is used to detect product in the interstice between the inner and outer walls of the secondary containment system. A monitoring device such as an electronic sensor must be installed in all secondary containment sumps where product or water can accumulate to comply with Rules .04(3)(d)1.(i) and .04(4)(c)1(i). The monitoring system must be a method that is third-party approved and on the National Work Group on Leak Detection Evaluations website at www.nwglde.org. [4]

Interstitial monitoring, if designed and performed properly, will usually detect releases before they can contaminate the environment. Some interstitial monitoring devices use sensors that indicate the presence of liquid. Other monitoring devices check for a change in condition that indicates a hole may be in the inner or outer wall of the secondary containment system. These conditions may include a loss of pressure or a change in the level of fluid between the walls of a secondarily contained system.

Some double-walled tanks have fluid, a vacuum, or an electronic sensor within the interstitial space. A change in fluid level or vacuum, or an electronic sensor alarm may indicate a breach of the inner or outer wall of the tank and is considered an unusual operating condition that must be reported as a suspected release. [5]

[2] Required by Rule 0400-18-01-.04(1)(a)5
[3] Required by Rule 0400-18-01-.04(1)(a)4
[4] Required by Rule 0400-18-01-.04(1)(a)5
[5] Required by Rule 0400-18-01-.05(1)(a)

DEFINITIONS

Compartmentalized tank- a single UST that consists of two or more tank compartments, which are separated from each other by a wall or bulkhead.

Containment Sump- a liquid-tight compartment that provides containment of any product releases. Containment sumps are typically used underneath product dispensers and/or for enclosing the submersible turbine pump (STP) assembly and piping connections at the top of a pressurized piping UST system.

Discriminating sensor- a sensor with the ability to distinguish between petroleum hydrocarbons and water.

Dispenser- a device designed to transfer petroleum products from USTs into tanks in motorized vehicles, equipment tanks, or other containers, while simultaneously measuring the amount of product dispensed.

Interstitial sensor- an electronic device installed within the secondary containment system (tank interstice, tank top sump, transition sump, or dispenser sump) which is connected to a monitoring console or another device that will signal an alarm. The sensor alerts the operator when the presence of petroleum, liquid, or loss of vacuum is detected.

Non-discriminating sensor- a sensor that activates in the presence of any liquid.

Penetration fitting- a gasket or sealing device installed on secondary containment sumps to allow piping and electrical connections to enter the sump. These fittings allow the piping to enter the containment sump and the sump to remain liquid-tight.

Positive Shutdown- an optional feature for underground storage tank piping systems which disables the power supply to the submersible turbine pump, preventing the flow of additional product into any connected product lines when the presence of liquid or fuel (discriminating sensors only) is detected. Positive shutdown is required by Rule for UST systems which utilize low level integrity testing for secondary containment sumps.

Release- any spilling, overfilling, leaking, emitting, discharging, escaping, leaching, or disposing of a petroleum substance from a UST including its associated piping into groundwater, surface water, or subsurface soils.

Release Detection- a method used to determine whether a release of petroleum has occurred from the UST system into the environment or into the interstitial space between the UST system and its secondary barrier immediately around or beneath it.

Repair- in the context of UST system operation, to restore the tank or UST system component that has caused the release of petroleum from the UST system. In the context of replacement of piping on or after July 24, 2007, restoration of a portion of piping in lieu of replacement of an entire piping run authorized by the Division in writing.

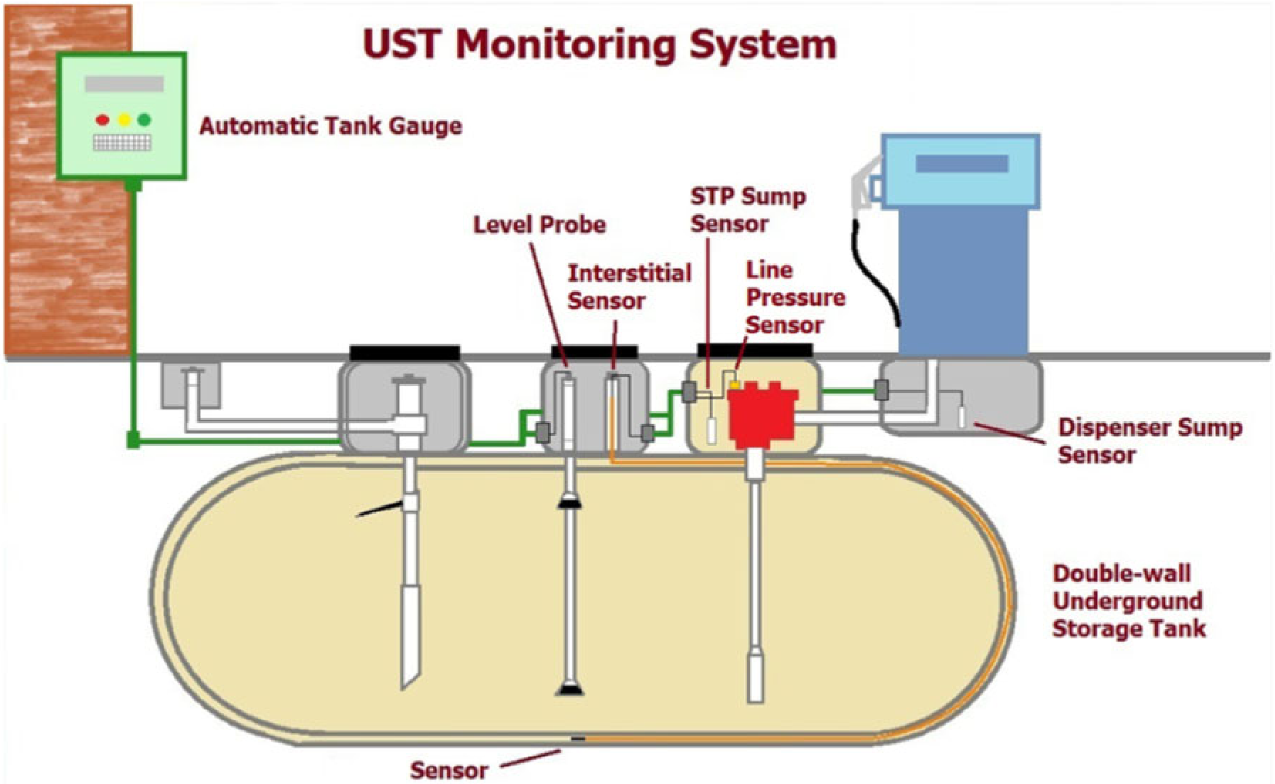
Replaced or Replacement- For a tank – to remove a tank and install another tank. For piping – to remove fifty percent (50%) or more of piping and install other piping, excluding connectors, connected to a single tank. For tanks with multiple piping runs, this definition applies independently to each piping run.

Routinely contains petroleum- those parts of the UST system designed to store, transport, or dispense petroleum.

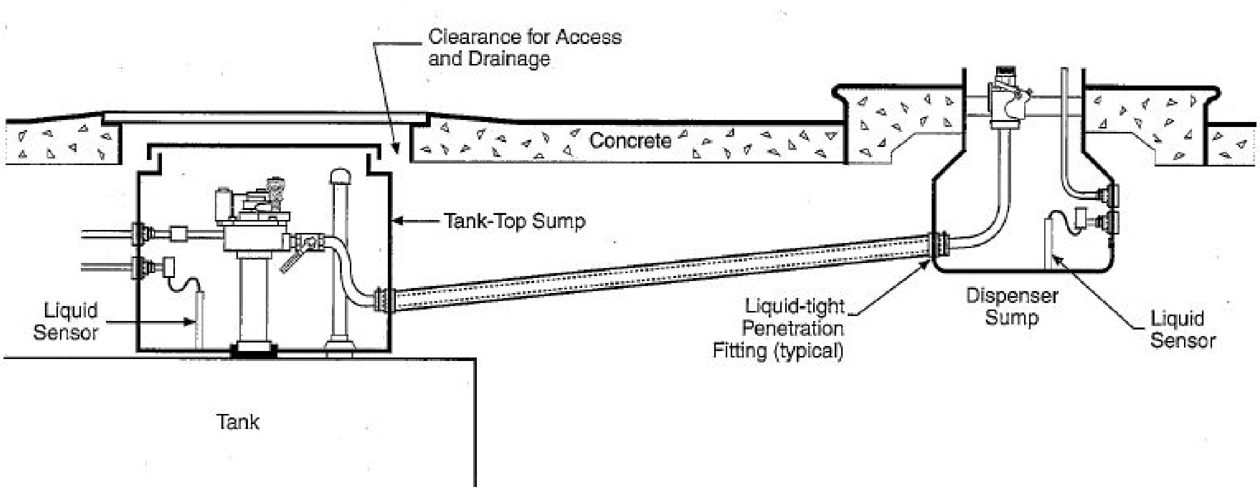
Secondary containment- a system designed and installed so that any material that is released from the primary containment is prevented from reaching the environment. Components of a secondary containment system include, but are not limited to, double-walled tanks, double-walled piping, tank sumps, transition sumps, dispenser sumps, and all of their associated components.

Test Boot- A boot found on secondarily contained piping and is a flexible sleeve usually made of rubber with a valve located on the piping in the sump. It is used to test the space between the inner and outer piping walls for tightness.

COMPONENTS OF SECONDARY CONTAINMENT SYSTEMS



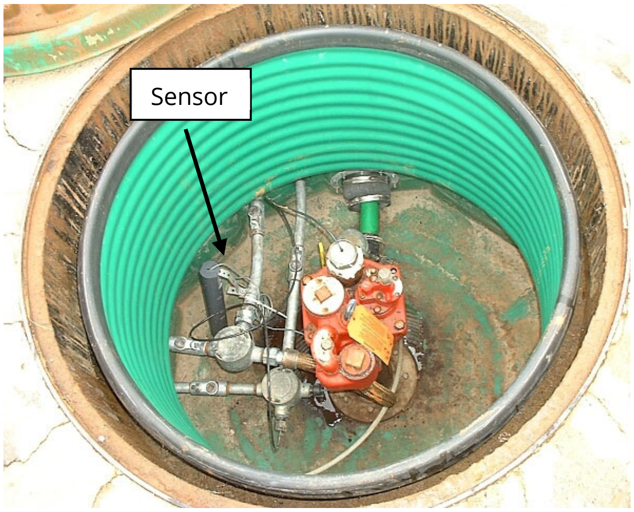
This illustration demonstrates some ways secondary containment may be used. Illustration provided courtesy of CommTank.



Secondary containment systems provide an additional layer of protection against the accidental release of petroleum into the environment. They should be designed to contain any release from tanks, piping, or associated equipment, allow the detection of any release, and provide access for recovery of released product. See Rules .02(1)(c) and .02(2). Secondary containment systems typically consist of:

1) **Tank Interstitial Space -** The space between the primary (inner) and secondary (outer) wall of a tank.

2) **Tank Sumps** - A liquid-tight containment device that houses the submersible turbine pump (STP) and product piping termination and is designed to temporarily contain leaking product. Tank sumps are also designed to provide access to the submersible turbine pump head unit above the tank. The tank sump may house the STP head unit, piping, line leak detectors, interstitial monitoring devices, wiring, and other equipment. Tank sumps are typically located directly above the USTs. Tank sump lids generally range from 3 to 4 feet in diameter and can be round, oval, square, or rectangular in shape. Tank sumps must be equipped with lids which have a properly fitted gasket. This gasket provides a watertight seal to the sump to prevent surface water intrusion.



Tank sump showing sump lid gasket in place and sensor in proper position in sump

Oval-shaped sump on fiberglass reinforced plastic (FRP) tank top

Shallow Under Dispenser Containment sump with sensor

Typical STP sump showing sump lid and cover

Water and product in sump and sensor has been moved out of position and cannot properly detect liquids in sump

Uncontained sump using a plastic container to keep backfill from caving in on pump head. This would not meet present installation standards.

3) **Dispenser Sumps -** Dispenser sumps are designed to contain any leaking product from fuel dispensers or their associated components within the sump. They also provide access to a portion of the piping, flex connectors, shear valves, and other equipment located beneath the dispenser. Dispenser sumps are found directly under the dispensers.

4) **Transition/Intermediate Sumps -** Transition/intermediate sumps are less common than other sumps but can be found along the piping runs that connect the tanks to the dispensers and are designed to provide access to the piping. Transition sumps are used to transition from above-ground piping to below-ground piping or, in some cases, to transition between different types of piping or where a piping union may occur. Intermediate sumps are located at key points in the piping system (e.g., low spots, branches, tees). Transition/intermediate sump lids generally range from 3 to 4 feet in diameter and can be round, oval, square, or rectangular in shape.

5) **Outer Secondary Piping -** The outer or secondary piping layer of a double-walled piping system is designed to contain a leaking primary line which may allow fuel to flow to a sump where it can be contained or detected. The outer secondary piping may be prefabricated or installed on-site in accordance with manufacturer instructions. All piping installed must be compatible with the product stored in the UST system as required by Rule .02(5). Installers are required to verify outer piping integrity at installation by performing pressure or vacuum tests in accordance with manufacturer's instructions or the National Fire Prevention Association (NFPA).

6) **Sump penetration fittings (secondary piping termination fittings) -** When piping enters a secondary containment sump, penetration fittings are installed in the sump to allow the piping to enter. These fittings are designed to provide a liquid-tight seal, preventing fuel from escaping the sump or water from entering. Penetration fittings are usually made of rubber or a composite material which can degrade over time. **These fittings should be maintained as required by Rules .02(2)(b)1.(ii), .02(2)(b)3., .02(2)(b)4., and .02(1)(c), to prevent fuel from escaping the secondary containment.**

The photos above show damaged penetration fittings allowing gravel backfill to enter the sump. The sump is no longer liquid-tight.

7) **Inlet Test Boots -** These boots are used during installation to verify secondary containment integrity by introducing air pressure into the piping interstitial area. Some test boots may be a part of the penetration fitting itself (figure 2), or in some flexible piping systems, it is a separate boot (figure 1) which can be adjusted to fit on the outer piping termination after it enters the sump. Inspectors should ensure the test boots are loosened or removed after installation **if** interstitial monitoring is required for release detection.

1. APT Poly-Tech Test Boot

2. Environ Geo-Flex Test Boot attached to penetration fitting; test boot on right is torn

Types of Electronic Interstitial Monitoring Methods

1) **Dry Annular**

Sensors are used in sumps or tank interstitial areas to detect the presence of fuel or water. Dry annular monitoring systems are capable of detecting breaches from the inner wall and intrusion of liquid through the outer walls of tanks, sumps and piping.

2) **Hydrostatic (liquid-filled)**

Sensors are used in an interstitial area filled with brine or other acceptable liquid which is monitored continuously. If the outer wall is breached, the loss of brine will activate a hydrostatic sensor and alert the operator of a problem. Hydrostatic monitoring systems are capable of detecting breaches in both the inner and outer walls of tanks, sumps and piping.

3) **Vacuum**

For double-walled tanks equipped with a vacuum interstice, the system uses vacuum generated by the turbine pump to continuously maintain a partial vacuum within the interstitial space. The system is designed to activate a visual and acoustic alarm, and optional turbine pump shutdown, before stored product can escape to the environment. Vacuum monitoring systems are capable of detecting breaches in the inner and outer walls of tanks, sumps, and piping. See Appendix 1 for more information.

TYPES OF SENSORS

1) **Float Switches (non-discriminating)**
   A basic float switch consists of two magnets, one of which is attached in a permanently fixed location inside the sensor. A second magnet is attached to an object that will float on fuel or water. When a liquid is introduced to a predetermined level, the magnets contact and complete an electronic circuit. The active circuit is then translated as an alarm by the monitoring device.

2) **Float Switches (discriminating)**
   A discriminating sensor can differentiate between fuel and water using multiple magnetic circuits in a single sensor. Since water and fuel have different liquid densities, each magnetic circuit will trigger a separate alarm.

3) **Optical Sensors (discriminating and non-discriminating)**
   Sensors that use a light beam directed at a reflective surface inside the sensor. When liquid is introduced, the light beam is refracted and converted to an electrical signal. The console is then notified of the presence of liquid.

4) **Electrical Conductivity**
   These devices take advantage of the electrical conductivity of fluids. When a liquid is in contact with the sensor, an electrical bridge is completed between two contact points and a signal is sent to the monitoring device.

5) **Pressure Monitoring Device**
   Uses pressurized nitrogen gas to continuously maintain an overpressure within the interstitial space of double-walled piping. The system is designed to activate a visual and acoustic alarm before stored product can escape to the environment. The system is capable of detecting breaches in both the inner and outer walls of double-walled piping.

6) **Vacuum Monitoring Device**
   Uses vacuum generated by the turbine pump or separate external vacuum pump to continuously maintain a partial vacuum within the interstitial space of double-walled tanks and double-walled piping. These systems are designed to activate a visual and acoustic alarm, and optional turbine pump shutdown, before stored product can escape to the environment. These systems are capable of detecting breaches in both the inner and outer walls of double-walled tanks and double-walled piping.

7) **Hydrostatic (Liquid-Filled) Interstitial Sensors**
   These systems use propylene glycol or a brine solution to fill the tank and/or piping interstice. The tank interstice and/or double-walled sump interstice (continuous with piping interstice) is monitored by a liquid level sensor and sends a continuous signal to the monitoring device. If liquid is removed, the electrical contact in the sensor is broken and an alarm is activated.

See Appendix 2 for additional sensor information and descriptions.

Some examples of each type of device are shown below:

Veeder-Root Interstitial Tank Sensor

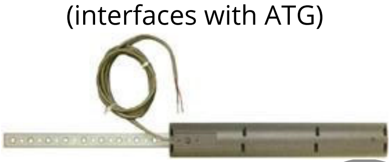
Veeder-Root Discriminating Sump Sensor

INCON Non-Discriminating Sump Sensor

Veeder-Root Vacuum Sensor (interfaces with ATG)

INCON Brine Interstitial Sensor

OPW Optical Interstitial Sensor



Veeder-Root Non-Discriminating Sump Sensor

Veeder-Root Mag Sump Sensor

Veeder-Root Hydrostatic Sensors

MONITORING CONSOLES

Electronic Interstitial Monitoring can be conducted using an Automatic Tank Gauging (ATG) console or a stand-alone console. Depending on the type of device installed, the system may or may not be able to generate a paper record. Most stand-alone monitoring consoles require the owner/operator (O/O) to manually document the monthly leak detection result by observing the device to determine if an active alarm is present. Some examples of each type of device are shown below:

1) **ATG Consoles**

Veeder-Root TLS-350

INCON TS-1001

Veeder-Root TLS-450 Plus

OPW ECCO 1500

INCON TS-2001

Franklin TS-550 EVO

EBW Auto Stik Jr.

Veeder-Root TLS-4 (no printer)

OPW Integra 100

2) **Stand-Alone Consoles**

PermAlert FluidWatch


Pneumercator LC1000

Centeron Wireless Monitor

Common Problems with Secondary Containment

1) **Fuel in Sumps or Interstitial Area**

The first sign of a problem with a secondary containment system is when petroleum product escapes from the primary tank or piping system. When the system is functioning properly, it is designed to allow fuel to accumulate at the lowest point where a sensor will automatically alert the operator. The most common source of fuel intrusion in containments sumps is leaking components of the STP manifold assembly, such as leak detectors, functional elements, gaskets or seals. Some components of the outer wall of flexible piping and sump systems manufactured prior to 2004 are not compatible with petroleum, and long-term exposure may lead to degradation. If the unexplained recurring presence of fuel is detected in any portion of the secondary containment system, this constitutes an unusual operating condition and must be reported to the Division within seventy-two (72) hours as a suspected release as required by Rules .04(1)(b) and .05(1)(a)2. and 3. Integrity testing of the containment sump is required in order to determine if petroleum has escaped from the UST system, as required by Rule .05(1)(a)2. If debris or liquid is found (small amounts of debris/liquid/residue are acceptable as long as it does not interfere with the placement or the operation of the sensor), it should be immediately removed and properly disposed of in accordance with local, state and federal requirements.

2) **Water Intrusion in Secondary Containment**

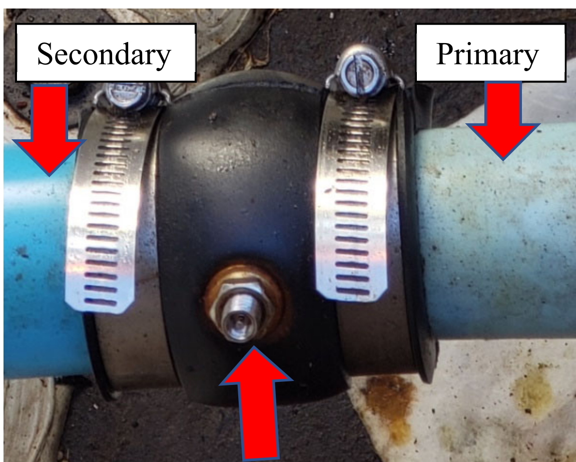
The presence of water in a containment sump or tank interstice may not necessarily be due to a leaking UST system. Loose or missing sump lid seals can allow surface or groundwater to accumulate and activate sensor alarms. Water should be removed and lids and all joints, seals, and boots should be visually inspected to determine the source of intrusion. Water intrusion will interfere with properly conducting continuous monitoring with UST systems that have IM as release detection. See Rule .04(3)(d)1.(ii). If water continues to accumulate in the secondary containment system and the intrusion cannot be eliminated, that is an indication the system is damaged and must be repaired to be in compliance with Rules .02(1)(c), .02(2)(a)3. and 4, .02(2)(b)3. and 4., and .02(2)(c)1. and 3. or replaced to be in compliance with Rules .02(6)(a) through (f). Recurring presence of water (not related to condensation) must be reported to the Division as a suspected release within seventy-two (72) hours in accordance with Rule .05(1)(a)2.

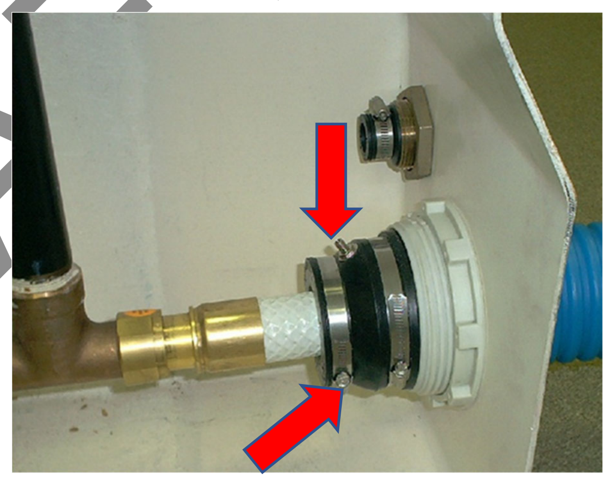
and 3. unless the device or containment system is immediately repaired or replaced, and additional monitoring within thirty (30) days eliminates water intrusion in the interstice as the cause of the alarm. The Division will determine if additional action is required on a site-specific basis. Integrity testing of secondary containment sumps upon completion of repairs is required within thirty (30) days in accordance with Rule .02(7)(d).

3) Improper Isolation of the Piping Interstice

When double-walled flexible piping is installed, piping manufacturers often provide a rubberized test boot over the primary and secondary piping inside the secondary containment sump. This test boot allows the installer to pressurize the secondary pipe to verify tightness at startup. If the O-ring clamps on the boots are not loosened or removed after air testing is completed, liquids cannot enter the containment sump and be detected by sensors for proper release detection as required by Rule .04(3)(d)1.

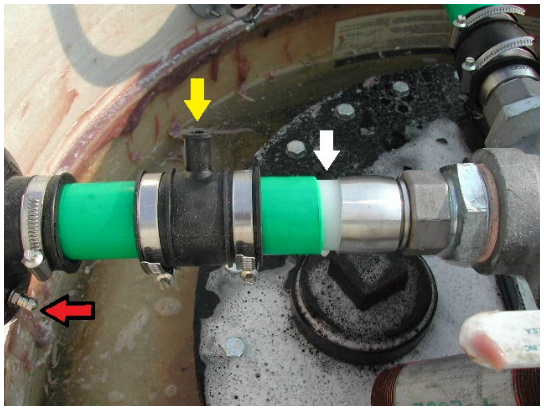
A problem may also exist when a closed fitting or a test boot equipped with a Schrader valve has the valve core in place. These situations will require the inspector to take a closer look. See following illustrations:



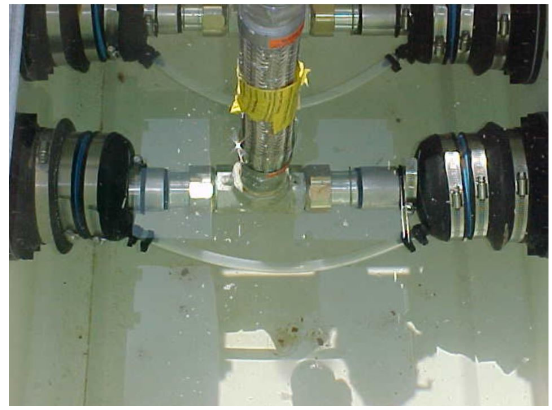


The left picture above is TCI double-wall piping. The valve core (middle red arrow) is used test the integrity of the secondary. The right picture is single wall flexible piping inside a chase.

Since the test boot clamps are tight and the valve core installed, product leaking from the primary pipe will not enter the sump and be detected by the sump sensor. Liquid accumulating under pressure in the interstice could result in a rupture of the chase piping and release to the environment that would not be detected by this interstitial monitoring method.



In this example, the piping is double-walled. Secondary containment is provided by the space between green outer layer and the white inner layer (white arrow). The Schrader valve (red arrow) would be used to test the integrity of the chase piping. The test boot has been pulled back allowing any product leaking from the primary piping to enter the sump. In this case, the test boot could be left in the testing position, as long as there is no obstruction in the nipple on the test boot (yellow arrow). The nipple allows for an air test of the secondary containment. Since it is difficult to verify whether there is an obstruction in the test boot, this is the preferred position of the test boot unless the secondary containment space is being tested.



Some product piping configurations are equipped with test jumper tubes that allow installers to verify the integrity of secondary containment during installation. Rule .04(4)(c)(v). requires the installation of sensors in every sump to monitor for the presence of liquid. In order for product to be able to enter the containment sump, jumper tubes should be removed or opened to allow any potential leaks to be detected by the sensor.

4) Flexible Piping Degradation

Flexible plastic piping has become popular for installation at new UST facilities because it can be installed in an individual piping run without sections or fittings. Some types of manufactured flexible plastic piping have experienced problems with swelling and deformity of end fittings near the tank or dispenser due to incompatibility with the petroleum product. In addition, microbial degradation has been found to cause piping failures in Total Containment (TCI) brand Enviroflex piping manufactured prior to 1994, referred to as 1st generation. 1st generation TCI piping, which is yellow in color, was recalled and shall be replaced as required by Rules .02(5) and .02(4)(b).

Pictured above is Environ's GeoFlex-D. A common failure mode is one where the outer layers of the primary pipes often swell and ultimately split. The pipe often feels sticky and spongy. The swelling can cause the pipe to grow several inches in length. This growth sometimes tears the secondary containment boot at the sump wall and overstresses the shear valve or flexible connector to which it is attached.

Pictured above is Total Containment's 2nd generation of Enviroflex pipe. Similar to problems with Environ's GeoFlex, the pipe has grown and stretched, causing excessive stress to the fittings.

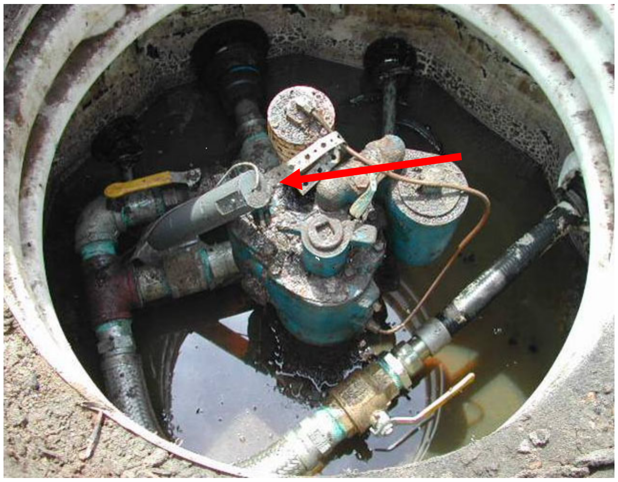
Common Problems with Interstitial Monitoring Devices

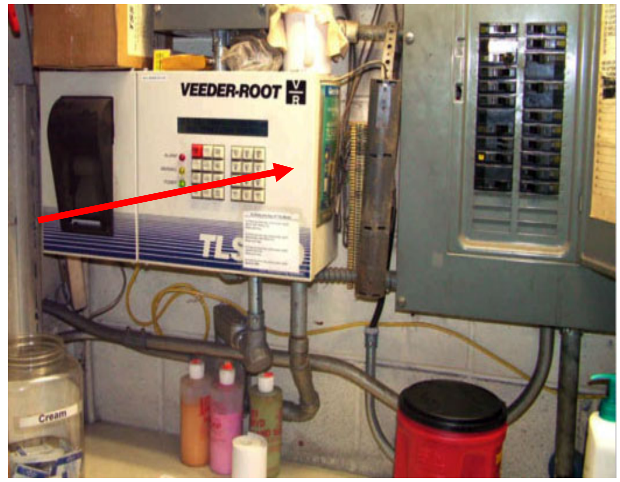
All interstitial monitoring consoles and sensors must be checked annually following the manufacturer's instructions in accordance with Rule .04(3)(d)1.(iii) and the results documented on the Division's form CN-1340 Annual Electronic Interstitial Monitoring Test Report (See Appendix 3). The sensor manufacturer may also be consulted for guidance.

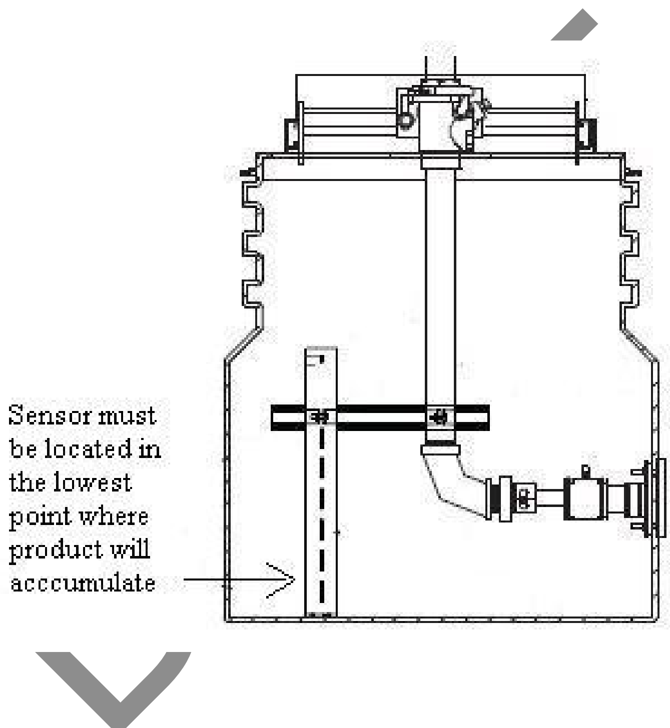
1) Sensors Installed Improperly

Tank and sump sensors must be installed in a location where they can detect a loss of product or liquid as soon as a problem occurs to comply with Rules .02(1)(c), .02(2)(a)2., and .02(2)(b)2. and .04(3)(d)1.(i) through (iii). Sensors that are not properly installed can allow a release to go undetected indefinitely.

The following photos demonstrate improper placement of sensors:







2) Sensor Alarm Warnings Ignored

IM systems are equipped with audible/visual alarms to alert the operator as soon as a problem is detected. If these devices are disabled, ignored, or silenced, this is considered a violation of Rules .04(1)(b) and .05(1)(a)3. Alarm messages generated from various ATG consoles may include, but not be limited to, the following:

i. Fuel Alarm- discriminating sensor has detected product in the interstice.

ii. High Liquid Alarm- sensor has detected eight inches of any liquid using a non-discriminating sensor, or water using a discriminating sensor.

iii. Liquid Alarm- sensor has detected one inch of any liquid using a non-discriminating sensor, or one inch of water using a discriminating sensor.

iv. Sensor Out Alarm- sensor has been disconnected or is inoperable.

v. Short Alarm- sensor has been disconnected or is inoperable.

vi. Active- used to describe any type of sensor alarm in the alarm history report.

vii. High Brine Level- sensor has detected an increase in brine level and therefore may indicate a release into the interstice or water ingress.

viii. Low Brine Level- sensor has detected a decrease in brine level and therefore may indicate a breach in the inner or outer containment.

The O/O should consult the operators manual for their specific monitoring device to determine what each alarm from their specific device means and to maintain compliance with Rule .04(1)(a)2(i) through (iii).

3) Failure to maintain or periodically test sensors

Residue or debris can accumulate on float switches and prevent them from functioning properly. Electrical conductivity sensors can corrode in humid environments. Optical sensors may have a film develop on the outside of the lens which interferes with their operation. All sensors should be checked during annual testing in accordance with the Division's IM form CN-1340 Annual Electronic Interstitial Monitoring Test Report as required by Rules .04(3)(d)1.(iii), .04(5), and .03(2)(b)11 (See Appendix 3).

INSTALLATION OF SECONDARY CONTAINMENT

UST system installations must be certified[6] when the UST system is registered by one of the following methods:

a. Manufacturer Certified Installer
b. Installation Certification by a registered professional engineer
c. Installation inspected/approved by Division personnel
d. Manufacturer's installation checklists are completed

The certification method must be indicated within fifteen (15) days of completion of installation using the Division's Notification Form (CN-1260) [7] for the newly installed system and within thirty (30) days of completion for any subsequent change in status as required by Rule .03(1)(g). Although the Division currently does not conduct UST installation certification inspections,[8] installers are encouraged to contact the local Division field office and notify them of construction activities before beginning work. The Pre-installation Notification Form (CN-1288) must be submitted fifteen (15) days prior to installation[9]. Division personnel may choose to observe and document the installation process to verify equipment installed, piping type, configuration, etc.

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[6] Required by Rules 0400-18-01-.03(1)(d)1. and .03(2)(a)1.
[7] Required by Rule 0400-18-01-.03(1)(a)2.
[8] as allowed under Rule .03(1)(d)1.(iii)
[9] Required by Rules 0400-18-01-.03(1)(a)1. and .02(1)(a)

Please be advised, manufacturers may also require specific training before the UST system is installed. UST system installers and service providers shall maintain current certifications and receive specific training for any products they install if the product manufacturer requires such training.

The following Division and manufacturer's requirements apply to installation of double-walled tanks, double-walled piping, and secondary containment systems for new tank systems:

Testing requirements during installation

UST component manufacturer's installation instructions and procedures may vary. The sections below outline the basic testing requirements that are required during the installation process. Installers must follow the manufacturer's instructions for the system to be in compliance.

1) **Double-wall tanks - dry (air/vacuum) or brine**

   Dry tank interstices are typically shipped from the factory with the interstitial space under vacuum. This allows for monitoring during the shipping, handling, and installation period. Minimum vacuum levels and vacuum time durations are required to be maintained by manufacturers. If the minimum vacuum requirements are not met or the tank is not shipped with vacuum on the interstice, the manufacturer may require the tank to be air tested prior to installation and again after backfill is brought to the top of the tank.

   For hydrostatic monitoring systems, the level of liquid in the monitoring reservoir is measured at the highest point and checked again after a period of time established by the tank/piping manufacturer. If no amount of liquid loss is measured, the secondary containment system is considered to be tight. The manufacturer may require air pressure tests to be conducted on the primary when backfill has been brought to the top of the tank. Air pressure should never be applied to a wet interstice.

2) **Double-wall piping- dry**

   Following installation but prior to backfilling, manufacturers require both the primary and secondary piping be tightness tested. This will ensure integrity of the piping, joints, and seals. Depending on the piping material and manufacturer requirements, these tests may be pneumatic, vacuum, or hydrostatic with varying test pressures and length requirements.

3) **Sump testing**

   All secondary containment sumps must be verified as "liquid-tight" upon completion of installation in order for the UST system to be in compliance with the secondary containment requirements.[10] Consequently, sumps must be hydrostatically or vacuum tested after all joints have been assembled, sealing materials have cured, and all penetration fittings have been installed, and prior to backfilling of piping trenches in accordance with the manufacturer's instructions. If no installation instructions are available, consult the procedure set forth in Appendix 4 to confirm all sumps are liquid-tight. If a sump is not liquid-tight at any time, it must be immediately repaired or replaced and retested for integrity.

[10] Required by Rules .02(2)(c)1., .04(4)(c)1(iii), and 04(4)(c)1.(iv)(I)II

The interstitial space of a double-wall sump is delivered to the site under vacuum from the manufacturer so it can be monitored during the installation process. This allows the integrity of the sump to be tested before installation. Manufacturers require the integrity of the interstitial space be tested following the installation of the fittings and piping.

Installation Checklists

The Division does not currently have a UST installation inspection program. However, certain documents are required to be completed by the installer and retained for the life of the UST system. Tank, piping, and sump manufacturers require installers to complete work checklists in order to validate the product warranties. The owner/operator may choose to have a registered professional engineer (RPE) certify the installation under Rule .03(1)(d)1.(ii), but documentation provided by the RPE is required to certify the installation.

The results of the tests are recorded on the manufacturer's installation checklist or warranty forms and should be maintained for the operational life of the UST system.[11] Upon transfer of ownership, including, but not limited to, sale of the UST systems, originals and/or copies of all documents required to satisfy the reporting and recordkeeping requirements shall be transferred to the new owner of the USTs at the time of ownership transfer. [12]

Installers are advised to consult Petroleum Equipment Institute Recommended Practices PEI-RP100 and the manufacturer's installation instructions for further guidance on installation of secondary containment systems and testing conducted during installation.

Startup Tank and Line Tightness Testing

Startup tank and line tightness tests are required upon completion of installation and prior to the dispensing of fuel. These records must be maintained for the operational life of the UST system and transferred at the time of ownership transfer[13]. Air pressure testing of the secondary containment cannot be done in lieu of tank and line tightness testing at installation. Startup testing must be conducted in accordance with Rules .04(3)(b) and .04(4)(b). See technical chapters 3.5 Pressurized Piping and 3.7 Tank Tightness Testing for tank and line testing requirements.

Fuel Compatibility

ST systems are required to be compatible with the petroleum substance being stored. This includes the tank, piping, containment sumps, pumping equipment, release detection equipment, spill equipment, and overfill equipment. Systems storing a petroleum substance containing greater than 10% ethanol or greater than 20% biodiesel must demonstrate compatibility by one of the following options:

1. UST equipment listed or certified by nationally recognized laboratory,
2. Manufacturer approval in writing,
3. Division guidance, or
4. Another option determined by the Division to be no less protective of human health and the environment.

Prior to putting a UST system designed to store ethanol blended fuels greater than 10% ethanol into service, tank owners must complete and submit an Ethanol Equipment Compatibility Checklist (CN-1285)

[11] Required by Rule 0400-18-01-.02(1)(d)3.
[12] Required by Rule 0400-18-01.03(2)(d).
[13] Required by Rule 0400-18-01-.02(1)(d)5.

and a Statement Of Compatibility (CN-1283) indicating the UST system components will be compatible with the product stored. [14]

OPERATIONAL REQUIREMENTS

The purpose of this section is to outline the operational requirements for secondarily contained systems using interstitial monitoring for release detection. In order to properly perform this release detection method, the following operational requirements must be met: All systems installed after October 13, 2018 must begin three-year sump integrity testing, monthly and annual walkthrough inspections immediately. Interstitial systems installed prior to October 13, 2018 must have a sump integrity test and begin monthly and annual walkthrough inspections by October 13, 2021. Sump testing and walkthrough inspections shall be conducted and recorded according to Rule 0400-18-01-.02(8)(a).

Monthly Interstitial Monitoring

Interstitial Monitoring shall be performed continuously as required by Rule .04(3)(g)1.(ii) and the results recorded on the Division's form CN-1340 Monthly Electronic Interstitial Monitoring Report (see Appendix 3) as required by Rules .04(3)(d)1.(iii), .04(5), and .03(2)(b)11.

Manual (visual) monitoring is not allowed as a monthly interstitial monitoring method.[15] Manual monitoring cannot be designed, constructed, and installed to detect a leak. Visual inspections or manual gauging of secondary containment for the presence of liquid does not meet the requirements for continuous interstitial monitoring as a monthly release detection method for tanks or piping.

Monthly or periodic interstitial monitoring is also not allowed for UST systems which can generate a monthly alarm history report. This method allows the generation of a sensor status report at any time during the 30-day monitoring period, and therefore does not provide evidence of continuous operation of the device.[16] If a stand-alone monitoring system is used, monthly sensor status reports may be used to meet release detection requirements.

Continuous interstitial monitoring requires a liquid, vacuum, or hydrostatic sensor to be installed in any secondary containment sump where product can accumulate such as under dispenser containment (UDC) sumps, tank top sumps, and transition sumps. Documentation must be provided showing that monitoring devices are operational at all times during the 30-day monitoring period.

Interstitial monitoring devices generate a sensor status report which indicates if liquid is in contact with the sensor at the time the report is generated. In order to provide documentation that the monitoring device is operating continuously as designed during the entire monitoring period, and that no alarms occurred, an alarm history report must be generated to demonstrate compliance with continuous interstitial monitoring requirements.

Walkthrough Inspections

On October 13, 2018, the Tennessee Division of Underground Storage Tanks implemented new rules to maintain state program approval with the Environmental Protection Agency (EPA). Division rules require

[14] Required by Rule 0400-18-01-.02(5)(b)

[15] Required by Rules 0400-18-01- .04(3)(d)1.(ii). and .04(4)(c)1.(ii)

[16] Required by Rules 0400-18-01-.04(3)(d)1. and 0400-18-01-.04(4)(c)1,

periodic operation and maintenance walkthrough inspections that must begin no later than three (3) years after the effective date of this rule or October 13, 2021 for systems installed prior to October 13, 2018. UST Systems installed on or after October 13, 2018 require periodic operation and maintenance walkthrough inspections starting at the time of installation. Rule .02(8)(a)1.(i)II and (ii)(I) require monthly walkthrough inspections of release detection equipment and annual visual inspections of containment areas. Walkthrough inspections must be conducted in accordance with a standard code of practice developed by a nationally recognized association, nationally recognized practice (PEI), or in a format established by the Division.[17]

1) Monthly Walkthrough Inspection

Release detection equipment must be checked monthly to ensure it is operating with no alarms and no unusual operation condition present. Review and confirm release detection records are current and complete. Suspected releases must be documented and, if necessary, reported to the Division. Monthly walkthrough inspection records are to be maintained for one (1) year. [18] See recording keeping section below for additional information.

2) Annual Walkthrough Inspections

Secondary containment sumps used for interstitial monitoring must be visually inspected on an annual basis. The results of the inspection shall be recorded on the Division's Monthly/Annual Walkthrough Inspection Form (CN-????). Annual walkthrough inspection of secondary containment systems should include but not be limited to:

i. Condition of the sump walls, floor, lid and gaskets (no visible holes or leaks).
ii. Sump lids and gaskets are in suitable condition to prevent water ingress.
iii. Sump test boots are loose and allow open communication with the piping secondary.
iv. All penetration fittings within the sump appear to be liquid-tight.
v. Sensors are installed in every sump and placed at the lowest point in the sump.
vi. Any liquid (water or fuel) observed in the containment system must be immediately removed.
vii. Evidence of product escaping from the UST system must be reported to the Division within seventy-two (72) hours.
viii. If containment is double-walled and interstitially monitored, check for leaks in the interstitial area

Containment sumps are designed as spill containers, not storage vessels for product and/or water. Liquid present in containment sumps the liquid shall be removed. The problem shall be immediately investigated and resolved. If the issue is ignored, the sump and/or its associated components and product piping may be damaged, voiding any warranty provided by the manufacturer. Manufacturers, as part of routine maintenance, typically require sumps to be inspected and cleaned, removing all liquid and debris.

Note: Double-walled secondary containment sumps must still be inspected for integrity during walkthrough inspections. Containment sumps not used for interstitial monitoring must be

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[17] Required by Rule 0400-18-01.02(8)(a)2.

[18] Required by Rule 0400-18-01.03(2)(b)

visually checked for damage, leaks to the containment area, or releases to the environment. Liquid or debris in containment sumps shall be removed.[19]

Documentation of the annual secondary containment sump inspections shall be maintained for one (1) year, in accordance with Rules .02(8)(a)1. and .02(8)(b).

Annual Testing Requirements - ATG and Sensor Functionality Testing

The Automatic Tank Gauge must be checked for operability annually in accordance with Rules 04(3)(d)1.(iii), .03(2)(b)11., and .04(5). Operability checks should be conducted by a qualified technician and include the testing of alarms, verify system configuration, sensor setup, and testing of the battery backup.

All IM sensors shall be checked for operability on an annual basis in accordance with the manufacturer's recommendations for proper testing. The results shall be recorded on the Division's form CN-1339 Annual Electronic Interstitial Monitoring Test Report (see Appendix 3). See Rules .04(3)(d)1.(iii), .03(2)(b)11., and .04(5).

Three-Year Sump Integrity Testing

Systems using IM for piping release detection must conduct sump integrity test every three (3) years[20] and maintain those hydrostatic sump tests reports for three (3) years.[19]

Testing of secondarily contained components of UST systems may be done using the testing procedures specified in Petroleum Equipment Institute- Recommended Practices PEI-RP1200, 2012 edition or later or a NWGDLE third-party approved testing method. Proper documentation of such testing must be maintained in accordance with recordkeeping requirements in Rules .02 and .03.

Prior to beginning any of the procedures below, any measurable amount of water or free product must be safely removed, and secondary containment sumps must be thoroughly dried and wiped clean in order to ensure petroleum does not contaminate the water used as a test media. The Containment Sump Hydrostatic Integrity Test Report can be found in Appendix 4 of this document.

Some facilities that are capable of utilizing positive shutdown of product flow may choose to utilize the Low Level Hydrostatic Testing Procedure which can be found in Appendix 5 of this document. Sites utilizing low level sump testing must be approved by the Division.

[19] Required by Rule 0400-18-01.02(8)(a)1(ii)(I)

[20] Required by Rule 0400-18-01.04(4)(c)1.(iv)(I)II.

[19] Required by Rule 0400-18-01.03(2)(b)2

Additional test methods used for sump integrity testing include the following:

1) Dri-Sump™ Secondary Containment Test (Accent' Environmental)


The Dri-Sump Secondary Containment Test System utilizes a proprietary glycol-based fog additive which is introduced into each containment sump or spill bucket to be tested. Prior to testing, a series of test ports are installed within 18 inches of each device. A vacuum pump connected to each test port is used to apply vacuum for a specific period of time based on the size of the device being tested. A trained technician uses a laser indicator to look for the presence of fog within the vacuum test enclosure. This test procedure is limited in application when shallow groundwater is present in the vicinity of the containment sump or spill bucket. In this instance a conventional hydrostatic test procedure must be followed.

2) DPLeak Secondary Containment/Spill Test Method (Leak Detection Technologies)

The DP Leak Secondary Containment Test consists of the installation of a vacuum tight seal and the use of a vacuum inside the sump or spill bucket lid. Prior to testing, the surface area of the device is cleaned and soap spray liquid is applied to the surface area being tested. The test technician then utilizes high resolution camera images to inspect the surface for the presence of bubbles which would indicate a failing test result. This test method does not require the use of water for testing and is NWGLDE listed with a 0.1gph leak rate with a 100% probability of detection.

3) Franklin Fueling System's INCON TS-STS Sump Test System

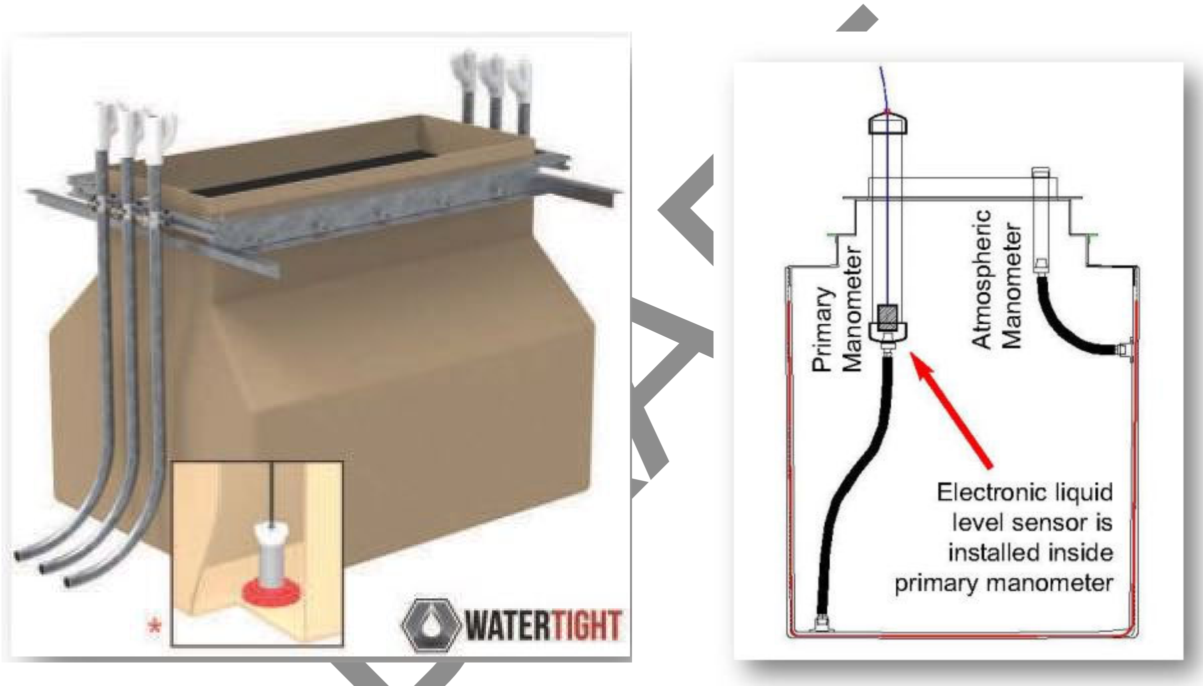
INCON TS-STS Sump Test System - A NWGLDE Certified accelerated test method uses a hydrostatic test based upon PEI RP1200. The device utilizes a magnetostrictive probe to measure rise or drop of liquid level in sump. Test time is 12 minutes and is able to use up to 4 probes at a time.

4) Fueling and Service Technologies, Inc.

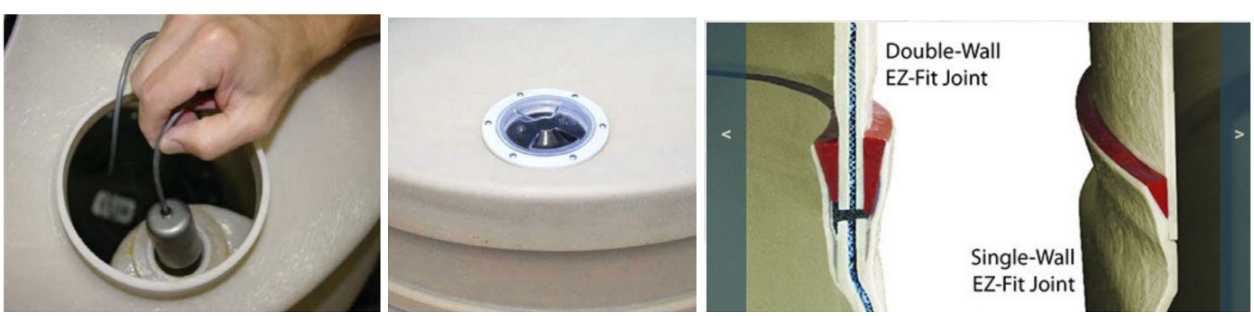
Hydro-Tite- A NWGLDE Certified accelerated test method uses a hydrostatic test based upon PEI RP1200. The device utilizes a magnetostrictive probe to measure rise or drop of liquid level in sump. Test time is 15 minutes and is able to test up to 4 sumps at a time.

Double-Walled Secondary Containment

UST systems with double-walled secondary containment sumps equipped with vacuum or brine in the interstitial space and interstitial sensors in the primary and secondary interstice are not required to conduct sump integrity testing every three (3) years (see Rule .04(4)(c)1). However, sensors must be tested annually. [20]



Photos courtesy of Bravo Containment Solutions



Containment Solutions double-wall sump sensor inspection port

[20] Required by Rule 0400-18-18-01-.04(1)(a)3.

Sump Sensor Application at Unattended Facilities

In Interstitial Monitoring applications, sump sensors are capable of signaling detection of liquid in interstitial spaces, however Rules .02(2)(a)4 and (b)4 also contains a provision which requires leaked product to be contained until it can be removed. It is not sufficient for sensors merely to sound an alarm when liquids are detected, action must also be taken to stop the further flow of product in accordance with Rule .04(3)(d)1.(iii) until the alarm can be investigated and, if a piping release is evident, a piping repair can be made. For unmanned facilities, this is not possible since there is no one present to shut down and investigate. Therefore, sump sensors at unmanned facilities must do this in one of two ways when liquid is detected in a sump or secondarily contained space:

1. Sump sensors connected to an ATG console must shut off the power (positive shutdown) to the submersible turbine pump and prevent any additional transfer of fuel if liquid is detected in the sump.
2. Stand-alone (not connected to an ATG console) dispenser sensors must disable the operation of the component(s) they are monitoring when liquid is detected.

Alarms do not guarantee that product leaking into the interstitial space will be contained until it can be removed. Positive shutdown is required because alarms can go unnoticed, unaddressed, alarms can be silenced, and a leak to could continue unabated. If sensors are configured to interrupt the flow of product, releases and damage to the environment should be minimized until the alarm condition is investigated and addressed.

Temporarily Out of Service (TOS) Requirements

When a UST system is temporarily closed and storing fuel, owners, operators, and/or other responsible parties shall continue operation and maintenance of release detection in accordance with Rules .04 and .17. However, release detection, operation and maintenance testing, and inspections in .02 and .04 are not required as long as the UST system is empty.[21] The UST system (tanks, piping, and containment sumps) is empty when all material has been removed so that no more than 2.5 centimeters (or one inch) of residue remains in the system.

When a UST system is temporarily closed for three (3) months or more, owners, operators, and/or other responsible parties shall leave vent lines open and functioning and cap and secure all other lines, pumps, manways, and ancillary equipment.[22] This requirement includes containment sumps.

Rule 0400-18-18-01.07(1)(a) exempts sumps from meeting the release detection operation and maintenance testing requirements, but not the installation requirements outlined in Rule 0400-18-18-01-.02. Dispensers installed on or after July 24, 2007 are required to be secondarily contained. [23] Dispenser, tank top, and transition sumps shall be liquid-tight on the sides, bottom, and at any penetration fittings. Sumps shall be repaired if the dispenser sump does not appear to be liquid-tight by visual observations. [24]

[21] Required by Rule 0400-18-18-01-.07(1)(a)

[22] Required by Rule 0400-18-18-01.07(1)(b)

[23] Required by Rule 0400-18-18-01.07(1)(b)

[24] Required by Rules 0400-18-18-01-.02(2)(b)(ii) and .02(2)(c)1

REPAIRS AND MAINTENANCE

UST systems components are manufactured to meet petroleum compatibility standards established by Underwriters Laboratories (UL) in accordance with EPA and various other implementing agencies. Any subsequent repairs to components that are designed to contain or convey liquid or detect a leak (tanks, piping, containment sumps, spill prevention device, etc.) must also comply with these standards and follow a recognized practice established for this purpose. The following table contains industry practices and nationally recognized practices for UST system installation, maintenance and repair procedures:

UST System Component	Document Number	Standard/Recognized Practice Name
Steel Tanks	API STD 1631	Interior Lining and Periodic Inspection of Underground Storage Tanks
	STI SP 131	Standard for Inspection, Repair and Modification of Shop Fabricated Underground Tanks for Storage of Flammable and Combustible Liquids
	UL 58	Standard for Steel Underground Tanks for Flammable and Combustible Liquids
Fiberglass Tanks	Fiberglass Tank and Pipe Institute RP-T-95-1	Remanufacturing of Fiberglass Reinforced Plastic Underground Storage Tanks
	UL 1316	Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures
	UL-1856	Underground Fuel Tank Internal Retrofit Systems
Secondary Containment Sumps	NLPA/KWA Standard 823	Standard for Preventative Maintenance, Repair and In-situ Construction of Petroleum Sumps
	UL-2447	Outline of Investigation for Containment Sumps, Fittings and Accessories for Fuels
Steel Piping	Sections of steel piping cannot be replaced and must be replaced with material which is constructed of UL-971 compatible material.	
Fiberglass Reinforced Plastic Piping	RP 1997-5	Fiberglass Reinforced Thermoset Plastic Tank & Piping Standards
	UL-971	Standard for Nonmetallic Underground Piping for Flammable Liquids
Flexible Plastic Piping	Repairs are not allowed; damaged piping sections must be replaced in accordance with manufacturer's specifications. All flexible plastic piping systems utilized for UST systems must comply with UL-971 standards for non-metallic piping for flammable liquids.	
Spill Buckets	Consult spill bucket manufacturer if aftermarket repairs are allowed. Some aftermarket components such as inserts, or gaskets may be approved prior to replacement.	
Ancillary Fittings, valves and thread sealants	UL-2447	Outline of Investigation for Containment Sumps, Fittings and Accessories for Fuels

Repair and maintenance to secondary containment components used for interstitial monitoring shall be conducted in accordance with manufacturer's recommendations, a nationally recognized practice such as NLPA 823, or guidance provided by the Division as required by Rules .04(3)(d)1.(iii), .04(5), .03(2)(b)8. and (11)., and .02(7)(h). Repairs of secondary containment components must be conducted to effectively prevent releases for the operational life of the UST system. In the absence of specific manufacturer's instruction, the Division also recognizes the use of "aftermarket" repair components from third-party manufacturers that meet UL standards for petroleum compatibility and construction. Nationally recognized repair standards such as "NLPA/KWA Standard 823: Standard for Preventative Maintenance, Repair and In-situ Construction of Petroleum Sumps" may be utilized to repair existing containment sumps in the event the original sump manufacturer does not offer repair options.

Types of materials used for repair of containment sumps constructed of fiberglass reinforced plastic include copolymer resins that are compatible with petroleum products. These materials are typically evaluated and approved in accordance with UL 2447. Fiberglass sump repairs are typically made by cleaning and preparing the fiberglass surface with abrasion and bonding a fiberglass mat with a copolymer resin. Depending on the size and shape of the repair, additional heat or curing time may be needed in order to allow the bonding agent within the resin to completely dry.

Non-manufacturer approved sump repairs using UL listed components require prior Division approval, proof of compatibility with petroleum substances stored, and integrity testing upon completion as required by Rules 0400-18-01-.02(5)(b) and 0400-18-01-.02(7)(d).

Sumps

Repairs to secondary containment areas of tanks and piping used for interstitial monitoring and to containment sumps used for interstitial monitoring of piping must have the secondary containment tested for tightness according to the manufacturer's instructions or in accordance with guidance provided by the Division within thirty (30) days following the date of completion of the repair.[25] Records documenting the replacement of tanks, piping, and/or dispensers shall be maintained for the operational life of the UST system. [26]

Piping

The Division may, under Rule .02(6)(c) and (d), allow piping repairs that are not considered a replacement. Requests for piping repair must be submitted in writing to the Division's Environmental Fellow in the Central Office prior to beginning the repair as required by Rule .02(6)(d)2. Piping repairs must be made in accordance with the manufacturer's specifications as required by Rules .02(1)(b) and .02(7)(c). All repaired piping must be tightness tested within thirty (30) days of completion as required by Rule .02(7)(d). Reference technical chapter 3.5 for additional information.

IM Sensor Replacement

Sensors should be maintained and repaired in a timely manner to obtain sensor status report within thirty (30) days. Sensor repairs must be approved in writing by the manufacturer.

[25] Required by Rule.02(7)(d)

[26] Required by Rule .02

RECORDKEEPING

Results of monthly interstitial monitoring records and release detection records must be maintained for at least one (1) year as required by Rules .03(2)(b)11., .04(3)(d)1.(iii), and .04(5)(b) and must be recorded on the Division's form CN-(draft) Monthly Walkthrough Form.

The following reports shall be generated monthly to demonstrate compliance with continuous interstitial monitoring requirements:

1. Monthly Sensor Status Reports (attached to Monthly Walkthrough Form)
2. Alarm History Report (attached to Monthly Walkthrough Form)
3. Alarm Logs recorded on page 4 and 5 of Monthly Walkthrough Form
4. Documentation of all completed repairs, service invoices, or leak detection equipment replacement if alarm is indicated (attached to Monthly Walkthrough Form)

If IM is being done by a stand-alone sensor not connected to an automatic tank gauge such as at a dispenser, there will not be an electronic record for such stand-alone sensors to attach to the monthly walkthrough form. This form should still be used to record monthly IM results for stand-alone sensors.

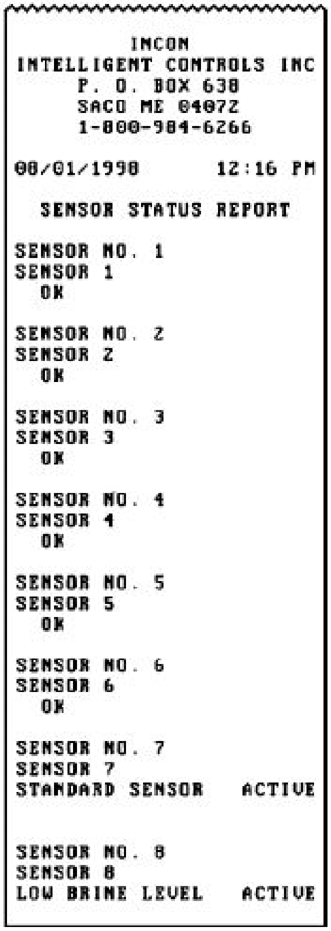
Annual interstitial monitoring test records must be recorded on the Division's form CN-1340 Annual Electronic Interstitial Monitoring Test Report (see Appendix 3) and maintained for at least three (3) years in accordance with Rule .04(5)(b)2.

Records of all calibration, maintenance, and repairs of release detection equipment permanently located on-site must be maintained for at least one (1) year after the servicing work is completed as required by Rule .04(5)(c). Written performance claims pertaining to release detection systems must be retained for five (5) years from the date of installation or until the release detection method is no longer used, whichever is later as required by Rule .04(5)(a).

Records must be kept at the UST site and immediately available for inspection by the Division, or at a readily available alternative site and be provided for inspection to the Division upon request. See Rules .03(2)(c)1. and .03(2)(c)2.

Upon transfer of ownership, including, but not limited to, sale of the UST systems, originals and/or copies of all documents required to satisfy the reporting and recordkeeping requirements shall be transferred to the new owner of the USTs at the time of ownership transfer. See Rules .03(2)(d)., .04(3)(d)1.(iii), and .04(5)(b).

EXAMPLES OF SENSOR STATUS AND ALARM HISTORY REPORTS



INCON
INTELLIGENT CONTROLS INC
P. O. BOX 638
SACO ME 04072
1-800-984-6266

08/01/1998 12:16 PM

SENSOR STATUS REPORT

SENSOR NO. 1
SENSOR 1
OK

SENSOR NO. 2
SENSOR 2
OK

SENSOR NO. 3
SENSOR 3
OK

SENSOR NO. 4
SENSOR 4
OK

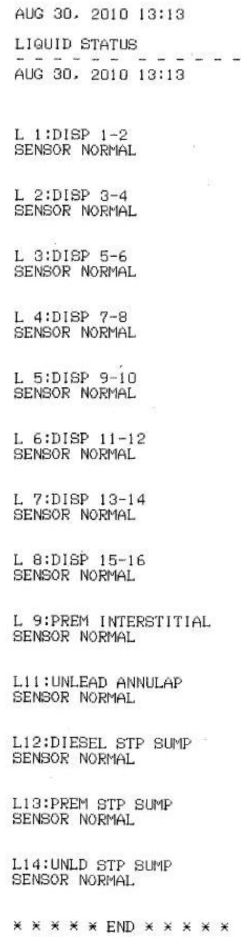
SENSOR NO. 5
SENSOR 5
OK

SENSOR NO. 6
SENSOR 6
OK

SENSOR NO. 7
SENSOR 7
STANDARD SENSOR ACTIVE

SENSOR NO. 8
SENSOR 8
LOW BRINE LEVEL ACTIVE

INCON TS-1001 Sensor Status Report



AUG 30, 2010 13:13

LIQUID STATUS

AUG 30, 2010 13:13

L 1:DISP 1-2
SENSOR NORMAL

L 2:DISP 3-4
SENSOR NORMAL

L 3:DISP 5-6
SENSOR NORMAL

L 4:DISP 7-8
SENSOR NORMAL

L 5:DISP 9-10
SENSOR NORMAL

L 6:DISP 11-12
SENSOR NORMAL

L 7:DISP 13-14
SENSOR NORMAL

L 8:DISP 15-16
SENSOR NORMAL

L 9:PREM INTERSTITIAL
SENSOR NORMAL

L11:UNLEAD ANNULAP
SENSOR NORMAL

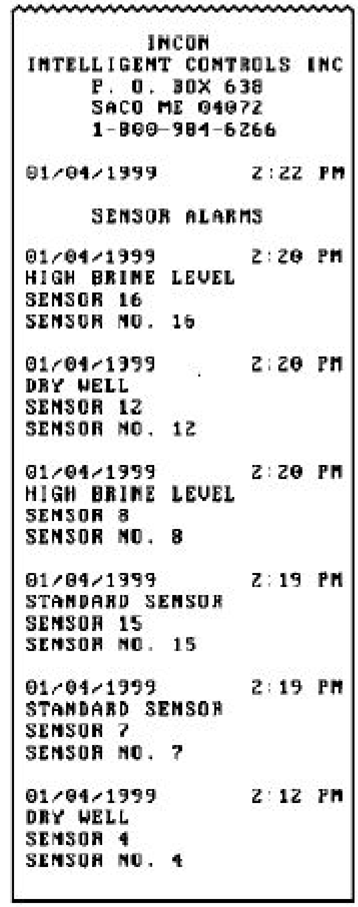
L12:DIESEL STP SUMP
SENSOR NORMAL

L13:PREM STP SUMP
SENSOR NORMAL

L14:UNLD STP SUMP
SENSOR NORMAL

* * * * * END * * * * *

Veeder-Root TLS-350 Liquid Status Report



INCON
INTELLIGENT CONTROLS INC
P. O. BOX 638
SACO ME 04072
1-800-984-6266

01/04/1999 2:22 PM

SENSOR ALARMS

01/04/1999 2:20 PM
HIGH BRINE LEVEL
SENSOR 16
SENSOR NO. 16

01/04/1999 2:20 PM
DRY WELL
SENSOR 12
SENSOR NO. 12

01/04/1999 2:20 PM
HIGH BRINE LEVEL
SENSOR 8
SENSOR NO. 8

01/04/1999 2:19 PM
STANDARD SENSOR
SENSOR 15
SENSOR NO. 15

01/04/1999 2:19 PM
STANDARD SENSOR
SENSOR 7
SENSOR NO. 7

01/04/1999 2:12 PM
DRY WELL
SENSOR 4
SENSOR NO. 4

INCON TS-1001 Sensor Alarm History

REPORTING

When a release is suspected or confirmed for any of the following conditions, the Division shall be contacted within seventy-two (72) hours:

- Sensor alarm indicates the presence of liquid, unless the alarm is immediately investigated (within 72 hours), the alarm condition is resolved, and no evidence of petroleum escaping the UST system is found. If the alarm or liquid reoccurs within thirty (30) days, the alarm condition is not resolved. See Rules .04(1)(b) and .05(1)(a)2. and 3.

- Unexplained presence of fuel in secondary containment or sump not indicated by alarm. See Rule .05(1)(a)2 (i) through (iii).

- Recurring presence of water or Sensor Out alarm unless the device or containment is immediately investigated (within 72 hours), repaired, or replaced and additional monitoring within thirty (30) days does not indicate water intrusion into the interstice. See Rule .05(1)(a)2 (i) through (iii) and 3.

- Evidence of a leak into the environment from a secondary containment sump or interstice is required to be reported under Rules .05(1)(a)1. and .06(3)(a).

For UST systems installed on or after July 24, 2007, if interstitial monitoring cannot be conducted as required by Rule .04(3)(d)1. due to failure of the secondary containment or the IM system and cannot be repaired or replaced as allowed by Rules .02(6) and (7), the portion of UST system which can no longer be monitored must be permanently closed following the applicable parts of Rule .07.

REFERENCES

NFPA 30 Underground Tank Installation, Chapter 4 Tank Storage

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Veeder-Root Dispenser Pan Sensors & Containment Sump Sensors Installation Guide, 576013-306, Rev. G, 2007

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INCON Tank Sentinel Operator's Guide, 000-152 Rev. C, 2009

Iowa Department of Natural Resources, UST Compliance Inspection Guide, July 2007

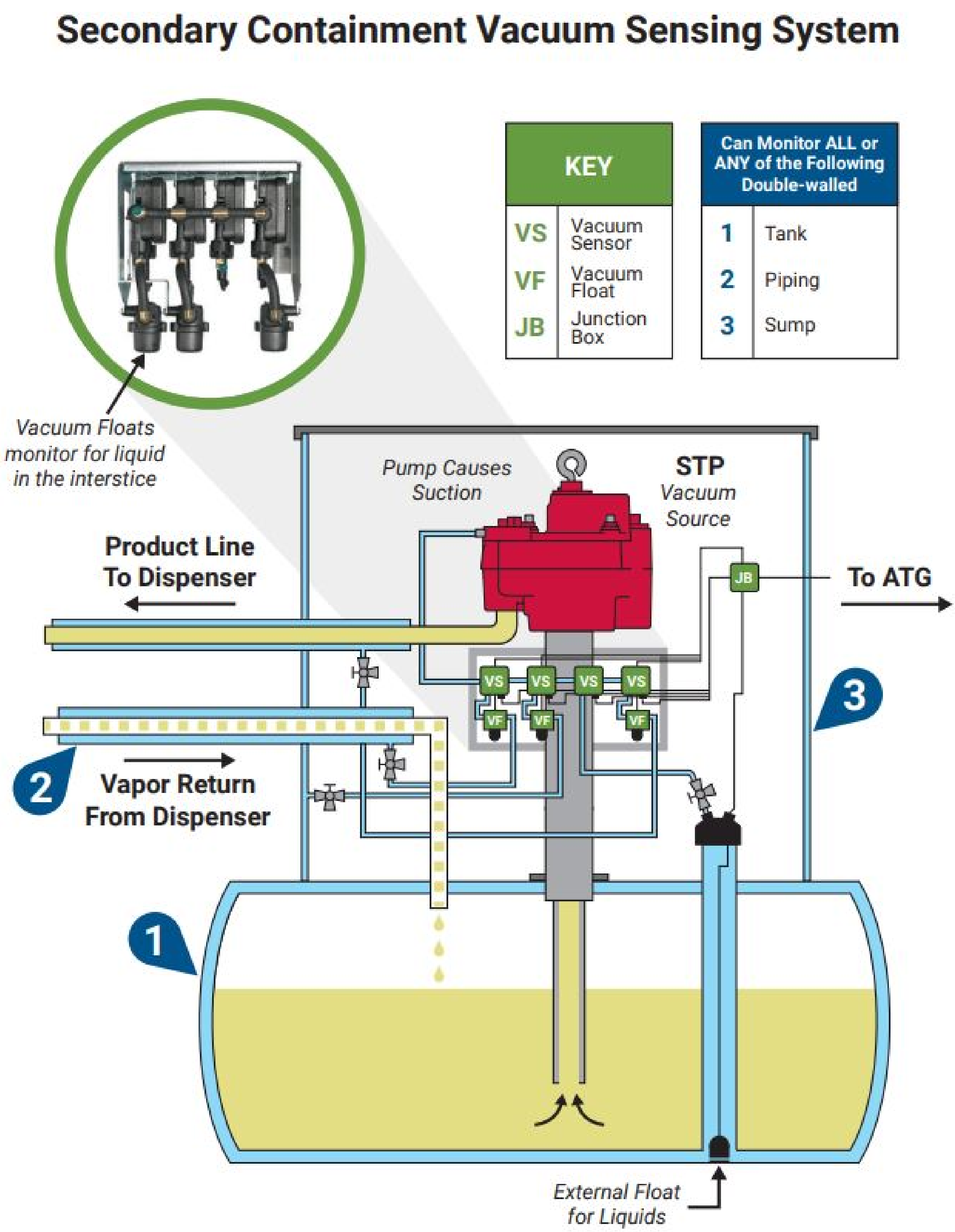
APPENDICES

1. **Secondary Containment Vacuum Sensing System diagram**
2. **Sensor Descriptions Table**
3. **Annual Electronic Interstitial Monitoring Test Report (CN-1339)***
4. **Sump Integrity Hydrostatic Testing Procedure and Test Report (CN-draft)***
5. **Low Level Sump Integrity Testing Procedure and Test Report (CN-draft)***

*Fillable form versions of these documents are available on the Division website.

APPENDIX 1

Secondary Containment Vacuum Sensing System Diagram



APPENDIX 2

Sensor Descriptions

Operating Principle	Test Method (Sensor Category)	Description of Operating Principle	Estimate of Current Use (High/Med/Low)
Liquid-filled interstitial monitoring	Continuous interstitial monitoring method (liquid-filled)	A fluid reservoir containing brine, water, or propylene glycol is attached at the top of the tank and opens to the interstice. The reservoir is equipped with a dual -point float switch to provide for low-level and high-level alarms.	Low/Med (Varies with geography. Low in the mid-continent. Med in states where secondary containment is required)
Pressure-filled interstitial monitoring	Continuous interstitial-line-monitoring method (pressure/vacuum)	Uses a pump to pressurize an inert gas to continuously maintain an overpressure using a pressure sensor within the interstitial space of double-walled piping. System is designed to activate a visual and acoustic alarm before stored product can escape to the environment. Capable of detecting breaches in both the inner and outer walls.	Low (Mainly found on newer installations in CA)
Pressure-voided interstitial monitoring	Continuous interstitial-tank-monitoring method (pressure/vacuum)	Uses an integral vacuum pump and a vacuum sensor to continuously maintain a partial vacuum within the interstitial space of double-walled tanks. System is designed to activate a visual and acoustic alarm before stored product can escape to the environment. Capable of detecting breaches in both the inner and outer walls.	Low (Mainly found on newer installations in CA)
Metal-oxide semiconductor	Interstitial liquid-phase & vapor-phase	Detects petroleum hydrocarbon vapors by monitoring for a change in electrical current in a cell inside the sensor.	Very Low
Float switch/Reed switch/Magnetic switch	Interstitial liquid-phase & out-of-tank liquid-phase	A device that monitors for a change in the level of a liquid. A float switch is made up of a reed switch activated by a magnet inserted in a float. These devices are generally specified as "normally open" or "normally closed" depending on how they are oriented.	High (The most commonly used interstitial sensor)

		The switch completes a circuit of interrupts a circuit.	

Operating Principle	Test Method (Sensor Category)	Description of Operating Principle	Estimate of Current Use (High/Med/Low)
Electrical conductivity	Interstitial liquid & out-of-tank liquid-phase	Uses hydrocarbon-permeable coated wire that indicates a change in the resistance of the wire when the coating degrades as a result of contact with petroleum hydrocarbons.	Very Low (Old technology - late '80s to early '90s)
Capacitance change/RF-attenuation/Proximity sensors (capacitive)	Interstitial liquid-phase, out-of-tank liquid phase	Monitors for changes in capacitance.	Very Low
Capacitance change/RF-attenuation/Proximity sensors (capacitive)	Interstitial liquid-phase, out-of-tank liquid phase	Monitors for changes in capacitance.	Very Low
Thermal conductivity	Interstitial liquid phase	Designed to respond to heat differences between air, water, and hydrocarbons. The temperature inside the sensor element rises and triggers a response at the console.	Very Low
Fiber-optic chemical sensor	Out-of-tank liquid-phase	Characterized by a chemically sensitive film deposited on the end of an optical fiber. Any change to the film results in a decrease of light being emitted, sending a signal to the console.	Extremely Low
Adsistor/adsorption sampling	Vapor-phase	Changes electrical resistance in the presence of petroleum hydrocarbon vapors.	Very Low (Old technology)
Photo-ionization	Vapor-phase	Uses ultraviolet radiation to ionize and detect small concentrations of volatile organic compounds in ambient air.	Very Low
Chromatographic (i.e., color change)	Vapor-phase	A granular material that changes in color in the presence of hydrocarbon vapors.	Low

Table from LustLine #60, February 2009

APPENDIX 3

Annual Electronic Interstitial Monitoring Test Report

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS
William R. Snodgrass Tower,
312 Rosa L. Parks Avenue, 12th Floor
Nashville, TN 37243

ANNUAL ELECTRONIC INTERSTITIAL MONITORING TEST REPORT

This report is used to document functional testing of electronic interstitial monitoring devices.

- In the absence of an approved 3rd party test procedure or manufacturer's recommended practice, the procedure outlined below may be used to verify the interstitial monitoring devices are working properly.
- Interstitial monitoring is required on all UST systems installed after July 24, 2007.
- Report any unusual operating conditions or suspected releases discovered during this test to the division within 72 hours of discovery. Failure to do so could affect fund coverage in the event of a release.
- Attach documentation of all completed repairs, service invoices, or leak detection equipment replacement to this report, and maintain these records for a period of 12 months.

I. UST FACILITY		II. PERSON CONDUCTING TEST	
UST Facility ID #:		Name:	
Facility Name:		Company:	
Address:		City:	State
City:	County:	ZIP:	Phone:
Tester Signature:		Test Date:	

III. TEST AND MONITORING DEVICE INFORMATION (Attach additional pages as necessary)

Sensor ID								
Manufacturer								
Model #								
Location:								

Type of Sensor(s) (Check all that apply)

☐ Float Switch- Type: (☐ discriminating ☐ non-discriminating)
☐ Optical Sensor ☐ Electrical Conductivity Sensor ☐ Pressure Monitoring Device
☐ Vacuum Monitoring Device ☐ Other (specify):

System Setup (Check all that apply)

If a sensor is activated, the interstitial monitoring system responds with the following actions:
☐ Visual Alarm ☐ Audible Alarm ☐ Tank Monitor Leak Alarm
☐ Submersible Pump Shutdown ☐ Off Site Telemetry Alarm ☐ Other (specify)

IV. ELECTRONIC INTERSTITIAL MONITORING TEST PROCEDURE

Check Completed	Task
☐	Monitoring console is operational, no current active alarms. Activate "test" or "diagnostic" mode if applicable.
☐	Sensors are present and installed at proper level to detect a release in all appropriate locations.
☐	Sensors alarm when activated (immersed in appropriate liquid or other applicable method).
☐	Simulated alarm condition causes the appropriate response indicated in the section above.
☐	Document the simulated alarms in the facility's alarm history report records as "annual functional test".
☐	Inspect all secondary containment sumps: no evidence of leaks, appear to be liquid tight.
☐	Inspect all sump inlets and boots connected to the piping where liquid enters the sump, free of obstructions.
☐	Inspect tank sump covers to ensure gaskets and seals are installed properly to prevent surface water intrusion.

Comments (list all problems found, repairs, work performed or other information):

CN- 1339 RDA 2394

APPENDIX 4

Containment Sump Integrity Hydrostatic Testing Procedure

A test must be performed on each sump, including under dispenser containment (UDC), submersible turbine pump (STP), and piping transition, upon initial installation. The test must be conducted for a minimum of one (1) hour. The test should be conducted only during a time when there is no chance of precipitation because inclement weather would cause the water in the device to increase by an unknown amount. If obvious damage such as cracks, holes, or defective seal is observed, the sump cannot be tested.

A. Before Testing:

1. Ensure all containment sumps that are to be tested are thoroughly clean prior to the introduction of water or test media.
2. Use a measuring device that is capable of measuring to at least one-sixteenth of an inch.
3. Ensure that the sump is thoroughly clean.
4. Close all interstitial piping connections using test boots or valve core caps prior to testing in order to prevent test water from entering the piping interstitial space.

B. Visual inspection prior to testing:

1. Conduct a visual inspection of all sump floors and walls for evidence of cracks or holes.
2. Inspect all sump penetrations fittings and test boots for tears or damage.
3. If the sump fails a visual inspection, the sump fails the test. Do not proceed with the hydrostatic test procedure prior to conducting repairs or replacement.

At this point, the tester must visually inspect the sensor and electrical connections for signs of damage or corrosion to a point where functioning may be impaired. Signs of corrosion suggest the sensor may soon deteriorate and become inoperable. If you believe the sensor is damaged, check with the manufacturer. Do not continue with the test if any electrical conduits or junctions appear to be open or could be exposed to water.

C. Conducting the test:

1. Mark the inside of the sump at a level which is at least four inches above the highest penetration fitting.
2. Fill the sump with water to the level of the marking.
3. Wait 5 minutes prior to beginning step 4 (Waiting allows the water level sufficient time to settle in case there is sump deflection from the weight of the added water). Add water back to the mark if needed.
4. Allow water to stand for a minimum of one (1) hour. If no change is detected, the test may be ended.
5. Measure the difference of the water level using a tape measure to the nearest one-eighth of an inch.
6. Empty the sump.
7. At the end of the test, the water may be re-used for additional testing or be disposed of properly.

D. After Completing the Test

1. Remove the measuring stick from the sump.
2. Remove water from the sump.
3. Open the piping interstices.
4. Reposition the sensor and replace the sump cover and manhole cover.

E. Results:

If the water level in the sump decreases by as much as one-eighth of an inch or more, the sump fails the test. The sump must be evaluated to determine if it can be repaired (if allowed by the manufacturer) or if it must be replaced. If the water level in the sump decreases less than one-eighth of an inch, the sump passes the test.

F. Reporting and Recordkeeping:

Secondary containment sumps discovered containing product that subsequently fail an integrity test must be reported to the Division within seventy-two (72) hours as a suspected release in accordance with Rule .05(1)(a)2. Sump integrity test records must be maintained for one (1) year as required by Rule .04(5)(d). If a sump does not pass the integrity test, the sump shall be repaired or replaced as allowed by Rules .02(6) and .02(7). Repairs must be made in accordance with Rule .02(7)(a) and in accordance with guidance published by the sump manufacturer. Records of repairs must be kept for the life of the UST system or until the sump is replaced as required by Rule .02(7)(h) and transferred to any new tank owner required by Rule .03(2)(d).

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 12th Floor
Nashville, TN 37243-1541

CONTAINMENT SUMP INTEGRITY HYDROSTATIC TEST REPORT

- Use this form in conjunction with **Technical Chapter 3.4 SECONDARY CONTAINMENT AND INTERSTITIAL MONITORING**, APPENDIX 4 "Containment Sump Integrity Hydrostatic Testing Procedures".
- If a defective secondary containment sump is discovered at any time, then the device shall be repaired or replaced. Repairs to secondary containment sumps used for interstitial monitoring of piping must be tested for tightness according to the manufacturer's instructions or in accordance with this form within 30 days following the date of completion of the repair.
- A failing test result may require reporting of a suspected release. Consult Appendix 4 of Technical Chapter 3.4 for further guidance. You may need to notify the Division within 72 hours to allow Division personnel to be present to determine if an environmental impact has occurred, and if additional action will be required.
- All test water shall be disposed of in accordance with local, state and federal requirements.

I. FACILITY		II. OWNER
UST Facility ID #:		Name/Company:
Facility Name:		Address:
Address:		City, State, Zip:
City:	County:	Phone:

III. TESTER

Tester Name:	Company Name:
Tester Phone Number:	Company Address:
Email Address:	City, State, Zip:

IV. TEST RESULTS

Sump Location (Ex: RUL STP, Disp 1/2)							
1.Liquid and debris removed; sump wiped clean prior to test? (Yes/No)							
2.Visual Inspection Results (Pass/Fail)							
Visual inspection includes inspection of all seals, gaskets, side walls, test boots and penetrations. If cracks, loose parts or separation of the containment sump is found, the sump fails the visual inspection. Do not introduce water if the sump fails the visual inspection.							
3.Water Level is a minimum of 4" above the highest penetration fitting? (Yes/No)							
4.Sensor is positioned in the lowest portion of the sump? (Yes/No)							

IV. TEST RESULTS (cont'd)

Sump Location (Ex: RUL STP, Disp 1/2)							
5.Sensor generates an audible/visual alarm? (Yes/No)							
6.Sensor triggers appropriate positive shutdown as required by Division? (Yes/No)							
7.Starting Water Level (inches)							
8.Test Start Time (AM/PM)							
9.Ending Water Level (inches)							
10.Test End Time (AM/PM)							
11.Test Period (Minimum Test Time 1 hour)							
12.Test Results? (PASS/FAIL)							

For a passing test result, each sump must pass a visual inspection and have a water level change of less than 1/8 inch in 1 hour.

V. AFTER TEST STEPS

13.Measuring device removed from sump? (Yes/No)							
14.Removed all test water from the sump? (Yes/No)							
15.Sensor is positioned in lowest point of the sump? (Yes/No)							
16.Secure all sump lids, manhole covers or dispenser doors? (Yes/No)							
17.Secondary piping test boots or valve cores returned to open position? (Yes/No)							
18.Does the test liquid contain any visible product or sheen? (Yes/No)							
19.Has the test liquid been properly characterized? (Yes/No)							

20.Method of Test Water Management / Disposal?	☐ Private Recycler or Treatment Facility	☐ Public Owned Treatment Works	☐ Waste Hauler	☐ Other ________ Describe

Tester's Signature:	Test Date:

APPENDIX 5

Low Level Sump Integrity Testing Procedure

Owners and/or operators are required to test the functionality of the liquid level sensor in conjunction with the site-specific Division-approved low level sump testing procedure (see Rules .04(3)(d)1. and .04(4)(c)1.(iii).

The Division requires owners and/or operators to obtain advance site-specific approval prior to utilizing Low Level Sump Integrity Testing to meet the integrity testing requirements for secondary containment. Failure to comply with the Division's written pre-approval may result in rescinding the use of this test method or rejection of the test results. Division staff may require integrity testing of the sump if visual inspection of the sump indicates a portion of the sump may not be liquid-tight. If you wish to conduct low level sump testing at your facility, contact the Division for prior approval. The request shall include the following:

1. Method utilized for positive shutdown (dispenser or submersible pump)
2. Method for acknowledging sensor alarms
3. Number of sumps, location, and material of construction
4. Is a facility operator present at all times when UST system is operational?
5. Does an activated dispenser alarm shut down all product flow from the pump?

A. Before Testing:

1. Ensure all containment sumps that are to be tested are thoroughly clean prior to the introduction of water or test media.
2. Verify an operational sump sensor is mounted at the lowest point in the sump.
3. A measuring device that is capable of measuring to one-sixteenth of an inch shall be used.
3. Ensure that the sump is thoroughly clean.
4. Close all interstitial piping connections using test boots or valve core caps prior to testing in order to prevent test water from entering the piping interstitial space.

B. Visual inspection prior to testing:

1. Conduct a visual inspection of all sump floors and walls for evidence of cracks, holes tears, damage, or compromised penetration boots located in the portion of the sump where water will be added during the low liquid sump test. If any of these are present this is considered a sump test failure.
2. All components which are visibly damaged must be repaired or replaced prior to beginning a new test on the repaired sump.
3. Do not proceed with the low-level hydrostatic test procedure prior to conducting repairs or replacement.

To meet the requirements for low level sump testing, UST owners must verify that the sensor is configured to shut down the appropriate pump or dispenser when activated by the presence of liquid in the sump. For piping systems which connect to multi-product dispensers (MPD's), the positive shutdown feature must disable the submersible pump motor for every UST system associated with the MPD. Dispenser shutdown is only allowed for pressurized or suction piping systems connected to a single product dispenser at manned facilities when the pumps are operational.

In addition, Rule .04(4)(c)1.(v) requires an annual test of any liquid sensor used as part of a release detection system. The test of the liquid level sensor performed at the time of low level sump testing may be used to comply with the annual sensor test requirements of Rule .04(4)(c)1.(v), if all other conditions of for interstitial monitoring and secondary containment are completed as required.

To use these procedures, ensure all sensors are properly installed and programmed so that they shut off either the pump or dispenser per the instructions above when the sensor detects liquid. You may only use these instructions if your sensors are programmed to both alarm and shut off when in contact with any liquid.

C. Conducting the test

1. Determine if there is liquid present in the sump at levels high enough to trigger a properly positioned sensor, even if the alarm is not activated. Active alarms discovered prior to testing shall be investigated as a suspected release in accordance with Rule .05(1)(a)3. Remove any debris or liquid in the containment sump prior to testing.
2. Identify if sensors' positions are elevated or otherwise manipulated to prevent activation.

   At this point, the tester must visually inspect the sensor and electrical connections for signs of damage or corrosion to a point where functioning may be impaired. Signs of corrosion suggest the sensor may soon deteriorate and become inoperable. If you believe the sensor is damaged, check with the manufacturer. Do not continue with the test if any electrical conduits or junctions appear to be open or could be exposed to water.

3. Mark the inside of the sump at a level which is at least four inches above the sensor activation level.
4. Fill the sump with water to the level of the marking.
5. Wait 5 minutes prior to beginning step 4 (Waiting allows the water level sufficient time to settle in case there is sump deflection from the weight of the added water). Add water back to the mark if needed.
6. Allow water to stand for a minimum of one (1) hour. If no change is detected, the test may be ended.
7. Measure the difference of the water level using a tape measure to the nearest one-eighth of an inch.
8. Empty the sump.
9. At the end of the test, the water may be re-used for additional testing or be disposed of properly.

D. After Completing the Test

1. Remove the measuring stick from the sump.
2. Remove water from the sump.
3. Open the piping interstices.
4. Reposition the sensor and replace the sump cover and manhole cover.

E. Results:

If the water level in the sump decreases by as much as one-eighth of an inch or more, the sump fails the test. The sump must be evaluated to determine if it can be repaired (if allowed by the manufacturer) or if it must be replaced. If the water level in the sump decreases less than one-eighth of an inch, the sump passes the test.

F. Reporting and Recordkeeping:

Secondary containment sumps discovered containing product which subsequently fail an integrity test must be reported to the Division within seventy-two (72) hours as a suspected release in accordance with Rule .05(1)(a)2. Sump integrity test records must be maintained for one (1) year as required by Rule .04(5)(d). If a sump does not pass the integrity test, then the sump shall be repaired or replaced as allowed by Rules .02(6) and .02(7). Repairs must be made in accordance with Rule .02(7)(a) and in accordance with guidance published by the sump manufacturer. Records of repairs must be kept for the life of the UST system or until the sump is replaced as required by Rule .02(7)(h) and transferred to any new tank owner required by Rule .03(2)(d).

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 12th Floor
Nashville, TN 37243-1541

LOW LEVEL CONTAINMENT SUMP INTEGRITY HYDROSTATIC TEST REPORT

- Use this form in conjunction with **Technical Chapter 3.4 SECONDARY CONTAINMENT AND INTERSTITIAL MONITORING,** APPENDIX 5 "Low Level Sump Integrity Testing Procedure".
- ****Written pre-approval for use of this procedure is required at each facility****. Testing must be conducted in accordance with the requirements of the Division's pre-approval. Failure to comply with the Division's written pre-approval may result in this test method and/or results being rescinded or rejected.
- If a defective secondary containment sump is discovered at any time, then the sump shall be repaired or replaced in accordance with manufacturer's instructions. Repairs to secondary containment sumps used for interstitial monitoring of piping must be tested for tightness according to the manufacturer's instructions or in accordance with this form within 30 days following the date of completion of the repair.
- A failing test result may require reporting of a suspected release. Consult Appendix 5 of Technical Chapter 3.4 for further guidance. You may need to notify the Division within 72 hours to allow Division personnel to be present to determine if an environmental impact has occurred, and if additional action will be required.
- All test water shall be disposed of in accordance with local, state and federal requirements.

I. FACILITY		**II. OWNER**
UST Facility ID #:		Name/Company:
Facility Name:		Address:
Address:		City, State, Zip:
City:	County:	Phone:

III. TESTER	
Tester Name:	Company Name:
Tester Phone Number:	Company Address:
Email Address:	City, State, Zip:

IV. TEST RESULTS

Sump Location (Ex: RUL STP, Disp 1/2)							
1.Liquid and debris removed; sump wiped clean prior to test? (Yes/No)							
2.Visual Inspection Results (Pass/Fail)							
Visual inspection includes inspection of all seals, gaskets, side walls, test boots and penetrations. If cracks, loose parts or separation of the containment sump is found, the sump fails the visual inspection. Do not introduce water if the sump fails the visual inspection.							
3.Water Level is a minimum of 4" above the sensor activation level? (Yes/No)							
4.Sensor is positioned in the lowest portion of the sump? (Yes/No)							

IV. TEST RESULTS (cont'd)							
Sump Location (Ex: RUL STP, Disp 1/2)							
5.Sensor generates an audible/visual alarm? (Yes/No)							
6.Sensor triggers appropriate positive shutdown as required by Division? (Yes/No)							
7.Starting Water Level (inches)							
8.Test Start Time (AM/PM)							
9.Ending Water Level (inches)							
10.Test End Time (AM/PM)							
11.Test Period (Minimum Test Time 1 hour)							
12.Test Results? (PASS/FAIL)							
For a passing test result, each sump must pass a visual inspection and have a water level change of less than 1/8 inch in 1 hour.							
V. AFTER TEST STEPS							
13.Measuring device removed from sump? (Yes/No)							
14.Removed all test water from the sump? (Yes/No)							
15.Sensor is positioned in lowest point of the sump? (Yes/No)							
16.Secure all sump lids, manhole covers or dispenser doors? (Yes/No)							
17.Secondary piping test boots or valve cores returned to open position? (Yes/No)							
18.Does the test liquid contain any visible product or sheen? (Yes/No)							
19.Has the test liquid been properly characterized? (Yes/No)							

20.Method of Test Water Management / Disposal?	☐ Private Recycler or Treatment Facility	☐ Public Owned Treatment Works	☐ Waste Hauler	☐ Other __________ Describe

Tester's Signature:	Test Date: