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EFG (07-90)

United States Government **Department of Energy**

memorandum

DATE: March 8, 1999

REPLY TO ATTN OF: Office of Environmental Guidance cc:DiCerbo:6-5047

SUBJECT: DOE's Underground Storage Tank (UST) Leak Detection Workshop

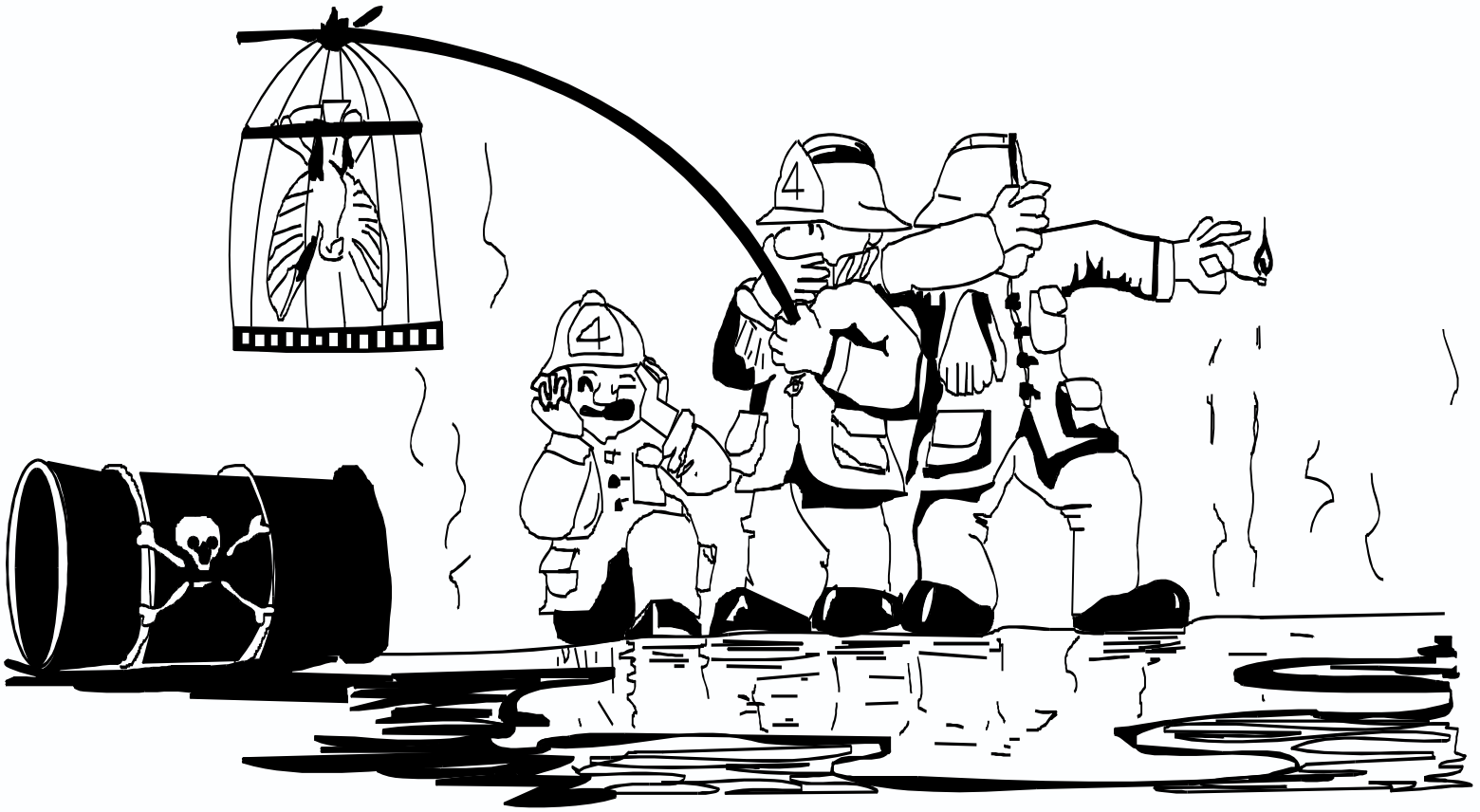
TO: Distribution

The Office of Environmental Guidance, RCRA/CERCLA Division (EH-231) sponsored an Underground Storage Tank (UST) Leak Detection workshop in Atlanta, Georgia on April 26, 1994. The workshop was designed to familiarize participants with the regulatory and technical basis for identifying and reporting leaks from USTs. The workshop utilized a combination of lectures and interactive discussions and included the following modules:

- Leak detection methods and deadlines;
- Inventory control including measurements and calculations;
- Recordkeeping;
- Designing and implementing a teak detection program;
- Selecting the proper leak detection technology;
- What to do when a leak occurs; and
- Contracting considerations

The following materials are from this training course.

Selection, Design, and Operation of Leak Detection Systems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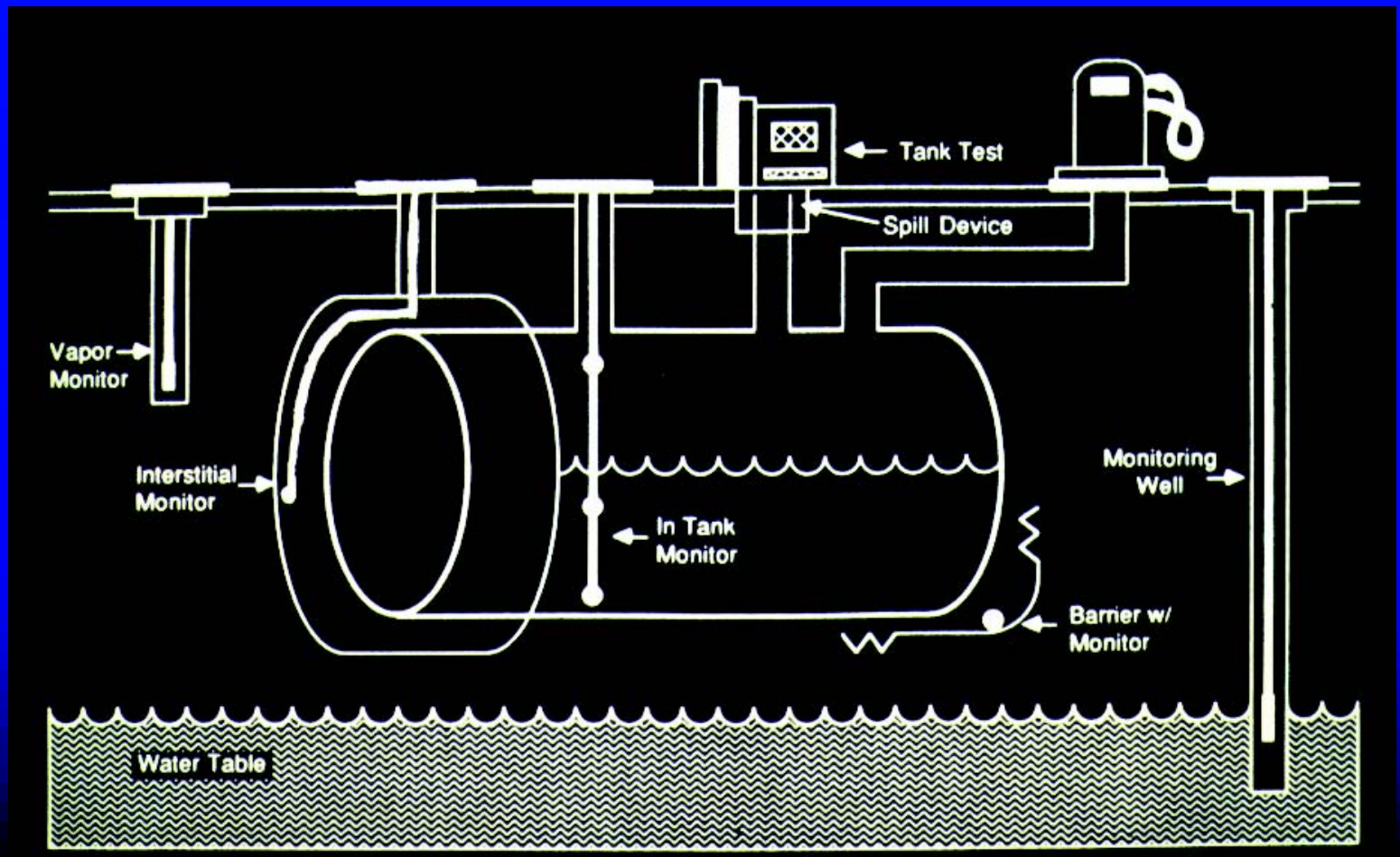
Considerations in System Selection and Design

- **Screens out false alarms**
- **Minimizes maintenance requirements**
- **Works well with existing tank systems**
- **Provides reliable detection**

Leak Detection Alternatives



Tank Integrity Testing

Tank Integrity Testing

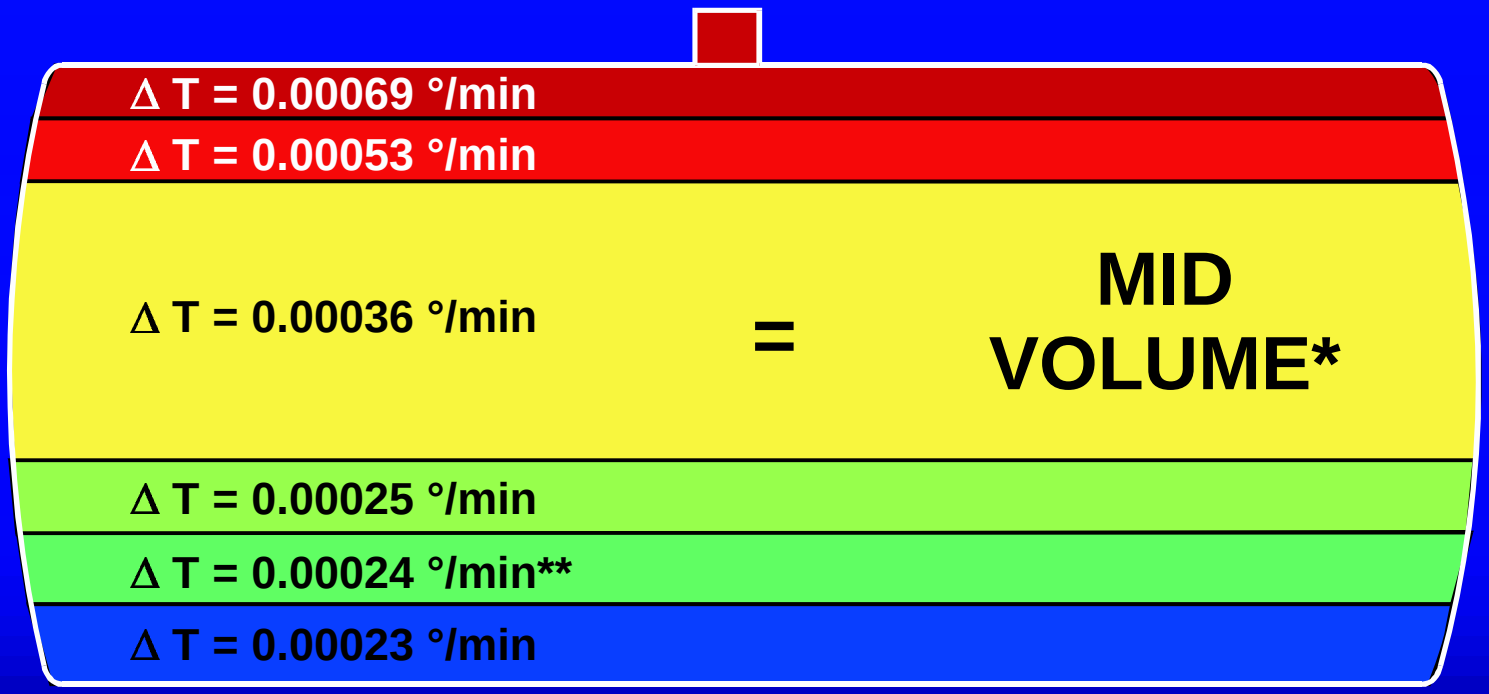
- **Vendors must demonstrate that methods meet EPA performance standards of detecting releases of 0.1 gallons per hour with a probability of detection of 95% and probability of false alarm of 5% (independent third party testing *not* required, but is available).**
- **Tank systems which meet new tank standards for corrosion protection and overfill controls must be tested every 5 years.**
- **Tank systems which do *not* meet new tank standards must be tested yearly.**
- **Testing must be combined with daily inventory control and monthly reconciliation.**

Testing for Underground Leaks

“Precision Test as used throughout this pamphlet means any test that takes into consideration the temperature coefficient of expansion of the product being tested as related to any temperature change during the test, and its capability of detectting a loss of 0.05 gallons per hour.”

Source: NFPA 329

Temperature Variation

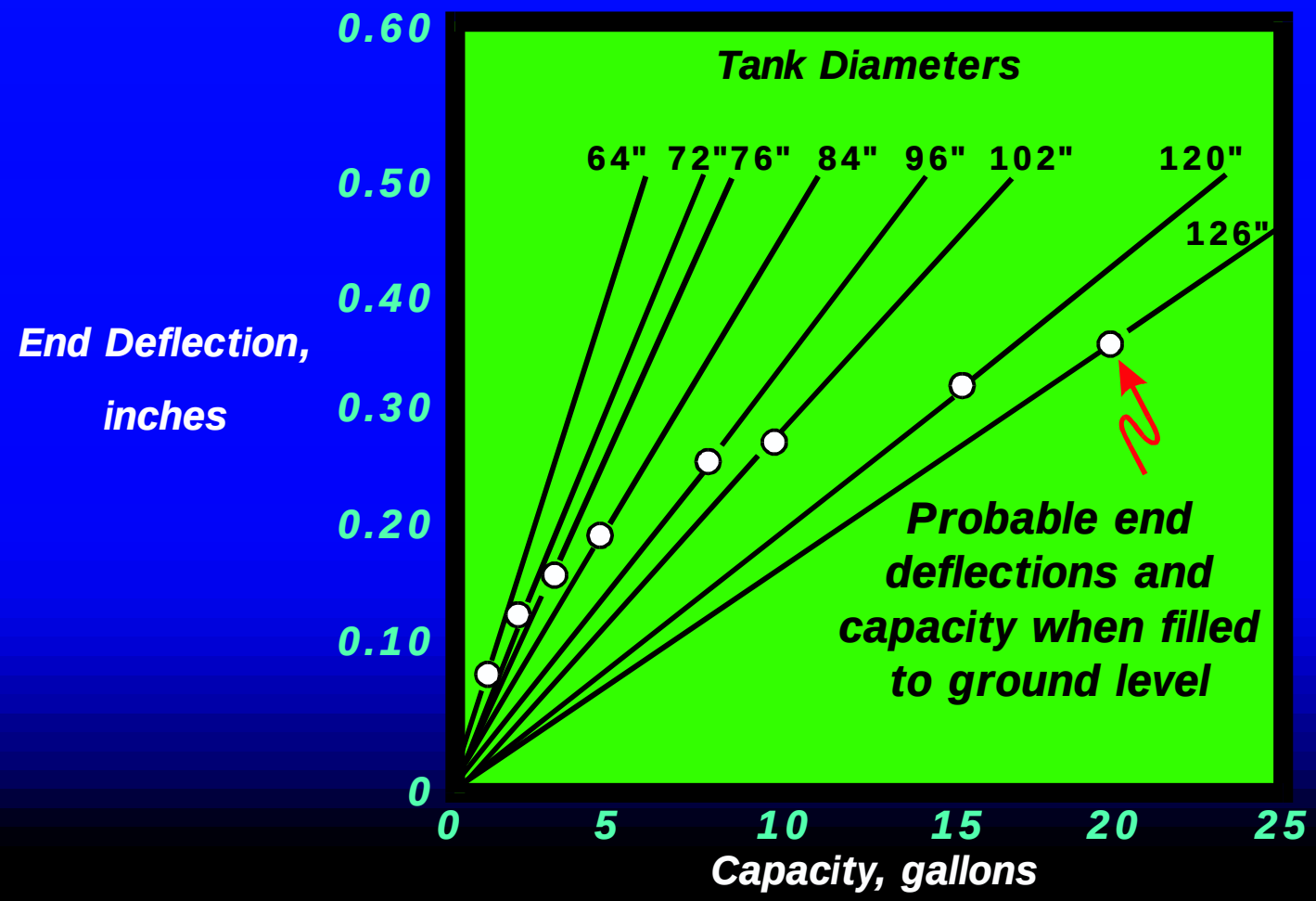


* AVG Δ T = 0.00039 °/min

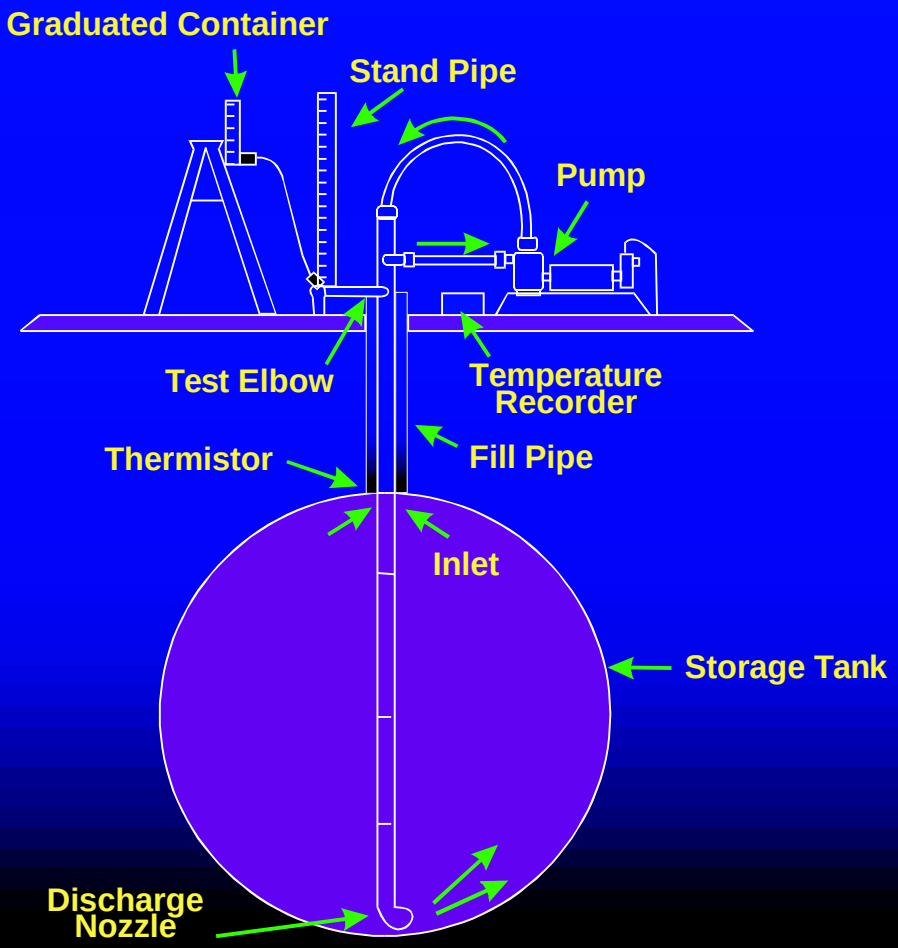
**Location of Average Tank Temperature

Extrapolated from SRI Technical Report 1, June, 1979

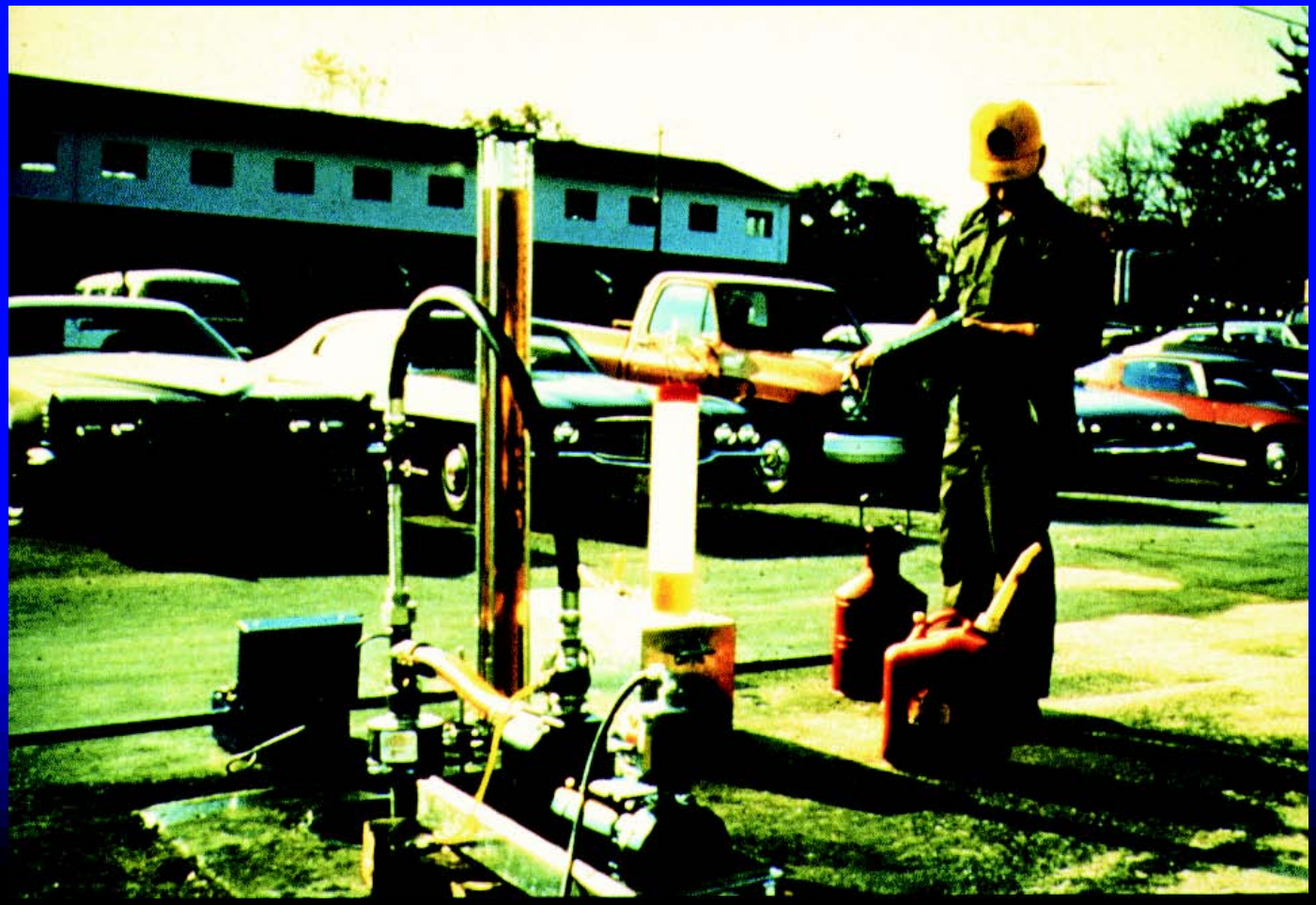
Tank Deflection



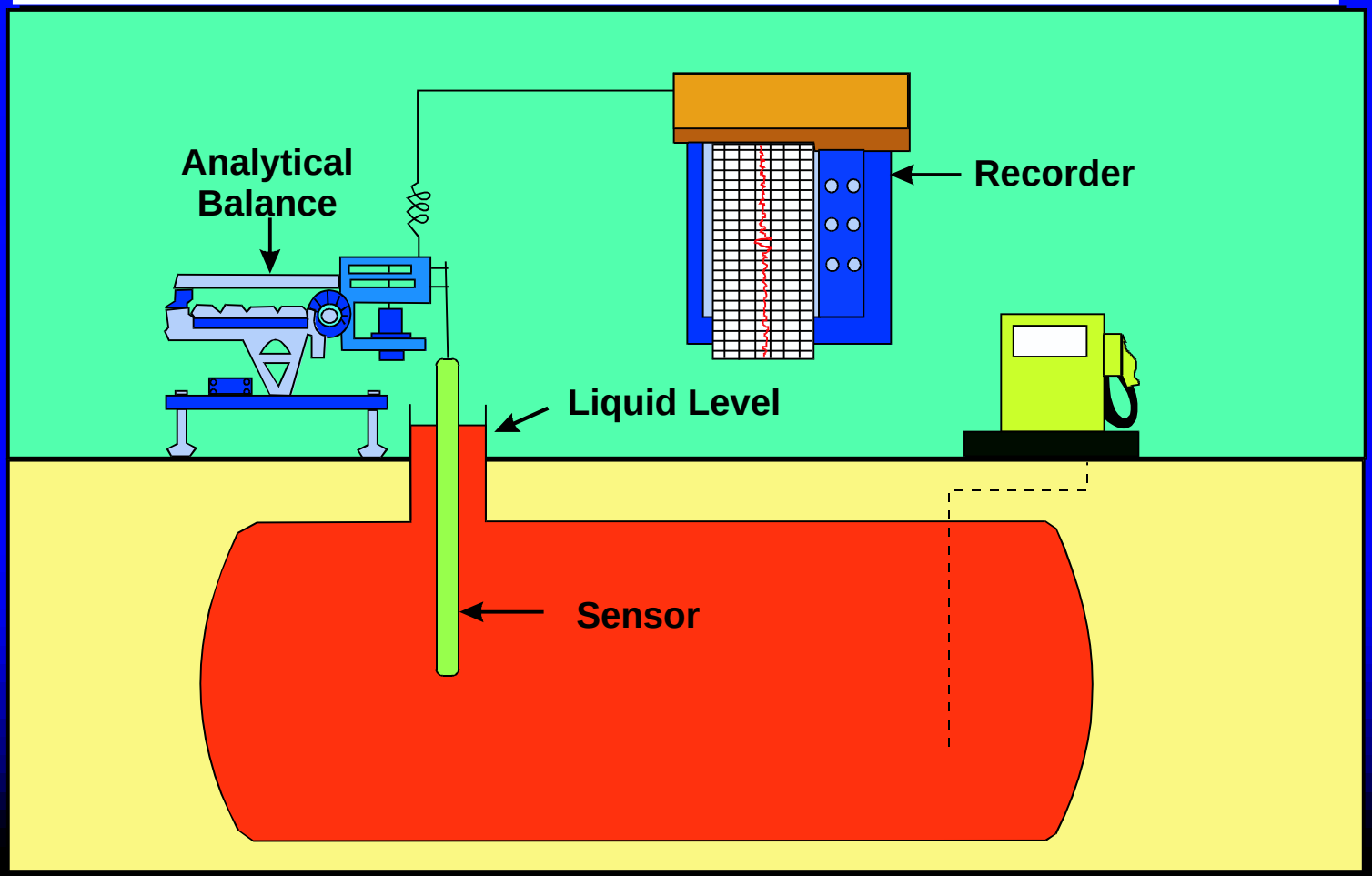
Schematic of PETRO TITE® System



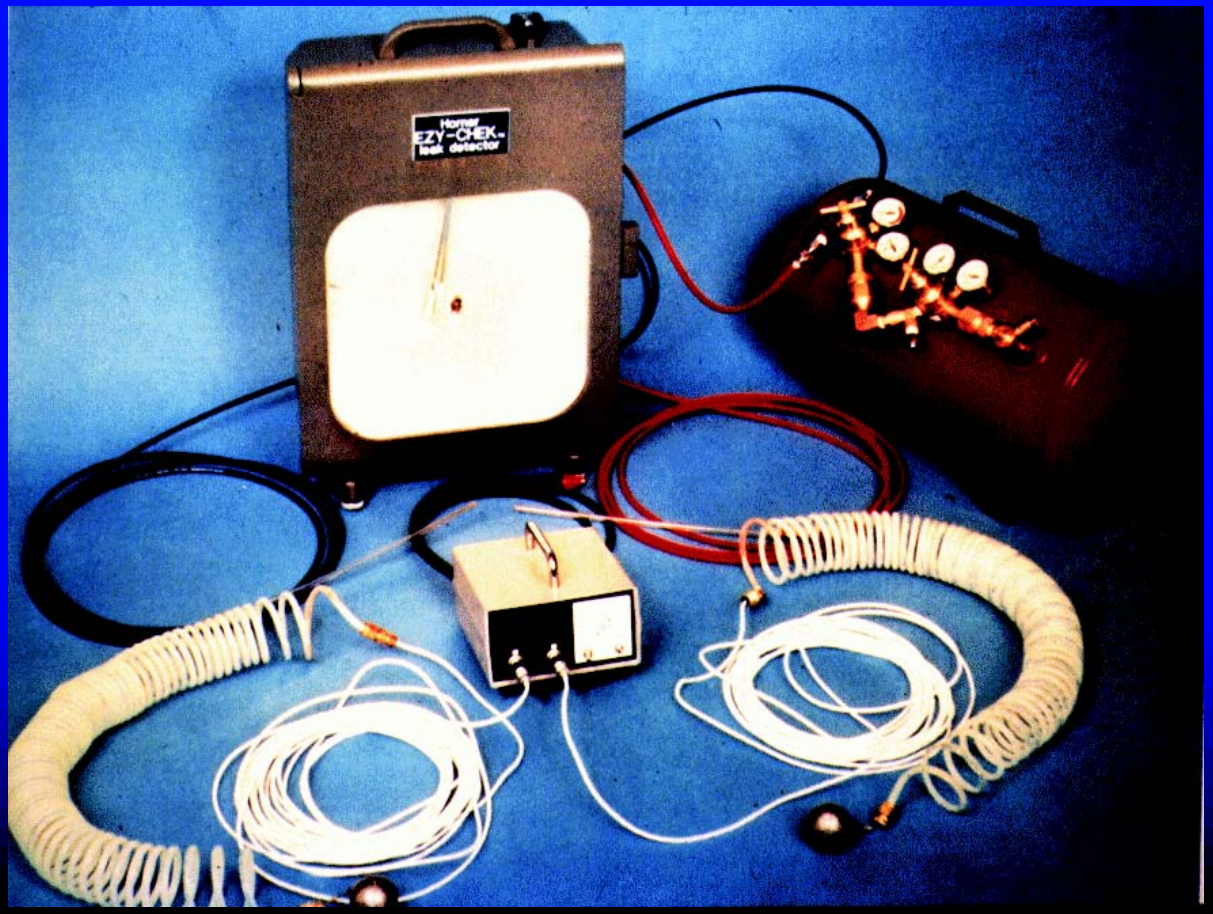
PETRO TITE® Tank Tester



Buoyancy Probe



Horner EZY-CHEK™ System



Tank Integrity Testing

- **Does not require capital expenditure**
- **Can be less expensive than external methods**
- **Provides an indication of the integrity of the tank systems, whether or not leakage is present**

Tank Integrity Testing (cont.)

- **Its reliability is uncertain.**
- **Testing it can be costly if system modifications or repairs are needed.**
- **Most methods require tank system to be taken out of operation for up to one day.**
- **It only provides a one-time indication of tank systems status.**
- **It does not provide an indication of environmental contamination.**
- **It does not provide frequent or continuous monitoring.**
- **It will be phased out between 1998 and 2008.**

Tank Integrity Testing

- **Training and experience requirement of technicians**
- **State certifications (if applicable)**
- **Detailed descriptions of each tank to be tested (as-builts)**
- **Tester to specify detailed procedures to be followed for testing and criteria to be used to evaluate data**
- **Tester to specify conditions necessary to conduct test**

Water Table Monitoring

Water Table Monitoring

- **Tank contents must be immiscible in water and have a specific gravity<1.**
- **Method must be capable of detecting a floating layer as small as 1/8 inch.**
- **Monitoring well must by placed so as to “best intercept” migrating releases.**
- **Soil must be sufficiently permeable to allow quick migration to detector.**
- **Water table must be no more than 20 feet from surface of ground (full or partial secondary containment must be used if water table is deeper than 20 feet).**

Water Table Sampling

Water Table Monitoring (cont.)

- **Some methods may be low cost.**
- **It can be used in shallow water tables.**
- **It can be used to monitor piping systems as well as tanks.**

Water Table Monitoring (cont.)

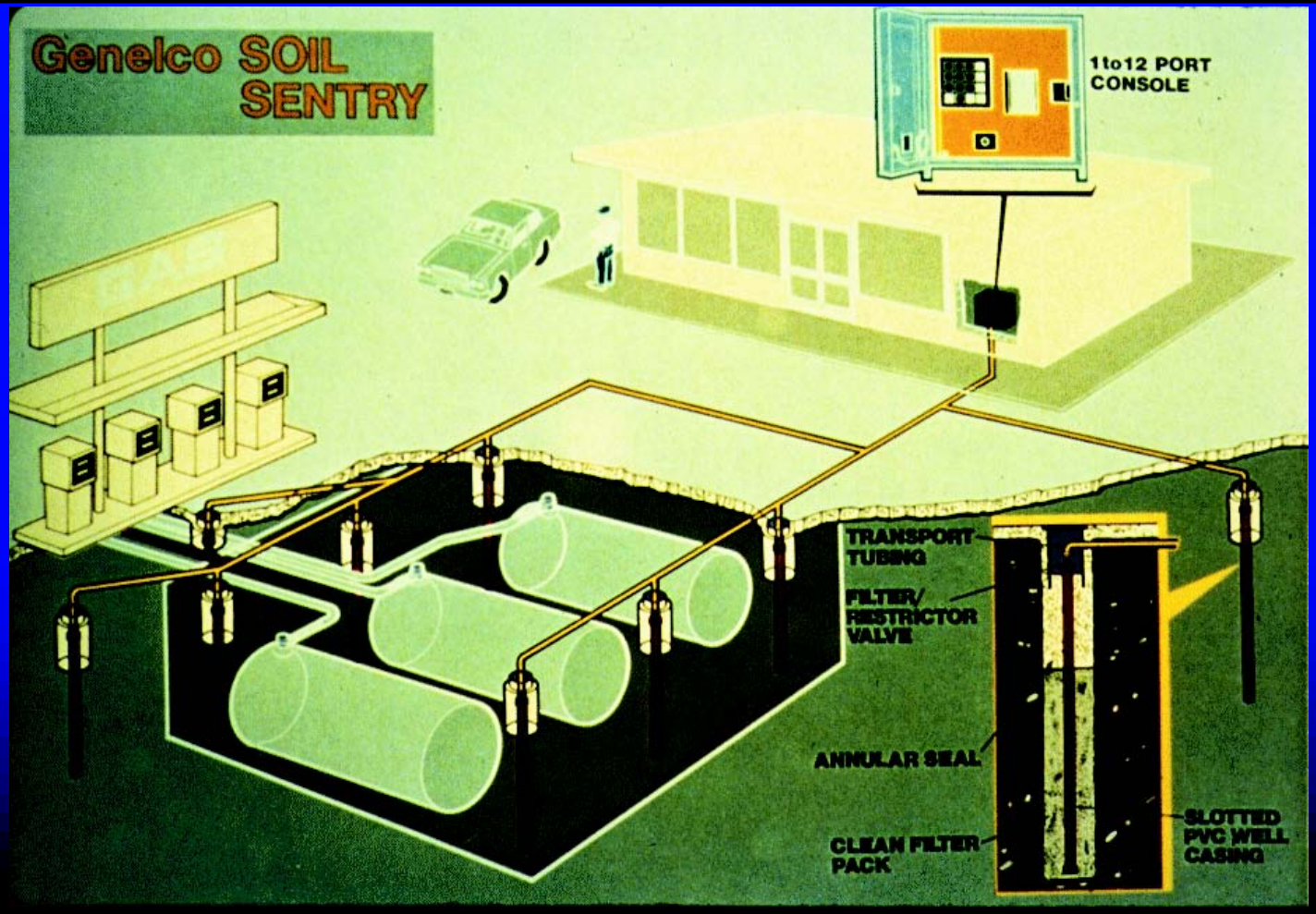
- **Detection of floating product means groundwater contamination has already occurred.**
- **Method is outlawed or discourged in some states without secondary containment.**
- **Water table monitoring cannot be sued when water table is more than 20 feet from ground surface at any time.**
- **Site assessment is required.**
- **It can be as costly as more sensitive vapor monitoring.**

Vapor Monitoring

Vapor Monitoring

- **Monitoring well must be in backfill.**
- **Tank contents must be volatile.**
- **Backfill must be permeable.**
- **Site assessment is required.**
- **Monitoring must be done at least every 30 days.**

Deployment of Cable-Type Leak Detector



Vapor Monitoring (cont.)

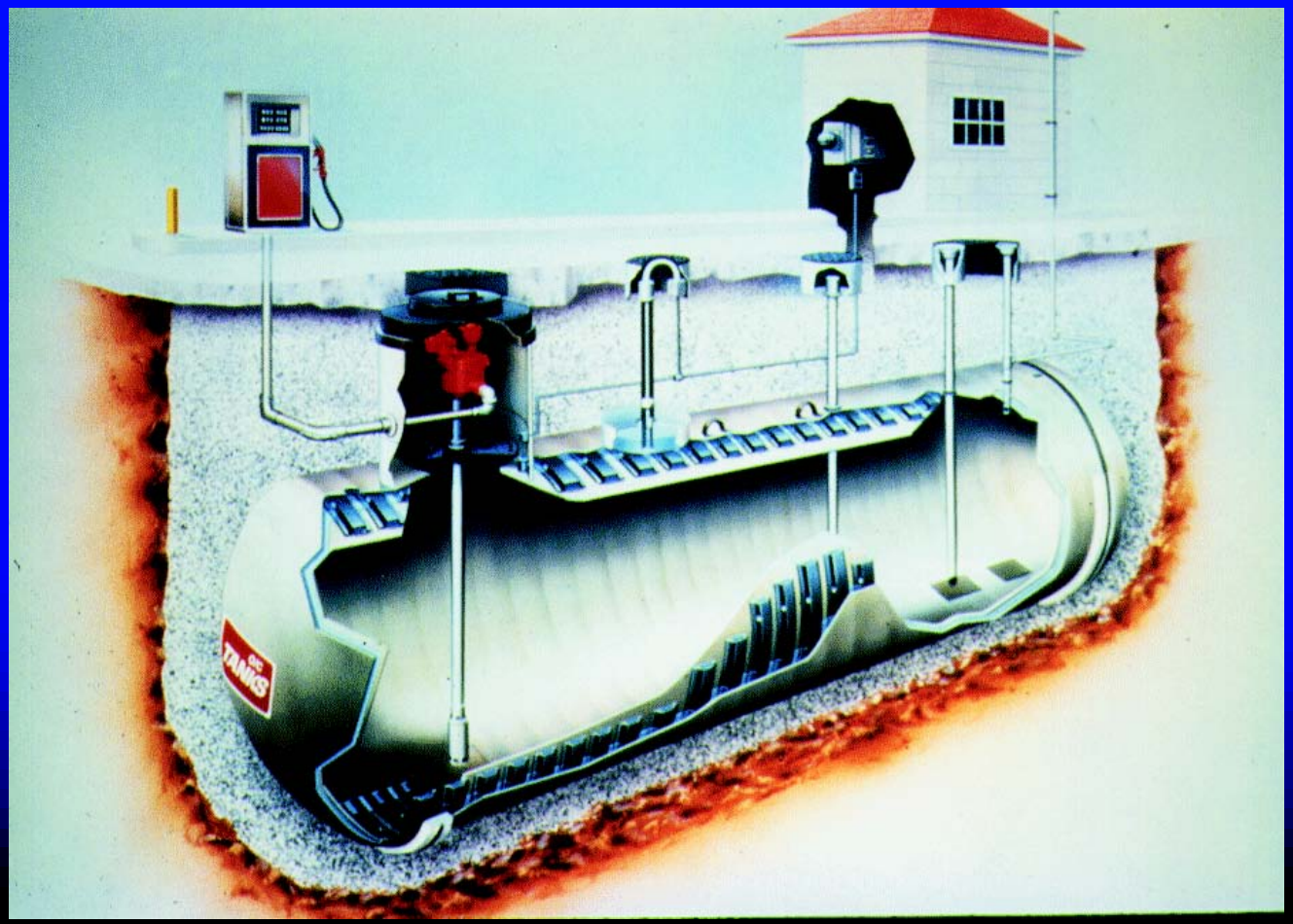
- **Sensitivity can provide quick response.**
- **Automatic systems can provide printed output or an alarm.**
- **Site operators can be locked out of the system to prevent tampering.**
- **Automatic systems can signal remote responders.**
- **Vapor monitoring can be used for piping systems as well as tanks.**

Vapor Monitoring (cont.)

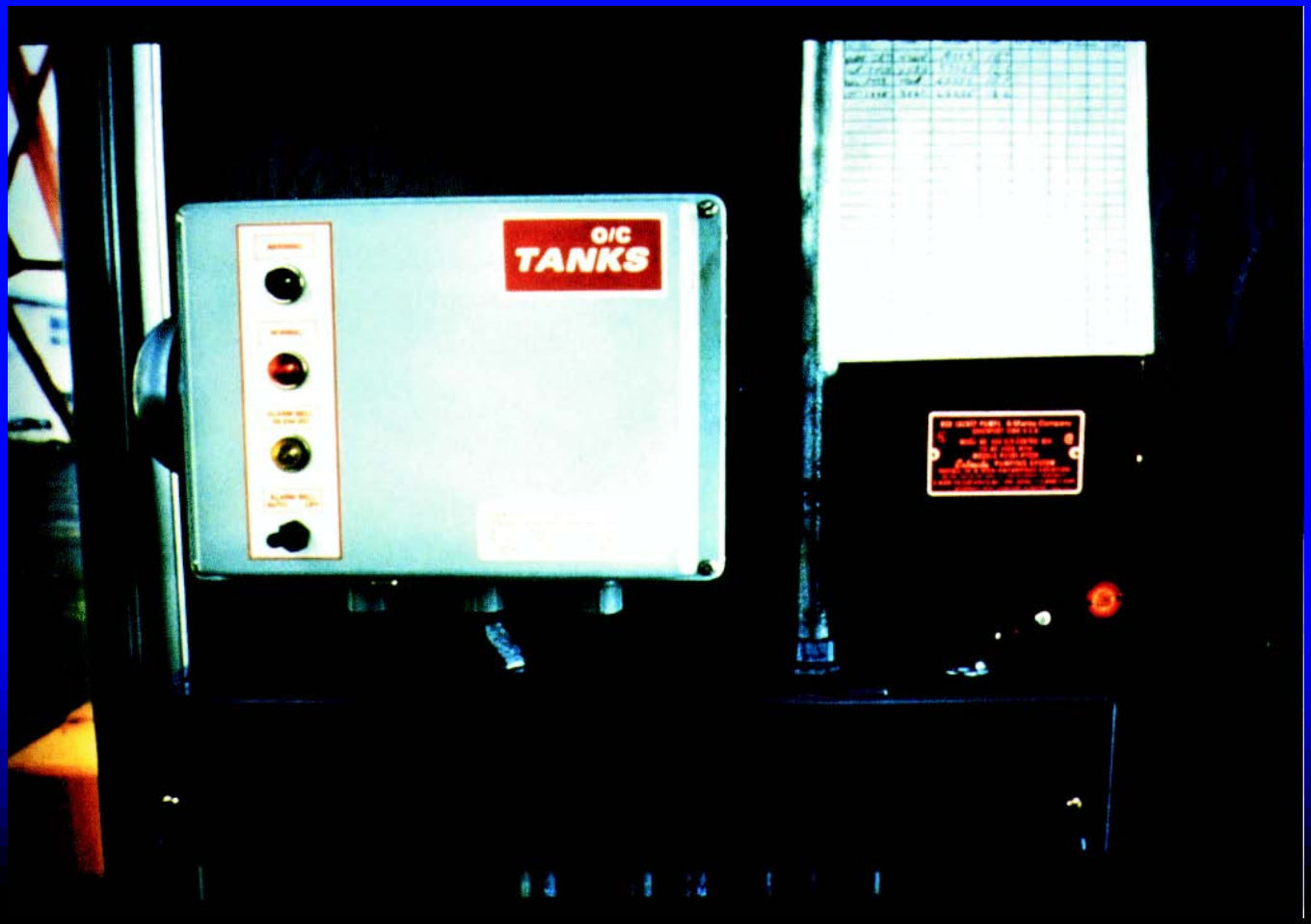
- **System can be overly sensitive.**
- **Vapor monitoring is not appropriate for shallow water tables.**
- **Automatic systems can be expensive.**
- **Sensitivity varies with volatility of tank contents.**

Synthetic Liner Containment

Interstitial Leak Detection



Interstitial Leak Sensing System



Secondary Containment

Secondary Containment

- **The controlled environment provides almost certain leak detection.**
- **Leaked product is contained for detection and response before any environmental contamination occurs.**
- **Vacuum and liquid head systems allow leaks to be detected before releases occur.**

Disadvantages

Double-walled tanks cost 40 to 120 percent more than single-walled tanks.

In-Tank Monitoring

In-Tank Monitoring

- **System must be able to detect leak rates as low as 0.2 gallons per hour when the tank is between 70 and 85 percent full.**
- **System must be operated in a tank test mode at least once every 30 days.**
- **Inventory records must be kept and reconciled monthly.**

In-Tank Monitoring (cont.)

- **It provides useful operational asset (inventory control) as well as leak detection.**
- **Accuracy improves with time.**
- **It eliminates need for manual inventory control.**
- **It reduces human error.**
- **Inventory can be monitored remotely.**

In-Tank Monitoring (cont.)

- **Cost is similar to vapor detection methods.**
- **Tank system must be shut down monthly during the test (four to eight hours).**
- **If one monthly monitoring event is missed during the year, another method must be used.**
- **It cannot be used for piping systems.**

Statistical Inventory Reconcilation

Statistical Inventory Reconciliation (SIR)

- **Inexpensive**
- **Can be reliable if thorough records are kept over long time periods**

Disadvantages

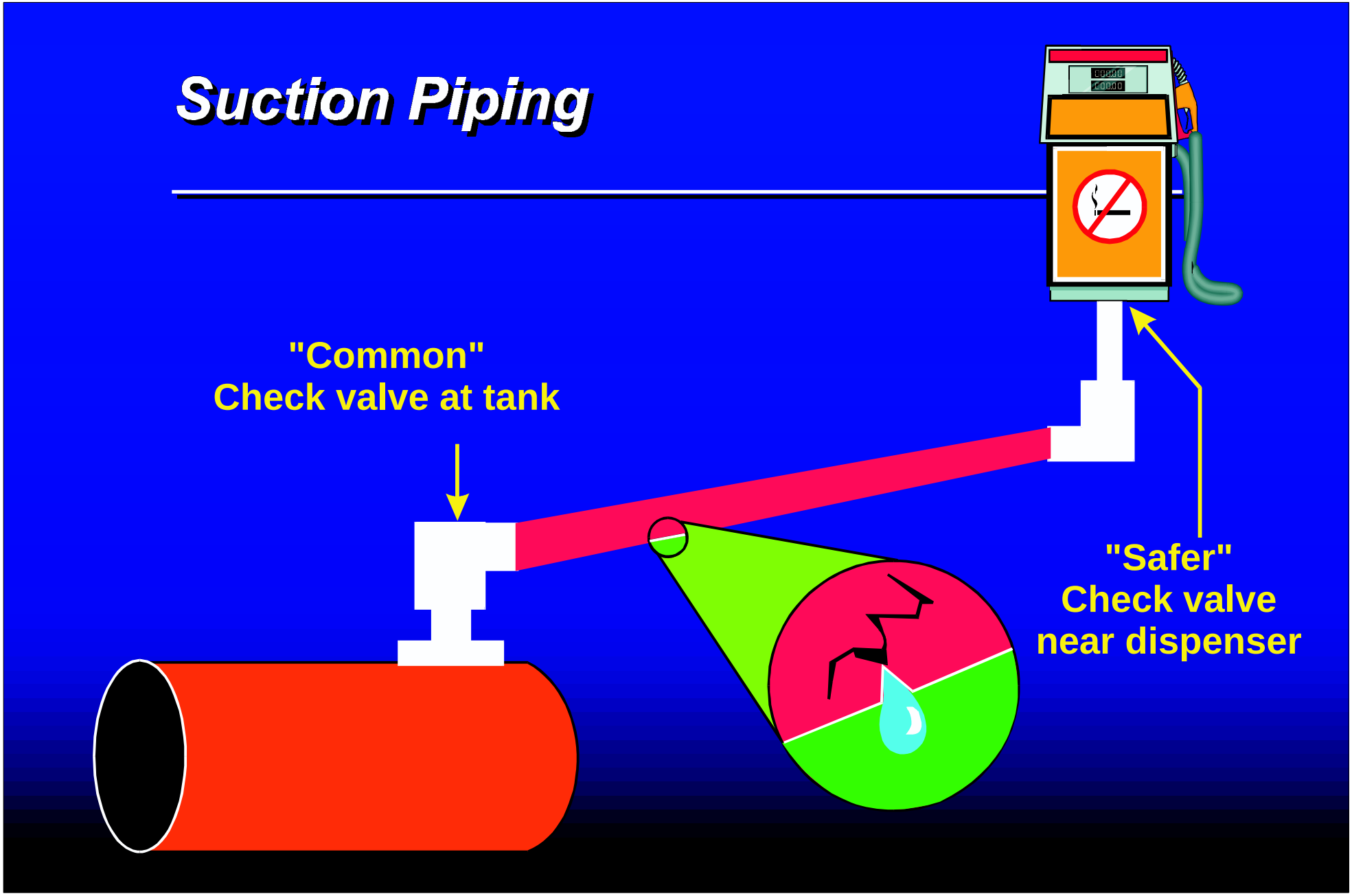
- **Does not provide an indication of environmental contamination**
- **Requires thorough records of daily activity (can be very difficult at remotely-operated sites or without highly dedicated personnel)**

Leak Detection for Piping

Piping System Requirements

- **Automatic shutoff,**
- **Annual test of pipe and automatic shutoff system, or**
- **External monitoring as with tanks**

Pressurized Line Detector


Suction Piping
"Common"
Check valve at tank
"Safer"
Check valve
near dispenser

Piping System Requirements (cont.)

- **Pressure test piping every three years, or**
- **External monitoring as with tanks**

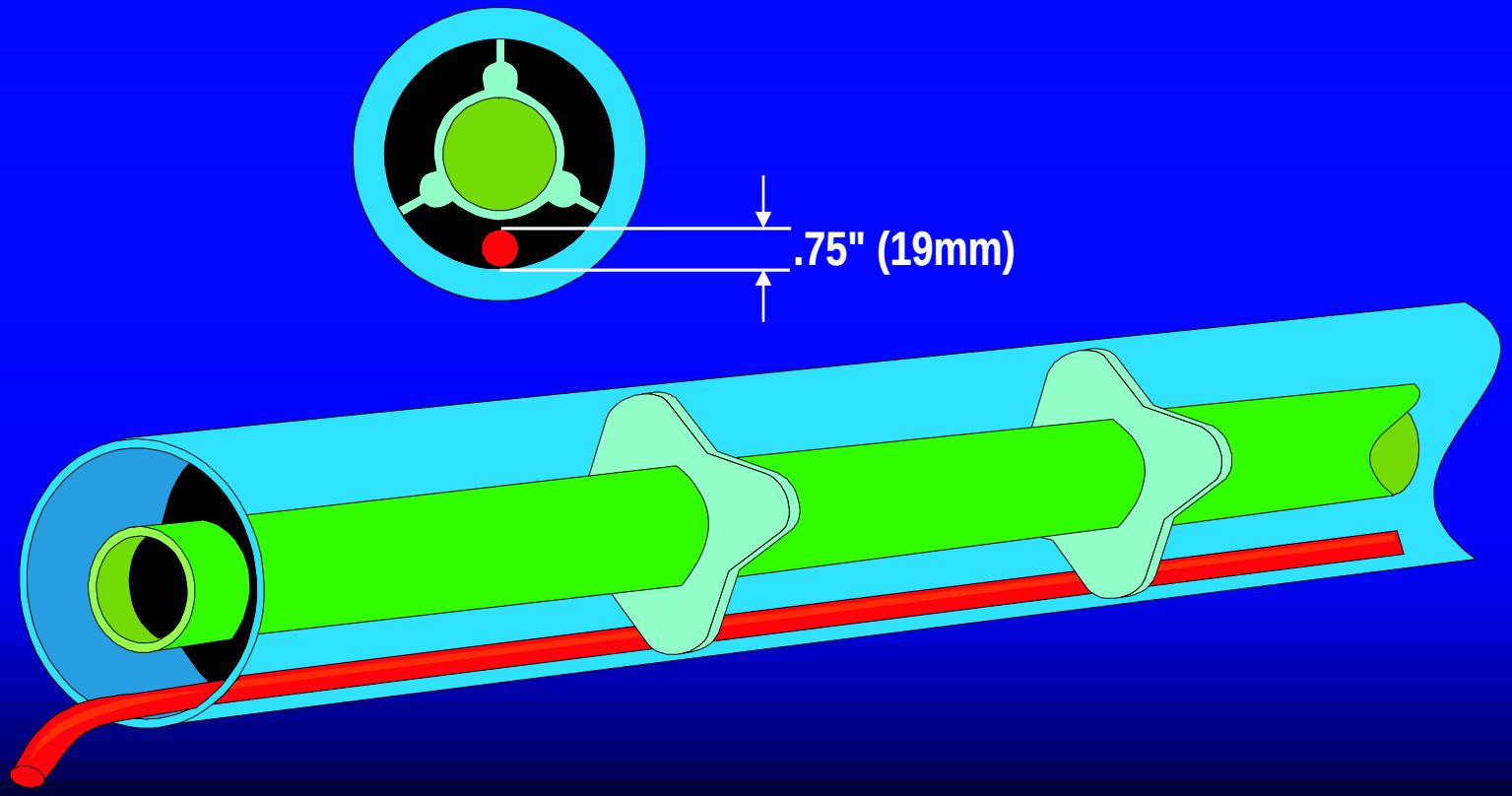
Piping System Requirements (cont.)

There are *no* requirements for "newer" suction systems.

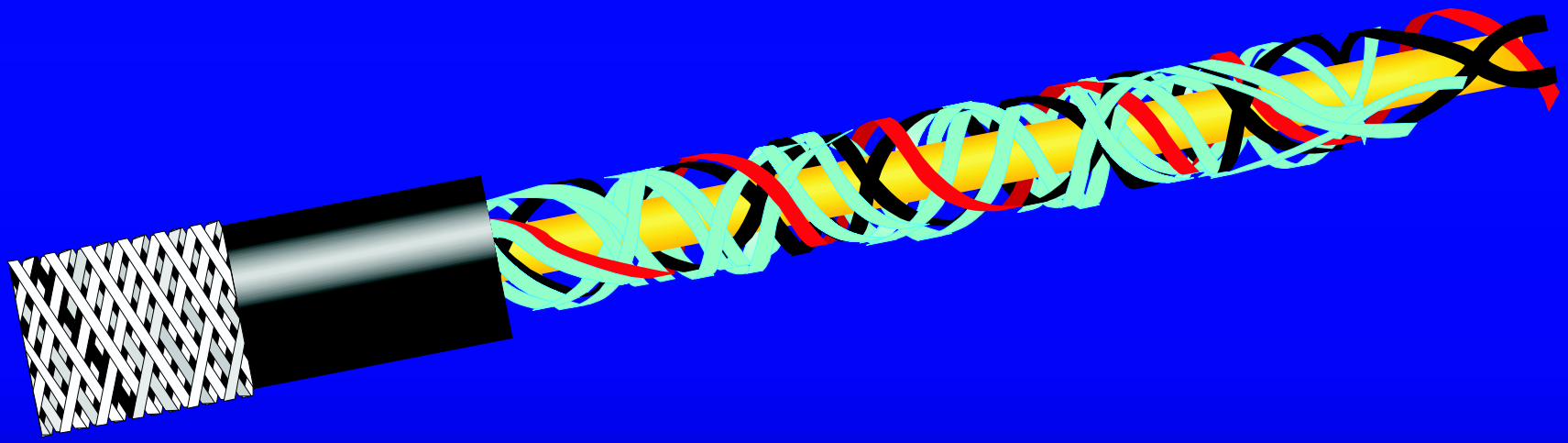
Piping - Secondary Containment

- **It can utilize same sensors as for tank lead detection systems.**
- **More typically, piping is sloped to an observation well or manway so leakage drains into well or manway is visually observed.**
- **Cable detectors are also available.**

Deployment of Cable-Type Leak Detector



Cable-Type Leak Detector



Flexible Piping System

Flexible Piping System

Reporting
&
Record Keeping

Record Keeping Requirements

- **Records must show results of last two annual inspections of corrosion protection equipment.**

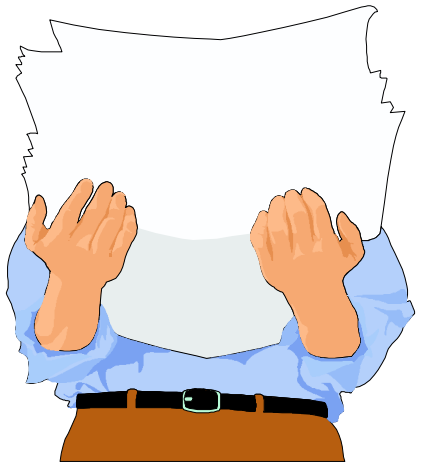
Repaired or Upgraded USTs

- **Records must be kept demonstrating the system was properly repaired or upgraded.**

Record Keeping Requirements

Leak Detection

- **Monitoring results for last 12 months (and most recent tightness test, if appropriate)**
- **Copies of manufacturer performance claims on leak detection equipment in use**
- **Records of any recent maintenance, repair, and calibration of equipment**



Record Keeping Requirements

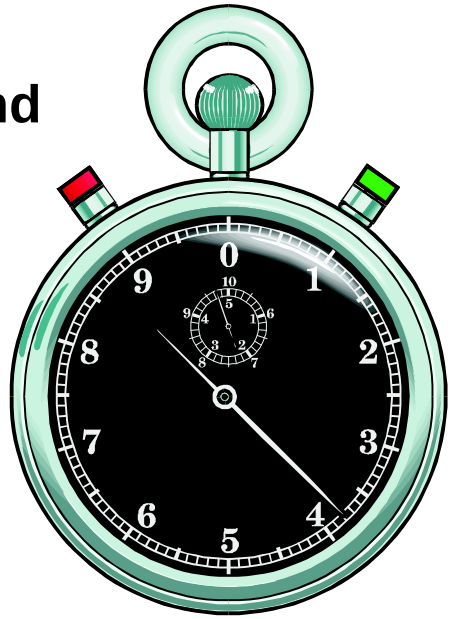
- **Site assessment results of permanent UST closures must be maintained for 3 years.**

- **Other records may be required by state programs.**

Reporting Requirements

Notification required within 24 hours for any of the following:

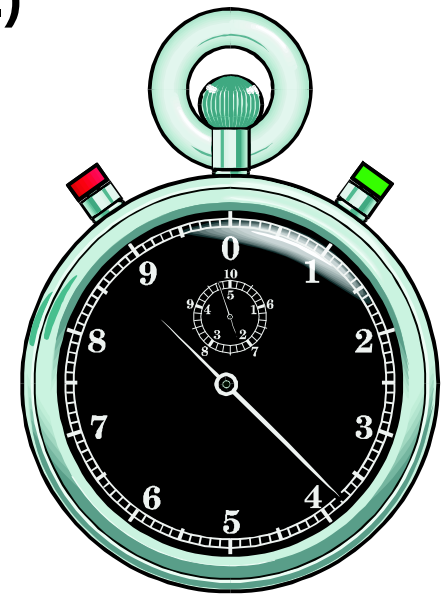
- Discovery of released substance on-site or in surrounding area.
- Unusual operating conditions not found to be tied to faulty equipment.
- Positive results from your monthly release detection method.
- In the case of inventory control, two consecutive months of data



Reporting Requirements

Notification also required for any of the following spill/overfill conditions:

- **Product loss in excess of 25 gallons. (Containment and cleanup should begin immediately.)**
- **A release that results in a sheen on nearby surface water.**
- **Any spill that equals or exceeds its CERCLA-reportable quantity.**



Corrective Action

Corrective Action

Within 24 Hours	● **Report suspected leaks** - **Report and cleanup spills and overfills** - **Alleviate imminent hazards**
Within 24 Hours	● **Investigate and confirm**
Within 20 Days	● **Report on initial abatement steps**
Within 45 Days	● **Complete site assessment** - **Report on free product recovery**
ASAP	● **Corrective action plan**

Corrective Action (cont.)

“All confirmed releases requiring a corrective action plan require public notice (by the implementing agency)”

Corrective Action Plan

- **Free product removal**
- **Groundwater treatment**
- **Treatment of soil in contact with groundwater**

Corrective Action Approaches

- **Pump and treat**
- **Soil vapor extraction**
- **“Bioventing”**
- **Thermal treatment**
- **Bioremediation (“passive” and active)**
- **Excavate and dispose**

Considerations in Remediation

- **Risk**
- **State/local cleanup requirements**
- **Design/capital costs**
- **Maintenance and operating costs**
- **Length of time**