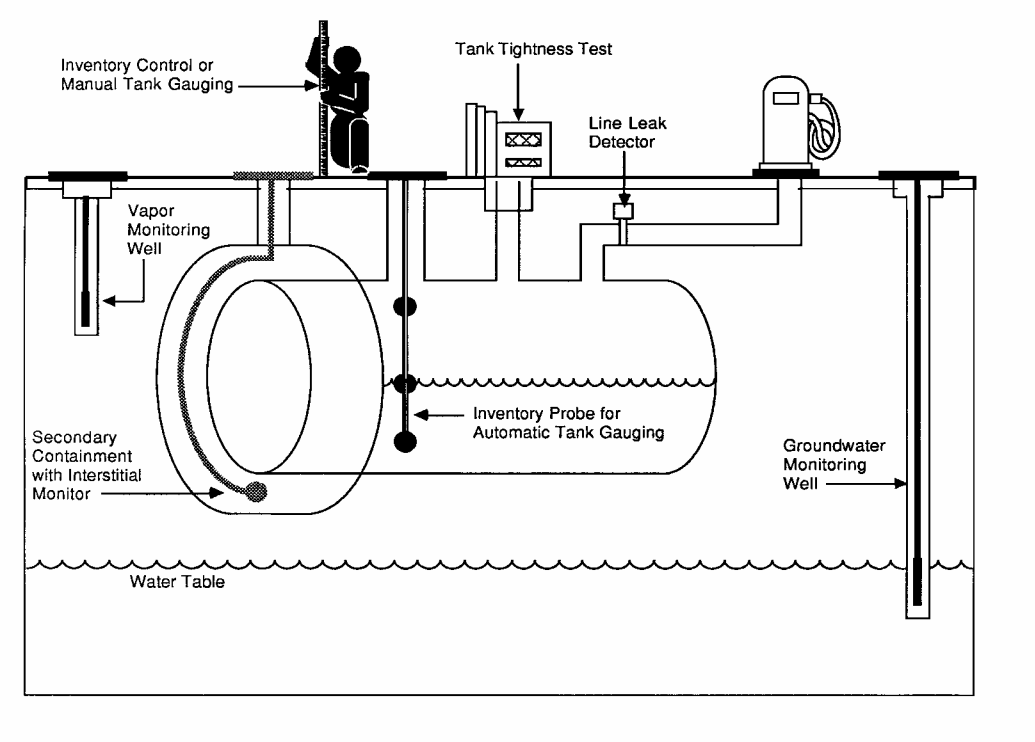
South Dakota
Department of Environment & Natural Resources
Ground Water Quality

Operational Compliance Guidance

For Regulated Underground Storage Tanks and Piping Leak Detection and Cathodic Protection --- Different Methods and Regulatory Requirements



NOTE: The requirements of leak detection for petroleum underground storage tanks and piping referred to in this booklet can be found in the Administrative Rules of South Dakota Chapter 74:56:01 (previously codified as 74:03:28) and the Code of Federal Regulations (CFR), see 40 CFR, Part 280. Sections of the CFR can be ordered from the Superintendent of Documents, Box 371954, Pittsburgh, PA 15250-7954. This document was modified, with EPA consent, from an EPA publication dated September 1997 entitled " ***Leak Detection Methods for Petroleum Underground Storage Tanks and Piping****"*
(EPA 510-B-97-007)*.*

DISCLAIMER: Any reference to or depiction of commercial products in this booklet is solely for explanatory purposes and is <u>not</u> intended as an endorsement of these products.

An Overview of Leak Detection Requirements

All new underground storage tanks (USTs) (those installed after December 1988) must have leak detection when they are installed.

USTs installed before December 1988 (called "existing USTs") had compliance deadlines for leak detection phased in over 5 years.
By December 1993, *all "existing USTs"* had to have leak detection.

DENR has identified the following methods that owners and operators may use to meet the leak detection requirements:

- Secondary Containment With Interstitial Monitoring
- Automatic Tank Gauging Systems
- Vapor Monitoring
- Groundwater Monitoring
- Statistical Inventory Reconciliation
- Other Methods Meeting Performance Standards

Make sure the vendor of the leak detection method you use has provided you with evidence that your leak detection meets regulatory requirements for performance.

The leak detection methods noted above are all ***monthly monitoring methods*** and eventually everyone must use at least one of them. However, as a ***temporary*** method, you can combine ***tank tightness testing*** with inventory control (or with manual tank gauging if you have a small tank).

Look For The "Proof" Of A Third-Party Evaluation

An evaluation performed by a third party (someone who is independent of the manufacturer or vendor of the leak detection system) shows that a leak detection system can work as designed. The evaluation follows required evaluation procedures, and often takes place in a laboratory. EPA and third parties have developed evaluation procedures for all leak detection systems.

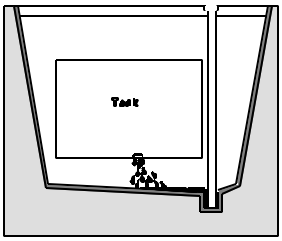
Although an evaluation and its resulting documentation are technical, you should be familiar with the evaluation's "results" form and, when provided, its "description" form. You should obtain these forms from the leak detection vendor and keep them on file. They contain a signed certification that the system performed as described, as well as documenting any limitations of the system. This information is important to your compliance with the UST requirements. For example, if a tank tightness test was evaluated and certified only for tests taking 2 hours or more, then your UST must be tested for at least 2 hours or it would fail to meet the leak detection requirements.

Underground piping connected to your USTs must also have leak detection
See the section on leak detection for piping

Secondary Containment with Interstitial Monitoring

Will you be in compliance?

When installed and operated according to the manufacturer's specifications, secondary containment with interstitial monitoring meets the leak detection requirements for USTs. Operation of the monitoring device at least once each month fulfills the requirements for the life of the tank. Secondary containment with interstitial monitoring can also be used to detect leaks from piping (see the section on leak detection for piping).



How does the leak detection method work?

Secondary containment

- Secondary containment provides a barrier between the tank and the environment. The barrier holds the leak between the tank and the barrier so that the leak is detected. The barrier is shaped so that a leak will be directed towards the interstitial monitor.

- Barriers include:

  - Double-walled or "jacketed" tanks, in which an outer wall partially or completely surrounds the primary tank;

  - Internally fitted liners (“bladders”); and

  - Leakproof excavation liners that partially or completely surround the tank.

- Clay and other earthen materials cannot be used as barriers.

Interstitial monitors

- Monitors are used to check the area between the tank and the barrier for leaks and alert the operator if a leak is suspected.

- Some monitors indicate the physical presence of the leaked product, either liquid or gaseous. Other monitors check for a change in condition that indicates a hole in the tank, such as a loss of vacuum or a change in the level of a monitoring liquid between the walls of a double-walled tank.

- Monitors can be as simple as a dipstick used at the lowest point of the containment to see if liquid product has leaked and pooled there. Monitors can also be sophisticated automated systems that continuously check for leaks.

What are the requirements?

- The barrier must be immediately around or beneath the tank.
- The interstitial monitor must be checked at least once every 30 days. If monitoring is by visual inspection a log must be kept. If by alarm, alarm must be checked monthly and a log kept of status. Monitoring records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility itself.
- A double-walled system must be able to detect a release through the inner wall.
- An excavation liner must:
  - Direct a leak towards the monitor;
  - Not allow the specific product being stored to pass through it any faster than 10^{-6} cm/sec;
  - Be compatible with the product stored in the tank;
  - Not interfere with the UST's cathodic protection;
  - Not be disabled by moisture;
  - Always be above the groundwater and the 25-year flood plain; and
  - Have clearly marked and secured monitoring wells, if they are used.
- A bladder must be compatible with the product stored and must be equipped with an automatic monitoring device.

Will it work at your site?

- In areas with high groundwater or a lot of rainfall, it may be necessary to select a secondary containment system that completely surrounds the tank to prevent moisture from interfering with the monitor.

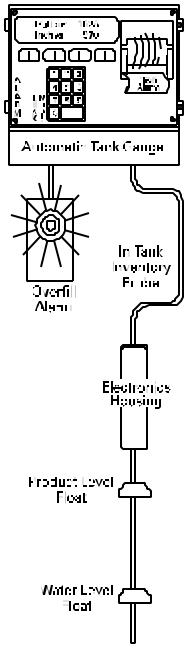
Anything else you should consider?

- This method works effectively only if the barrier and the interstitial monitor are installed correctly. Therefore, trained and experienced installers are necessary.

Automatic Tank Gauging Systems

Will you be in compliance?

When installed and operated according to the manufacturer's specifications, automatic tank gauging systems (ATGS) meet the leak detection requirements for ***tanks*** (this method does not detect piping leaks). A test performed each month fulfills the requirements for the life of the tank. (For additional requirements for piping, see the section on leak detection for piping)



How does the leak detection method work?

- The product level and temperature in a tank are measured continuously and automatically analyzed and recorded by a computer.
- In the "inventory mode," the ATGS replaces the use of the gauge stick to measure product level and perform inventory control. This mode records the activities of an in-service tank, including deliveries.
- In the "test mode," the tank is taken out of service and the product level and temperature are measured for at least one hour. Some systems, known as "continuous ATGS," do not require the tank to be taken out of service to perform a test. This is because these systems can gather and analyze data during many short periods when no product is being added to or taken from the tank.
- Some methods combine aspects of automatic tank gauges with ***Statistical Inventory Reconciliation***.

What are the requirements?

- The ATGS must be able to detect a leak of 0.2 gallons per hour with certain probabilities of detection and of false alarm. Some ATGS can also detect a leak of 0.1 gallons per hour with the required probabilities.
- A “Passed” test slip must be available for each tank for the past month. Results must be kept for past 12 months. Records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility itself.

Will it work at your site?

- ATGS have been used primarily on tanks containing gasoline or diesel, with a capacity of up to 15,000 gallons. If considering using an ATGS for larger tanks or products other than gasoline or diesel, discuss its applicability with the manufacturer's representative.
- Water around a tank may hide a leak by temporarily preventing the product from leaving the tank. To detect a leak in this situation, the ATGS should be capable of detecting water in the bottom of a tank.

Anything else you should consider?

- The ATGS probe is permanently installed through an opening (not the fill pipe) on the top of the tank. Each tank at a site must be equipped with a separate probe.
- The ATGS probe is connected to a console that displays ongoing product level information and the results of the monthly test. Printers can be

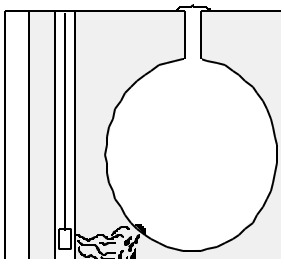
connected to the console to record this information.

- ATGS are often equipped with alarms for high and low product level, high water level, and theft.
- ATGS can be linked with computers at other locations, from which the system can be programmed or read.
- For ATGS that are not of the "continuous" type, no product should be delivered to the tank or withdrawn from it for at least 6 hours before the monthly test or during the test (which generally takes 1 to 6 hours).
- An ATGS can be programmed to perform a test more often than once per month (a recommended practice).

Vapor Monitoring

Will you be in compliance?

When installed and operated according to the manufacturer's instructions, vapor monitoring meets the leak detection requirements for USTs. Operation of a vapor monitoring system at least once each month fulfills the requirements for the life of the tank. Vapor monitoring can also be installed to detect leaks from piping (see the section on leak detection for piping).



How does the leak detection method work?

- Vapor monitoring senses or measures "fumes" from leaked product in the soil around the tank to determine if the tank is leaking.

- Fully automated vapor monitoring systems have permanently installed equipment to continuously or periodically gather and analyze vapor samples and respond to a release with a visual or audible alarm.

- Manually operated vapor monitoring systems range from equipment that immediately analyzes a gathered vapor sample to devices that gather a sample that must be sent to a laboratory for analysis. Manual systems must be used at least once a month to monitor a site.

- All vapor monitoring devices should be periodically calibrated according to the manufacturer's instructions to ensure that they are properly responding.

- Before installation, a site assessment is necessary to determine the soil type, groundwater depth and flow direction, and the general geology of the site. This can only be done by a trained professional.

- The number of wells and their placement is very important. Only an experienced contractor can properly design and construct an effective monitoring well system. Vapor monitoring requires the installation of monitoring wells within the tank backfill. A minimum of two wells is recommended for a single tank excavation. Three or more wells are recommended for an excavation with two or more tanks.

What are the requirements?

- The UST backfill must be sand, gravel or another material that will allow the vapors to easily move to the monitor.

- The backfill should be clean enough that previous contamination does not interfere with the detection of a current leak.

- The substance stored in the UST must vaporize easily so that the vapor monitor can detect a release. Some vapor monitoring systems do not work well with diesel fuel.

- High groundwater, excessive rain, or other sources of moisture must not interfere with the operation of vapor monitoring for more than 30 consecutive days.

- Monitoring wells must be secured and clearly marked.

- Monitoring wells must be checked at least once every 30 days, if monitoring is by manual inspection. A log must be kept. If monitoring is by alarm, alarm must be checked monthly and a log kept of status. Monitoring records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility itself.

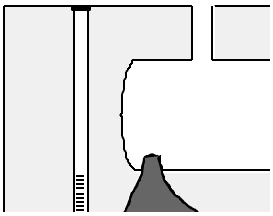
Will it work at your site?

- Before installing a vapor monitoring system, a site assessment must be done to determine whether vapor monitoring is appropriate at the site. A site assessment usually includes at least a determination of the groundwater level, background contamination, stored product type, and soil type. This assessment can only be done by a trained professional.

Groundwater Monitoring

Will you be in compliance?

When installed and operated according to the manufacturer's instructions, a groundwater monitoring system meets the leak detection requirements for USTs. Operation of a groundwater monitoring system at least once each month fulfills the requirements for the life of a tank. Groundwater monitoring can also be used to detect leaks in piping (see the section on leak detection for piping).



How does the leak detection method work?

- Groundwater monitoring involves the use of permanent monitoring wells placed close to the UST. The wells are checked at least monthly for the presence of product that has leaked from the UST and is floating on the groundwater surface.
- The two main components of a groundwater monitoring system are the monitoring well (typically a well of 2-4 inches in diameter) and the monitoring device.
- Detection devices may be permanently installed in the well for automatic, continuous measurements for leaked product.
- Detection devices are also available in manual form. Manual devices range from a bailer (used to collect a liquid sample for visual inspection) to a device that can be inserted into the well to electronically indicate the presence of leaked product. Manual devices must be used at least once a month.
- Before installation, a site assessment is necessary to determine the soil type, groundwater depth and flow direction, and the general geology of the site. This assessment can only be done by a trained professional.
- The number of wells and their placement is very important. Only an experienced contractor can properly design and construct an effective monitoring well system. A minimum of two wells is recommended for a single tank excavation. Three or more wells are recommended for an excavation with two or more tanks.

NOTE: Groundwater monitoring cannot be used at sites where groundwater is more than 20 feet below the surface.

What are the requirements?

- Groundwater monitoring can only be used if the stored substance does not easily mix with water and floats on top of water.

- If groundwater monitoring is to be the sole method of leak detection, the groundwater must not be more than 20 feet below the surface, and the soil between the well and the UST must be sand, gravel or other coarse materials.

- Product detection devices must be able to detect one-eighth inch or less of leaked product on top of the groundwater.

- Monitoring wells must be properly designed and sealed to keep them from becoming contaminated from outside sources. The wells must also be clearly marked and secured.

- Wells should be placed in the UST backfill so that they can detect a leak as quickly as possible.

- Monitoring wells must be checked at least once every 30 days. If monitoring is by manual inspection a log must be kept. If by alarm, alarm must be checked monthly and a log kept of status. Monitoring records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility itself.

Will it work at your site?

- In general, groundwater-monitoring works best at UST sites where:

  - Monitoring wells are installed in the tank backfill; and

  - There are no previous releases of product that would falsely indicate a current release.

- A professionally conducted site assessment is critical for determining these site-specific conditions.

Statistical Inventory Reconciliation

Will you be in compliance?

Statistical inventory reconciliation (SIR), when performed according to the vendor's specifications meets leak detection requirements for USTs as follows. SIR with a 0.2 gallon per hour leak detection capability meets the requirements for monthly monitoring for the life of the tank and piping. SIR with a 0.1 gallon per hour leak detection capability meets the requirements as an equivalent to tank tightness testing. SIR can, if it has the capability of detecting even smaller leaks, meet the requirements for line tightness testing as well. (For additional requirements for piping, see the section on leak detection for piping)

How does the leak detection method work?

- SIR analyzes inventory, delivery, and dispensing data collected over a period of time to determine whether or not a tank system is leaking.

- Each operating day, the product level is measured using a gauge stick or other tank level monitor. You also keep complete records of all withdrawals from the UST and all deliveries to the UST. After data have been collected for the period of time required by the SIR vendor, you provide the data to the SIR vendor.

- The SIR vendor uses sophisticated computer software to conduct a statistical analysis of the data to determine whether or not your UST system may be leaking. The SIR vendor provides you with a test report of the analysis.

- Some methods combine aspects of automatic tank gauges with statistical inventory reconciliation. In these methods, sometimes called hybrid methods, a gauge provides liquid level and temperature data to a computer running SIR software, which performs the analysis to detect leaks.

What are the requirements?

- To be allowable as monthly monitoring, a SIR method must be able to detect a leak at least as small as 0.2 gallons per hour and meet the requirements regarding probabilities of detection and of false alarm. Data must be submitted at least monthly.

- To be allowable as an equivalent to tank tightness testing, a SIR method must be able to detect a leak at least as small 0.1 gallons per hour and meet the requirements regarding probabilities of detection and of false alarm.

- The individual SIR method must have been evaluated with a test procedure to certify that it can detect leaks at the required level and with the appropriate probabilities of detection and of false alarm.

- The method's evaluation must reflect the way the method is used in the field. If a SIR method is not performed by the SIR vendor, then the method's evaluation must be done without the involvement of the SIR vendor. Examples of this situation are SIR methods licensed to owners and hybrid ATGS/SIR methods.

- If the test report is not conclusive, you must take the steps necessary to find out conclusively whether your tank is leaking. Because SIR requires multiple days of data, you will probably have to use another method.

- You must keep on file both the test reports and the documentation that the SIR method used is certified as valid for your UST system. Records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility itself.

Will it work at your site?

- SIR has been used primarily on tanks no more than 18,000 gallons in capacity. If you are considering using a SIR method for larger tanks, check the method's evaluation to confirm that it will meet regulatory requirements and your needs.

- A SIR method's ability to detect leaks declines as throughput increases. If you are considering using a SIR method for high throughput UST systems, check the method's evaluation to confirm that it will meet regulatory requirements and your needs.

- Water around a tank may hide a hole in the tank or distort the data to be analyzed by temporarily preventing a leak. To detect a leak in this situation, you should check for water at least once a month.

Anything else you should consider?

- Data, including product level measurements, dispensing data, and delivery data, should all be carefully collected according to the SIR vendor's specifications. Poor data collection produces inconclusive results and noncompliance.

- The SIR vendor will generally provide forms for recording data, a calibrated chart converting liquid level to volume, and detailed instructions on conducting measurements.

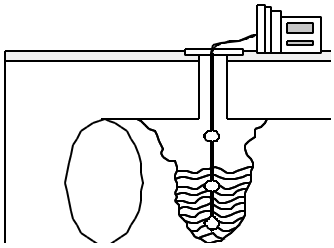
- SIR should not be confused with other release detection methods that also rely on periodic reconciliation of inventory, withdrawal, and delivery data. Unlike manual tank gauging or inventory control, SIR uses a sophisticated statistical analysis of data to detect releases.

Tank Tightness Testing With Inventory Control

Will you be in compliance?

When performed according to the manufacturer's specifications, periodic tank tightness testing combined with monthly inventory control can ***temporarily*** meet the leak detection requirements for ***tanks*** (this method does not detect piping leaks).

These two leak detection methods must be used together, because neither method alone meets the requirements for leak detection for tanks. Tightness testing is also an option for underground piping, as described in the section on leak detection for piping



Because they must be used together, both tank tightness testing and inventory control are discussed in this section. Tank tightness testing is discussed first, followed by inventory control.

Tank Tightness Testing

How does the leak detection method work?

Tightness tests include a wide variety of methods. Other terms used for these methods include "precision," "volumetric," and "nonvolumetric" testing.

- Many tightness test methods are "volumetric" methods in which the change in product level in a tank over time is measured very precisely (in milliliters or thousandths of an inch).
- Other methods use acoustics or tracer chemicals to determine the presence of a hole in the tank. With such methods, all of the factors in the following bullets may not apply.
- For most methods, changes in product temperature also must be measured very precisely (thousandths of a degree) at the same time as level measurements, because temperature changes cause volume changes that interfere with finding a leak.
- For most methods, a net decrease in product volume (subtracting out volume changes caused by temperature) over the time of the test indicates a leak.
- The testing equipment is temporarily installed in the tank, usually through the fill pipe.
- The tank must be taken out of service for the test.
- Many test methods require that the product in the tank be a certain level before testing, which often requires adding product from another tank on-site or purchasing additional product.

- Some tightness test methods require all of the measurements and calculations to be made by hand by the tester. Other tightness test methods are highly automated. After the tester sets up the equipment, a computer controls the measurements and analysis.

- A few methods measure properties of the product that are independent of temperature, such as the mass of the product, and so do not need to measure product temperature.

- Some automatic tank gauging systems are capable of meeting the requirements for tank tightness testing and can be considered as an equivalent method.

What are the requirements?

- The tightness test method must be able to detect a leak at least as small as 0.1 gallon per hour with certain probabilities of detection and of false alarm.

- Tightness tests must be performed periodically. New UST systems—those installed after December 1988—must have tank tightness tests every 5 years for 10 years following installation.
  In most cases, existing UST systems—those installed before December 1988—that have spill, overfill, and corrosion protection must have tank tightness tests every 5 years for 10 years following upgrade. Existing UST systems that have not been upgraded must have tank tightness tests ***annually*** until December 1998, after which these tanks must be upgraded, replaced, or closed.

- After the applicable time period noted above, you must have a monitoring method that can be performed at least once per month.

- Records for the last year test should be readily available for inspection. They may be kept at a central office rather than the facility.

Anything else you should consider?

- For most methods, the test is performed by a testing company. You just observe the test.

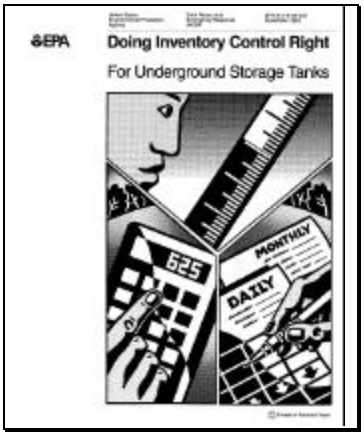
- Tank tightness testing has been used primarily on tanks no more than 15,000 gallons in capacity containing gasoline and diesel. If you are considering using tightness testing for larger tanks or products other than gasoline or diesel, discuss the method's applicability with the manufacturer's representative.

- Manifolded tanks generally should be disconnected and tested separately.

- Procedure and personnel, not equipment, are usually the most important factors in a successful tightness test. Therefore,
  well-trained and experienced testers are very important.

Inventory Control

How does the leak detection method work?



Inventory control requires frequent measurements of tank contents and math calculations that let you compare your "stick" inventory (what you've measured) to your "book" inventory (what your recordkeeping indicates you should have). Some people call this process "inventory reconciliation." If the difference between your "stick" and "book" inventory is too large, your tank may be leaking.

EPA has a booklet, **Doing Inventory Control Right**, that fully explains how to do inventory control. The booklet also contains standard recordkeeping forms. You can order this free booklet by calling EPA's toll-free Hotline at 800 424-9346.

- UST inventories are determined each operating day by using a gauge stick and recording the data on a form. The level on the gauge stick is converted to a volume of product in the tank using a calibration chart, which is often furnished by the UST manufacturer.

- The amounts of product delivered to and withdrawn from the UST each operating day are also recorded. At least once each month, the gauge stick data and the sales and delivery data are reconciled and the month's overage or shortage is determined. If the overage or shortage is greater than or equal to 1.0 percent of the tank's flow-through volume plus 130 gallons of product, the UST may be leaking.

What are the requirements?

- Inventory control must be used in combination with periodic tank tightness tests.

- The gauge stick should reach the bottom of the tank and be marked so that the product level can be determined to the nearest one-eighth of an inch. A monthly measurement should be taken to identify any water at the bottom of the tank.

- Product dispensers must be calibrated to the local weights and measures standards.

- Records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility.

Anything else you should consider?

- Inventory control is a practical, commonly used management tool that does not require closing down the tank operation for long periods.

- The accuracy of tank gauging can be greatly increased by spreading product-finding paste on the gauge stick before taking measurements.

- If your tank is not level, inventory control may need to be modified. You will need to get a corrected tank chart.

Time restrictions on the use of this combined method...

Existing UST systems—those installed before December 1988—that have not been fully upgraded with spill, overfill, and corrosion protection must have tank tightness tests ***annually*** until December 1998, after which these tanks must be upgraded, replaced, or closed.

The combined method using tank tightness testing every 5 years is valid only after the entire UST system has met spill, overfill, and corrosion protection standards. Following entire UST system upgrade, this combined method may be used for 10 years (or until December 1998, whichever is later) after the date the tank was installed or upgraded with corrosion protection. Note that the end date is based on the compliance status of the ***tank only***, not the entire UST system. As a result, some USTs may not be able to use this combined method for as long as 10 years (see discussion below). At the end of the valid time period, you must use one of the monthly monitoring leak detection.

The combined method can be used only temporarily. Be sure you know how long you can use the combined method to meet federal, state, or local requirements.

Unique time restriction for some existing USTs...

For some existing USTs—those which had corrosion protection ***before*** the entire UST system met upgrade standards—this combined method of inventory control and tightness testing every 5 years may be valid for less than 10 years.

Federal regulations state that the combined method can be used: 1) until December 1998 or 10 years after the tank is protected from corrosion (whichever date is later), and 2) the period of validity cannot begin until the entire UST system meets upgrade standards.
Therefore, in those cases where the tank had corrosion protection before the UST system met upgrade standards, the period of validity is less than 10 years. The effect of this restriction will be clear in the following example: a bare steel tank upgraded with corrosion protection in 1986 (or the tank was made of noncorrodible material and installed in 1986), but the piping, spill, and overfill upgrades were not added until 1995. The UST system in this example could start using the combined method only in 1995 (when the full system met upgrade standards) and could use the combined method only until 1998 (the date which is the later of either 1998 or 10 years after the tank has corrosion protection). In this example, the UST may use the combined method to meet leak detection requirements only for three years (from 1995 to 1998).

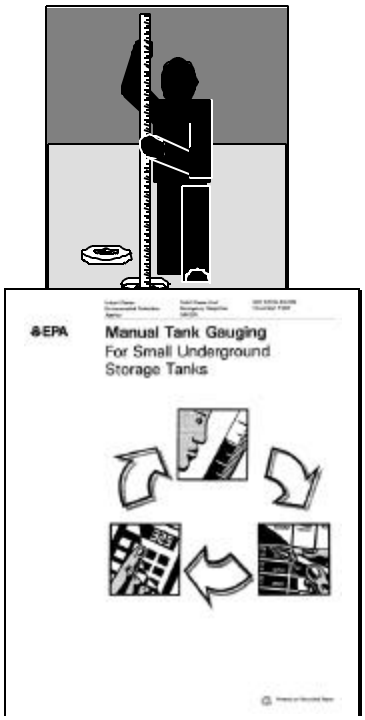
Correspondingly, when the period of validity is less than 10 years, fewer periodic tightness tests may be required.

Check with DENR for guidance.

Manual Tank Gauging

Will you be in compliance?

NOTE: ***Manual tank gauging can be used only on tanks 2,000 gallons or less capacity.*** *Tanks 1,000 gallons or less can use this method alone. Tanks from 1,001-2,000 gallons can temporarily use manual tank gauging only when it is combined with tank tightness testing. Manual tank gauging cannot be used on tanks over 2,000 gallons.* When performed according to recommended practices, manual tank gauging meets the leak detection requirements for USTs with a capacity of 1,000 gallons or less for the life of the tank. Manual tank gauging detects leaks only from ***tanks*** (this method does not detect piping leaks). For requirements for piping, see the section on leak detection for piping.



How does the leak detection method work?

EPA has a booklet, **Manual Tank Gauging**, that fully explains how to do manual tank gauging correctly. The booklet also contains standard recordkeeping forms. You can order this free booklet by calling EPA's toll-free Hotline at 800 424-9346.

- Four measurements of the tank's contents must be taken weekly, two at the beginning and two at the end of **at least a 36-hour period** during which nothing is added to or removed from the tank. See the table of Test Standards for Manual Tank Gauging.

- The average of the two consecutive ending measurements are subtracted from the average of the two beginning measurements to indicate the change in product volume.

- Every week, the calculated change in tank volume is compared to the standards shown in the table on the next page. If the calculated change exceeds the weekly standard, the UST may be leaking. Also, monthly averages of the four weekly test results must be compared to the monthly standard in the same way. See the table of Test Standards for Manual Tank Gauging.

What are the requirements?

- Liquid level measurements must be taken with a gauge stick that is marked to measure the liquid to the nearest one-eighth of an inch.

- Manual tank gauging may be used as the sole method of leak detection for tanks with a capacity of 1,000 gallons or less for the life of the tank. Tanks between 551 and 1,000 gallons have testing standards based on their diameter or their additional use of tightness testing (see table).

Table of Test Standards for Manual Tank Gauging

Tank Size	Minimum Duration Of Test	Weekly Standard (1 test)	Monthly Standard (4-test average)
up to 550 gallons	36 hours	10 gallons	5 gallons
551-1,000 gallons (when tank diameter is 64")	44 hours	9 gallons	4 gallons
551-1,000 gallons (when tank diameter is 48")	58 hours	12 gallons	6 gallons
1,001-2,000 gallons (also requires periodic tank tightness testing)	36 hours	26 gallons	13 gallons

- For tanks with a capacity of 1,001-2,000 gallons, manual tank gauging must be combined with periodic tightness testing. This combined method will meet the federal requirements only ***temporarily***. You must eventually have another monitoring method that can be performed at least once a month.

- Tanks greater than 2,000 gallons in capacity may not use this method of leak detection to meet the leak detection requirements.

- Records for the last year should be readily available for inspection. They may be kept at a central office rather than the facility.

Anything else you should consider?

- You can perform manual tank gauging yourself. Correct gauging, recording, and math are the most important factors for successful tank gauging. The accuracy of tank gauging can be greatly increased by spreading product-finding paste on the gauge stick before taking measurements.

Leak Detection For Underground Piping

Will you be in compliance?

When installed and operated according to the manufacturer's specifications, the leak detection methods discussed here meet the regulatory requirements for the life of underground piping systems. Your UST may have ***suction*** or ***pressurized*** piping, which are discussed below.

What are the requirements for suction *piping?*

- No leak detection is required if the suction piping has (1) enough slope so that the product in the pipe can drain back into the tank when suction is released and (2) has only one check valve, which is as close as possible beneath the pump in the dispensing unit. If a suction line is to be considered exempt based on these design elements, there must be some way to check that the line was actually installed according to these plans.

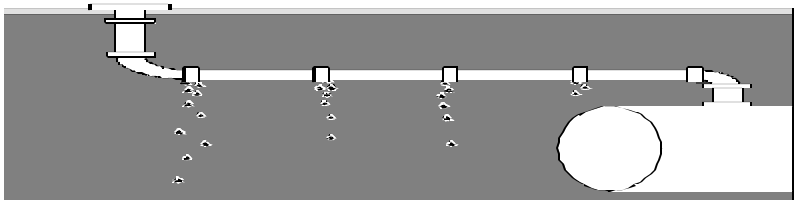
- If a suction line does not meet all of the design criteria noted above, one of the following leak detection methods must be used:

  - A line tightness test at least every 3 years; or
  - Monthly interstitial monitoring; or
  - Monthly vapor monitoring; or
  - Monthly groundwater monitoring; or
  - Monthly statistical inventory reconciliation; or
  - Other monthly monitoring that meets performance standards.

The line tightness test must be able to detect a leak at least as small as 0.1 gallon per hour at 1.5 times normal operating pressure with certain probabilities of detection and of false alarm.

Interstitial monitoring, vapor monitoring, groundwater monitoring, and statistical inventory reconciliation have the same regulatory requirements for piping as they do for tanks.

What are the requirements for pressurized *piping?*



Each pressurized piping run must have one leak detection method from each set below:

An Automatic Line Leak Detector:

- Automatic flow restrictor; or
- Automatic flow shutoff; or
- Continuous alarm system.

And One Other Method:

- Annual line tightness test; or
- Monthly interstitial monitoring; or
- Monthly vapor monitoring; or
- Monthly groundwater monitoring; or
- Monthly statistical inventory reconciliation; or
- Other monthly monitoring that meets performance standards.

- The automatic line leak detector (LLD) must be designed to detect a leak at least as small as 3 gallons per hour at a line pressure of 10 pounds per square inch within 1 hour by shutting off the product flow, restricting the product flow, or triggering an audible or visual alarm.

- The line tightness test must be able to detect a leak at least as small as 0.1 gallon per hour when the line pressure is 1.5 times its normal operating pressure. The test must be conducted each year. If the test is performed at pressures lower than 1.5 times operating pressure, the leak rate to be detected must be correspondingly lower.

- Automatic LLDs and line tightness tests must also be able to meet the requirements regarding probabilities of detection and false alarm.

- Interstitial monitoring, vapor monitoring, groundwater monitoring, and statistical inventory reconciliation have the same requirements for piping as they do for tanks.

How do the leak detection methods work?

Automatic line leak detectors (LLDs)

- Flow restrictors and flow shutoffs can monitor the pressure within the line in a variety of ways: whether the pressure decreases over time; how

long it takes for a line to reach operating pressure; and combinations of increases and decreases in pressure.

- If a suspected leak is detected, a *flow restrictor* keeps the product flow through the line well below the usual flow rate. If a suspected leak is detected, a *flow shutoff* completely cuts off product flow in the line or shuts down the pump.

- A *continuous alarm system* constantly monitors line conditions and immediately triggers an audible or visual alarm if a leak is suspected. Automated internal, vapor, or interstitial line monitoring systems can also be set up to operate continuously and sound an alarm, flash a signal on the console, or even ring a telephone in a manager's office when a leak is suspected.

- Both automatic flow restrictors and shutoffs are permanently installed directly into the pipe or the pump housing.

- Vapor, interstitial, or other monitoring systems can be installed to shut off flow, restrict flow, or trigger an alarm whenever a leak is detected. If it meets the applicable standards, such a setup meets the monthly monitoring requirement as well as the LLD requirement.

Line tightness testing

- Tracer methods do not measure pressure or flow rates of the product. Instead they use a tracer chemical to determine if there is a hole in the line. With tracer methods, all of the factors below may not apply.

- The line is taken out of service and pressurized, usually above the normal operating pressure. A drop in pressure over time, usually an hour or more, suggests a possible leak.

- Suction lines are not pressurized very much during a tightness test (about 7 to 15 pounds per square inch).

- Most line tightness tests are performed by a testing company. You just observe the test.

- Some *tank* tightness test methods can be performed to include a tightness test of the connected piping.

- For most line tightness tests, no permanent equipment is installed.

- In the event of trapped vapor pockets, it may not be possible to conduct a valid line tightness test. There is no way to tell definitely before the test begins if this will be a problem, but long complicated piping runs with many risers and dead ends are more likely to have vapor pockets.

- Some permanently installed electronic systems (which often include ATGS) can meet the requirements of monthly monitoring or a line tightness test.

Secondary containment with interstitial monitoring

- A barrier is placed between the piping and the environment. Double-walled piping or a leakproof liner in the piping trench can be used.

- A monitor is placed between the piping and the barrier to sense a leak if it occurs. Monitors range from a simple stick that can be put in a sump to see if a liquid is present, to continuous automated systems that monitor for the presence of liquid product or vapors.

- Proper installation of secondary containment is the most important and the most difficult aspect of this leak detection method. Trained and experienced installers are necessary.

Vapor or groundwater monitoring

- Vapor monitoring detects product that leaks into the soil and evaporates.

- Groundwater monitoring checks for leaked product floating on the groundwater near the piping.

- A site assessment must be used to determine monitoring well placement and spacing.

- UST systems using vapor or groundwater monitoring for the tanks are well suited to use the same monitoring method for the piping.

Cathodic Protection Operation and Maintenance Requirements

All regulated underground storage tanks system (USTs) must have cathodic protection.

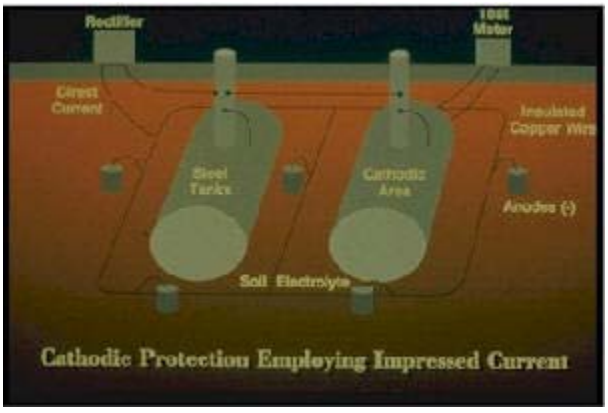
State and federal rules require corrosion protection for UST systems because unprotected steel UST systems corrode and release product through corrosion holes. You already meet the requirements for corrosion protection if your UST system matches one of the following performance standards for new USTs:

Tank and piping completely made of no corrodible material, such as fiberglass. Corrosion protection is also provided if tank and piping are completely isolated from contact with the surrounding soil by being enclosed in no corrodible material (sometimes called "jacketed" with no corrodible material).

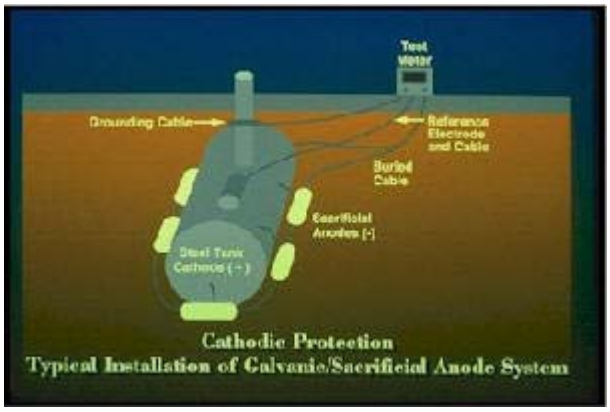
Tank and piping made of steel having a corrosion-resistant coating <u>AND</u> having cathodic protection (such as an sti-P_3® tank with appropriate piping). A corrosion-resistant coating electrically isolates the coated metal from the surrounding environment to help protect against corrosion. *Asphaltic coating does not qualify as a corrosion-resistant coating.*

Tank made of steel clad with a thick layer of no corrodible material
(such as an ACT-100® tank). This option does not apply to piping.
Galvanized steel is <u>not</u> a non corrodible material.

Impressed current system. An impressed current system uses a rectifier to convert alternating current to direct current (see picture below). This current is sent through an insulated wire to the "anodes," which are special metal bars buried in the soil near the UST. The current then flows through the soil to the UST system, and returns to the rectifier through an insulated wire attached to the UST. The UST system is protected because the current going to the UST system overcomes the corrosion-causing current normally flowing away from it.



Sacrificial anode system. Another type of cathodic protection (see picture below) is called a sacrificial anode or galvanic system. Although sacrificial anode systems work with new USTs (sti-P_3® tanks single or double wall), corrosion protection experts generally agree that *sacrificial anodes do not work effectively or economically with most existing steel USTs*. Only a qualified cathodic protection expert can determine what kind of cathodic protection will work at your UST site.



Operation and maintenance requirements

- A qualified cathodic protection tester must test the system within six months after installation and every three years thereafter.
- A negative potential of –850 millivolts or –0.85 volts should be obtained between the UST system and a reference electrode touching the soil above the tank.
- Results of the last two inspections performed by a qualified cathodic protection tester must be kept.
- In addition, an impressed current system must be checked by the owners or operators every 60 days to ensure that the system is operating properly.
- A log must be kept for the last three check ups to show that the impressed current system is operating properly.
- The records may be kept at a central office rather than the facility itself.

If you have any further questions, please contact the South Dakota Department of Environment and Natural Resources, Ground Water Quality Program, Storage Tank Section.
Pierre (605) 773-3296, Rapid City (605) 394-2229 or Sioux Falls (605) 362-3500