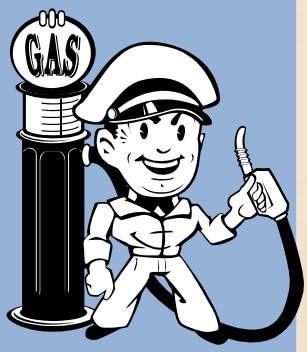
VERMONT "SIMPLE SUCTION" UNDERGROUND STORAGE TANK SYSTEM

TRAINING MANUAL FOR CLASS A & B OPERATORS

First edition, April 2012



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This manual has been prepared to assist owners and operators of category one underground storage tank systems comply with the Operator training requirements contained in the federal Energy Act of 2005, and written into the Vermont UST Rules (see section 8-307 and 8-308 of the Vermont UST Rules for the specific requirement). This manual is intended to be a helpful study guide for those seeking to be designated as Class A and B operators of underground storage tank systems equipped with suction dispensers. **It is not intended to cover pressurized piping systems.**

This manual serves as a study guide for the test the Vermont UST Program has developed for simple suction systems. It will also serve as a useful reference guide for day-to-day operation of your underground storage tank system. **This manual does not supersede or replace the Vermont Underground Storage Tank Rules.**

Questions and comments should be directed to the Vermont Underground Storage Tank Program. The UST program’s mailing address is 1 National Life Dr. Davis 1, Montpelier, VT 05620-3704. The Program’s phone number 802-828-1138.

For more information on the Vermont UST Program, visit our web site at:

http://www.anr.state.vt.us/dec/wastediv/ust/home.htm

Some sections of this manual were adapted from the TankSmart Guide produced by the Maine Department of Environmental Protection. We sincerely thank our colleagues in the Maine DEP for permission to use and adapt that material.

This manual, and the associated test, are intended for operators of UST systems that are equipped with suction dispensers. Because suction systems are simpler than pressurized piping systems, you do not have to be familiar with line leak detectors, piping tests, sump monitoring, or any of the other requirements associated with pressurized piping. But there is still a lot you must know, so let's get started!

What is operator training?
Operator training is a 3-tiered training program for the operation of Underground Storage Tanks (USTs). The training is required by federal law, and is intended to ensure that those who own and operate category one underground storage tanks (i.e. tanks that must be permitted by the Vermont Department of Environmental Conservation) understand how to operate and maintain UST systems properly. Every facility must have three classes of operators; the permittee of each UST facility must designate a Class A, Class B, and Class C operator. One person may hold all three designations for a given facility, if desired.

When must operators be trained?
August 1, 2012 is the deadline in Vermont. By that date, individuals seeking to be designated Class A or B operators must pass an approved test, and the permittee must submit the name(s) of the Class A and B operators. The permittee does not have to submit the name(s) of Class C operator(s), but the names of Class C operators must be available at the facility. Training is valid for two years.

How do I become a trained operator? What level of knowledge must each class have?
Individuals can be designated Class A or B only by passing an exam approved by the Vermont UST Program. Class C designation can be achieved by passing an approved exam, or by receiving training directly from a Class A or B operator.

The Vermont UST Program also accepts some operator training programs provided by another state. As of April, 2012, Vermont has accepted Class A and B operator training programs in Maine and New Hampshire as being acceptable in Vermont.

<u>Class A</u>
Class A operators have the primary responsibility to operate and maintain the UST system. Their responsibilities include managing resources and personnel to achieve and maintain compliance with the UST Rules. Class A operators must be knowledgeable of the broad aspects of the statutory and regulatory requirements for compliance. The Class A operator **must** pass an exam to demonstrate knowledge in the following areas:

1. A broad knowledge of UST system requirements regarding compliance, operation, maintenance, and recordkeeping requirements defined in the UST Rules. This includes knowledge of:
    i. Spill prevention
    ii. Overfill prevention
    iii. Release detection
    iv. Corrosion protection
    v. Emergency response
    vi. Product compatibility
    vii. Recordkeeping and documentation.
2. Financial responsibility
3. Notification and permitting requirements
4. Release and suspected release reporting
5. Temporary and permanent UST closure requirements
6. Operator training requirements

Class B

Class B operators implement the UST Rules "on the ground." These individuals ensure that all equipment is functional, the necessary documentation is maintained, and that appropriate personnel are trained to respond to emergencies. Class B operators must have knowledge of UST operation and maintenance. The Class B operator must pass an exam to demonstrate knowledge of the following:

1. Components of UST systems
2. Materials comprising UST components
3. Methods of release detection and release prevention for USTs
4. Reporting and recordkeeping requirements
5. Operation and maintenance requirements in the UST Rules including:
    - Spill prevention
    - Overfill prevention
    - Release detection
    - Corrosion protection
    - Emergency response
    - Product compatibility
    - Component compatibility, e.g. which types of overfill devices are compatible with suction dispensers, one- and two-point vapor recovery systems, etc.
6. Class C operator training requirements

Class C

The Class C operator is trained to be the first to respond to an emergency. This individual may be designated as a Class C operator either by passing an exam that has been approved by the Vermont UST Program, or by receiving training directly from a designated Class A or Class B operator. The Class A or B operator is responsible for ensuring that the Class C operator has sufficient knowledge in the following areas:

1. Actions to take in response to an emergency related to the UST system, e.g. where emergency shut-off switches are located, and how to operate them; appropriate numbers to call to report a spill or other emergency; how to contain spilled petroleum product, etc.
2. Electronic monitoring system alarm conditions, and appropriate responses to those conditions
3. UST facility layout (i.e., location of tanks, containment sumps, dispensers, fill ports, emergency shutoffs, alarms)

If I have only one facility, and it has one particular type of UST system, do I have to be trained on all different types of UST systems?

It is acceptable for the Class A or B operator to be trained only on the types of equipment found at the facility he or she will be operating. For example, if a country store has fiberglass tanks and suction dispensers with intrinsically safe piping, the Class A or B operator for that facility need not demonstrate knowledge and understanding of cathodic protection systems, or requirements that apply to pressurized piping systems.

Permits and Financial Responsibility

Permits – Under Vermont law, it is illegal to operate a Category One underground storage tank unless the tank owner or operator has applied for and been issued a permit from the UST Program, a part of the Vermont Agency of Natural Resources. Category one tanks include underground motor fuel tanks at retail, commercial, industrial, or municipal facilities; underground tanks that supply a backup generator; and underground tanks containing used oil. Application for a permit involves filling out an application

which asks basic information on the tank system, the facility where the tank is or will be located, the tank owner and the tank operator.

For new underground tank systems, the UST program issues a **construction permit**, which allows the permittee to install the tank system and to operate the tank system for a maximum of 30 days. The construction permit expires if the underground tank system has not been installed within one year of the date the construction permit was issued. **Once the tank system is installed, the permittee may operate the tank system for 30 days.** During that period the permittee must submit installation checklists for the tank(s) and piping, photos, and an as-built diagram. When the UST Program receives these items, if they show that the tank system was installed in accordance with the construction permit, the UST program will issue an **operating permit**. If the permittee fails to submit the required documentation, it is illegal to continue operating the tank system more than 30 days beyond the completion of construction. **The operating permit must be posted in a prominent location at the facility.**

Operating permits can be valid for up to five years, but the permit fee must be paid every year, in the anniversary month of when the permit was originally issued. Municipalities are exempt from paying the permit fee.

Financial responsibility – In order to ensure that money is available for the cleanup of a petroleum release from an underground storage tank, all owners/permittees of a Category One UST are required to demonstrate the ability to pay for the cleanup and to compensate third parties. Under Vermont law, the owner/permittee has several options (more fully described below) for meeting financial responsibility obligations. There are many allowable mechanisms for demonstrating financial responsibility, including qualification as a self-insurer, financial guarantee, surety bond, letter of credit, private insurance, risk retention pool, and payments to the Vermont Petroleum Cleanup Fund.

Although those mechanisms are allowable, few Vermont tank owners have the financial ability to make them workable, so almost all Vermont tankowners (96%) pay into the Petroleum Cleanup Fund. **As long as you pay the PCF assessment on time each year (on or before October 1), and you operate your tank system in compliance with Vermont's UST Rules, you have the required financial responsibility.** The UST program will not issue a permit for an underground tank, unless the tank owner has the required financial responsibility.

Record Keeping

Missing or incomplete paperwork is one of the most frequent causes of regulatory citations. Keeping your records in order is important, and is a good way to demonstrate to an inspector that you are in compliance with Vermont's rules. Organized records help make an inspection go smoothly. Some tank owners keep their UST records on a computer, while others prefer a paper system. Either will satisfy Vermont's UST recordkeeping requirements. A three-ring binder with tabbed dividers is a good way to organize your information so that it is easily located. Unless the UST program has granted a variance, you are required to keep records within the State of Vermont. You must keep records for 3 years and be able to provide any records to the UST Program officials within 24 hours of an information request.

ALL facilities must have the following documents:

- **Vermont UST Permit** *(This document must be posted in a visible location at your facility. It's a good idea to keep a copy in your files as well.)*
- **Release Detection Monitoring Records**
- **Inventory Records**
- **Monthly Inspection Records**
- **Repair and testing records (cathodic protection testing, etc.)**

Spill cleanup and reporting

Spilled fuel from any source at your facility must be addressed immediately. All spills—even relatively small spills—can contaminate drinking water supplies as well as our lakes and rivers. Small, ongoing drips can add up to a lot of spilled fuel over time. Spills onto unpaved areas are a particular threat to groundwater. Facility operators need to pay attention and know what to do if a spill occurs. Spill cleanup and reporting are top priorities.

Do You Have Emergency Spill-Response Procedures?

Your facility should have an emergency action plan that includes emergency response procedures that describe the actions an operator must take should a spill occur. Be sure to review spill-response procedures for your facility periodically and ensure that all facility personnel are familiar with the action plan. If you have not yet established emergency spill response procedures, **NOW** is a good time to do so. Spill-response procedures should include the following actions:

- Stop the release of fuel, and contain the spill.
- Report the spill, if more than 2 gallons have been released.
- Clean up all spills immediately. Small spills can usually be handled by on-site personnel, but larger spills frequently require cleanup by a contractor who specializes in environmental cleanup.
- Keep appropriate spill cleanup materials handy at all times.
- Submit a written report to the DEC spill response program — what happened and what was done to clean it up. A brief e-mail to the UST program will suffice for minor spills; a more thorough report is required for large spills.

Spill Cleanup

If a spill occurs take all appropriate measures to stop the release, such as turning off leaking equipment. Use absorbent materials to prevent the spread and soak up as much spilled fuel as possible. **Once the leak has been stopped, the next step is to contain the spill by surrounding it with absorbent material such as Speedy-Dry or kitty litter. Once the spill is surrounded with a small dike, then apply the absorbent material to the surface of the spilled material.** Never leave fuel-soaked materials lying around—they are a fire hazard. Fuel-contaminated soils and fuel-soaked materials must be managed as hazardous waste and disposed of properly. **Do not dispose of fuel-soaked absorbent material in the regular trash.**

Even though absorbent material was placed on the spilled diesel fuel, the fuel flowed off the concrete pad because the employee did not surround the spill with absorbent material. Remember: first surround the spill with absorbent material, then cover it!

Spill Reporting

All spills in excess of two gallons must be reported to the DEC! Vermont's UST Rules require that spills be reported immediately, although common sense dictates that spills should be stopped and contained before picking up the phone. As soon as the situation is stabilized, spills must be reported. Spills can be reported directly to the Waste Management Division at (802) 828-1138 during regular business hours. The Spill Reporting Hotline is available 24 hours a day, 7 days a week.

Vermont Spill Reporting Hotline: 1-800-641-5005

Ethanol-Blended Gasoline

Now that ethanol (also called ethyl alcohol) is routinely blended with gasoline (the typical blend in Vermont is 10% ethanol with 90% gasoline, known as E10), UST owners and operators must pay attention to several new issues. Ethanol's unique characteristics may cause problems with fuel quality, and may contribute to leaks in tanks, piping, and/or dispensers. The potential issues you should be aware of are:

- **Compatibility with system components**
- **Phase separation**
- **Mobilization of sludge and particulates**

Compatibility with System Components

E10 has been used for many years in the Midwest, and experience has shown that as long as fuel storage tank systems are well maintained, traditional fuel storage and dispensing systems are not adversely affected by the presence of ethanol at this level. Experience with higher concentrations of ethanol in

gasoline is much more limited. It is not known whether intermediate blends of ethanol (e.g., E15, E25) will have adverse effects in tank systems that were designed for traditional gasoline without ethanol. This issue is currently being studied at the national level. High concentrations of ethanol such, as E85, are NOT compatible with conventional storage and dispensing systems.

Storage and dispensing systems that are compatible with up to 100% ethanol are available, but these systems must be specially manufactured for alcohol service. You cannot store and dispense high alcohol blends, such as E85, in standard UST systems. Many Midwestern states have more experience storing high-ethanol blends of gasoline. If you want to know more about this issue, Iowa's Department of Natural Resources has a lot of useful information on its website:
www.iowadnr.gov/land/ust/technicalresources/ethanol.html

Phase Separation
Ethanol mixes reasonably well with gasoline, but it is very highly attracted to water. Ethanol would rather be in water than in gasoline. When a very small amount of water infiltrates a tank through spill bucket drain holes or loose tank-top fittings, the water will be absorbed into the ethanol. But, if enough water is present – and it doesn't take very much – the ethanol and water mixture separate out of the gasoline and fall to the bottom of the tank. This is known as "phase separation." The amount of water that causes phase separation varies with temperature, but in all cases it takes only a small amount of water. At 60 degrees F, 0.5% water (less than 4 teaspoons in a gallon of E10 gasoline) will cause phase separation. At 20 degrees, it takes only 0.35% water, or less than 3 teaspoons of water in a gallon.

When phase separation occurs, the tank contains a bottom layer of water and alcohol, and an upper layer of gasoline that no longer meets octane and other specifications. Depending on how much water has entered the tank, that bottom layer will have between 40% and 90% of the ethanol that was originally mixed with the gasoline. **So, if just 15 gallons of water leak into a tank a tank holding 3000 gallons of E10, phase separation will occur, creating a bottom layer that contains about 120 gallons of ethanol, and 15 gallons of water.** If the gasoline is very cold, just 10 gallons of water could cause phase separation in 3000 gallons of fuel. If more water leaks in, even more ethanol will drop out of the gasoline, creating a bottom layer that could hold as much as 250 gallons of ethanol.

Since UST systems draw gasoline from the bottom of the tank, the alcohol/water mixture will be drawn into the pump intake and dispensed into vehicles. Vehicles receiving this mixture will stall out almost immediately after filling their fuel tank and will not run again until their fuel systems are completely cleaned out. In addition, the underground tank, piping, and dispensers now hold a concentrated alcohol/water mixture that contains as much as 90% ethanol. **Many of these components are not compatible with the alcohol/water mix so it is very important that this liquid be pumped out of the tank and flushed from the piping and dispensing system as soon as possible.**

It is critically important to ensure that NO WATER gets into any tank containing E10 from any of the tank-top fittings. Water in a spill bucket should NEVER be drained into the tank. All water-intrusion problems must be corrected if you are storing ethanol-blended fuel.

You should check your fuel tanks for water frequently to prevent phase separation problems, with a gauge stick and water-finding paste specifically formulated for alcohol fuels. The color changes that occur when water is present are different for alcohol pastes than for non-alcohol pastes. You should use a gauge stick to monitor for water, even if you have an automatic tank gauge that has water-sensing capabilities. Many tank-gauge water sensors are not sensitive enough to detect the small amounts of water that can cause phase-separation problems.

NOTE: Water intrusion sufficient to cause phase separation is evidence of a possible leak, which must be reported to the UST Program at 802-828-1138 or the 24-hour Spill Hotline at 1-800-641-5005.

Mobilization of Sludge and Particulates
Ethanol loosens scale deposits on the internal surfaces of tanks and piping and mobilizes sludge in the bottom of the tank. If the interior of the tank is not clean there may be a lot of impurities in the fuel, especially right after the first few loads of ethanol-blended fuel are delivered. Be sure to use filters in your dispensers that are intended for use with alcohol fuels.

There have been a few instances in older steel tanks in which the sludge and particulates in the tank were plugging corrosion holes and preventing the tanks from leaking. When ethanol fuel was introduced, the fuel cleaned out the sludge and particulates so that the tanks began to leak. Pay particular attention to leak detection when adding ethanol fuel to a tank that has previously held non-ethanol fuel.

Filtration of alcohol fuels is essential to protect fuel quality. Be sure to use filters intended for use with alcohol fuels.

Spill protection

All category one tanks must have a spill protection device, which is almost always a spill containment manhole, also called a spill bucket. The purpose of a spill bucket is to contain drips and spills of fuel that may occur when the delivery hose is uncoupled from the fill pipe.

Traditionally, spill buckets were capable of containing only about 5 gallons of spilled fuel. But because a typical 20-foot hose used to transfer fuel holds about 15 gallons, all new and replacement spill buckets are required to have a 15 gallon capacity, unless a variance is granted by the UST program. The UST Program usually grants a variance if the tank's fittings are too close together to allow a 15 gallon unit.

Spill buckets are not designed to contain fuel for long periods of time. Vermont's UST Rules require that spill buckets be maintained free of liquids, and during a delivery, any liquid captured by the spill bucket must be cleaned out before the delivery truck departs. If the fuel captured in the spill bucket is not suitable to be put in the tank, the liquid must be removed and managed in accordance with the Vermont's Hazardous Waste Rules. Over time, spill bucket lids sometimes get deformed so that they no longer fit tightly on the lip of the bucket. This can allow rain water to get in the spill bucket. Water that accumulates in spill buckets must be removed, and because residue from petroleum products is almost always present, the water must be managed as a hazardous waste.

A spill bucket should be inspected for oil, water, or debris accumulation before and after each delivery. The spill bucket should be emptied of liquid before the delivery begins, and should again be emptied if any fuel spills into the bucket when the hose is uncoupled. All liquid and debris removed from the spill bucket must be put into a suitable container and managed as hazardous waste.

Spill buckets are designed to catch small spills from the delivery hose, but they cannot function if they are full of water when the delivery truck arrives! In this example the fill pipe is submerged, which will cause water to get in the tank if the fill cap is opened before the water is removed. This is a perfect recipe for creating phase separation (see section on ethanol in gasoline).

Spill buckets wear out quickly. They typically last only about 5 years, and in Vermont’s harsh climate they very rarely last ten years. They must be checked regularly, and they must be replaced before they start to leak, and before the lid stops fitting securely. Leaky spill buckets are a common source of petroleum contamination in Vermont. **If you discover a leak in your spill bucket, notify the UST program, and make arrangements to replace the spill bucket. You may need to hire an environmental consultant to assess the soil around the spill bucket, since leaks from spill buckets are a common source of petroleum contamination.**

Some spill buckets have a drain valve or manual pump that allows accumulated fuel to be drained into your tank. But if the spill bucket was not clean to begin with, when the contents of the bucket are pumped or drained into your tank, water and debris will enter the tank, contaminating the fuel. This is a very good way to get phase separation in your tank – see the ethanol discussion above. Pumps in spill buckets are allowable, but **drain valves are not allowed for newly installed spill buckets**. If your spill buckets have drain valves, it is a good idea to replace them with liquid-tight plugs.

Fill pipes must be permanently marked (e.g., with a label, with paint) to identify the substance stored. Spill bucket covers also must be labeled or color coded

Overfill prevention

Overfill prevention equipment is installed in a tank to prevent it from being overfilled during fuel delivery. Overfill protection is designed to stop fuel flow, reduce fuel flow, or alert the delivery person during delivery **before** the tank becomes full and begins spilling petroleum into the environment. In a typical delivery, the tank on the delivery truck is empty before the underground tank is completely full. But if the underground tank fills completely before the truck is empty, the tank overfills, and the delivery

hose is full of fuel. If all components of the UST system are not perfectly tight, an overfill can lead to a large spill, causing severe environmental damage and very real danger to the public. In one particularly tragic case, an overfill in Biloxi Mississippi caused a spill of several hundred gallons of gasoline which ignited, killing five people and severely burning a sixth.

Overfill-prevention devices are your **backup** if you receive a delivery of too much fuel. **Remember, you are the primary overfill-prevention device**. The function of overfill-prevention devices is to stop or severely limit the flow of product into the tank **BEFORE** the tank is filled to the very top, so there is still room to fit the contents of the hose into the tank.

The driver who delivers the fuel into the tank should be next to the delivery hose, carefully monitoring the delivery the whole time fuel is being dropped into the underground tank.

Ball float valves are a common overfill prevention device in some UST systems, but ball floats are not compatible with suction dispensers. This manual is intended for tank owners who have suction systems, therefore, you don't have ball floats, right?

Regardless of which overfill prevention device you use, it must be tested regularly to ensure that it works properly!

What Is YOUR Job in Preventing Delivery Overfills?
Fire codes require that delivery drivers stand by their vehicles and pay attention to the delivery. But, you are the person who is legally responsible for the tanks at your UST facility and therefore it is also your responsibility to ensure that all product deliveries are done safely in order to prevent overfills. It is useful to have a written delivery procedure, which should include the following measures:

- **Ensure there is enough room in the tank before each delivery.** Measure the fuel level in your tank(s) before each delivery. Know the "working" capacity of your tank(s). (The working capacity is the amount of fuel the tank will hold **without** triggering the overfill-prevention device.) This is the most important thing you can do to ensure that your USTs are never overfilled.
- **Monitor all fuel deliveries from beginning to end.** Delivery drivers tend to be more careful if someone is watching. If you have security cameras, focus one on your fuel-delivery area and let drivers know that they are on camera.
- **Inspect your spill buckets routinely.** If necessary, clean them before and after each product delivery.
- **Report, and clean up all spills.** Have spill cleanup materials handy for small spills, and for bigger spills, post emergency phone numbers in a prominent location so you can report the spill to the appropriate authorities.

Before we can discuss the merits of different overfill prevention devices, we need go over a few **Fuel Delivery Terms:**

Pumped delivery: Fuel is pumped under substantial pressure from the truck to the tank. Most often the fuel flows through a long hose (hundreds of feet) stored on a reel on the truck. You receive a delivery ticket printed by a meter on the truck that shows an exact number of gallons delivered. Home heating oil delivery trucks, also called "peddle trucks" are pumped delivery trucks.
Gravity delivery: Fuel flows under the influence of gravity from the truck to the tank. Most often the fuel flows through a short hose (10 to 20 feet long) that is connected and disconnected to the truck and the tank for each delivery. You receive a bill of lading printed at a terminal or bulk-storage plant that

shows the number of gallons loaded onto the truck. Most (but not all) large tractor-trailer delivery trucks use gravity delivery.
Tight fill: The delivery hose is fastened to the fill-pipe opening using a delivery fitting that clamps onto the fill-pipe opening with a liquid-tight connection. Gasoline deliveries should be made using tight-fill connections.
Loose fill: Delivery is accomplished by inserting a short length of pipe into the tank-fill opening, much the same way as a fueling nozzle is inserted into an automobile fill pipe.

Every category one tank must have an overfill prevention device, except for those tanks that never receive more than 25 gallons at a time (e.g. used oil tanks). There are three common types of overfill prevention compatible with suction piping systems:

- overfill alarms
- automatic shutoff devices
- vent alarms

Ball-Float Valves (also called Float-Vent Valves)
We hesitated to put this section in this manual because ball float valves are not compatible with suction systems, and this manual is directed at tank owners who have suction dispensers. But we know there are still some UST systems in Vermont equipped with suction dispensers and ball float valves. **If you have this combination, you need to replace your ball float with another overfill prevention device that is compatible with a suction dispenser.**

Ball floats consist of a short length of pipe that extends down into the top of the tank from the vent opening. Typically, a wire cage containing a hollow ball is fastened to the lower end of the pipe. The ball sits below the end of the pipe within the wire cage. As long as the product level is below that of the ball, the tank vent pipe remains open and the tank can breathe. If the fuel level is too high, the ball floats up and blocks the vent opening. With the vent blocked, very little fuel can flow into the tank. For a ball float valve to work, the delivery hose must be tightly clamped to the fill pipe. Otherwise, fuel will back up the fill pipe and spill out of the fill opening. Ball float valves **must be set to operate at 90% of full-tank volume.**

When Should Ball-Float Valves NOT Be Used?
Ball-float devices increase the pressure in the tank so that fuel can splash back on the driver if he tries to disconnect any hoses. Drivers often relieve the pressure in the tank by either opening the drain in the spill bucket or removing the cap on the ATG riser. This releases flammable vapors and creates a serious explosion hazard. There are so many potential problems with ball-float devices that the Petroleum Equipment Institute recommends that ball-float valves NOT be used at all. (See PEI/RP100 *Recommended Practices for Installation of Underground Liquid Storage Systems.*) If you have ball-float overfill-prevention devices, be aware of the following situations that create extremely hazardous conditions:
DO NOT Use Ball-Float Devices…

- **On tanks that receive pressurized (pumped) deliveries.** The tank may become over pressurized, causing it to rupture. If the delivery is metered at the delivery truck, it is probably pressurized.
- **On tanks with remote fills and gauge openings.** Fuel may escape through the gauge opening if the tank is overfilled.
- **On tanks with suction pumps.** When the ball closes off the vent pipe, pressure builds in the tank and the fuel looks for an escape route—the pump. An overfill at the tank can force fuel out the air eliminator, and create a fuel spill at the dispenser.

- **With loose fills.** If the delivery hose is not tightly clamped to the tank fill pipe, fuel will back up the fill pipe and spill onto the ground when the ball-float valve closes.
- **With coaxial Stage I vapor recovery.** In this situation the tank vents through the fill pipe, bypassing the regular vent. The ball-float valve is useless in preventing an overfill.
- **With generator or heating oil tanks.** These types of tanks very often have pumped deliveries and loose-fill connections, two things that are not compatible with ball-float valves.

Electronic Alarms
Of the available overfill-prevention technologies, electronic alarms are not used very often, even though they are the most versatile. Alarms may be used with tanks that receive pumped or gravity deliveries and with tight- or loose fill connections. A typical overfill alarm is tied into an automatic tank gauging (ATG) system. Most ATGs have the ability to trigger a remote alarm, which must be located outdoors near the fill area and labeled so the driver knows what it is. The alarm is triggered when the tank is 90% full.

How Does an Electronic Alarm Work?
As the underground tank is being filled, a float located inside the tank rises. When it reaches the trigger point, it closes a circuit and the alarm sounds. The fuel-delivery driver must be able to see and hear the alarm while filling the tank. When the driver hears the alarm, he should close the valve at the tanker and drain the delivery hose into the tank. If you want belt-and-suspenders protection, an alarm is a good backup for either drop-tube or ball-float overfill-prevention devices.

> ***NOTE:*** *While it is NOT an overfill-prevention device by itself, your ATG will probably sound a beep when the tank is 90% full. Since the ATG is inside the building and the delivery driver is outside, the ATG alarm is* ***not*** *an effective method overfill protection. The delivery driver must be able to see and/or hear the alarm.*

When an overfill alarm triggers often, do not ignore it. It means that there is something wrong with your delivery procedure. Perhaps the working capacity of your tank is less than you think it is. Call your service provider to verify your alarm setting(s) and the working capacity of your tank(s).

Remember, an electronic alarm does not stop or slow down the flow into your tank. It only sounds an alarm when the tank is getting close to full. The delivery driver must know what the alarm means, and must manually shut off the flow of fuel into the tank. It is very important to place a sign near the fill pipes, in clear view of the delivery person saying there is an overfill alarm for that tank, what occurs when it activates, and the necessary actions to take when it activates. Make sure your sign is durable.

Fill Pipe Shutoff Valve (also called Automatic-Shutoff or "Flapper" Valve)
Fill pipe shutoff valves replace a section of the drop tube, a thin aluminum tube located inside the tank fill pipe and extending close to the bottom of the tank. Typically, there is a float-activated mechanism on the outside of the tube that releases a valve, or flapper, inside the tube when the liquid level in the tank reaches no more than 95% of full-tank volume. When this happens, the product flowing down the fill pipe slams the valve shut, closing off the drop tube and stopping flow of fuel into the tank. The delivery hose "jumps," alerting the driver that the flapper has closed. When this happens, the driver should stop the flow of fuel from the truck and drain any fuel left in the hose into the tank. To notice the hose jump, the delivery driver must constantly watch the delivery hose, not sit inside the truck or inside a building.

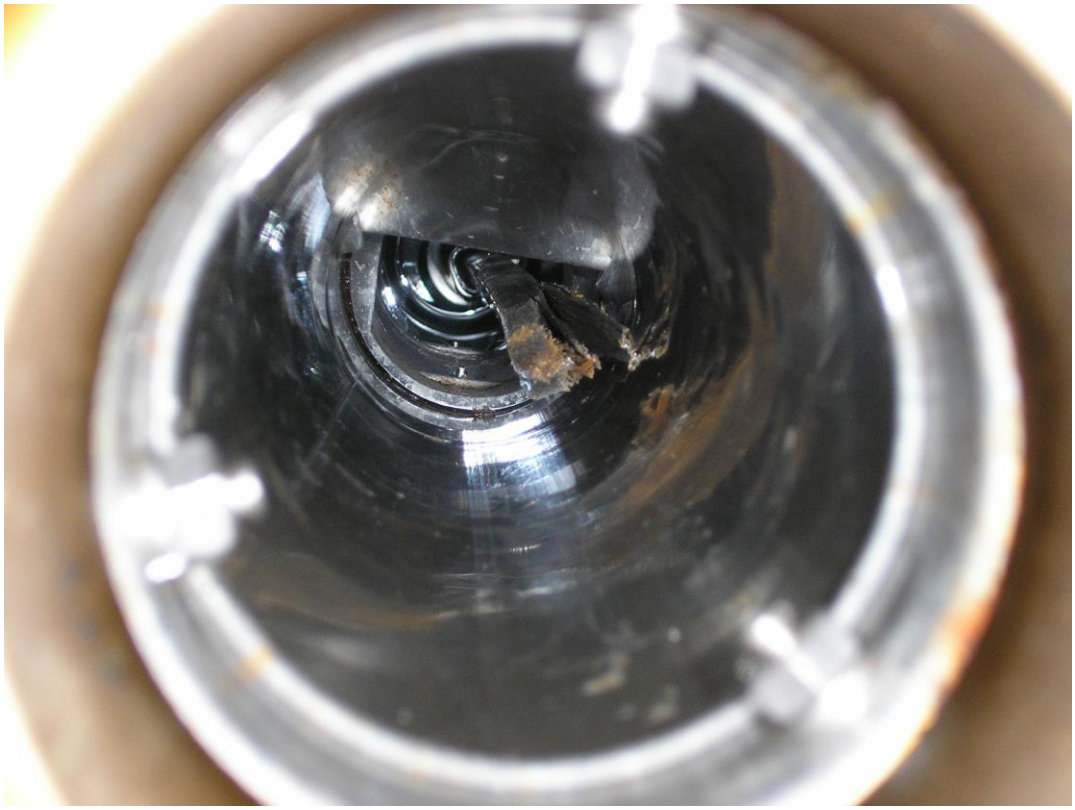
After the main valve closes, a bypass valve allows a small amount of product to flow (5- to 10-gallons per minute) and the hose to be drained. If the delivery is allowed to continue (10 minutes or so after the

main valve closes), the bypass valve also closes and the delivery hose can no longer be drained into the tank until the tank's liquid level is lowered.

Issues with Fill Pipe Shutoff Valves

Fill pipe shutoff valves work well as long as they are being used as intended and maintained properly. Be aware of the following potential problems associated with drop-tube devices:

- **Fill pipe shutoff valves have moving parts that can break.** To ensure your drop-tube device is working properly, it must be tested regularly. Several overfills have occurred in Vermont because critical parts of the fill pipe shutoff device were broken.
- **Fill pipe devices must not be disabled or bypassed.** A gauge stick in a fill pipe (see photo) will prevent the drop-tube shutoff valve from closing. Preventing an overfill prevention device from proper functioning is a serious violation of Vermont's UST Rules, and may result in substantial fines. If you find a gauge stick in your fill pipe, report it immediately to the UST Program, and call a service technician to check your overfill valve.
- **The sudden closing of the fill pipe valve puts a great deal of stress on the delivery system.** The hose connections to the tank and truck must be secure, or they may pop off, creating a significant surface spill.
- **There must be a tight-fill connection between the tank and the delivery hose.**
- **Deliveries must be made by gravity only.** If a delivery is made under pressure (pumped) and the device activates, something is likely to break.



This fill pipe shutoff valve has been rendered useless by placing a gauge stick in the drop tube. This is a serious violation of Vermont's UST rules, and may result in substantial fines.

Vent Whistle - A vent whistle is a small device, usually a tube, which typically is installed between your tank and the vent pipe. It signals that the tank is full, thereby minimizing the chance of overfilling. When oil is pumped into your tank, air is displaced from inside the tank through the vent pipe. As the air passes through the vent pipe, it makes a whistling sound. When the fuel reaches the end of the tube the whistling stops, which indicates that the tank is almost full. Vent whistles are typically used only on small tanks that receive deliveries from "peddle trucks." It is uncommon to find a vent whistle on a tank larger than 2,000 gallons.

Manual Measurement – UST systems that never receive more than 25 gallons at a time are not required to be equipped with an overfill prevention device. Typically, this only applies to tanks containing used oil. Even though no overfill device is required, these tanks still must not be overfilled. The liquid level in the tank must be measured with sufficient frequency – and at an absolute minimum, at least once per week – to ensure that the liquid level never exceeds 90 percent of the tank's capacity. You also must keep records of measurements made to prevent overfill. If you have a used oil tank, contact the UST Program if you are unsure if your measurement schedule and practices are regular and sufficient.

Corrosion protection

All regulated tanks that routinely contain regulated substances, and all components of the UST system, must be protected from corrosion. This can be accomplished by using non-metallic components such as fiberglass, by coating the metal to isolate it from contact with soil, or by using a technique called cathodic protection (CP). If properly installed and maintained, CP will prevent corrosion on the outside surfaces of steel tanks, piping, and other metallic storage-system components. It is the UST operator's job to ensure that the CP system is properly maintained so that the UST system remains protected from corrosion. **Cathodic protection only protects the outside surface of the metal that is in contact with the soil – it does not protect the inside surface of the tank.** For this reason it is very important to keep all water out of steel tanks. Water is an electrolyte and will promote corrosion. Petroleum products are not electrolytes, so corrosion on the inside of tanks should not be a problem as long as there is NO WATER present.

You can protect your underground tank from corrosion in several ways. Your tank may be:

- made of a non-corrodible material (such as fiberglass)
- a steel tank that is cathodically protected (through the use of either galvanic anodes or impressed current)
- a steel tank jacketed or clad with a non-corrodible material

Tank Type Descriptions

Protected Steel: Steel tank coated at the factory and built with sacrificial (galvanic) anodes, and usually equipped with dielectric nylon bushings in the bungholes. There are several industry codes for this type of tank, with sti-P3® being one of the most well-known. **Steel that is coated with paint or asphalt, but is not equipped with a sacrificial anode, is not protected from corrosion.**

Fiberglass-Reinforced Plastic: While the term Fiberglass-Reinforced Plastic (FRP) is technically correct, these tanks are more commonly referred to as fiberglass tanks.

Jacketed Steel Tank: This is a double-wall tank with a steel inner wall and a plastic or fiberglass outer wall. Titan® tanks, Permatanks®, and Total Containment Tank Jackets® are two common examples.

Clad Steel Tank: This is a steel tank that has a thick layer of non-corrodible material such as fiberglass or urethane that is mechanically bonded (clad) to the outer wall of the steel tank which protects the outer part of the steel wall from corroding. Examples include: ACT-100®, ACT-100-U®, Glasteel®, and Plasteel®.

Steel with Impressed Current: These tanks are either bare steel tanks that have been retrofitted with an impressed current system, or protected steel tanks (such as a sti-P3®) that had an anode failure that could not be remedied by addition of more galvanic anodes, and were retrofitted with impressed current.

Fiberglass (FRP) tanks, jacketed steel tanks, and clad steel tanks meet the corrosion protection requirements without additional equipment or operation and maintenance. Cathodic protection systems, both galvanic and impressed current, must be monitored and tested regularly. If your tank system uses cathodic protection, read on!

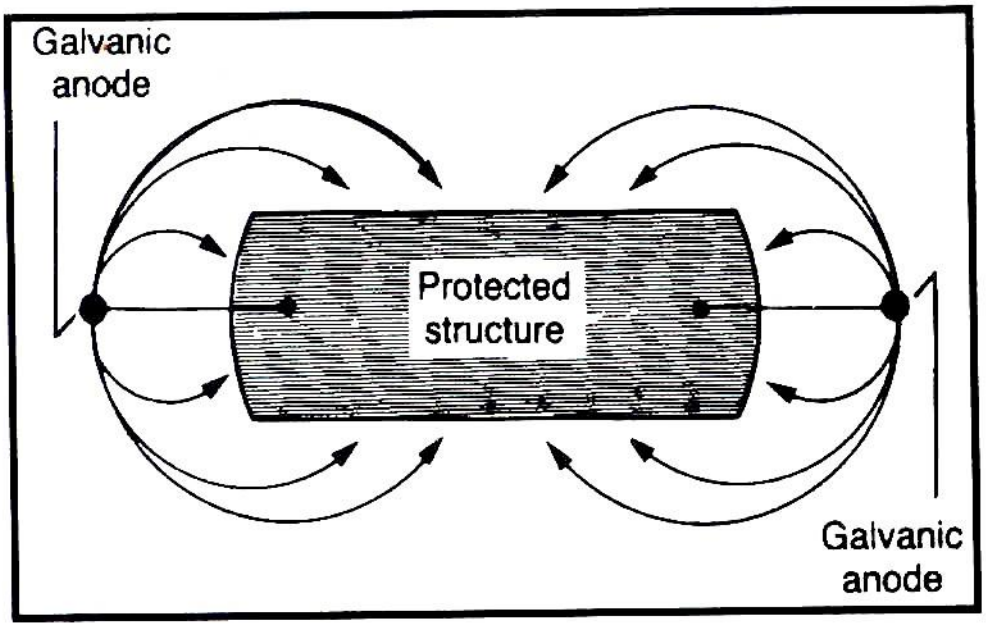
Cathodic Protection for Tanks & Piping

For corrosion to occur, four components must always be present: an electrolyte (for UST systems, moist soil is the electrolyte), an anode (a place on the metal where corrosion happens), a cathode (a place on the metal where corrosion does NOT happen), and an electrical pathway (usually the metal components of the storage system itself) between the anode and cathode. Corrosion always involves electricity—the movement of electrons from the anode, through the electrolyte, to the cathode.

How Does Cathodic Protection Prevent Corrosion?

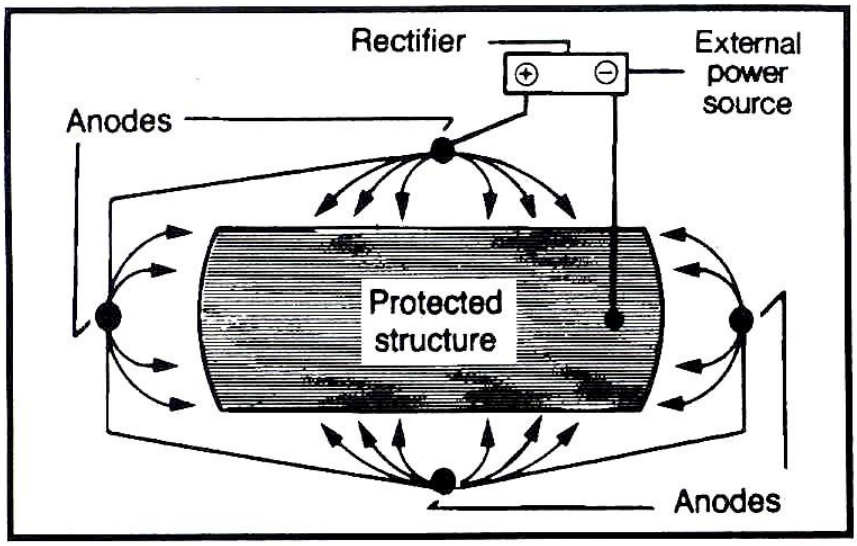
One of the four elements necessary for corrosion to occur is a cathode — a place where metal does not corrode. To combat corrosion with cathodic protection, the tank and/or its piping become the cathode. This is accomplished by creating a flow of electrons onto the surface of the protected metal. The corrosion happens at the place the electrons are flowing from (the anode). The anode will deteriorate over time and will need to be replaced, but as long as the anode is providing enough electrons, your tank and/or piping will be the cathode and will not corrode. There are two techniques for creating this flow of electrons from the anode to the cathode: galvanic CP and impressed current CP.

Galvanic CP is the most common type of cathodic protection used for steel underground tanks in Vermont. Galvanic cathodic protection uses simple chemistry, much like a flashlight battery, to produce the flow of electrons. The anode is typically a piece of zinc or magnesium that is attached to the tank and buried in the ground with the tank. Zinc and magnesium both have higher galvanic potentials than steel, so the electricity naturally flows from the piece of zinc or magnesium (anode), through damp soil (electrolyte), to the steel tank (the cathode). If you own a boat, you may be familiar with galvanic systems because zinc anodes are often used to protect outboard motors, propellers, and other metal components of boats.



A galvanic system uses the potentials of different metals so that the pieces of zinc or magnesium are the anodes, and the tank is the cathode, which does not corrode.

Impressed current CP uses standard 110-volt electricity from the power grid, just like the electricity that powers household lights and motors. The alternating current electricity from the power grid is first converted to direct current using a device called a **rectifier**. The direct current goes from the rectifier to the buried anodes that provide the electrons to protect the storage system.



The rectifier in an impressed current system sends electricity from the power grid to the anodes. The current passes through the soil into the tank (the cathode), which does not corrode.

How Do You Know If Your CP System Is Working?
Because anodes wear out over time, it is important to be able to tell when it is time to replace them. Fortunately, determining whether a CP system is working is relatively easy to do. It does not require any excavation, just a few specialized tools—a reference cell and a voltmeter. The reference cell is a copper rod inside a special container that is placed on clean soil at ground level (not on concrete or asphalt). The voltmeter reads the voltage between the reference cell and the buried tank or piping. The voltage readings are usually negative, and a reading equal to, or more negative than, -0.850 volts is the standard for steel to be adequately protected against corrosion. For example, -.875 volts, -.900 volts, and -1.10 volts are all passing readings; -.825 and -.750 volts are failing readings. **For impressed current systems, the rectifier must be turned off to make this measurement.**

This type of voltage measurement, called a structure-to-soil potential, is required for both galvanic and impressed current CP systems and must be repeated regularly. The measurements must be made by a professional with special training to test CP systems. **Tank systems with factory installed galvanic anodes (e.g. sti P3 systems) must be tested every three years. Galvanic systems that have had extra anodes added (field installed), and all impressed current systems, must be tested every year.**

Is There Anything Else You Must Do to Monitor Your CP System?
If you have a galvanic CP system, making sure that you have adequate structure-to-soil potential readings is all you have to do. **If you have an impressed current system, you must have adequate structure-to-soil potential readings each year AND you must also check the status of the rectifier at least once every two months (every 60 days).** As an UST operator you can do this bi-monthly reading yourself. Most rectifiers include meters that give you the voltage and amperage being produced by the rectifier. Every sixty days, write down the voltage and amperage numbers in a log that records the date, voltage reading, amperage reading, and your initials. Check to make sure the voltage and amperage readings are within the range specified by the engineer who designed the system. You must keep this log sheet on file for at least 3 years after the last reading.

The voltage and amperage readings on the rectifier will be different for each facility that has impressed current CP. The actual numbers are not important, but it is very important that the numbers do not change much over time. If the voltage or amperage readings change more than about 10% from what they were when the CP system was first installed, then something may have affected the system, and it needs to be checked out. The corrosion engineer who designed the system should be notified of the change immediately. If you need help locating a corrosion engineer, call the Vermont UST Program at 802-828-1138.

Conditions that Affect Structure-to-Soil Voltage
Age – Anodes get used up over time. Low voltage readings may indicate that anodes need to be replaced.
Weather – Dry or frozen soil can cause low voltage readings. It is almost impossible to get a valid reading when the soil is frozen. Schedule your annual inspection for a time of the year when soil is completely thawed and more likely to be wet.
Lack of Isolation – Other metal in contact with your tank or piping is a major cause of cathodic protection failure. If metal electrical conduit, rebar, or another piece of metal is touching the tank, the anodes will try to protect all that metal, which dilutes the protection the tank receives. Electrical currents from large power sources near the tank system (transformers, substations, etc.) can disrupt the electrical flow of the CP system and leave your tank or piping unprotected.

Leak Detection for Tanks

The most fundamental requirement of the UST Rules, is that all regulated tank systems must be tested and monitored to ensure that they are not leaking. Leak detection testing and monitoring is essential to protecting Vermont's groundwater, and to avoid dangerous vapors in basements.

All tanks in Vermont that dispense fuel through a metered dispenser must maintain and reconcile inventory records. In addition to inventory monitoring, another method of leak detection (also called release detection) must be used.

The only allowable method for leak detection for single-walled tanks larger than 550 gallons is in-tank monitoring (also called automatic tank gauging, or ATG), combined with inventory control. For double-walled tanks, the only allowable method of leak detection is interstitial monitoring combined with inventory control.

Leak detection monitoring must be conducted at least one per week in Vermont, and the results of the monitoring must be recorded. Leak detection records must be kept for at least three years, and the records must be organized in chronological order. Leak detection records should show the date and time, condition of the interstice or tank test result, the initials of the person who did the monitoring, and any actions that may be needed.

A suspected release must be reported to the Vermont Department of Environmental Conservation any time the release detection monitoring system indicates the system may be leaking. The report should be made as soon as the potential leak is discovered.

Leak Detection for Single-Wall Tanks

In-tank monitors (ITM), also commonly known as automatic tank gauges (ATG), can be programmed to run in "leak detect" mode regularly. When run in this condition, the ATG automatically calculates changes in fuel volume that can indicate a leaking tank. During the leak test (typically about 4 hours), nothing may be added to or withdrawn from the tank, so the station must be completely shut down during the test. Many store owners have their monitor programmed to test the tanks every night from midnight until 4:00 a.m. Receiving a fuel delivery during the test will cause an invalid test.

You are required to use your ATG system to test for leaks, and get valid results, at least **once every week**. If your ATG system does not produce a passing test result within one week, contact the UST program. Running the test every night can be a good way to ensure that you remain in compliance. Vermont's UST Rules allow you to run your ATG in leak detect mode only once per week, but if you receive a delivery during the test, you will have an invalid test for that week, which is a violation of Vermont's UST rules. If you run the test every night, an invalid test due to a delivery will not be a problem as long as you have passing test results for other nights that week. Make sure that the amount of fuel in your tank is sufficient to run the ATG leak test. The tank must contain a minimum amount of fuel to perform a valid leak detection test.

Stations that are open 24 hours do not have the required "down time" for an ATG test. If you have a single-wall tank at a facility that is open 24 hours per day, the only option is to have the electronic monitor programmed for continuous statistical leak detection. Not all electronic monitors have this capability.

An invalid test caused by a delivery or low fuel level does not have to be reported, but a failed test must be reported to the UST Program!

It is a good idea to have a qualified contractor inspect, calibrate, and test all ATG systems annually to ensure proper operation.

Leak Detection for Double-Wall Tanks

All underground storage tanks installed in Vermont after September 1, 1987, must be double-walled. Double-walled tanks are, in essence, a tank within a tank and designed to prevent releases into the environment by containing any fuel that leaks out from the inner tank in the “interstitial space” – the small gap between the two walls of the tank. When the interstitial space is monitored and problems are addressed as soon as they occur, fuel can be prevented from reaching the environment.

Double-walled tanks can be fashioned with both walls made of either steel or fiberglass or with an inner steel tank and an outer containment vessel constructed of fiberglass or polyethylene plastic, generally known as “jacketed” tanks. Double-walled tank technology is generally considered to be the most secure form of fuel storage, but a double-walled tank is only as good as its leak-monitoring system, what it tells the operator, and how the operator responds.

Interstitial monitoring is the only method of leak detection that can actually PREVENT a release to the environment, because the problem should be discovered while the product is still contained within the outer wall of the tank. Two methods of interstitial monitoring are available: manual monitoring and continuous electronic monitoring. Manual monitoring is inconvenient but costs very little; continuous electronic monitoring is very convenient, but the equipment can be costly.

How Do You Manually Monitor the Interstitial Space of Your Double-Walled Tank?

If you don’t have electronic monitoring for your tank, you must visually check your tank’s interstitial space every week for fuel or water. Your interstitial access is most likely a round, flat metal cover, usually about a foot in diameter, located in the concrete pad over the top of your tank(s). Interstitial monitoring ports are usually (but not always) located at the end of a tank. The cover may be marked with a triangle or it may have no identifying markings on it at all.

Remove the metal cover and you will find a cap that seals the top of the pipe that leads down into the tank interstitial space.

Use the following steps to check the interstitial space for each of your tanks:

- Carefully insert a CLEAN and DRY gauge stick into the interstitial space until it touches the bottom of the tank.
- Remove the stick and check to see if the end is wet. The stick should be dry. If so, record the results in your log book and proceed to the next tank.
- If any liquid is present, there may be a problem. The presence of liquid in the interstitial space is evidence of a possible leak and must be reported to the UST program and must be investigated. The first step in the investigation is to determine if water or fuel is in your interstitial space.
- Dry the end of the stick.
- Apply water-detecting paste to the bottom inch or so of one side of the clean and dry gauge stick.
- Apply fuel-detecting paste to the bottom inch or so of the opposite side of the same stick.
- Carefully insert the gauge stick into the interstitial space until it touches the bottom of the tank
- Leave the stick in the bottom of the tank for the amount of time recommended by the paste manufacturer (usually less than a minute).
- Remove the stick and check to see if the water- or fuel-detecting paste has changed color. This will tell you if the liquid is water or fuel. Report the findings to the Vermont UST Program.

- Keep a log of your weekly monitoring results.

Report evidence of a possible leak to the Vermont UST Program at 802-828-1138 or call the 24-hour Spill Hotline 1-800-561-0005.

How Do You Electronically Monitor the Interstitial Space of Your Double-Walled Tank?
A sensor is placed in the interstitial space and is connected to a console that continuously monitors for leaks and triggers an alarm if a problem is detected. Many consoles are combined with an automatic tank gauge (ATG). In either case, sensors will trigger an alarm at the console whenever the sensor detects liquid.

There are two types of sensors: discriminating and non-discriminating. A discriminating sensor can tell the difference between fuel and water and provides a different alarm for each type of liquid. A non-discriminating sensor, by far the most commonly used, only tells you that a liquid is present. With non-discriminating sensors, you have to visually investigate (using the manual method described above) to determine whether fuel or water has triggered the alarm.

You should keep a list of all the sensor locations with the sensor identification number or label posted close to the alarm console so you (and the service technician) can quickly tell which tank is causing the alarm. Respond immediately to any audible alarm or blinking red or yellow lights! If you do not know what to do, call your service technician or the UST Program.

You are required to check your monitor at least once each week, and record the status. If your monitor has a built in printer, you can simply file the slip of paper that shows the monitor is not in alarm. **Although Vermont's rules say that you are required to check and document the monitor at least once per week, it is a good idea to check your monitoring system EVERY DAY for alarms, which are evidence of a possible leak.** If your console is in alarm, take the following steps:
• Report evidence of a possible leak to the UST Program. Call 802-828-1138 during regular business hours, or 1-800-641-0005 anytime.
• Contact your tank installer or technician immediately to determine the cause of the alarm.

Suction Pumping Systems

In a suction pumping system, the pump is inside the dispenser cabinet, and the fuel is drawn from the tank by suction (like sucking liquid through a straw). It is relatively easy to tell when suction piping has a hole in it because the pump will not operate properly—try drinking through a straw with a hole in it. Fuel pumping systems have check valves that keep the piping full of liquid when the pump is turned off. The check valve opens whenever liquid is flowing toward the nozzle, and closes automatically whenever liquid tries to flow back toward the tank. It operates wherever it is located in the piping run—you can hold liquid in a straw by blocking the opening of the straw with either your finger at the bottom of the straw or your tongue at the top, or by squeezing the straw in the middle.

However, the location of the check valve in the fuel piping does make a difference with regard to leak detection. **Vermont's UST Rules require the check valve to be located just below the suction pump, at the top of the piping which is sloped uniformly uphill from the tank to the dispenser. This is known as "safe" suction because if a hole develops in the piping, air will be drawn into the pipe and the fuel will fall back into the tank, but there will be no leakage to the environment.**

How Do You Know If Your Suction System Is Leaking?
If there is a hole in the piping, air will enter the pipe, the pump will make strange noises when it is first turned on, and it will take a little longer for fuel to come out of the nozzle. These are indications that you may have a leak. Call the UST Program to report a suspected release and call your service technician right away to investigate the problem. Even if you have safe-suction piping, any product above the check valve in the dispenser piping or the pump itself cannot drain back to the tank and could leak into the environment.

Leak Detection for Suction Piping
If you have safe suction, you should have documentation (usually from the installer) that states the following:
• There is only one check valve in the piping system and it is located immediately below the pump.
• The pump is higher than the tank and the piping slopes uniformly from the pump down to the tank.

If you have evidence that the above provisions are correct, you are not required to conduct leak detection monitoring of your piping, since the piping is intrinsically safe: any leak in the pipe will cause the fuel to flow back into the tank, and not leak into the environment.

NOTE: If you have a situation where the pump is lower than the tank (e.g., a marina) you can NOT use this safe-suction technique to meet your leak detection requirements.

If there is a leak in your underground piping, no fuel should leak into the environment, but the pump probably will not work correctly. Indications of a possible leak include the pump sucking in air, pump hesitation, and an inability to pump fuel, even though there is fuel in the tank.

Report evidence of a possible leak to the Vermont UST Program at 802-828-1138 or call the 24-hour Spill Hotline 1-800-561-0005.

Monthly Inspections and Annual Self-Certification

Vermont's UST Rules require that the Class A or B operator, or a person working under the supervision of the A or B operator, check the UST systems for problems every month. The components that must be checked include:

- **Spill Buckets** – check for water or fuel. If present, remove and manage in accordance with the Vermont Hazardous Waste Management Rules. Check spill buckets for cracks, holes, or other leaks to be sure they are able to hold spilled fuel;
- **Tank Pad** – check all lids and covers for evidence of possible leaks or spills;
- **Dispensers and Fueling Pads** – Remove the dispenser skirt and check for evidence of possible leaks or spills; make sure that hoses and nozzles are in good repair;
- **Automatic Tank Gauge** (if applicable) – are any sensors in alarm?

The results of the monthly inspections must be recorded, and the records must be kept for at least a year.

Vermont's UST Rules also require that once per year, the tank system must be more thoroughly inspected, and the results of the inspection must be submitted to the UST Program. This annual inspection can be done by the A or B operator, or by a qualified contractor. The inspection must be documented on Vermont's self certification form and must be completed and certified by the permittee or someone authorized by the permittee. The deadline for submission is December 31 of each year.

In addition to the items required to be checked during the monthly inspections, the annual inspections require that the overfill prevention device be checked. (The annual inspections also require that many other components be checked for tank systems equipped with pressurized piping, but since this manual is aimed at operators of suction system, those issues are not discussed here.)

We’re finished!

If you have read through and understood everything in this manual, you should be ready to take Vermont’s test for Class A and B operators of suction dispensing UST systems. Good luck on the test!