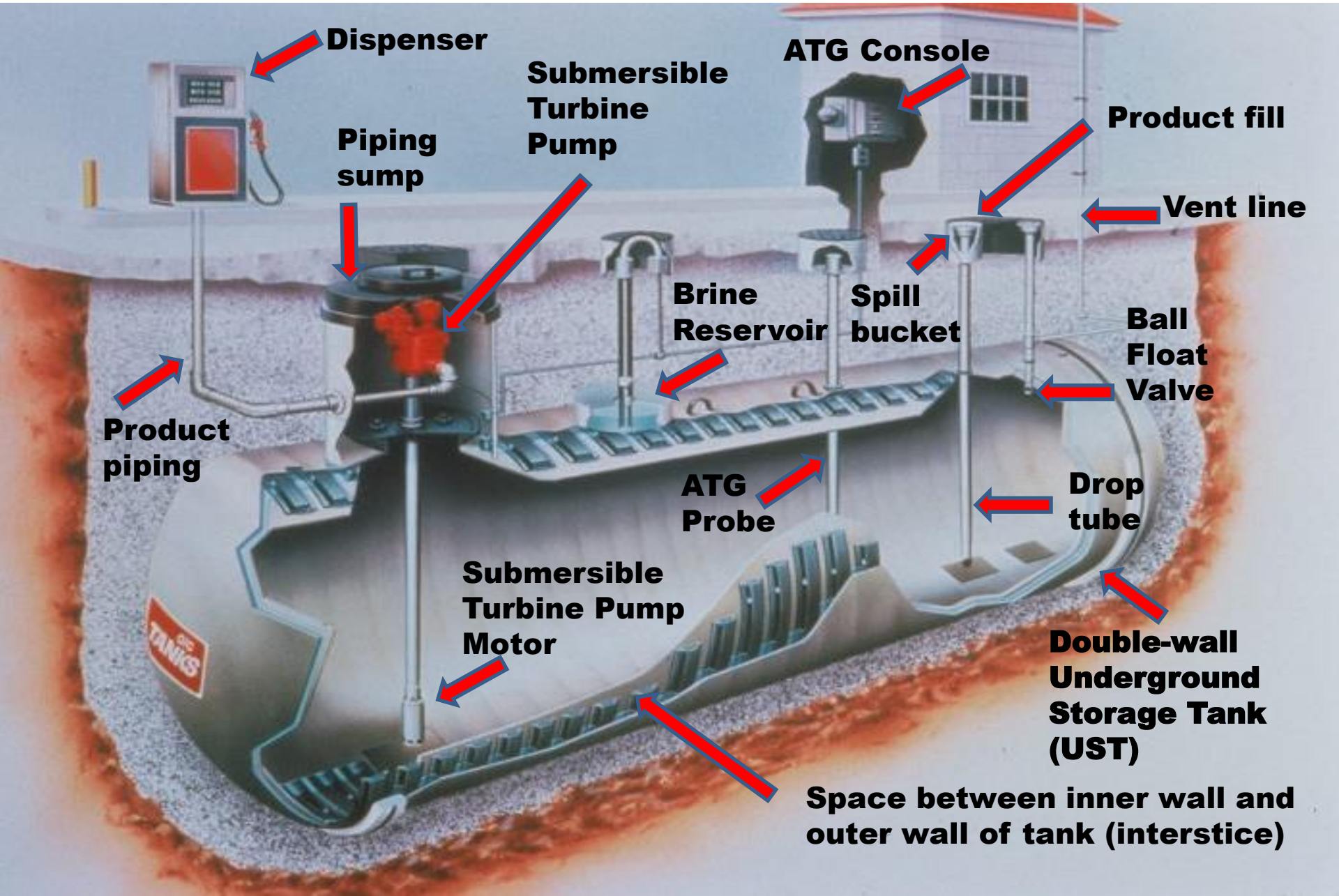
USTs and UST System Components

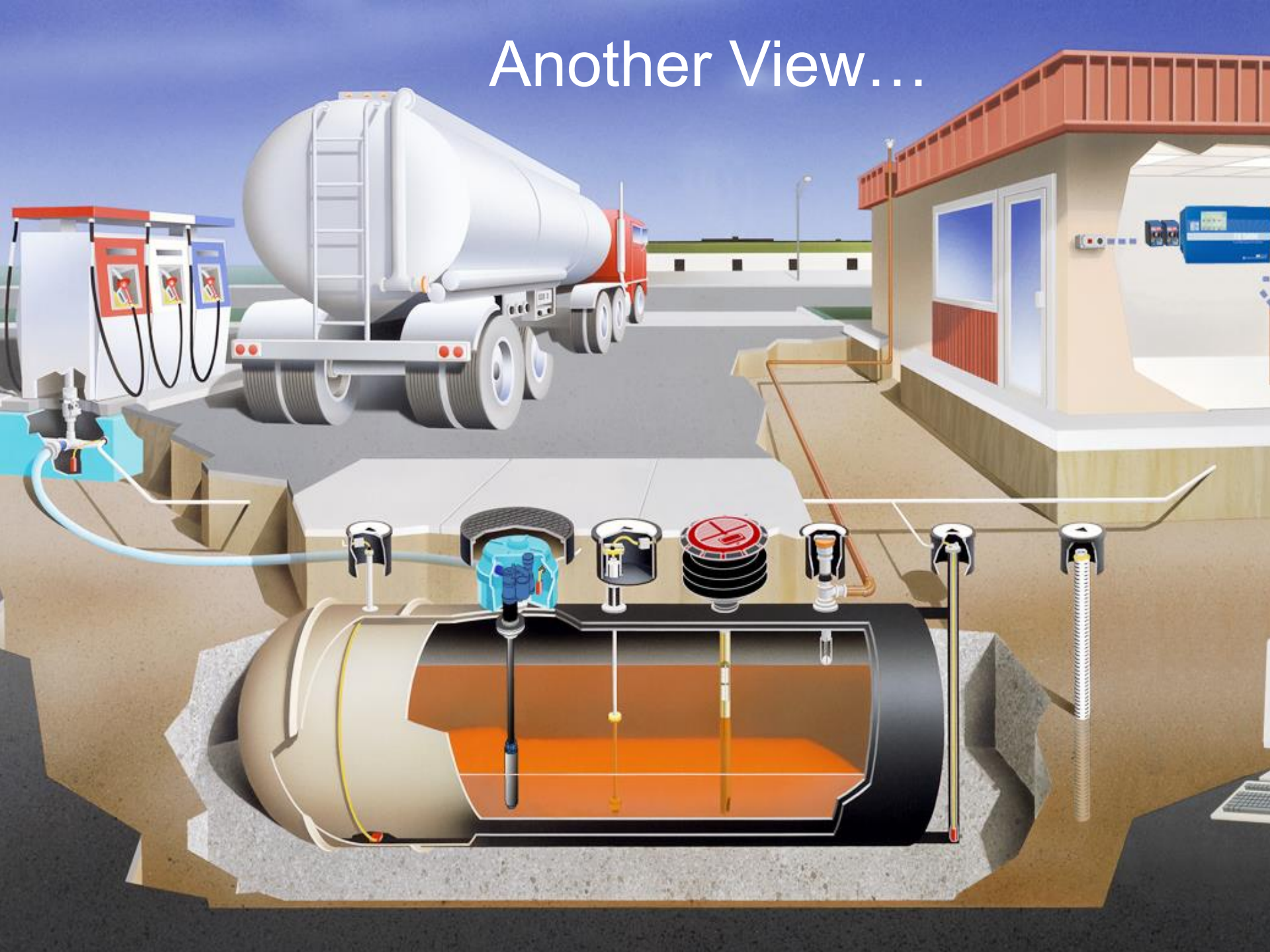
Tanks and Tank Components

The photograph below shows a model of a double-wall fiberglass UST. Tanks are also made from steel, and vary in size from 110 to 50,000 gallons. Most tanks used today at retail facilities are between 10,000 gallons and 30,000 gallons. Tanks and piping system equipment can be either single-wall or double-wall. The purpose for tanks….Storing the fuel!

An Underground Storage Tank System



Another View…



Tank Installers

Some states require that USTs be installed by "Certified" installers.

Installation

Storage tank systems must be installed in accordance with applicable industry reference standards, manufacturer's instructions, and local, state and federal rules

Commonly used types of Underground Storage Tanks

Compartmented UST's

All New and Replacement Underground Storage Tanks Systems Must have Secondary Containment

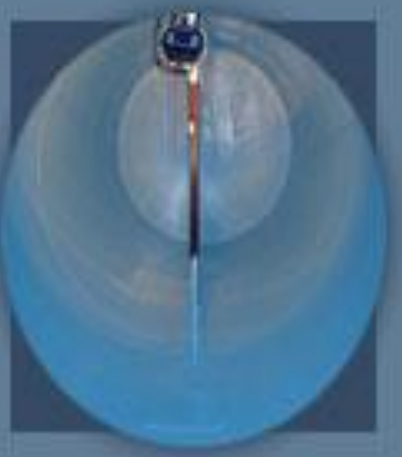
Other Types of UST Secondary Containment

Single-wall corrosion-protected tanks within a synthetic liner

Steel tanks inside concrete vaults

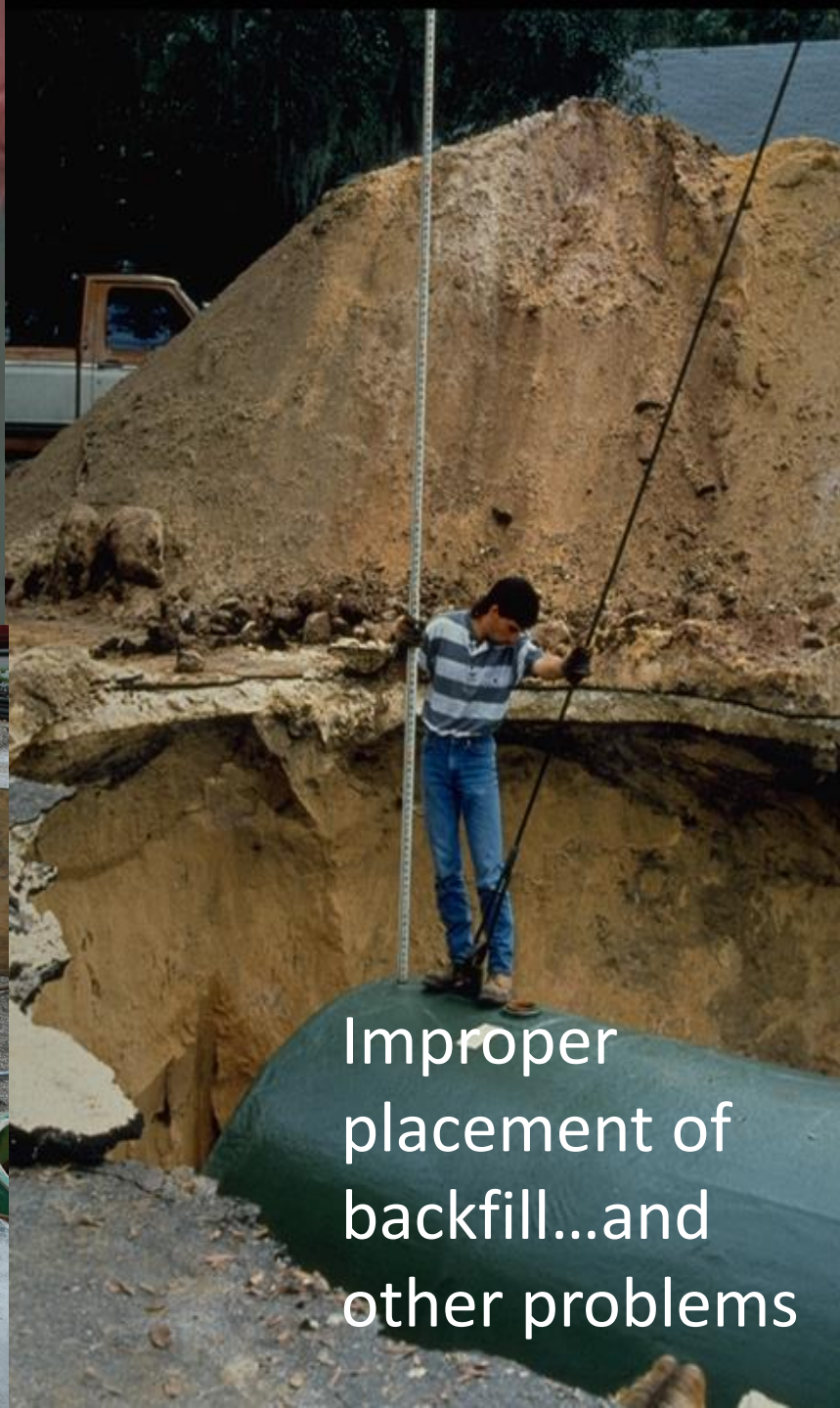
Internal Secondary Containment

Tank Tech & ZCL Phoenix System

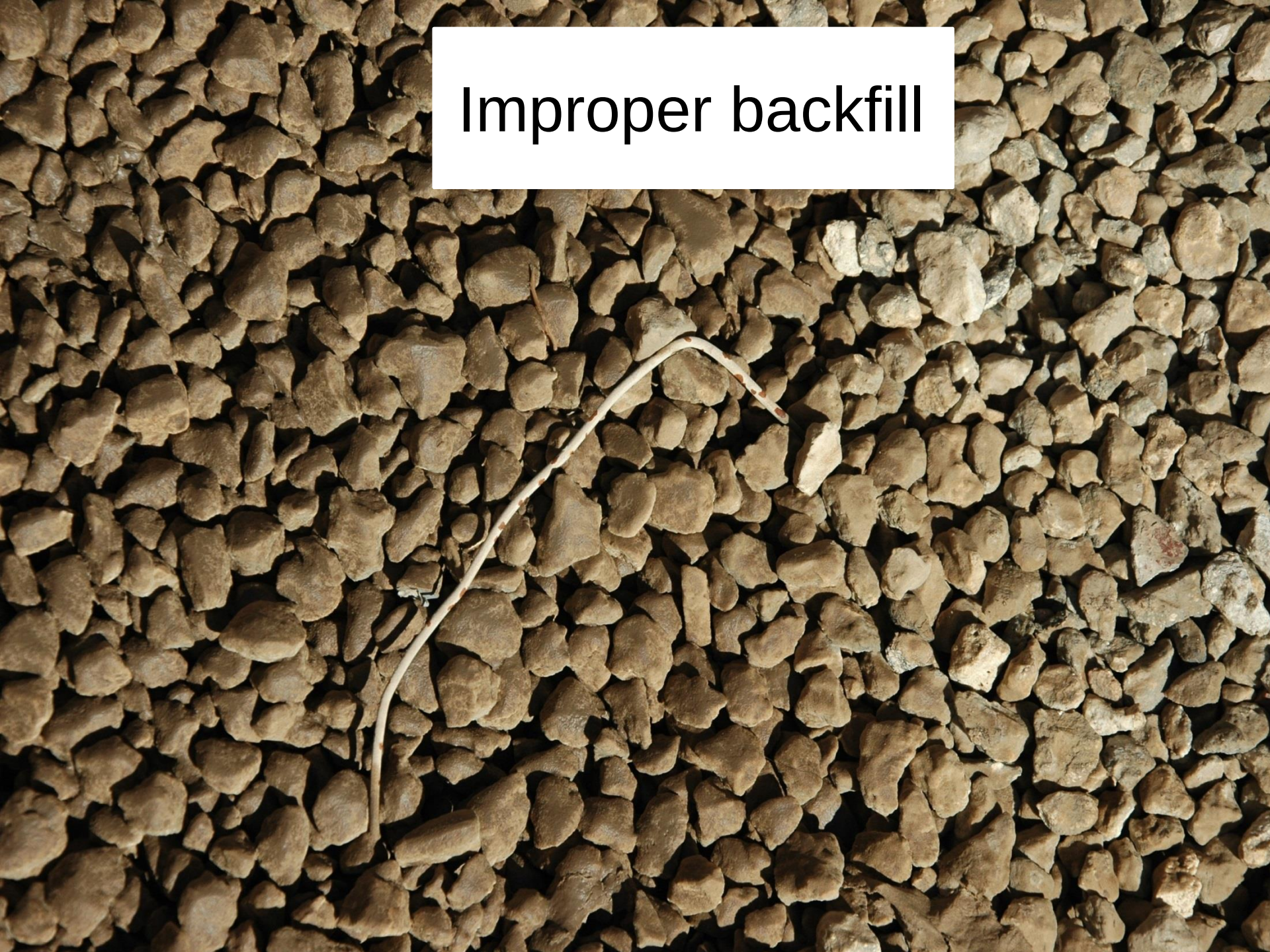



How not
to install
a UST...
Coating
damaged


Improperly
anchored
XERXES
CENTURY-CAST


Improper
placement of
backfill…and
other problems


Improper
backfill


Improper backfill


Improper
backfill

Damage by installers and improper backfill

Proper Backfill

Ballasting a tank and using divers

When installing a tank in solid rock…

Proper UST Installation with sloped sidewalls or sheet piling, proper equipment and safety measures

Piping

Piping conveys the fuel between the tank and the Dispenser

Second generation TCI Flexpipe

The second most frequent cause of leaks...

Piping Between USTs and Dispensers

There are two ways to get fuel out of an underground storage tank. You can push it out, or suck it out. Fuel can be pushed out of a UST with a Submersible Turbine Pump (STP) where the pump is inside near the bottom of the tank, or sucked out of a tank by a suction system where the vacuum pump is in the dispenser.

Suction System

Red Jacket STP

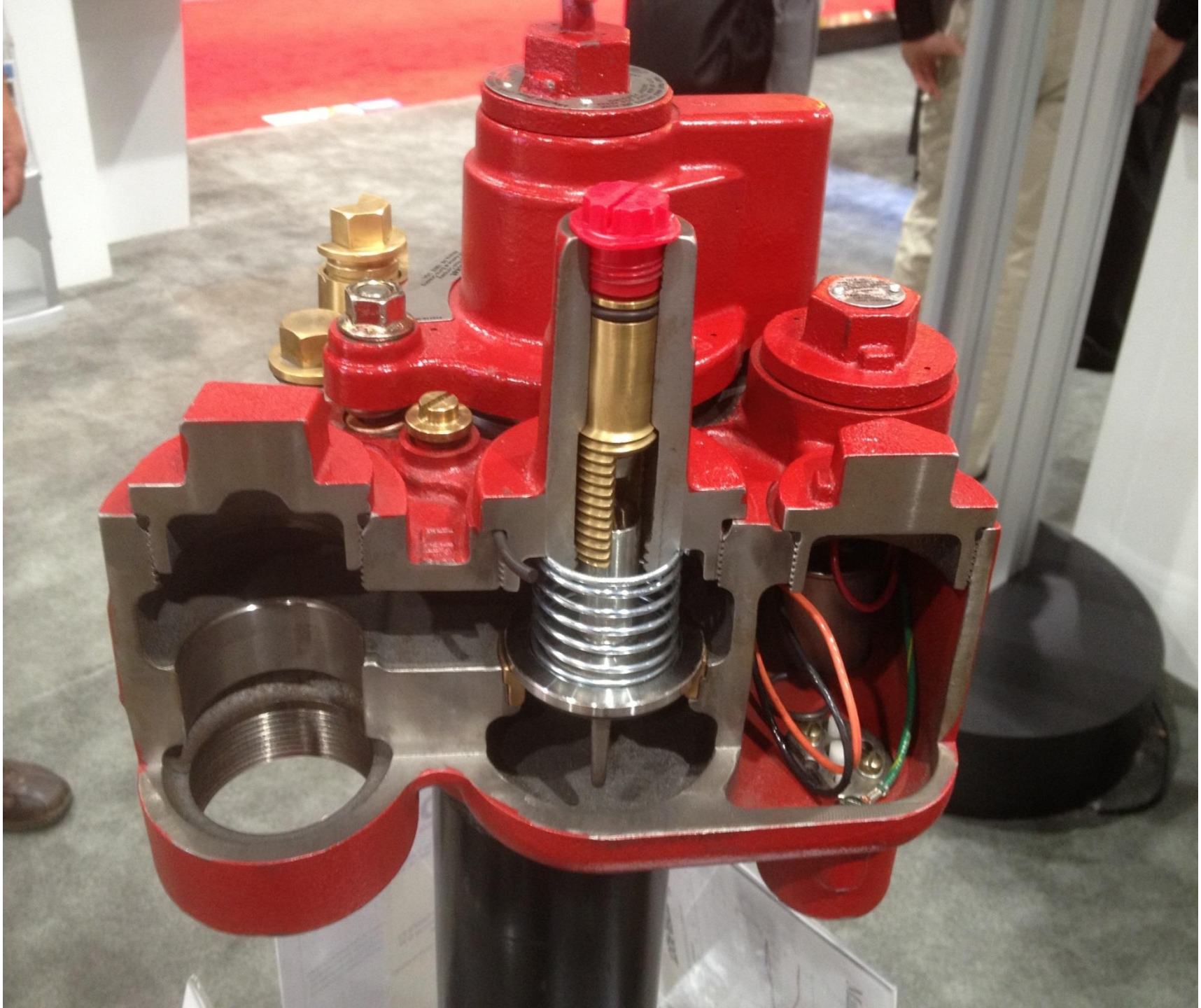
Red Jacket STP in Sump

Submersible Turbine Pumps (STPs)

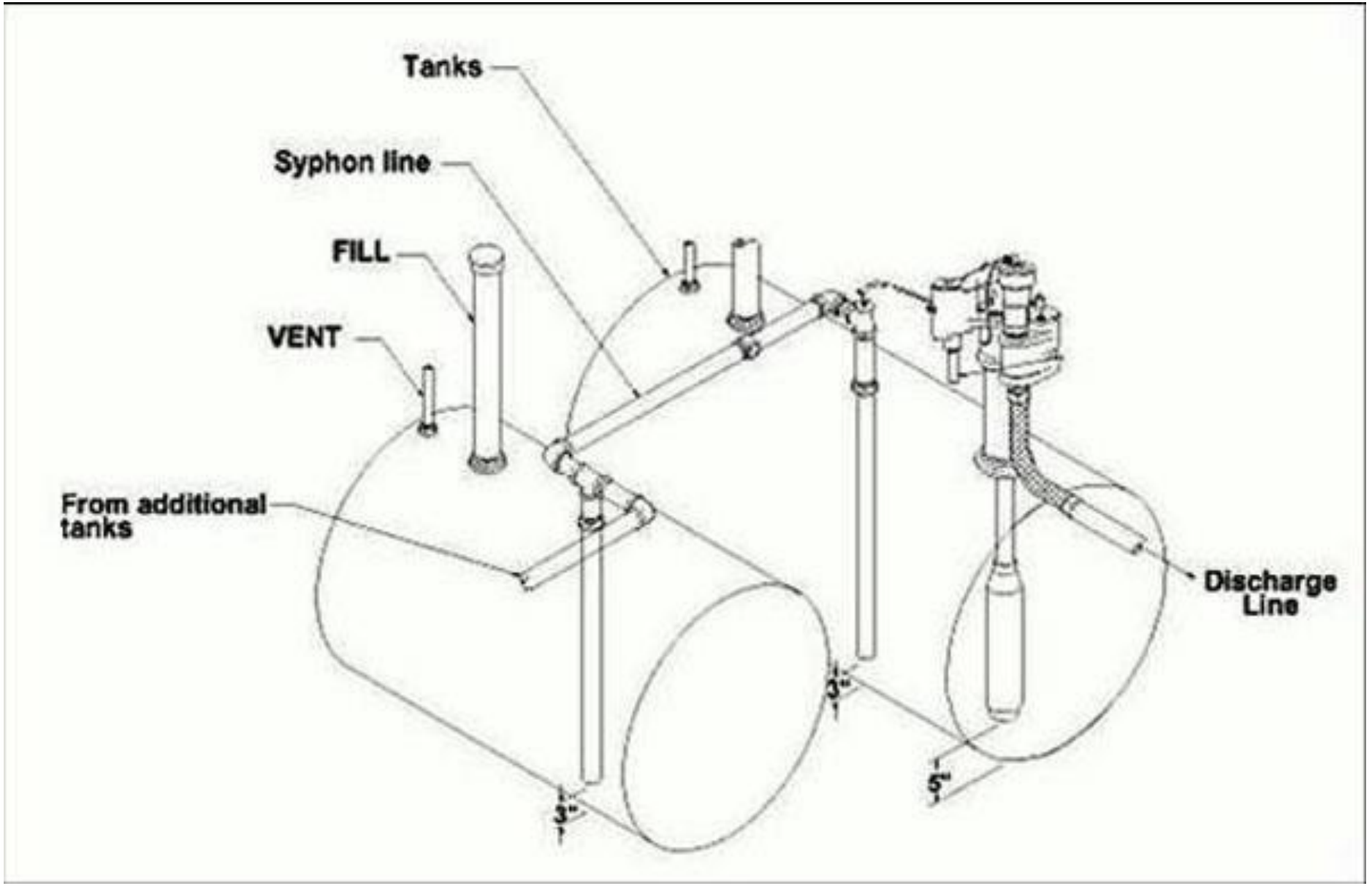
STP Head

Cut-away View of Pump

STP Head in Sump



Manifolded UST Systems



“Suction” System

Check Valve

Pump

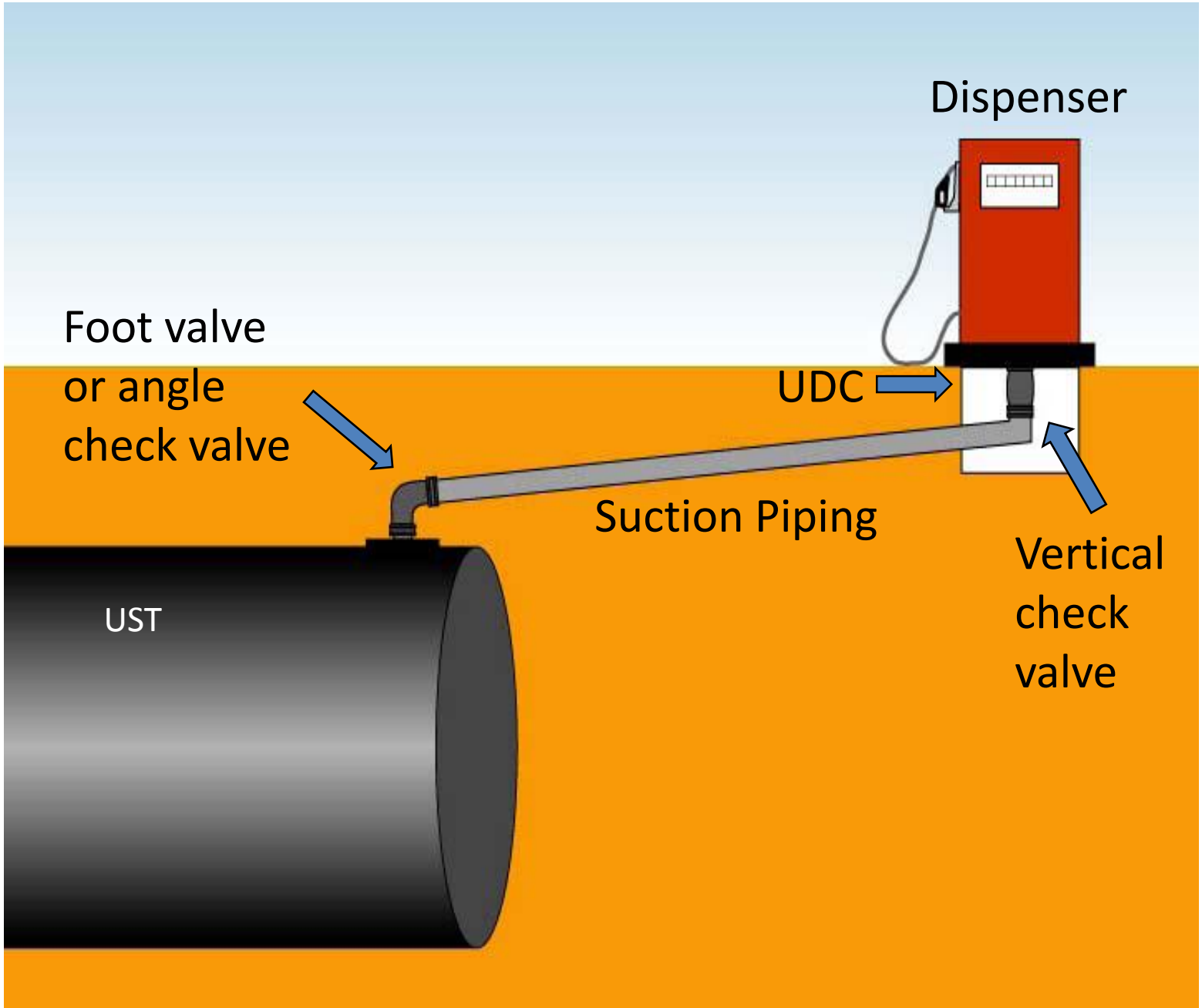
“Pressure” System

Meters

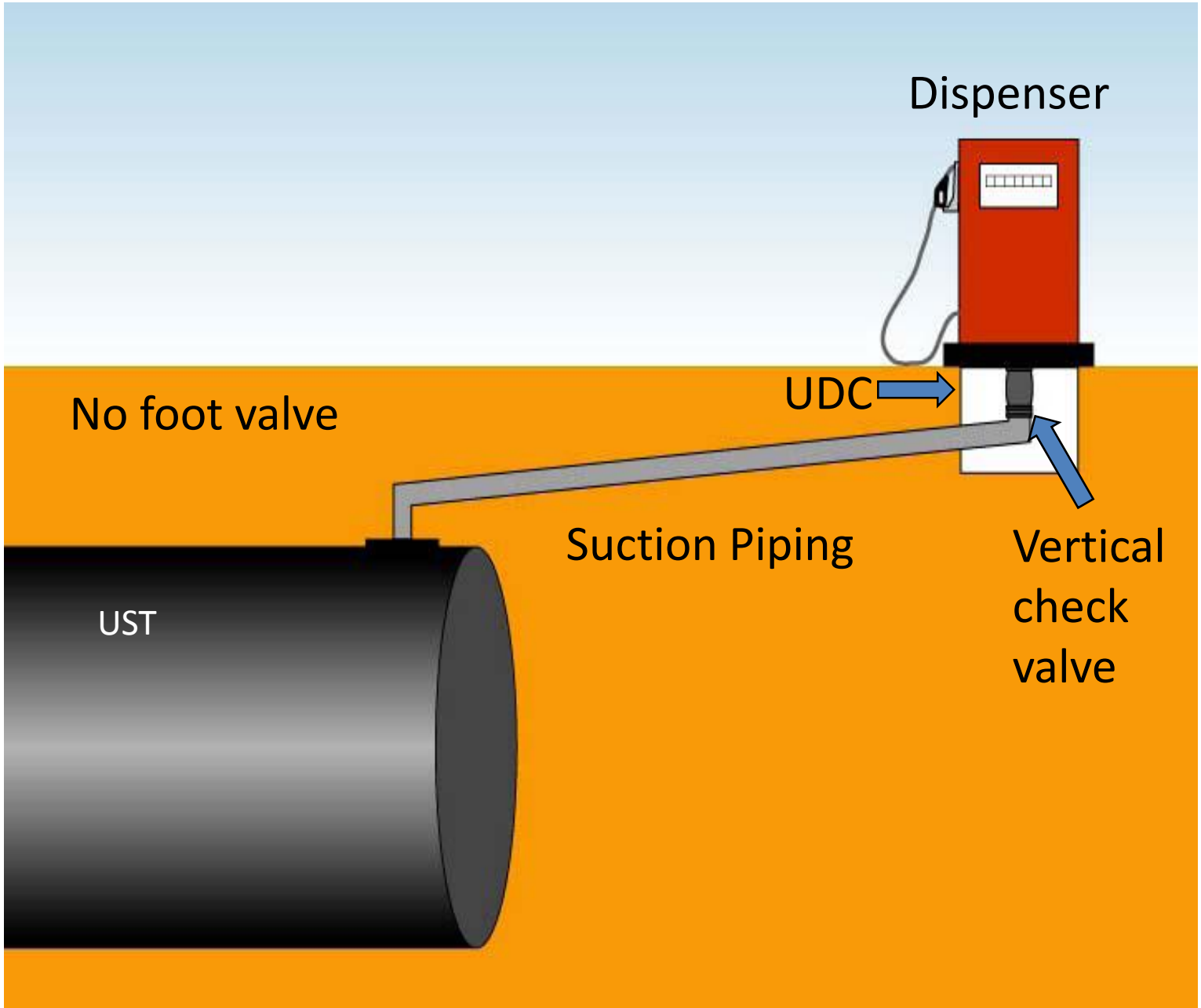
Filters

Most of the UST piping systems in the U.S. are pressurized

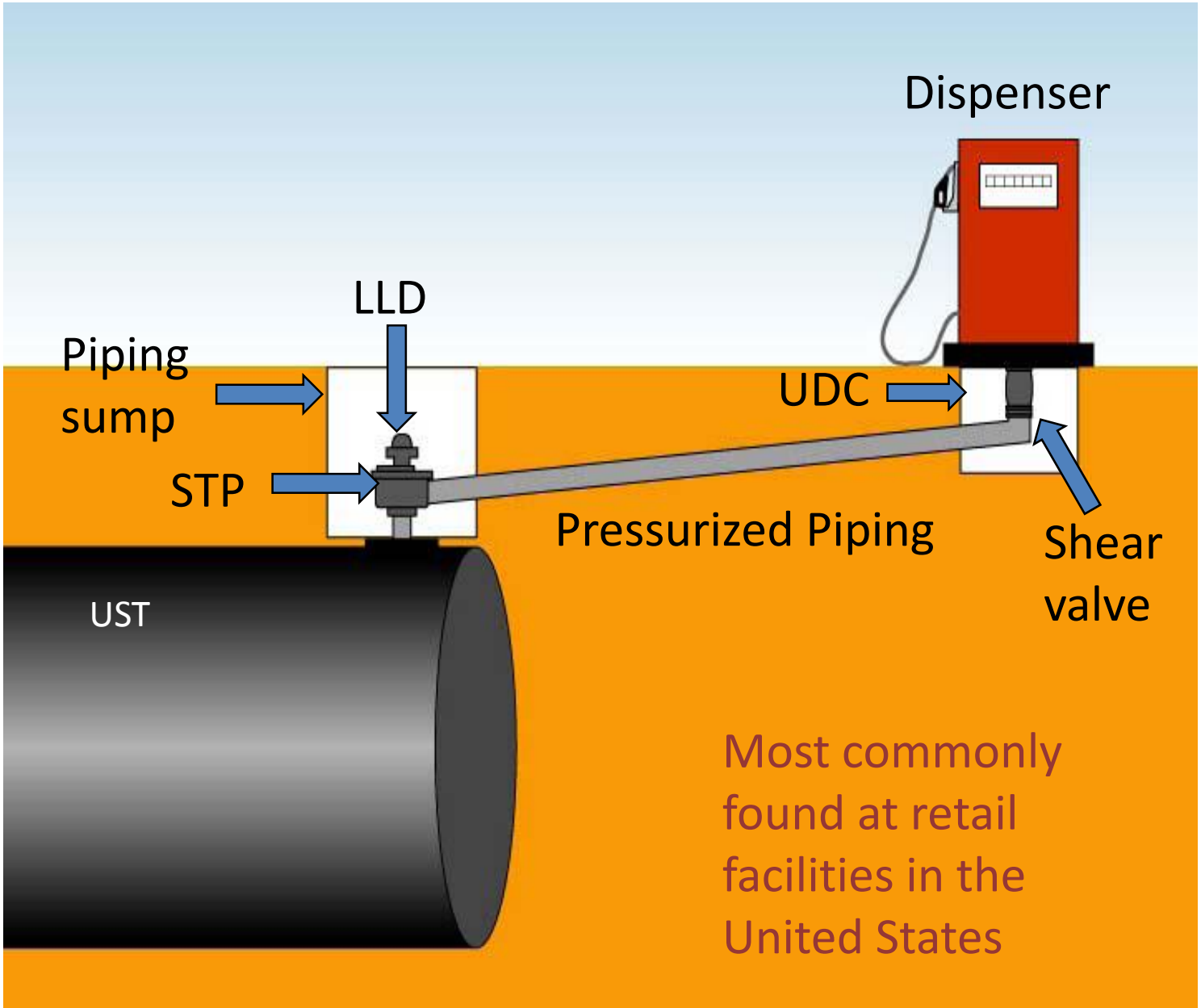
Standard Suction System



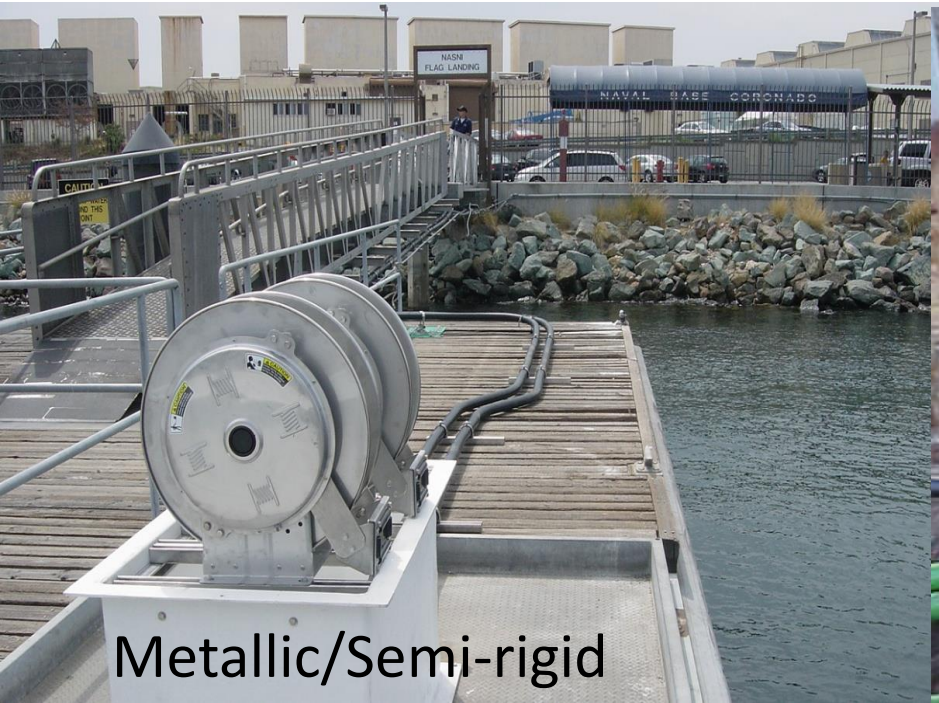
European "Safe" Suction System



Pressurized Piping System



Small Diameter Piping with Secondary Containment



Installation and pre-operational testing must be in accordance with applicable industry reference standards, manufacturer's instructions, and local, state and federal rules

Vacuum Gauges

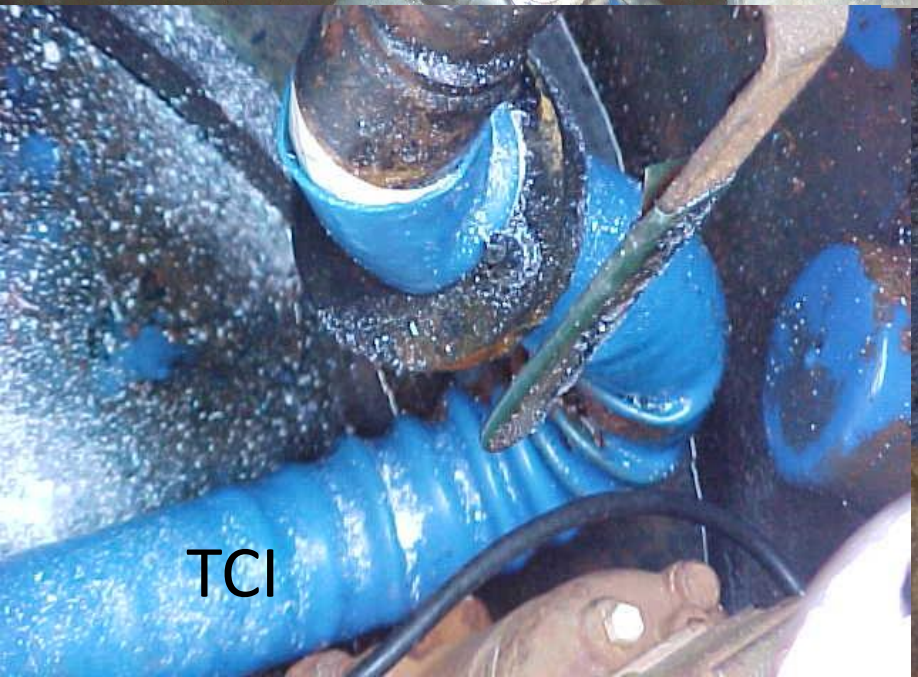
Be sure to use a pressure gauge that has units between 5 and 15” inches of mercury

Incorrect

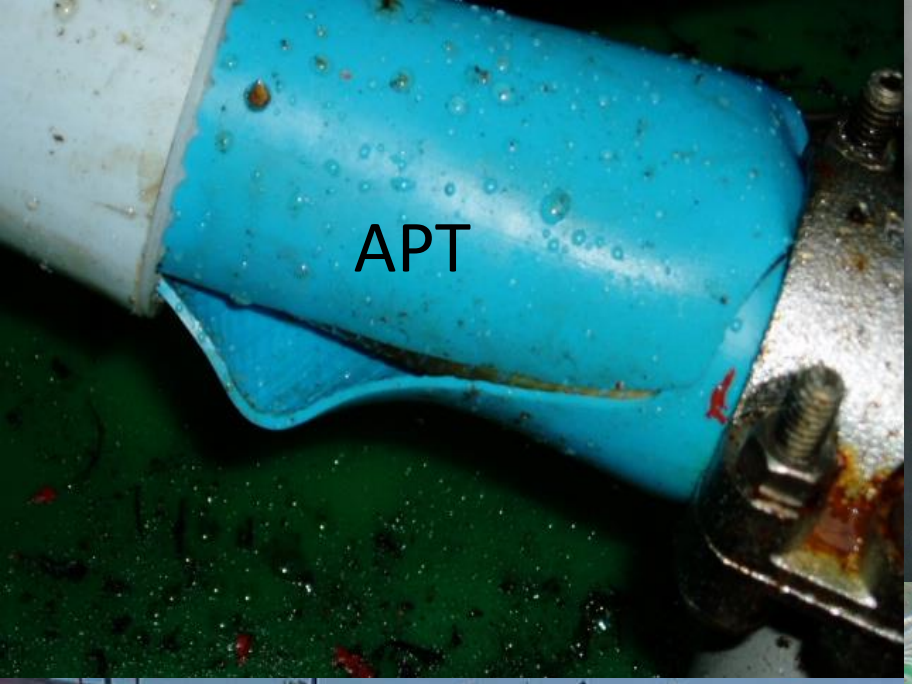
Correct

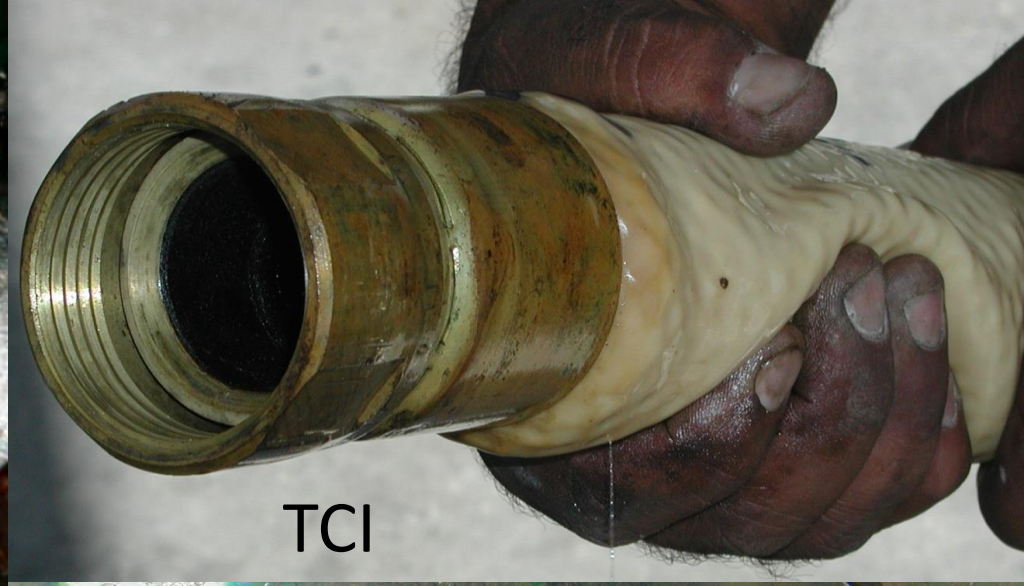

Environ


Problems!
TCI
17. 12. 2001


TCI


TCI

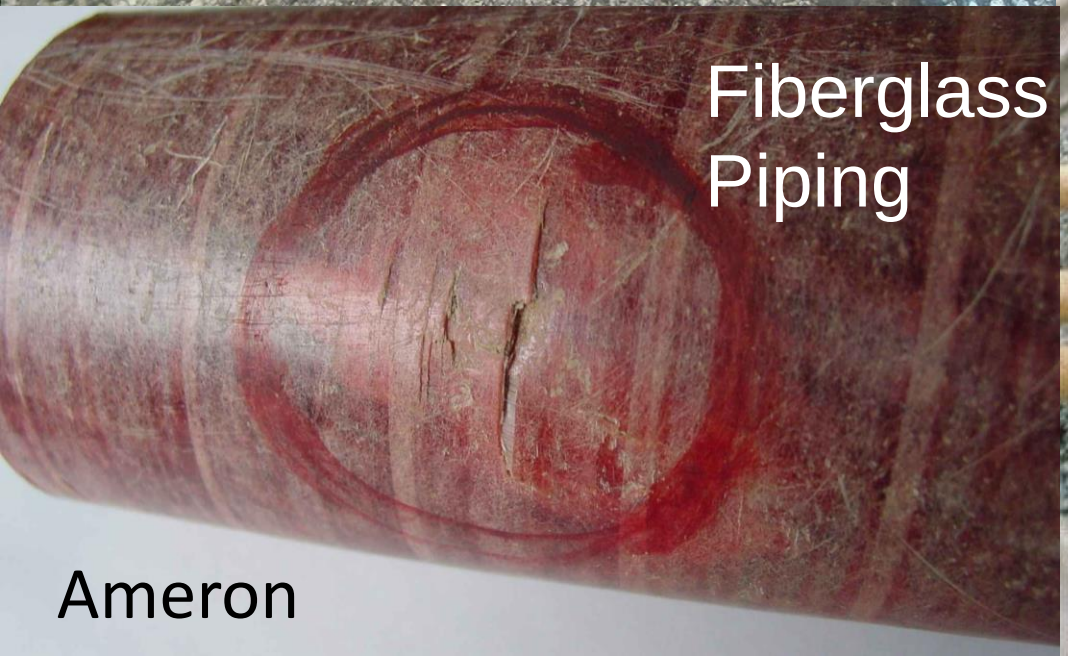

APT


TCI

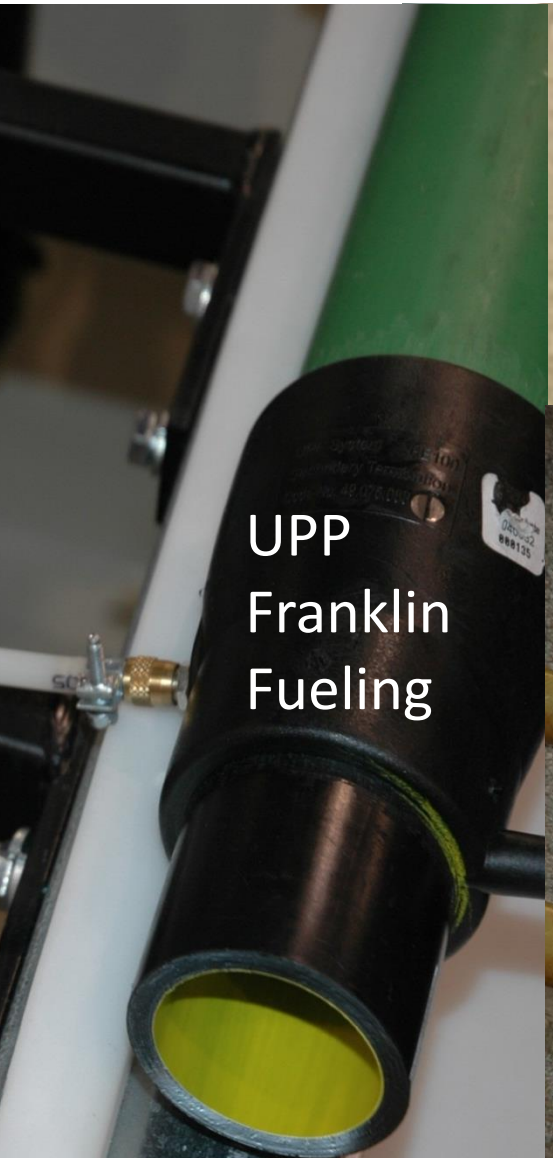

Pisces


Environ

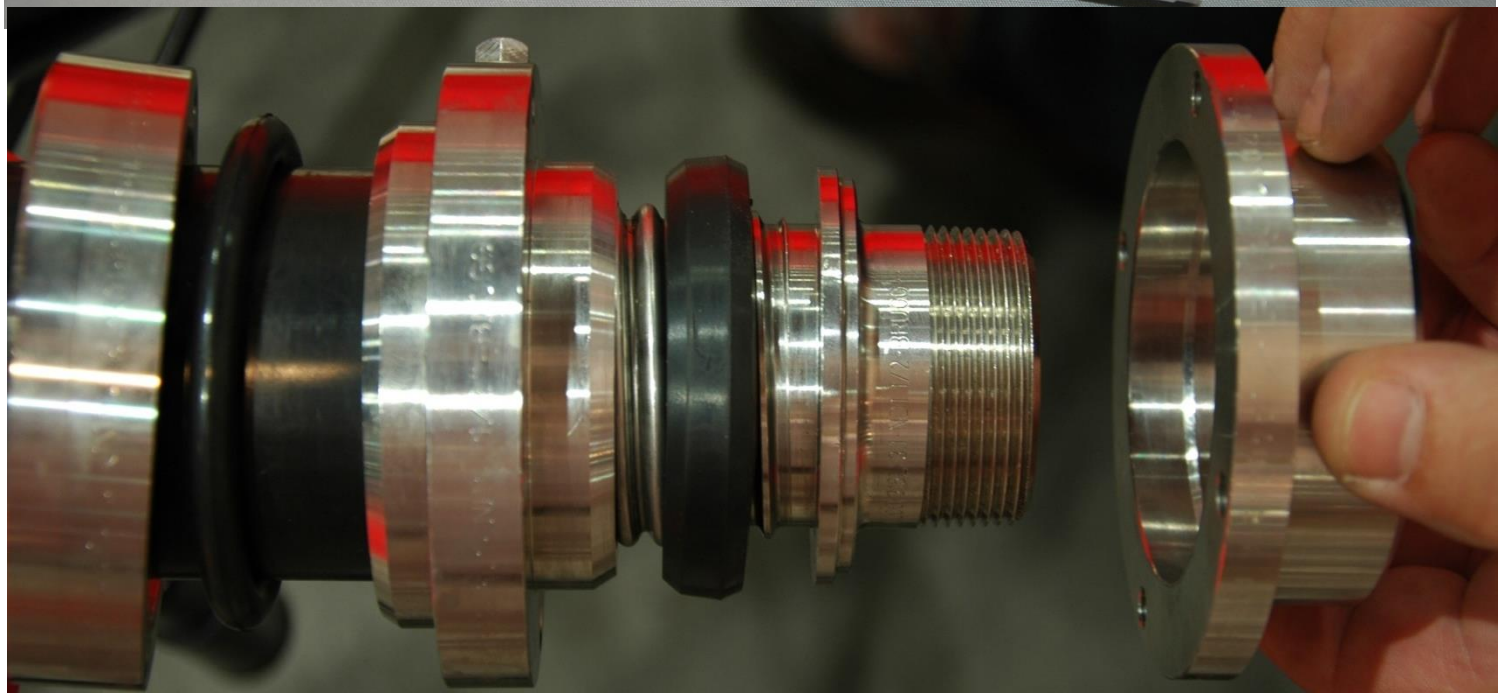
Improper installation can lead to releases



Double-wall Piping with a Good Performance Record in the Florida Leak Autopsy Study*



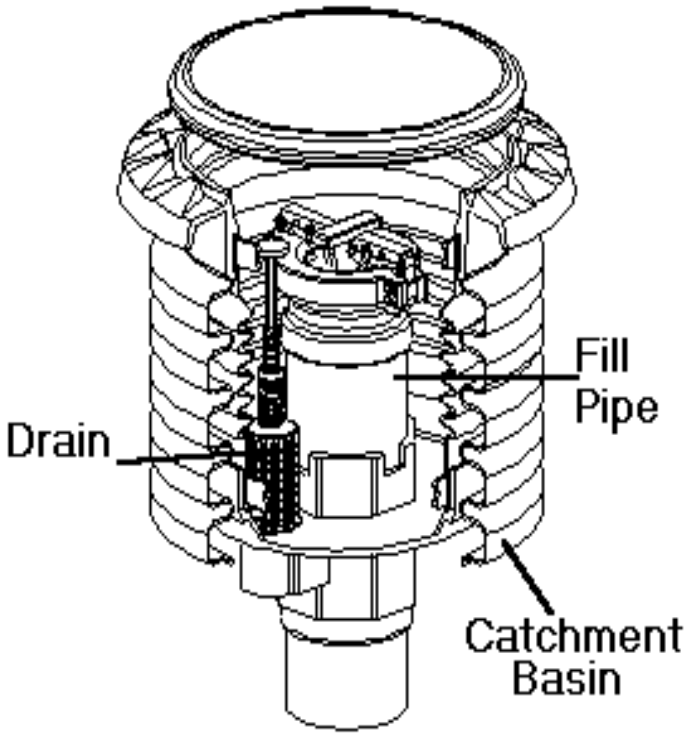
Brugg – Stainless Steel Primary & HDPE Secondary

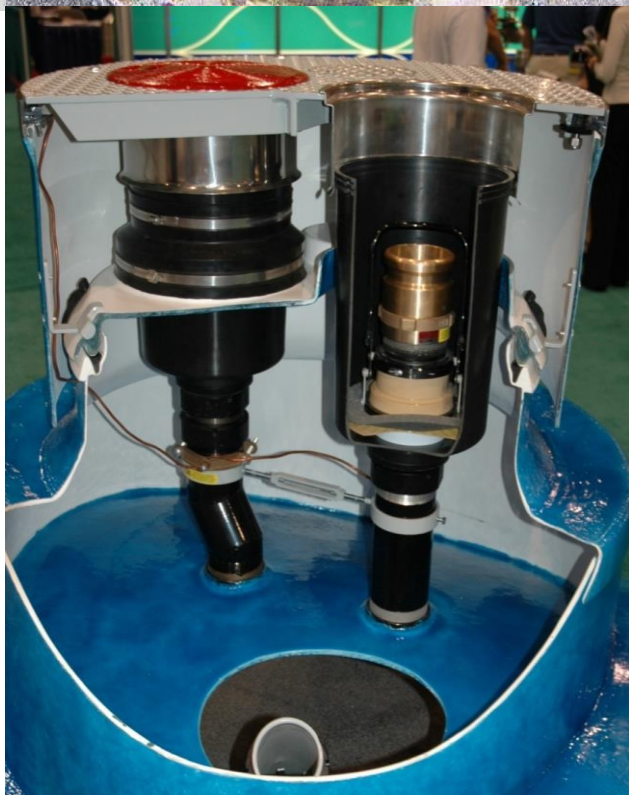


Spill Catchment Basins/Spill Buckets

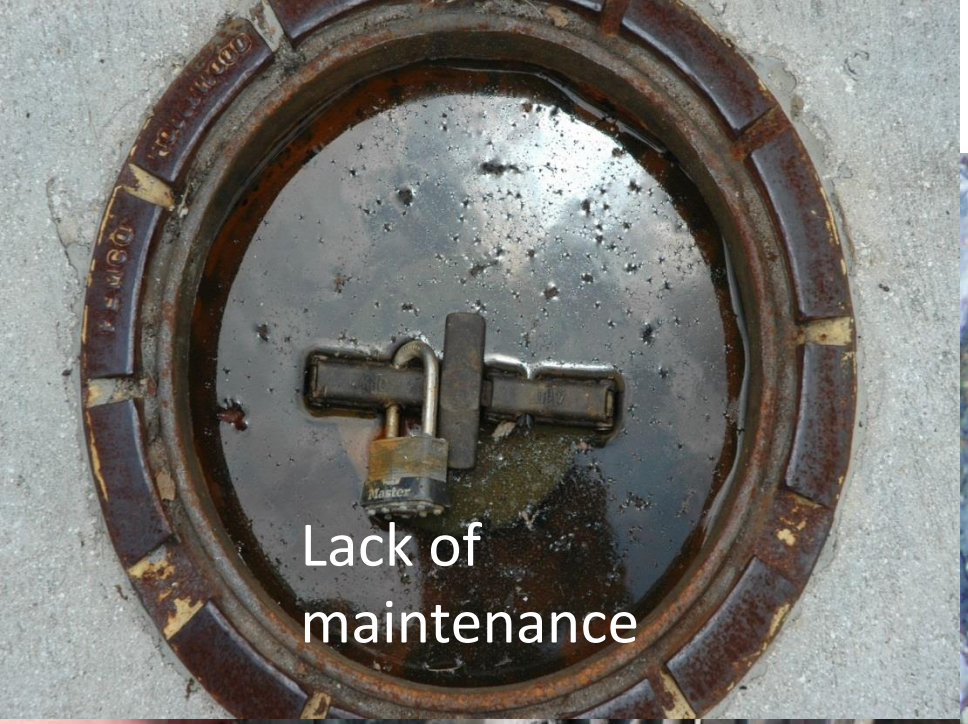
These components prevent spills to the ground during the tank filling process when the tanker truck driver disconnects his fuel delivery hoses. They are usually manufactured with either steel or polyethylene, but they can be made with nylon, fiberglass, or other compatible materials. They can be either single or double-wall.

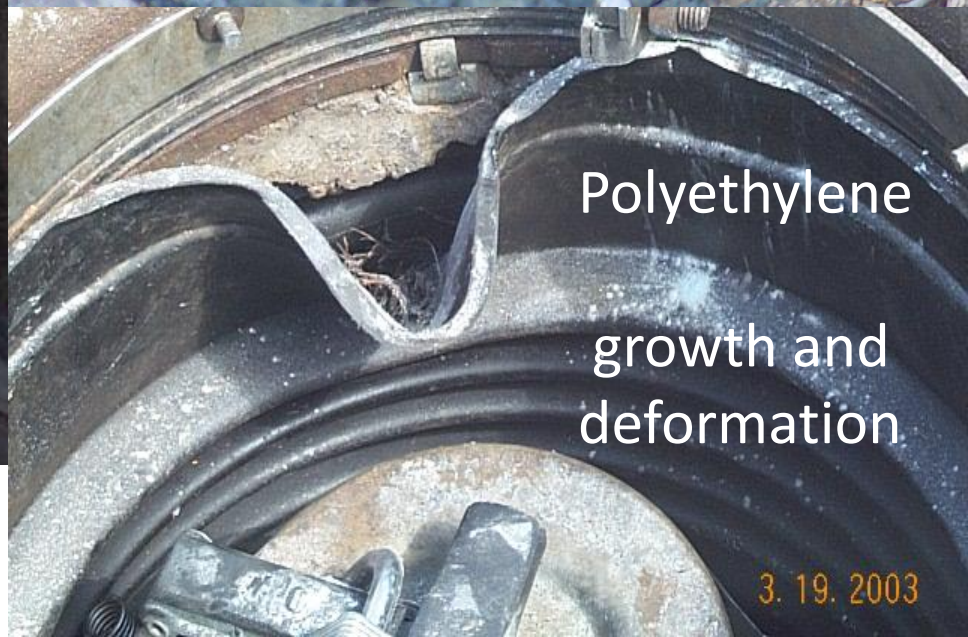
Spill Prevention





Problems!



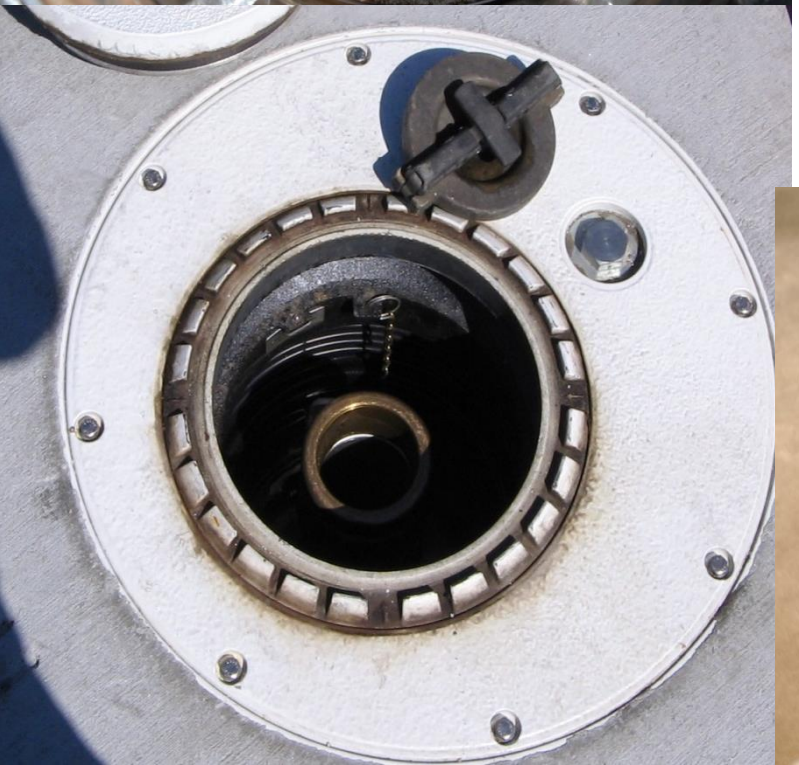


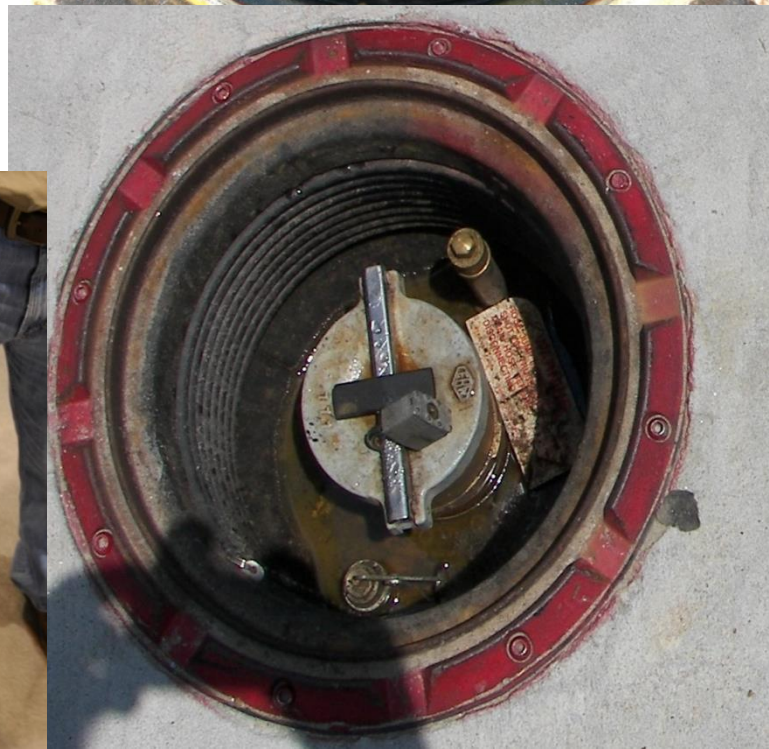
Spill buckets are the most frequent source of discharges…

Integrity Testing

EPA is proposing a rule that requires spill buckets be integrity tested every year

Double Wall Spill Buckets





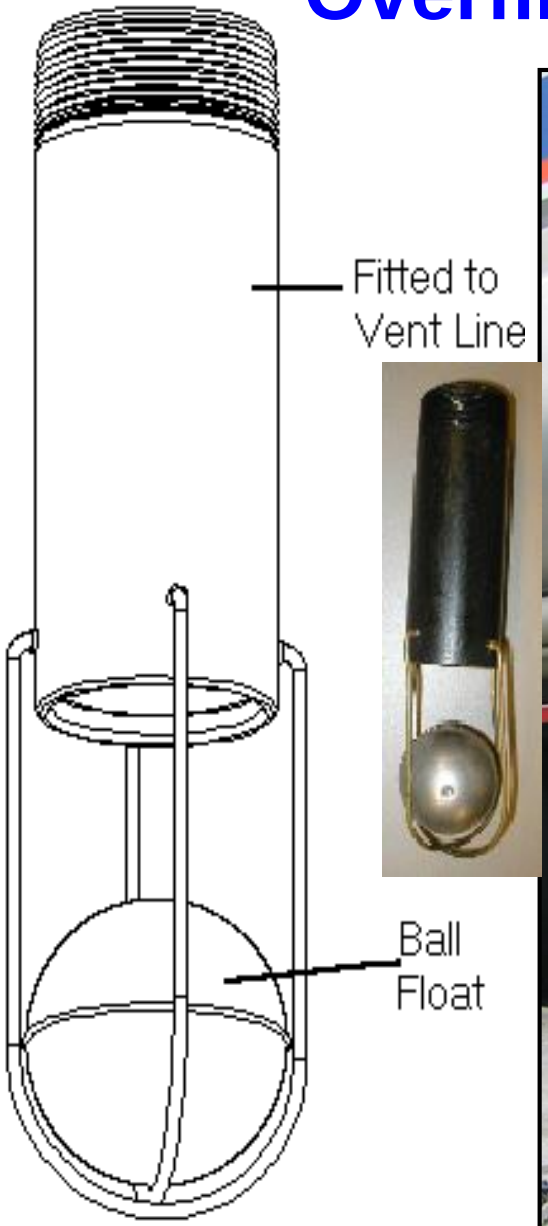
Spill Prevention Systems –recent innovations…

Some systems do not require the owner to break concrete for replacement. These are all double-wall systems, but double-wall systems are not required.

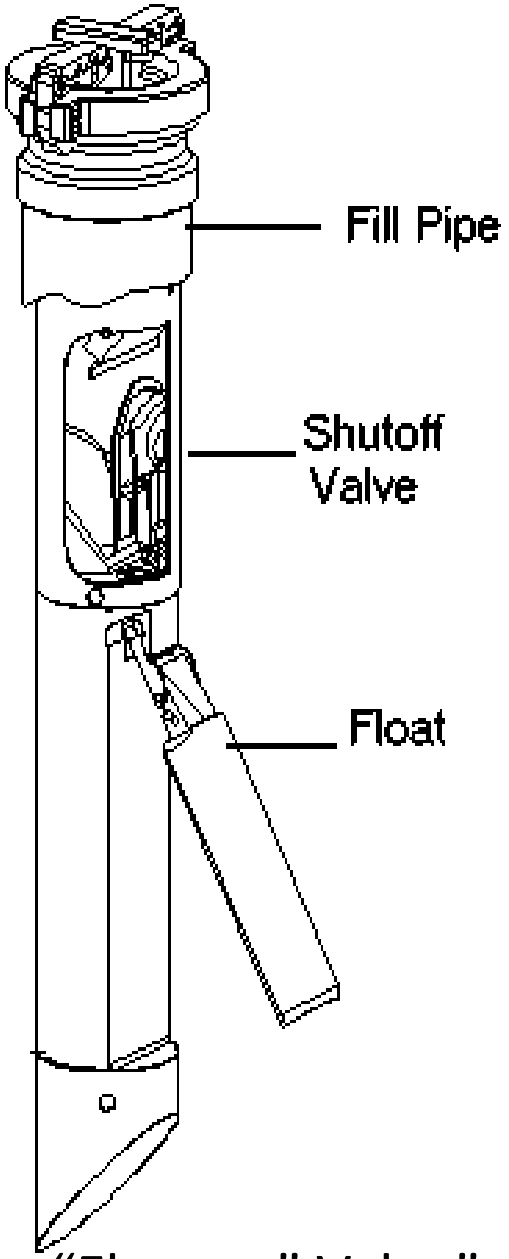
Overfill Prevention

Self-Explanatory - overfill prevention devices are designed to help prevent a tank from receiving more fuel than the tank is able to hold

Overfill Prevention Devices



Ball Float Valve



"Flapper" Valve"

Extracted “Flapper Valve”

Delivery Driver Circumventing the Overfill Prevention Device (Flapper)

Dispensers – Most

States regulate dispensers, but mainly just the hoses, sumps, and piping at or below the shear-valves

Under Dispenser Containment (UDCs) or Dispenser Liners

The purpose of UDC's is to contain any product that might be released from drips or leaks in the dispensing system or from routine filter-changes or other maintenance work.

Problems!

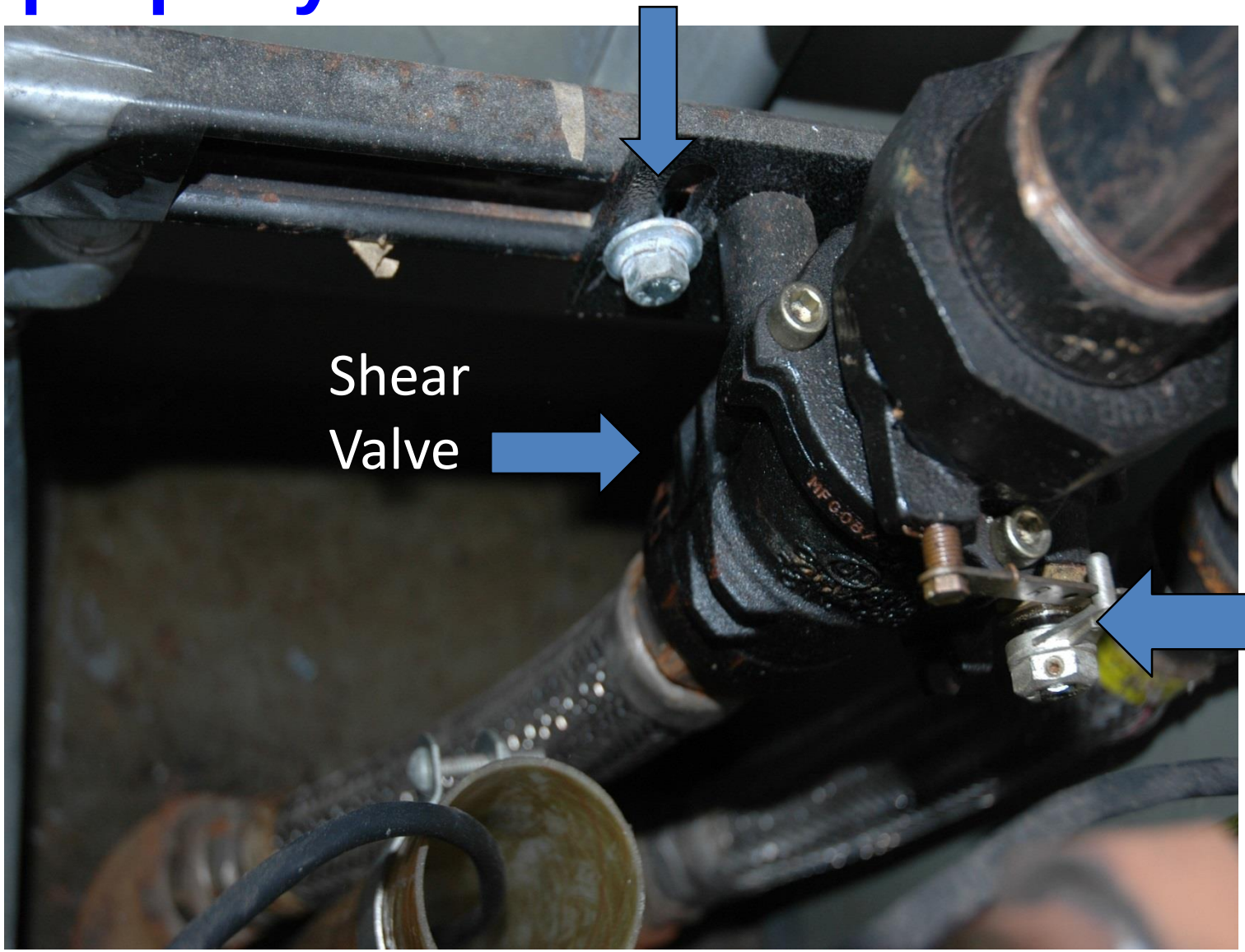

Frayed
hoses


UDC sensors disabled


Shear Valves non-functional

Make sure the shear valve is properly anchored

Shear (or Impact) Valves…



Make sure this pin is slotted within this notch

Dispenser Knock-Down

More Problems!

Safety Hazards…Black Widow Spiders!

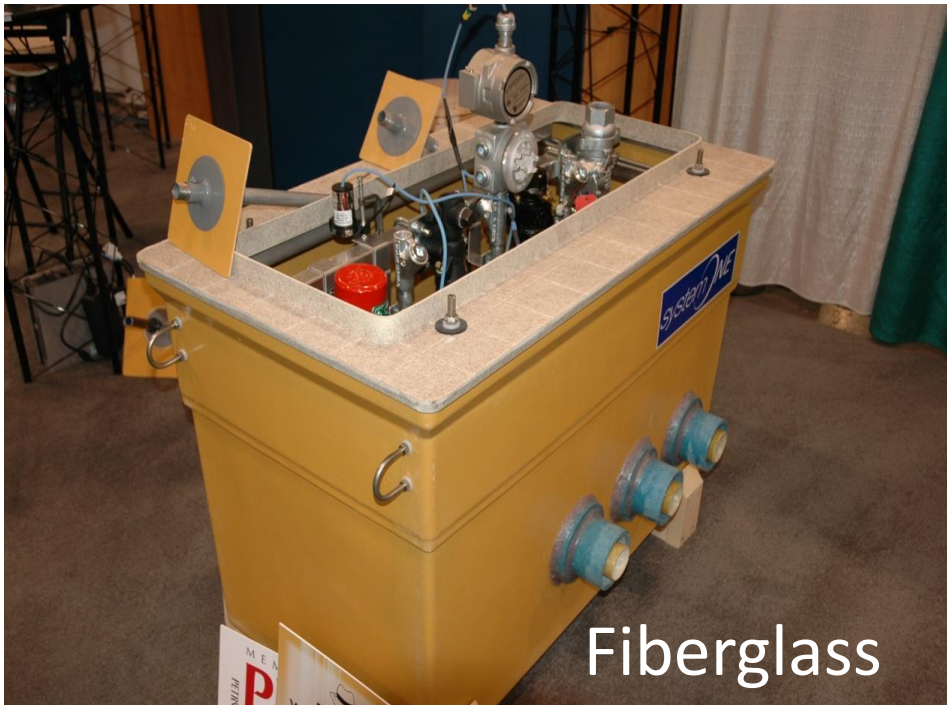
Wearing Gloves is recommended before reaching within Dispenser Sumps

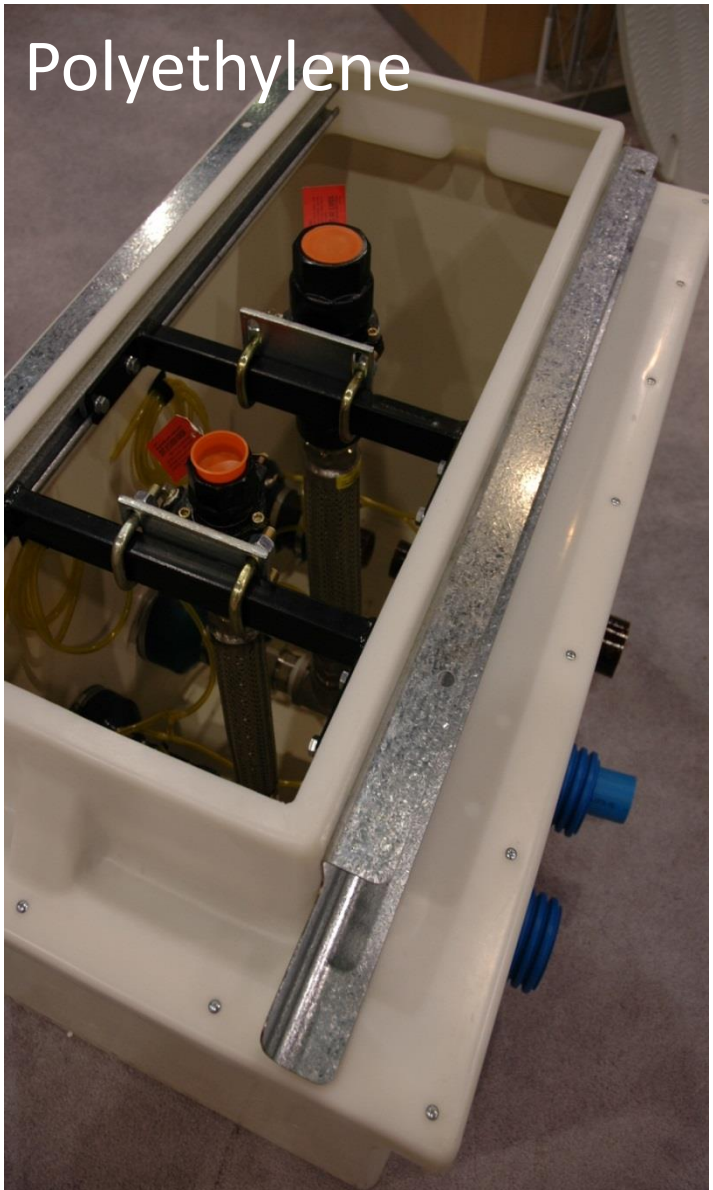
Under Dispenser Containment, UDC Sumps, or Dispenser Liners

Two main types…

Fiberglass or Polyethylene

Both have been manufactured with significant improvements in the past several years – stronger, and with better penetration fittings



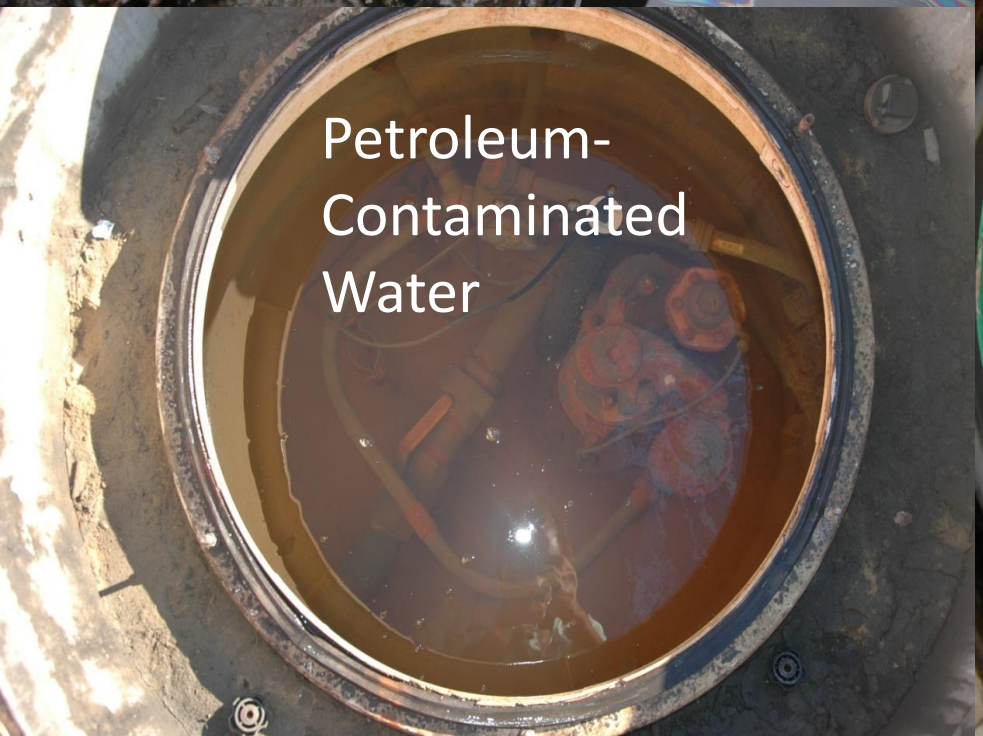


Piping Sumps

The purpose of piping sumps is to contain any product that might be released from drips or leaks from the submersible turbine pump, UST piping system, or any piping components such as flex-connector, unions, valves, or elbows. Piping sumps also are designed to prevent the intrusion of surface water, groundwater, or external contamination.

Piping Sumps

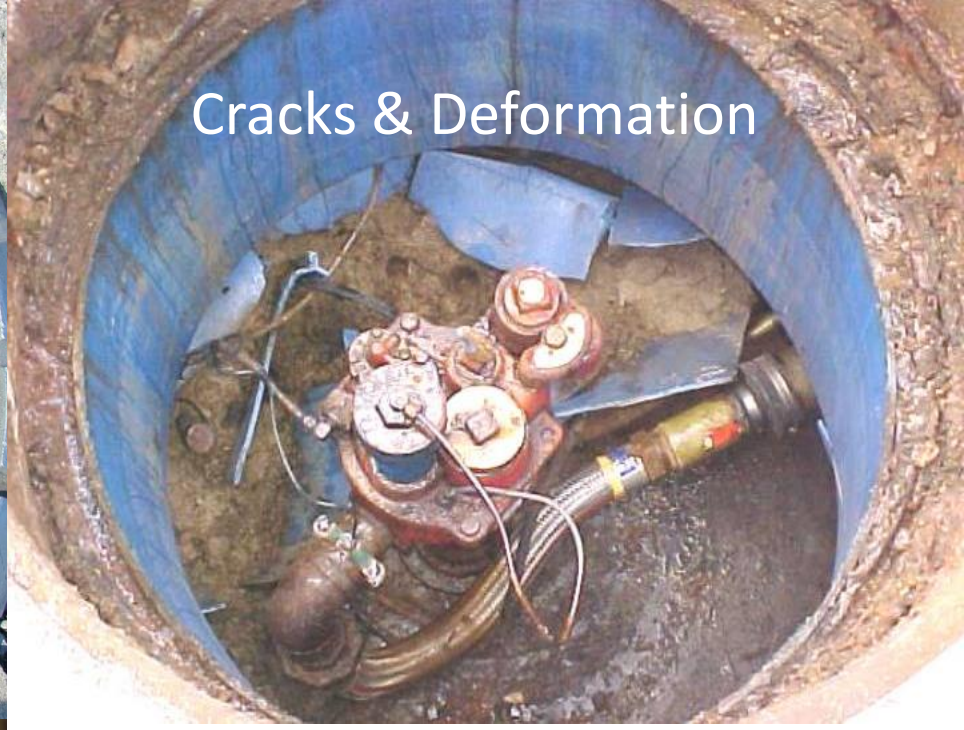
The most frequently cited violation by State UST Inspectors – water and fuel in sumps



Piping Sumps – The Way they Ought to Look…

Dry, clean, good sump-wall penetrations, no soil build-up between sump wall collars, no rust, sensors properly positioned, gaskets in good condition.


Broken
sump
covers


Cracks & Deformation

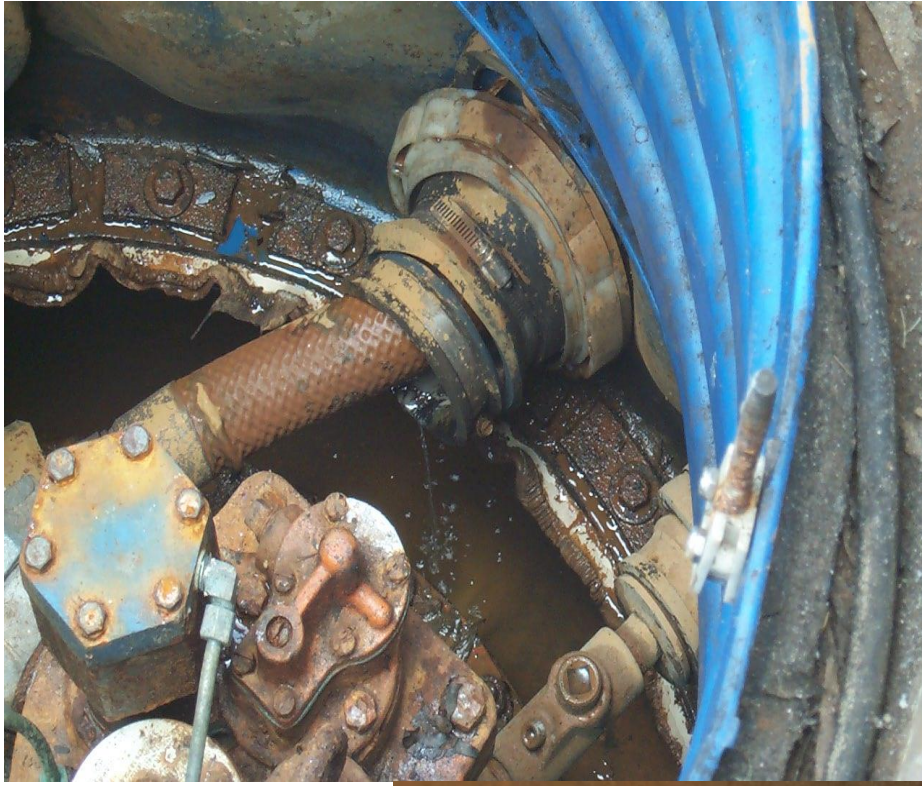
Problems!


Excessive
Rust


Fuel
leaks

More Problems…Dirt level build-up between the manway collar and the piping sump collar prevents proper sealing of the sump access cover

Also note the cracked concrete tank pad that has settled and allows ponding and easier ingress of stormwater



Sump-wall penetrations and Torn Boots

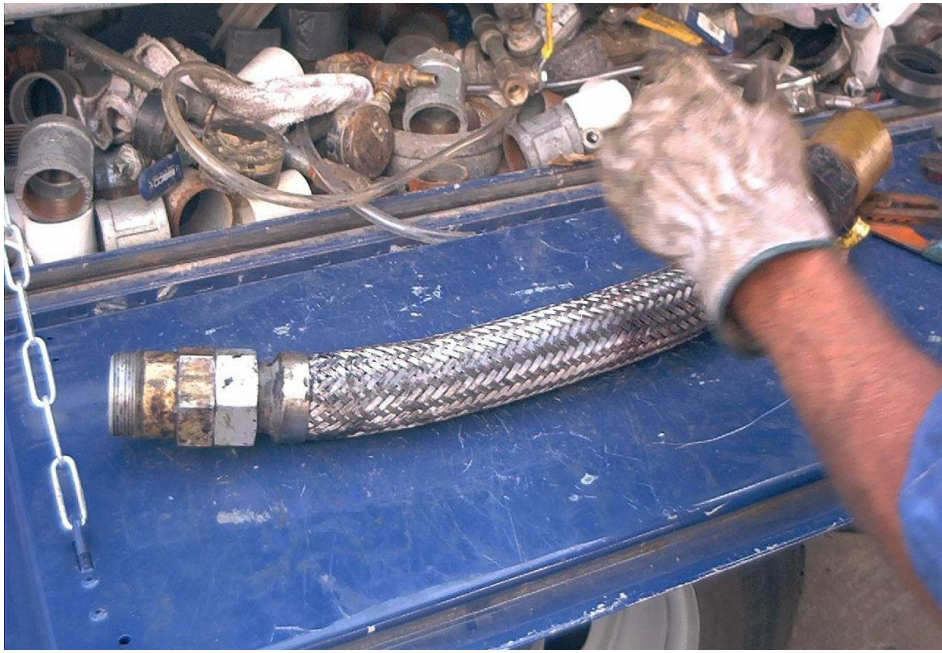
These problems affect the integrity of the STP sump and could lead to a release. Repairs are required

Piping Sumps

Additional Problems

Unsealed electrical conduits

Leaking Line Leak Detectors



Damaged Flex-connectors

Improvements in Piping Sump Covers

Submersible Turbine Pump Piping Sumps

Same as for Dispensers: Fiberglass or Polyethylene

Both have been manufactured with significant improvements in the past several years – stronger, and with better penetration fittings

Under dispenser containment and STP sumps should be annually inspected and a log kept of the results. If used to meet leak detection requirements, they must remain free of water.

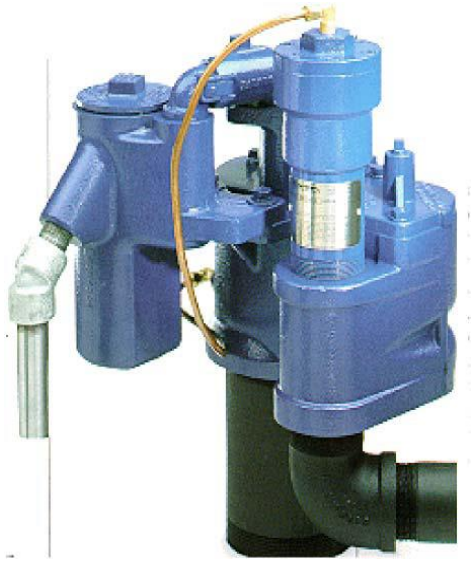
Line Leak Detectors – Examples of Different Types

Red Jacket Diaphragm

Veeder Root PLLD

Red Jacket MLLD

Vaporless MLLD



FE Petro MLLD

ELLD

Line Leak Detectors

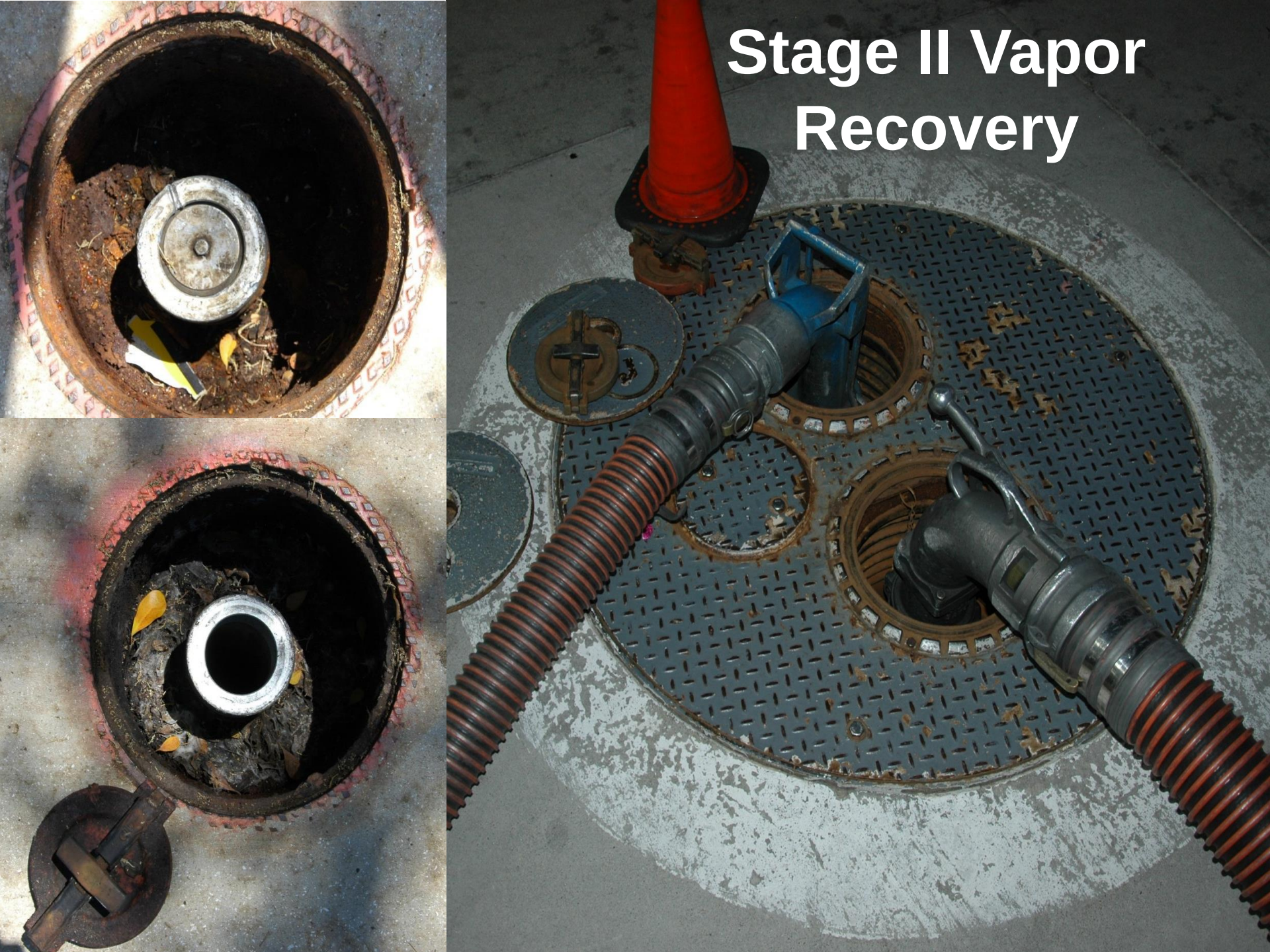
Line Leak Detectors - two main types, mechanical (MLLD) and electronic (ELLD). MLLD's restrict product flow when a leak rate of 3 gallons per hour or greater is detected. The two types of ELLD's are Pressurized Line Leak Detectors (PLLDs) and Wireless Pressurized Line Leak Detectors (WPLLDs). These systems can detect smaller leaks (.1 and .2 gallons per hour, and can shut of the flow of product in the piping. Line Leak Detectors must be tested annually to demonstrate they are functioning properly as designed and installed.

Flex-Connectors

Another potential point for releases, particularly if they are not properly installed. Flex connectors facilitate the connection of two rigid piping system points in piping sumps and UDCs such as the valve to elbow connection in the photo below

Vent Lines

Not regulated because they do not convey product. Nevertheless, they are sometimes the source of fuel leaks to the environment where the piping elbows vertical at the base


Stage II Vapor
Recovery

What is Stage One Vapor Recovery?

A co-axial aluminum drop tube. Fuel enters through the center, vapors return to the truck in the interstice

A

N

D

A pressure relief valve on top of the vent that allows vapors to vent only when the pressure is high enough to vent the tank

Credit Card “Skimming” Devices

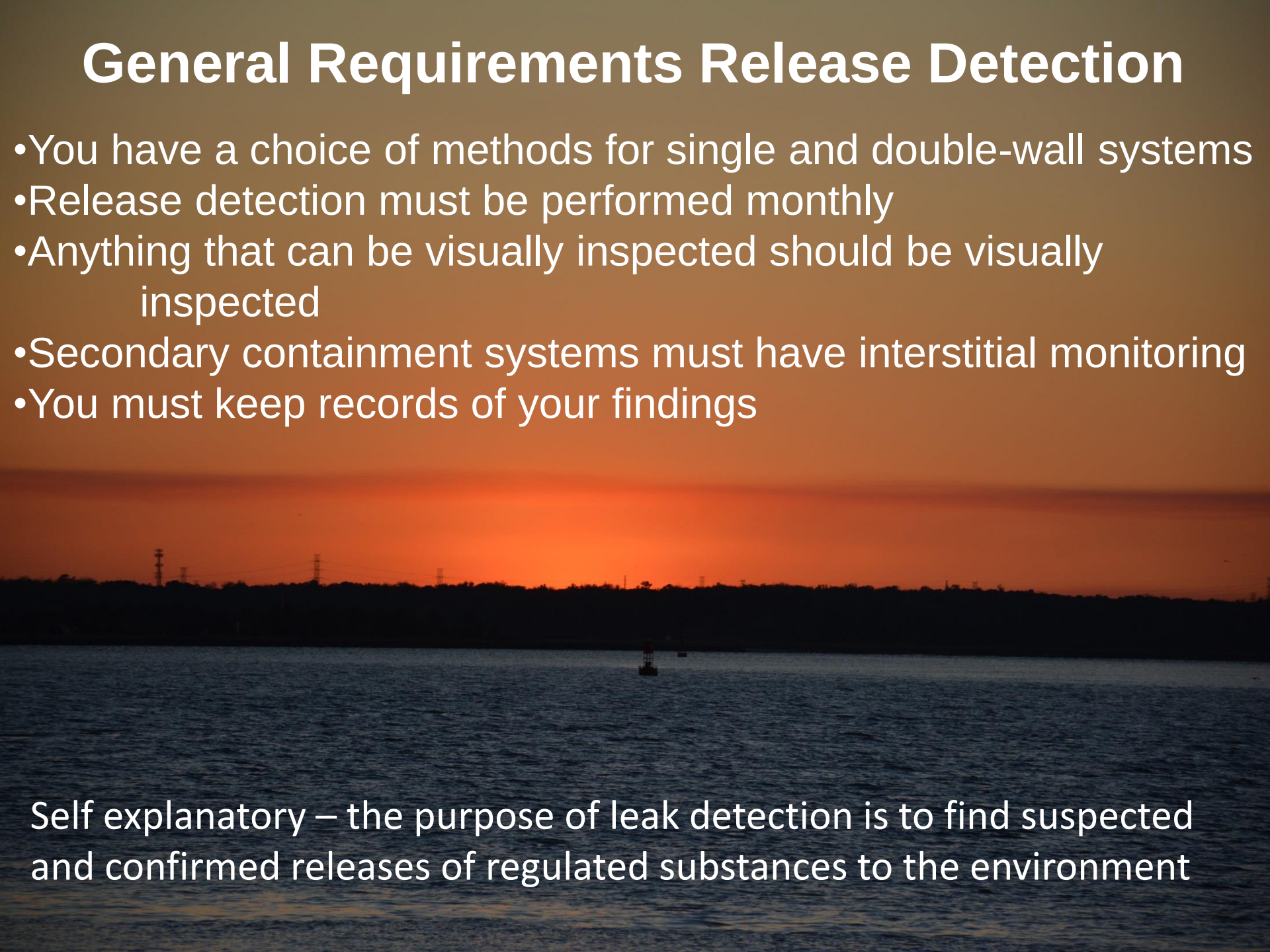
Be on the look-out for these devices that are clandestinely installed by identity thieves and computer hackers.

Fuel Theft


Release Detection

General Requirements Release Detection

- You have a choice of methods for single and double-wall systems
- Release detection must be performed monthly
- Anything that can be visually inspected should be visually inspected
- Secondary containment systems must have interstitial monitoring
- You must keep records of your findings

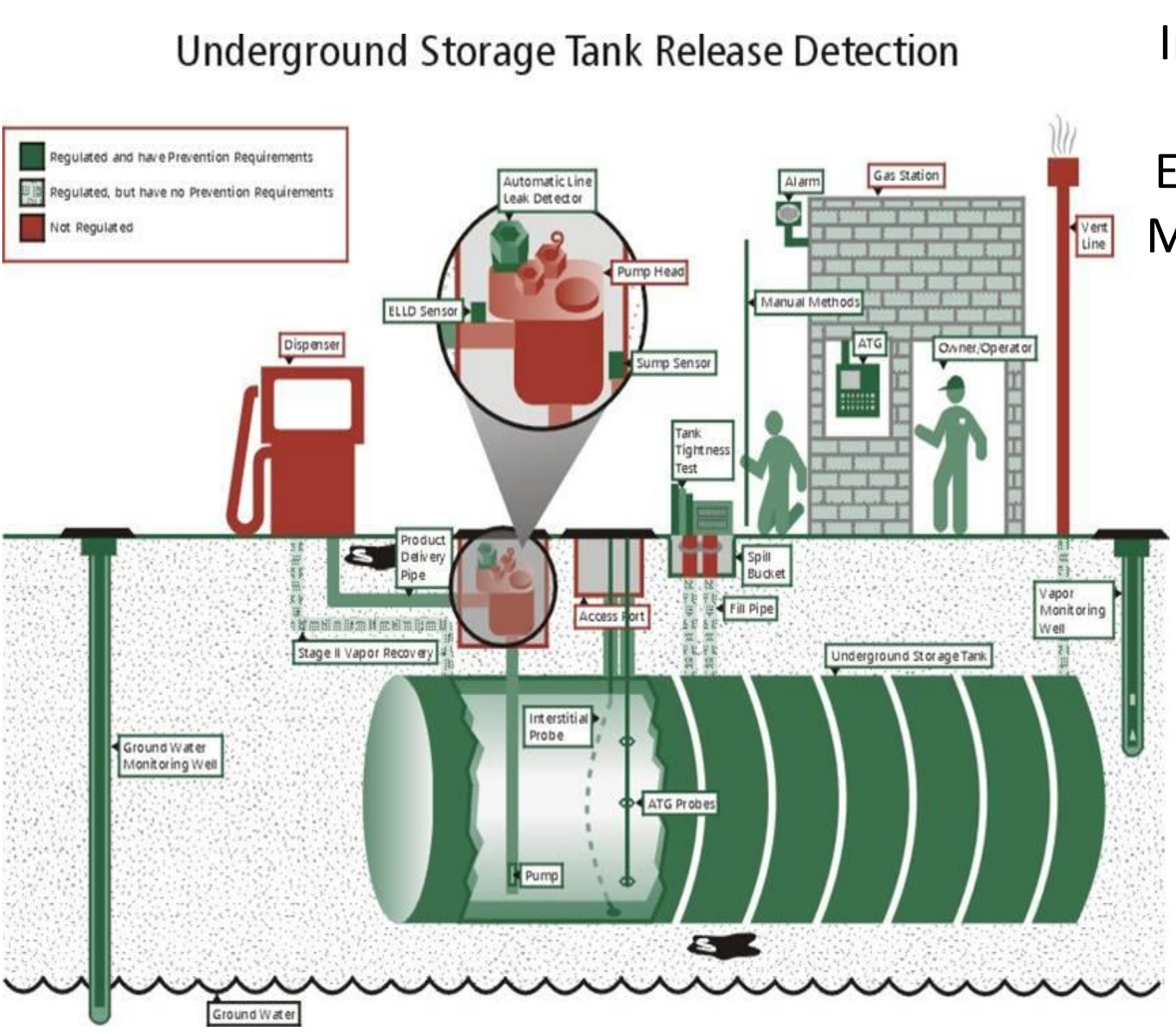


Self explanatory – the purpose of leak detection is to find suspected and confirmed releases of regulated substances to the environment

Performance Standards for Release Detection Methods

- General. Methods of release detection shall:

– Be capable of detecting a leak of 0.2 gallons per hour or 150 gallons within 30 days with a probability of detection of 0.95, and a probability of false alarm of 0.05, with the exception of tightness testing, visual inspections, groundwater or vapor monitoring; and manual tank gauging.
– Detect a leak from any part of the UST system, and have a third party certification/evaluation (from the NWGLDE)
– Must be installed in accordance with manufacturers specs.



Internal and External Methods

Single Wall and Double Wall Tanks

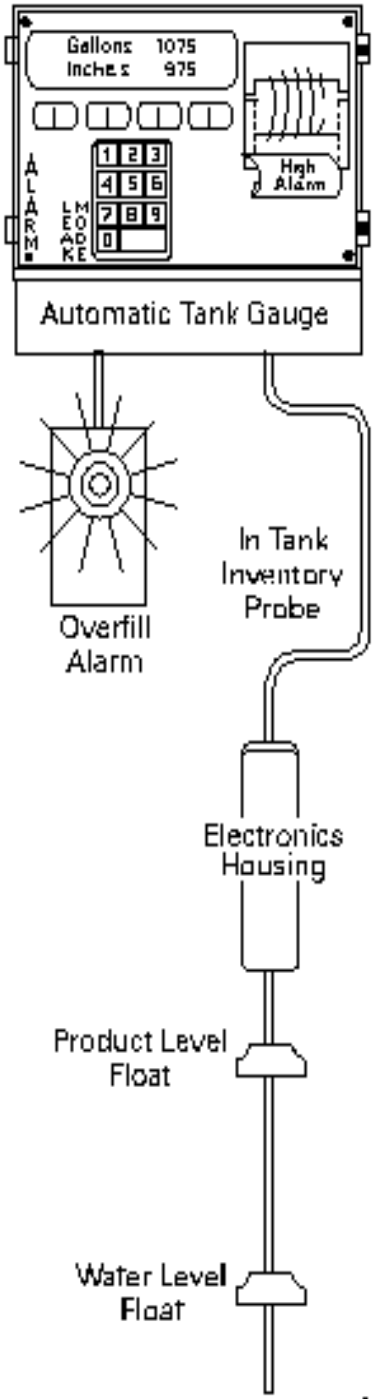
Single-Wall Release UST Detection Methods

Statistical Inventory Reconciliation (SIR)

SIR is a certified third-party method of monthly line and tank release detection for single-wall tank systems. Data from stick readings, delivery and sales totals are entered into a computer program that provides quantitative data demonstrating PASS, FAIL, or INCONCLUSIVE results for USTs and product piping. The data for the computer program can either be obtained by sticking the tank with a gauge stick or using the inventory data from an ATG.

Automatic Tank Gauges (ATG)

ATG's have a probe in each tank compartment and an electronic monitor that performs the leak testing. ATG's record product inventory, product temperature, water levels, ullage (amount of empty space in the tank) and delivery gallons, in addition to performing regular tank leak tests (CSLD tests). ATGs can also conduct line leak tests if they are connected to electronic line leak detectors.



Different Types of Automatic Tank Gauges

Three of commonly used ATGs…

What UST Inspectors Like to See…

What UST Inspectors Don't Like to See…

Most ATGs have alarm history and test reports that can be printed by UST regulators. Don't think that alarms can be ignored without consequences!

ATG Tapes…In compliance

Inventory

WINTER PARK,FL 32792
B058611405001

OCT 8, 2011 7:00 AM

INVENTORY REPORT

T 4:RUL
VOLUME = 9594 GALS
ULLAGE = 4950 GALS
90% ULLAGE= 3495 GALS
HEIGHT = 57.16 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 83.3 DEG F

T 5:PUL
VOLUME = 5234 GALS
ULLAGE = 4461 GALS
90% ULLAGE= 3491 GALS
HEIGHT = 48.49 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 85.0 DEG F

* * * * * END * * * * *

CSLD

APR 28, 2012 7:16 AM

CSLD TEST RESULTS
- - - - - - - - - - - -
APR 28, 2012 7:16 AM

T 1:REGULAR WEST
T 2:REGULAR
PROBE SERIAL NUM 823729

0.2 GAL/HR TEST
PER: APR 28, 2012 PASS

T 3:ULTRA
PROBE SERIAL NUM 278398

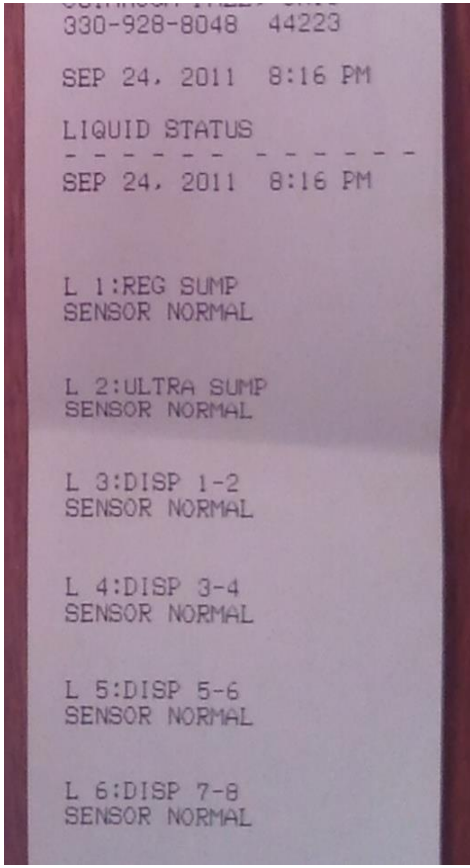
0.2 GAL/HR TEST
PER: APR 28, 2012 PASS

T 4:DIESEL
PROBE SERIAL NUM 207437

0.2 GAL/HR TEST
PER: APR 28, 2012 PASS

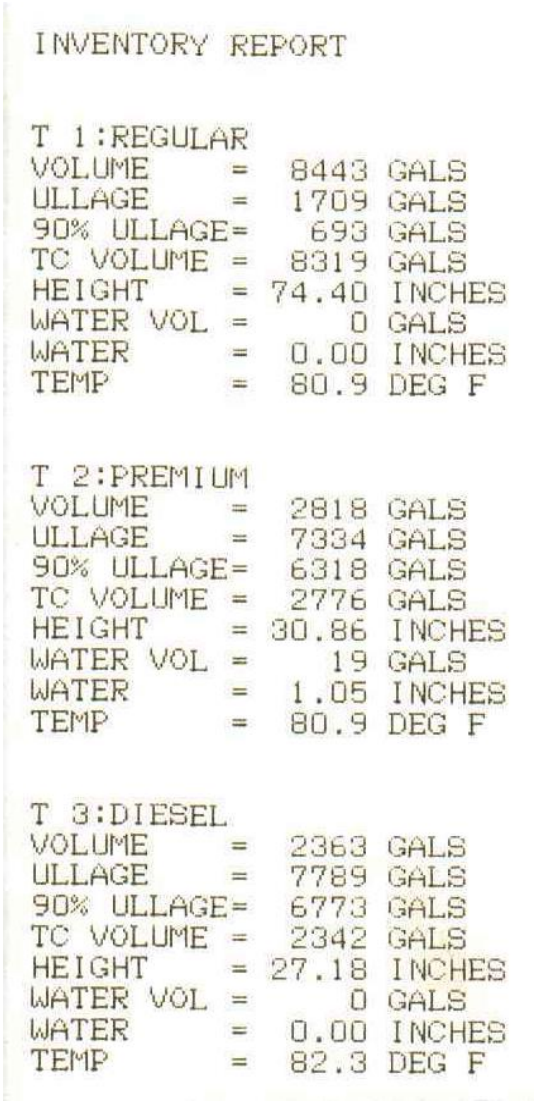
WPLLD

Liquid Status



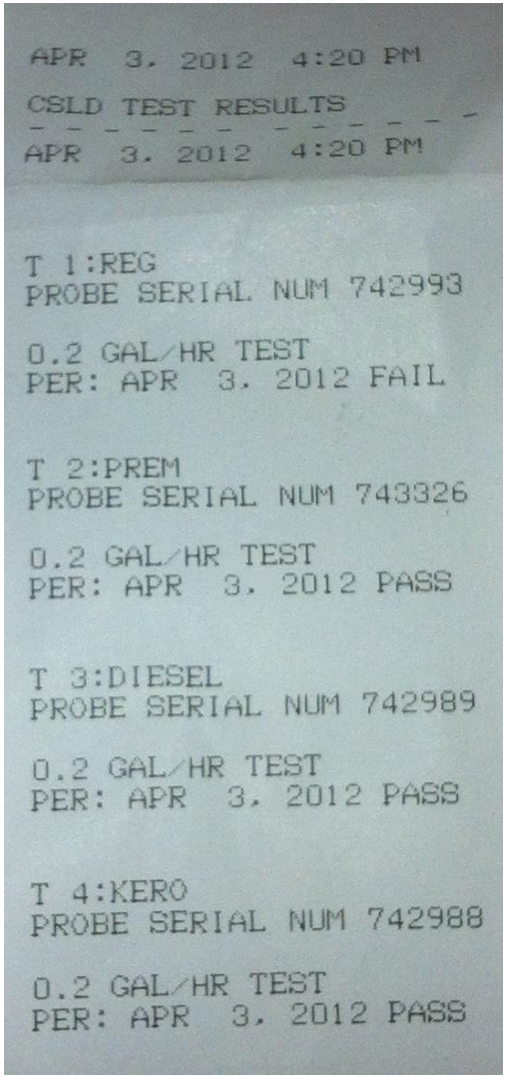
ATG Tapes…Out of compliance

Inventory



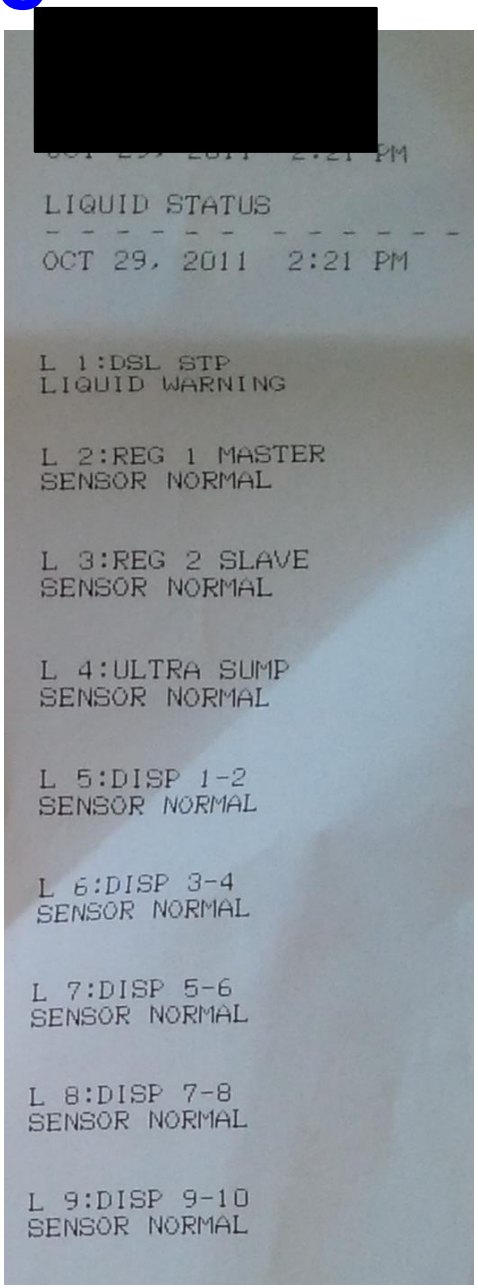
```
INVENTORY REPORT

T 1:REGULAR
VOLUME      =   8443 GALS
ULLAGE      =   1709 GALS
90% ULLAGE=    693 GALS
TC VOLUME   =   8319 GALS
HEIGHT      =  74.40 INCHES
WATER VOL   =      0 GALS
WATER       =   0.00 INCHES
TEMP        =   80.9 DEG F

T 2:PREMIUM
VOLUME      =   2818 GALS
ULLAGE      =   7334 GALS
90% ULLAGE=   6318 GALS
TC VOLUME   =   2776 GALS
HEIGHT      =  30.86 INCHES
WATER VOL   =     19 GALS
WATER       =   1.05 INCHES
TEMP        =   80.9 DEG F

T 3:DIESEL
VOLUME      =   2363 GALS
ULLAGE      =   7789 GALS
90% ULLAGE=   6773 GALS
TC VOLUME   =   2342 GALS
HEIGHT      =  27.18 INCHES
WATER VOL   =      0 GALS
WATER       =   0.00 INCHES
TEMP        =   82.3 DEG F
```

CSLD



```
APR  3, 2012  4:20 PM

CSLD TEST RESULTS
- - - - - - - - - - -
APR  3, 2012  4:20 PM


T 1:REG
PROBE SERIAL NUM 742993

0.2 GAL/HR TEST
PER: APR  3, 2012 FAIL


T 2:PREM
PROBE SERIAL NUM 743326

0.2 GAL/HR TEST
PER: APR  3, 2012 PASS


T 3:DIESEL
PROBE SERIAL NUM 742989

0.2 GAL/HR TEST
PER: APR  3, 2012 PASS


T 4:KERO
PROBE SERIAL NUM 742988

0.2 GAL/HR TEST
PER: APR  3, 2012 PASS
```

Liquid Status



```
[redacted]
LIQUID STATUS
- - - - - - - - - - - - - -
OCT 29, 2011  2:21 PM


L 1:DSL STP
LIQUID WARNING

L 2:REG 1 MASTER
SENSOR NORMAL

L 3:REG 2 SLAVE
SENSOR NORMAL

L 4:ULTRA SUMP
SENSOR NORMAL

L 5:DISP 1-2
SENSOR NORMAL

L 6:DISP 3-4
SENSOR NORMAL

L 7:DISP 5-6
SENSOR NORMAL

L 8:DISP 7-8
SENSOR NORMAL

L 9:DISP 9-10
SENSOR NORMAL
```

CSLD-

Continuous Statistical Leak Detection ATG testing of USTs

Tanks and Piping must pass a 0.2 test each month, and a 0.1 test each year.

[redacted]

NOV 2, 2011 7:22 PM

LEAK TEST REPORT

T 2:SUPER
PROBE SERIAL NUM 382340

TEST STARTING TIME:
NOV 2, 2011 4:51 PM

LEAK TEST RESULTS
GROSS TEST PASS

* * * * * END * * * * *

[redacted]

NOV 2, 2011 7:22 PM

LEAK TEST REPORT

T 3:DIESEL
PROBE SERIAL NUM 382337

330-928-8048 44223

SEP 24, 2011 8:16 PM

CSLD TEST RESULTS

- - - - - - - - - - - -

SEP 24, 2011 8:16 PM

T 1:REG
T 2:REG MAN
PROBE SERIAL NUM 201426

0.2 GAL/HR TEST
PER: SEP 24, 2011 PASS

T 3:ULTRA
PROBE SERIAL NUM 201422

0.2 GAL/HR TEST
PER: SEP 24, 2011 PASS

PLLD- Pressurized Line Leak Detection ATG testing of USTs

NOV 2, 2011 7:21 PM

PRESSURE LINE LEAK TEST
RESULTS

Q 5:DIESEL

3.0 GAL/HR RESULTS:

LAST TEST:
NOV 2,2011 6:01PM PASS

NUMBER OF TESTS PASSED
PREV 24 HOURS : 12
SINCE MIDNIGHT : 12

0.20 GAL/HR RESULTS:

NOV 1,2011 9:21AM PASS
OCT 28,2011 9:05PM PASS
OCT 26,2011 5:35AM PASS
OCT 22,2011 2:54PM PASS
OCT 18,2011 9:36AM PASS
OCT 14,2011 11:21PM PASS
OCT 12,2011 2:42AM PASS
OCT 8,2011 6:13AM PASS
OCT 4,2011 7:10PM PASS
SEP 30,2011 10:12AM PASS

0.10 GAL/HR RESULTS:

AUG 31,2011 8:32AM PASS

* * * * * END * * * * *

[redacted]

NOV 2, 2011 7:21 PM

PRESSURE LINE LEAK TEST
RESULTS

Q 4:SUPER 2

3.0 GAL/HR RESULTS:

LAST TEST:
NOV 2,2011 6:12PM PASS

NUMBER OF TESTS PASSED
PREV 24 HOURS : 16
SINCE MIDNIGHT : 11

0.20 GAL/HR RESULTS:

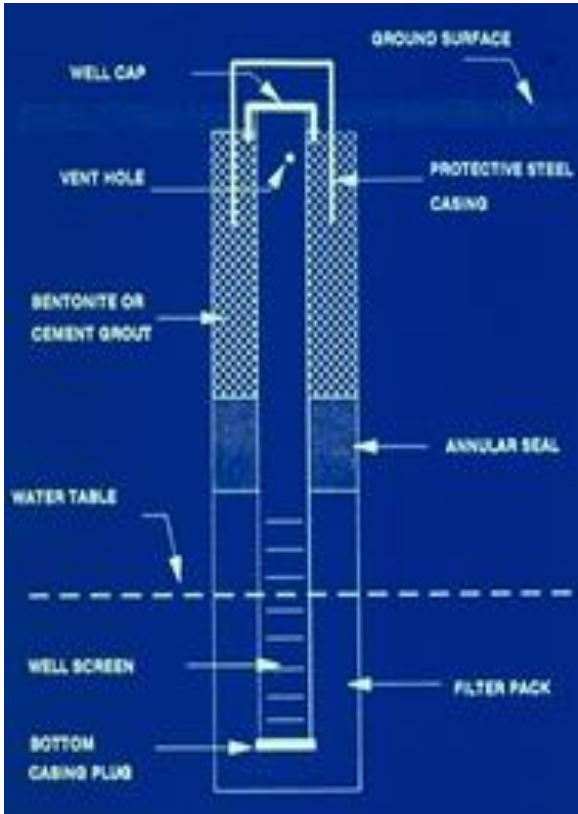
NOV 1,2011 9:51AM PASS
OCT 28,2011 7:23AM PASS
OCT 24,2011 1:30PM PASS
OCT 20,2011 8:28PM PASS
OCT 18,2011 2:32AM PASS
OCT 14,2011 9:14PM PASS
OCT 12,2011 3:16AM PASS
OCT 8,2011 10:17PM PASS
OCT 6,2011 7:47AM PASS
OCT 2,2011 11:02PM PASS

0.10 GAL/HR RESULTS:

SEP 2,2011 5:00AM PASS

External Release Detection for Single-wall Systems

- Well construction issues
- Site suitability concerns
- Groundwater/vapor monitoring
- Sampling issues



Five Ways to Do Interstitial Monitoring of Double-Wall Tanks…

- Visual
- Vacuum
- Pressure
- Hydrostatic
- Sensors

Visual Monitoring of the UST Interstice

Using a Gauge Stick to look for liquids

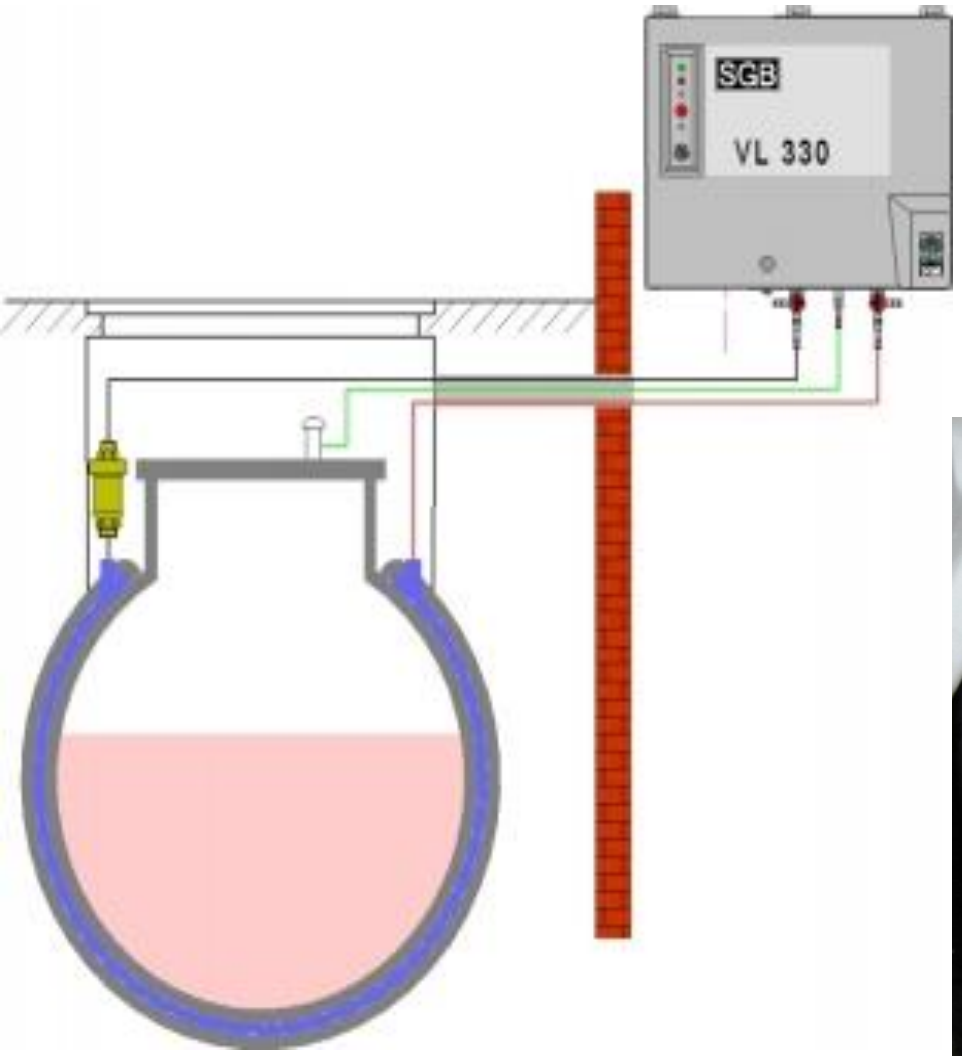
Gauge Stick found 27” of fuel in this interstice

Vacuum Gauges – Watch for trends, refresh if necessary

Vacuum Gauges

Gauges should be periodically recalibrated and be readable

Vacuum or Pressure Continuous Monitoring



Pressure monitoring not as common

1336 RALEIGH RD
ROCKY MOUNT NC

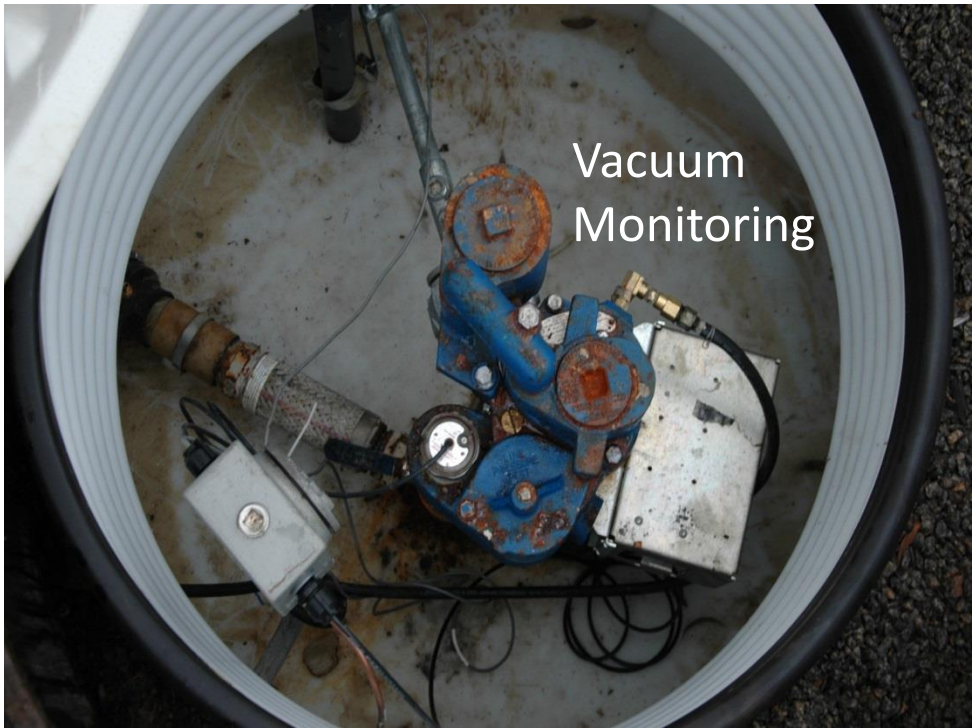
MAR 3, 2012 5:34 PM

SMART SENSOR STATUS

MAR 3, 2012 5:34 PM

s 2:VACUUM PREM
SENSOR NORMAL

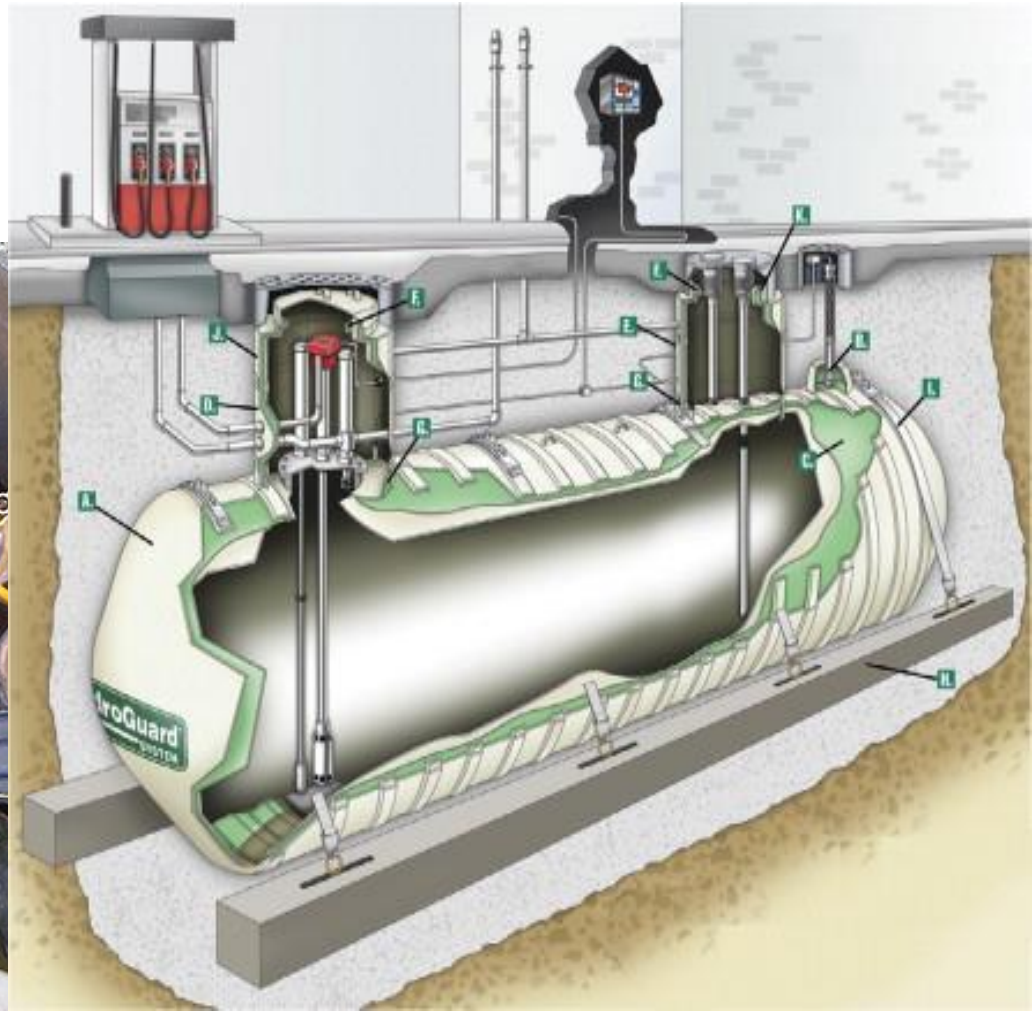
ATG Tape with vacuum sensor status

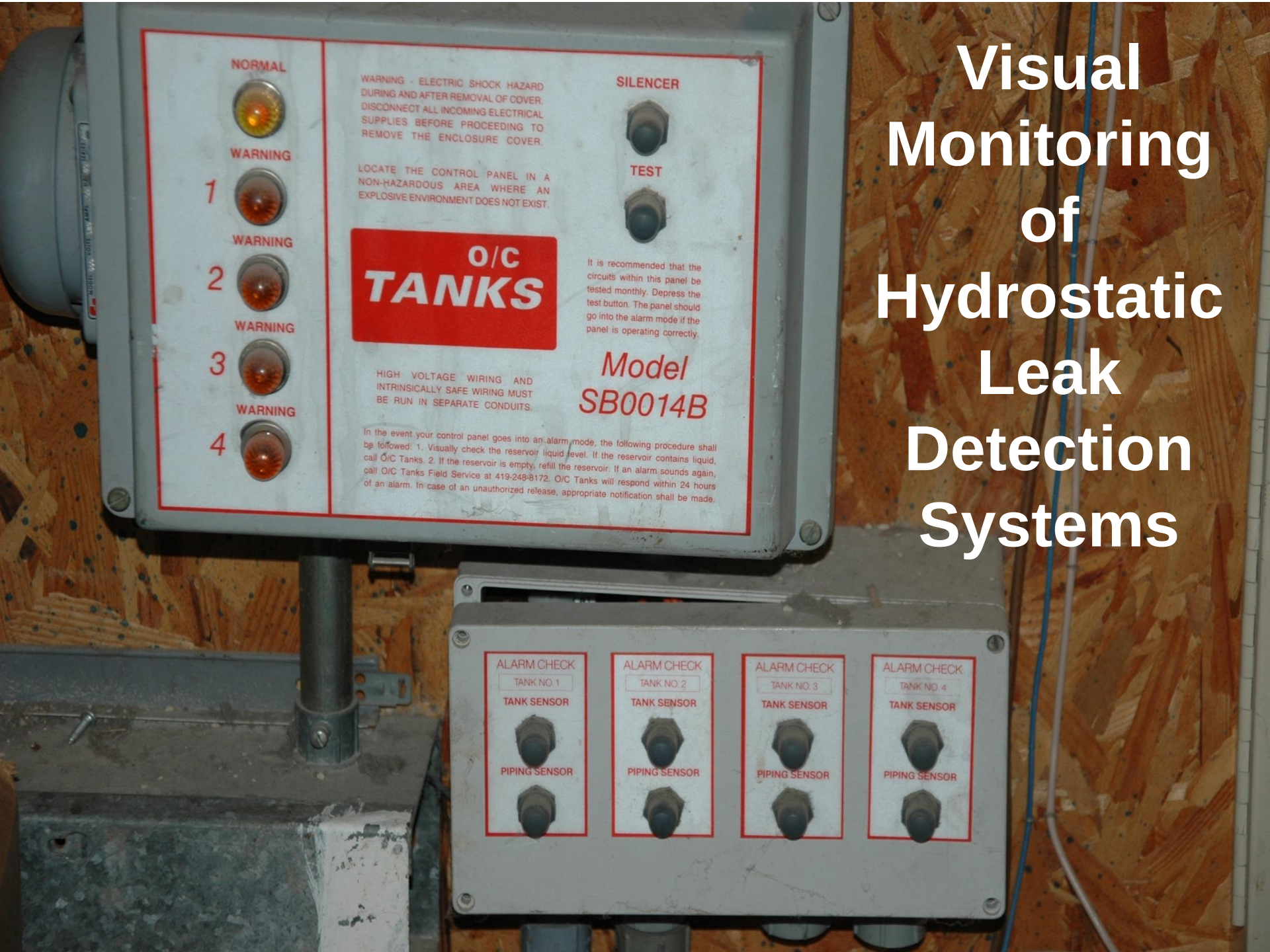


Hydrostatic – Liquid Level Sensing

The interstice is liquid-filled (usually a brine solution) and monitored to determine any change in static liquid levels

Less common than sensors or vacuum systems



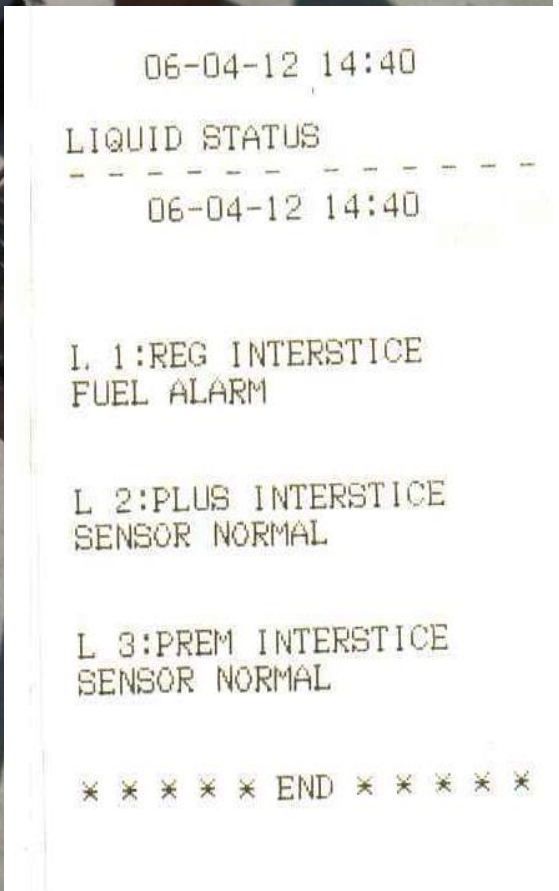


Visual Monitoring of Hydrostatic Leak Detection Systems

Use of Sensors to Monitor the UST Interstice

One of the most common methods of interstitial UST release detection, and usually is programmed to an ATG for Alarms

Sensor extracted for service



06-04-12 14:40

LIQUID STATUS

- - - - - - - - - - - - - - - -

06-04-12 14:40

L 1:REG INTERSTICE
FUEL ALARM

L 2:PLUS INTERSTICE
SENSOR NORMAL

L 3:PREM INTERSTICE
SENSOR NORMAL

* * * * * END * * * * *

Double-Wall Piping Leak Detection

WINTER PARK,FL 32792
B0586111405001

OCT 8, 2011 1:10 PM

LIQUID STATUS

OCT 8, 2011 1:10 PM

L 1:RUL STP SUMP
SENSOR NORMAL

L 2:PUL STP SUMP
SENSOR NORMAL

L 3:RUL FILL SUMP
SENSOR NORMAL

L 4:PUL FILL SUMP
SENSOR NORMAL

L 5:RUL ANNULAR
SENSOR NORMAL

L 6:PUL ANNLAR
SENSOR NORMAL

L 7:DISP 1-2
SENSOR NORMAL

L 8:DISP 3-4
SENSOR NORMAL

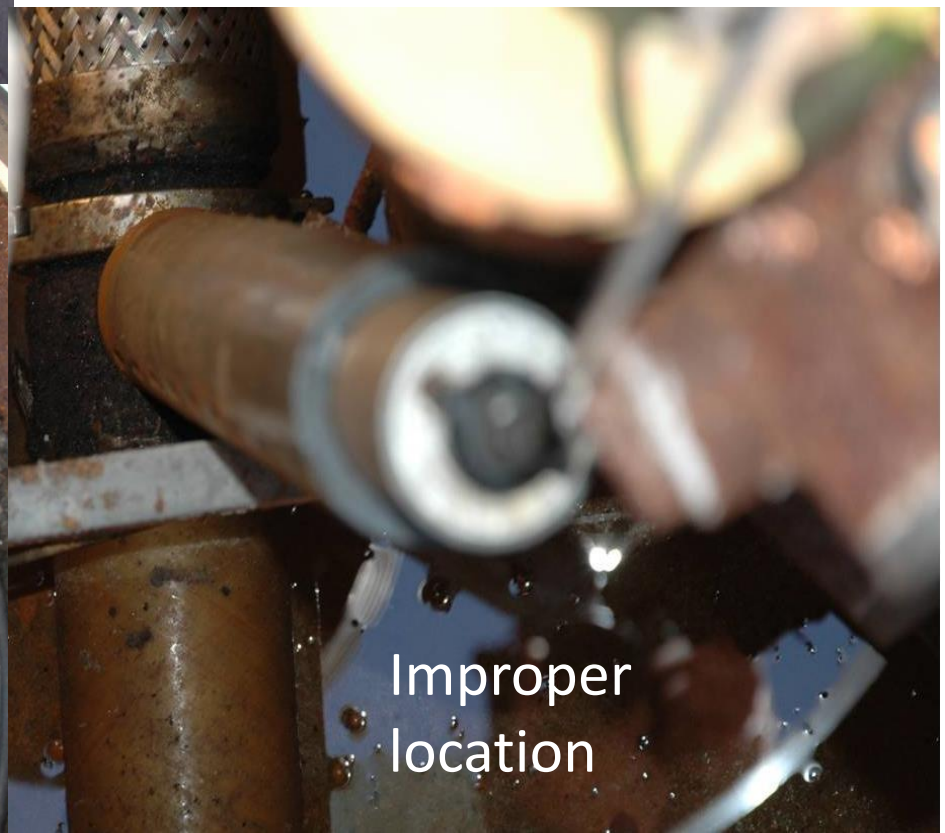
* * * * * END * * * * *

Piping Sump Sensor Leak Detection Circumvention

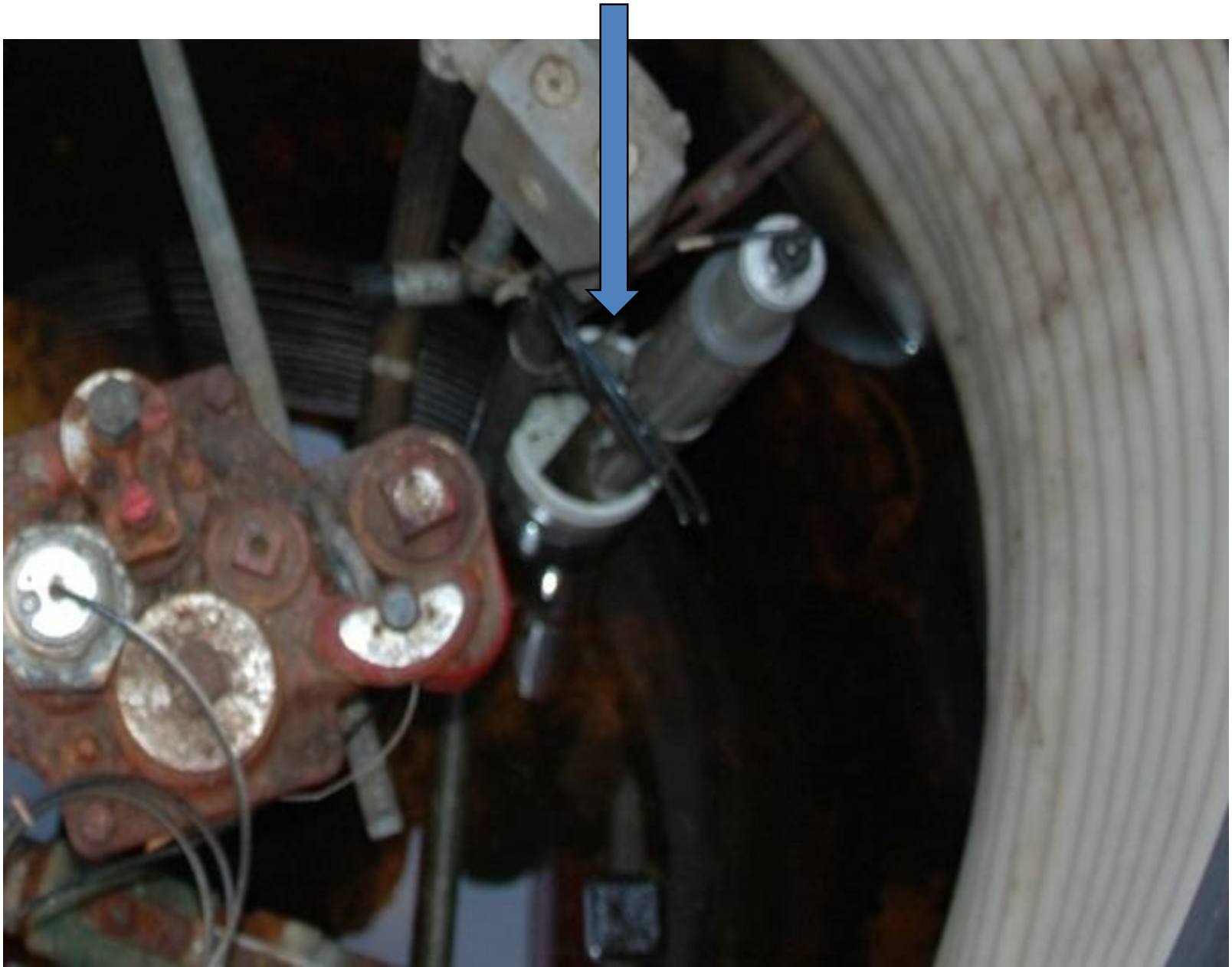

Broken Piping
Sump Sensors

Sump Sensor Problems

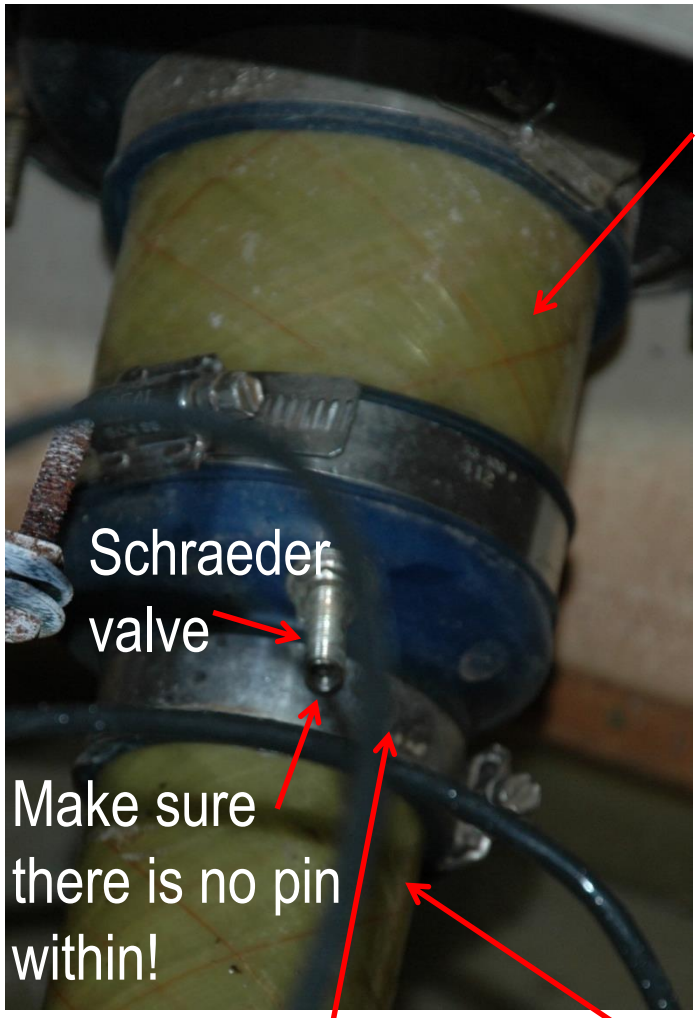
Sensors must be vertical, and located lower than the lowest sump side-wall penetration. Can be discriminating or non-discriminating



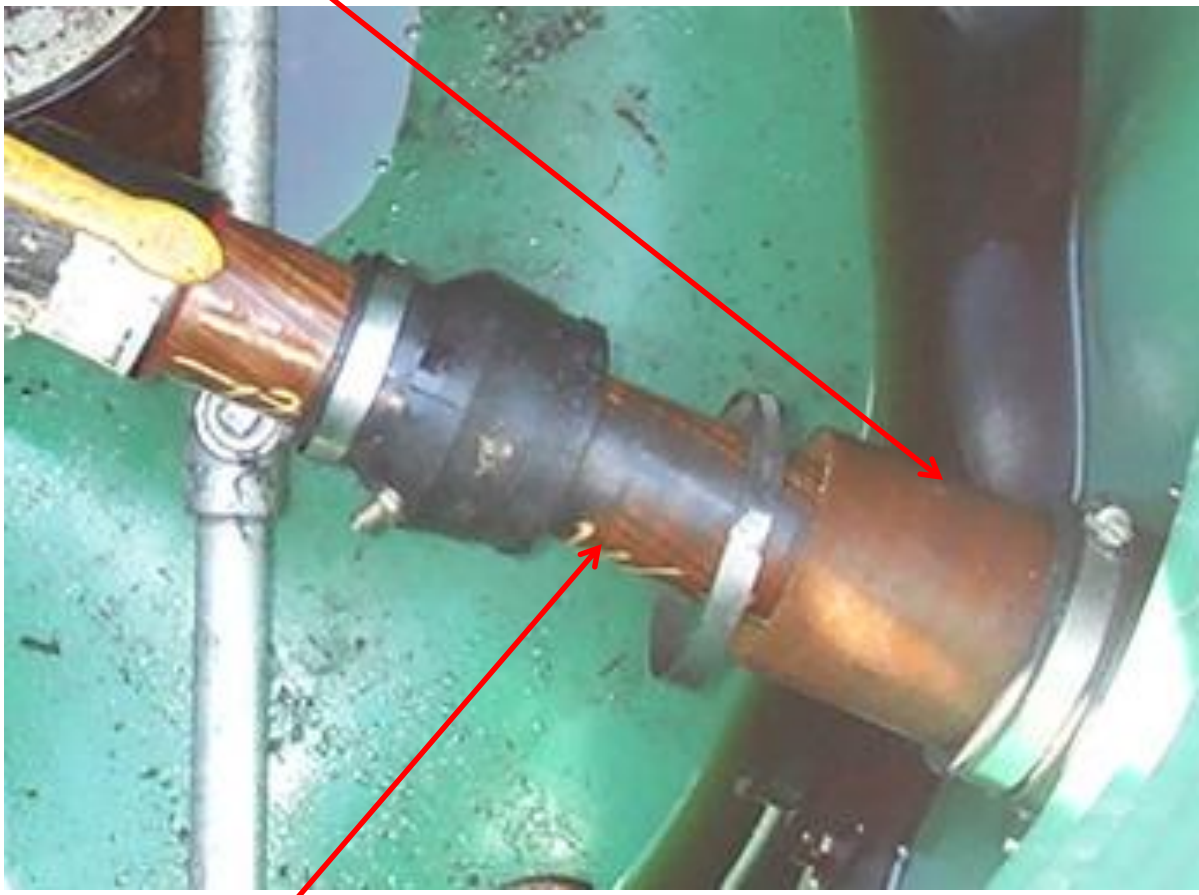
A closer Look…note bucket beneath sensor



Piping Leak Detection



Outer-wall



Inner-wall

Tight band clamp, no way for product to enter the sump unless the schraeder valve is open

Band clamp loose, free pathway for fuel to enter sump as shown

Sump sensors used for leak detection should be tested annually and a log kept of the test results

Monthly Visual Inspections

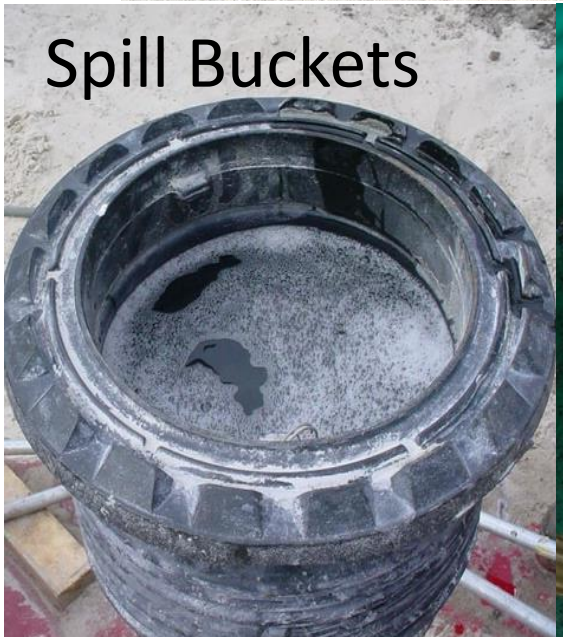
Required in some states,
Recommended in others,
Proposed as a New EPA Requirement

Testing

Testing

Hydrostatic testing

- Line Tightness Testing
- Line Leak Detector Tests
- Tank Tightness Testing
- Integrity testing of
  - Containment
  - Sumps



Proposed EPA Integrity Tests of Tanks and Piping

Applies to Tanks, Piping, Interstices, and Containment Sumps, and is in EPA's Proposed Revisions to the UST Rules.

Annual Operability Tests

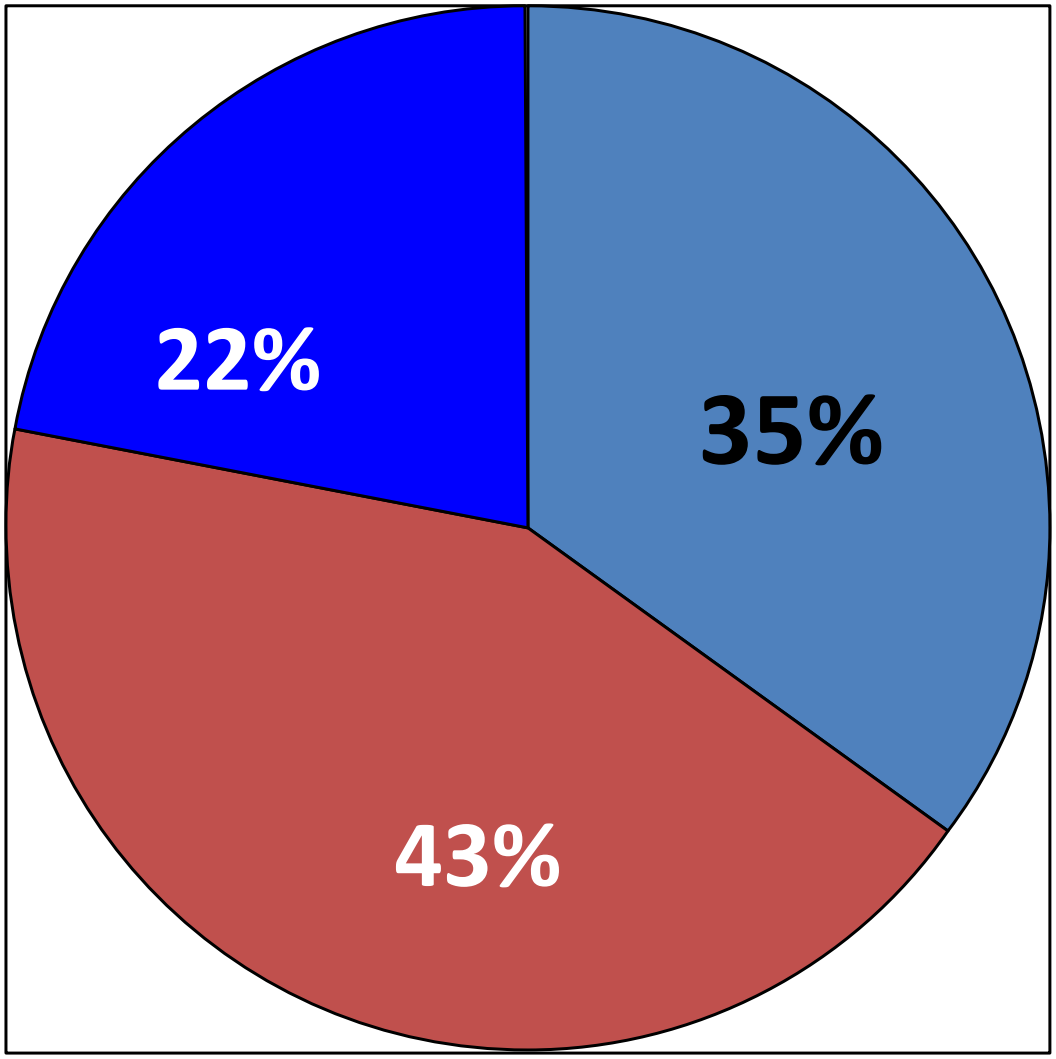
of leak detection equipment proposed by EPA

Sensors must be tested annually to ensure functionality

Sensor Testing

Success of Leak Detection – Data from Florida Leak Autopsy Study

Mar 08



The End