New England Interstate
Water Pollution Control
Commission

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L.U.S.T.LINE

A Report On Federal & State Programs To Control Leaking Underground Storage Tanks

Command and Control of Vapors at UST Work Sites

by Deborah Roy

Within one week, last December in California, explosions occurred inside tanks at two different locations. When all was said and done, one worker had died and three had suffered severe burns. Tank accidents happen. They shouldn't. They needn't. But they do. They happen when people are in a hurry and cut corners, or when site conditions change and the hazards are not recognized.

Despite the obvious potential for death from explosion, severe burns, petroleum or other chemical exposure, physical injury from heavy equipment, and lacerations and contusions from flying metal parts, many people who work around tanks do not, or do not want to, recognize the ever-present potential for danger. But tank-related accidents and near misses do, in fact, occur, and they occur all too often. Unfortunately, there is no system for recording and maintaining records of the number of tank-related accidents, deaths, or injuries in the United States.

The 1998 deadline will certainly add to the pressure on UST contractors and inspectors. For this reason, it will be even more critical for workers to be properly trained, to have adequate supervision, and to follow safe procedures. In my experience, most accidents occur because of poor control of vapors combined with the introduction of ignition sources. In this article, I'll discuss the safe handling of USTs and control of vapors during removal operations.

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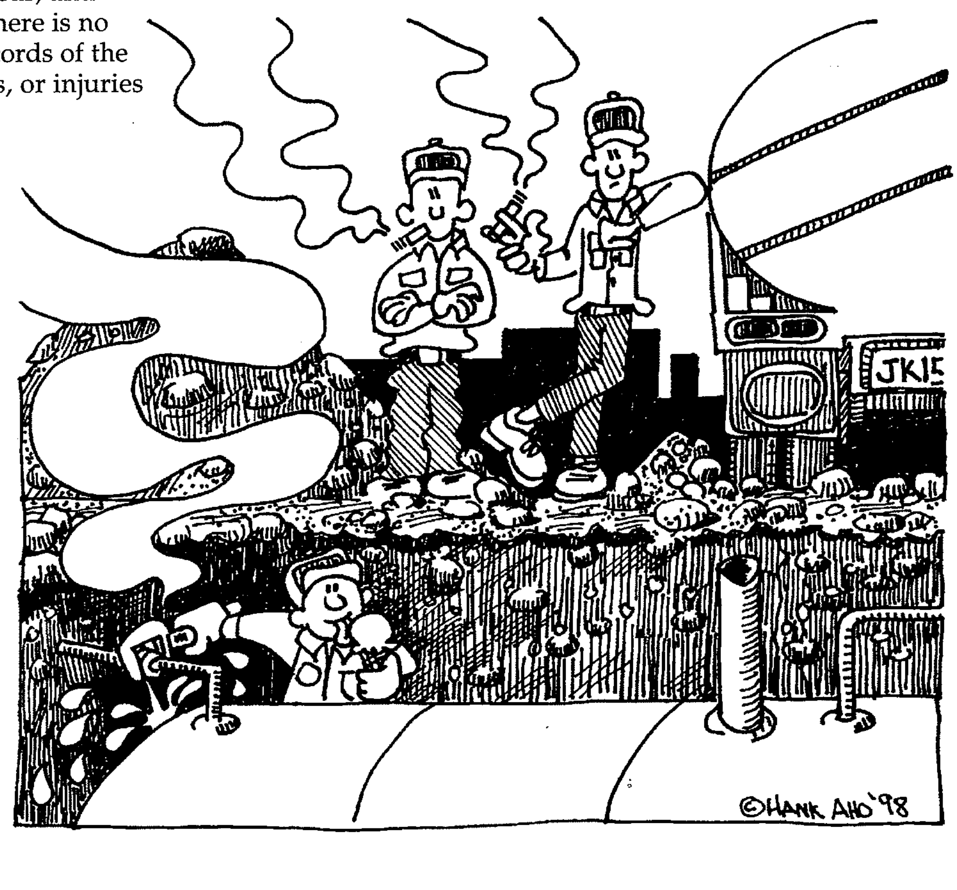

Inside

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OSHA Says...

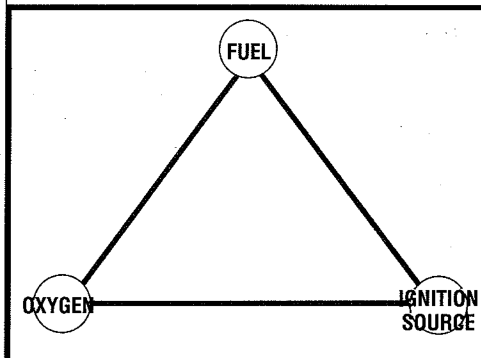
The California explosions resulted in Occupational Safety and Health Administration (OSHA) citations that illustrate the hazards that exist on UST sites when safety procedures are bypassed in order to save time. In both accidents, the tanks had not been purged of flammable vapors prior to work, the atmosphere inside the tanks had not been tested, and ignition sources had been introduced inside the tanks. In addition, both accidents involved tank lining operations, and some of the workers were actually in the tanks at the time of the explosions. Jobs such as tank cleaning, lining, and interior inspection involve a number of physical hazards in addition to the health effects from flammable liquids.

Since 1987, OSHA has required that anyone working on a hazardous waste site have health and safety training. These requirements involve 40 hours of initial training and an annual 8-hour refresher course. Hazardous waste sites include UST removal operations and corrective actions that involve tanks that contain or have contained chemicals or petroleum products. For certain types of tank work, OSHA's confined-space entry standard may apply. This standard also includes the training of workers and supervisors, if they are to enter a tank.

These OSHA regulations apply regardless of the type of chemical or petroleum contained in the tank. Products such as #2 fuel or diesel and heavy fuels such as #4, #5, or #6 may not be as flammable as gasoline, but they still constitute a health risk and, hence, require health and safety training.

The Fire Triangle

In order to create a fire or explosion, three elements are needed: an ignition source, fuel, and oxygen. These elements make up what is known as the "fire triangle." Let's look at each corner of the triangle.



Eliminating Ignition Sources

In tank removal, the possible presence of petroleum and chemical vapors is of paramount concern. Potential ignition sources need to be eliminated before heavy equipment is used in the vapor hazard area. Sources of ignition include heat, flame, static electricity, or any other process or equipment that produces a spark. Smoking is one of the most common sources of ignition and should be banned on the entire work site.

It is not unusual to see workers who are between tasks, stand and smoke near a tank excavation, downwind of the vapors, seemingly oblivious to the possibility that a hazard exists. Because the odor threshold for smelling gasoline is quite low, most people can't tell the difference between high and low concentrations in the air. In addition, gasoline vapors are heavier than air and will travel along the ground to remote areas of the site or collect under vehicles and other obstructions. Turning a vehicle ignition to the "on" position or keying a two-way radio may be enough to ignite accumulated vapors. For this reason, some local ordinances require that open flames and spark-producing devices be banned within 50 feet (or more) of a vapor hazard area.

On these hazardous work sites, it is essential that any electrical equipment be "explosion-proof"—that is to say, it should have a case that can withstand an explosion from within. Examples of such equipment are explosion-proof blowers used to vent flammable vapors out of a tank so that a worker can enter to clean it, or low-voltage or explosion-proof lighting used to illuminate work areas. Tank workers and inspectors need to use electronic equipment such hand-held radios and air monitoring equipment that is intrinsically safe and will not create a spark while operating in the vapor hazard area. Nonsparking tools, such as those made of brass or brass-coated, need to be used to perform tasks such as detaching piping from a tank.

Static electricity is an ignition source that is often forgotten. Movement of air or compressed gas, as well as movement of liquid, in a pipe or hose can cause static. To eliminate static electricity, a conductive path to discharge the static electricity can be created by connecting both ends of the flow conduit (e.g., the hose fitting to the tank and the other end to the truck) and then grounding the mechanical device that is moving the liquid or gas.

Other sources of ignition on a tank site include smoking materials thrown by bystanders or cars passing the site. Vehicular traffic can cause static electricity if metal components touch the ground and cause a spark. Underground utilities or other metal debris in the soil can create a spark when struck with a backhoe. Frayed electrical cords on power tools or extension cords with exposed wires can also create an ignition source.

LUSTLine

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Controlling Flammable Vapors

Flammable substances have a range of concentrations that will burn when the other two elements of the fire triangle (i.e., ignition source and oxygen) are present. A sufficient concentration of vapor to cause a fire or explosion will occur only if the temperature of the substance is above its flashpoint (i.e., the temperature at which a liquid will produce sufficient flammable vapors to support combustion). For example, gasoline generates enough vapors to support combustion at any temperature above minus 43 degrees Fahrenheit, its flashpoint. Fuel oil, on the other hand, has a flashpoint between 110 to 190 degrees Fahrenheit, depending on the grade of oil.

Flammable vapors may come from a variety of sources on a tank removal site. If the tank has leaked, excavating the contaminated soil will allow fresh vapor to evolve. Often the soil will be contaminated from overfills, even if the tank did not leak. The tank itself is a source, as is the piping, even after the product is removed, because residual product remains in the pores of the metal, causing the tank and piping to regenerate vapors over time. These vapors can accumulate to potentially explosive concentrations within the confined space of a tank or piping.

If not properly positioned, the vacuum truck used to remove residual product and vapor from the tank can also add a significant amount of vapor to the site. This potential build-up of vapors is particularly true if the flammable vapors are vented at ground level or if they are vented beneath an obstruction such as the pump canopy.

In general, the industry standard is to vent the vapors at least 12 feet above grade and at least 3 feet above adjacent structures. Some states have mandated these standards. If vapors are not properly vented and/or tall structures surround the site, the amount of vapor at ground level may accumulate within the flammable range of the chemical or petroleum product. Any ignition source introduced to the site may then cause an explosion.

Vapor hazards are often made worse by poor work practices that allow fresh product to be introduced into the soil on the tank site. This occurs when pipes are not properly drained prior to removal or when a tank with residual product is further damaged by the backhoe. Time pressure to finish the operation is often the cause of these incidents.

Monitoring is often the place in the vapor control procedure where tank workers take shortcuts. It can't be emphasized enough, however, that proper air monitoring is the only way to determine if atmospheric hazards exist.

Purging and Inerting Vapors

Control of vapor sources from the tank itself is accomplished by purging or inerting the tank. This procedure varies depending on state or local codes or on local tradition. A few states, including Maine, allow tanks to be removed while they are "overrich" (i.e., when vapor levels exceed the upper explosive limit; see LEL discussion below). This practice is not recommended but is becoming more common as the 1998 tank removal deadline looms.

Purging involves ventilating the tank and diluting the flammable vapors with air. This procedure reduces the fuel component of the fire triangle. Even though the oxygen and ignition components may still be present, fire or explosion will not occur. The two common methods of purging involve the use of a diffused-air blower or an eductor-type air mover. Either method requires bonding the pipe to prevent static buildup. It is important to always remember that purging is a *temporary* method of reducing flammable vapors. Sludge and product trapped in the tank pores will eventually evolve more vapors.

Vapor buildup is a particularly important consideration when a tank is removed and left on a trailer for a period of time or moved a distance to a tank yard. In fact, tanks should be considered to be "time bombs" during all phases of any tank removal operation.

Inerting involves reducing the concentration of oxygen by replacing it with an inert gas such as carbon dioxide or nitrogen. This method eliminates the oxygen element of the fire triangle, leaving the fuel and ignition elements, which cannot, by themselves, support combustion.

During the inerting procedure, carbon dioxide gas is generated through the use of dry ice, which should be distributed evenly in the bottom of the tank. The dry ice releases carbon dioxide as it warms. The amount needed is usually 15 to 20 pounds per 1,000 gallons of tank capacity. For example, a 10,000-gallon tank will require at least 150 pounds of dry ice to be properly inerted. Carbon dioxide inerting takes longer than some other methods because there is no additional air movement in the tank. Tank workers frequently underestimate the amount of dry ice or try to speed up the process. Monitoring the air in the tank is the only way to tell if the tank is safe to handle.

Nitrogen gas can also be used to inert a tank. Using nitrogen involves placing a hose in the tank and pumping the nitrogen gas into the bottom of the tank. Bonding and grounding of the cylinder nozzle is needed to prevent static buildup. This method may be quicker than using dry ice, but air monitoring is still needed to determine if the oxygen has been sufficiently removed.

As with purging, inerting is a temporary method of making a tank safe. If there are holes in the tank, oxygen may be reintroduced and an explosion could occur. The reintroduction of vapors is a particularly important consideration when a tank is removed and left on a trailer for a period of time or if it must be transported long distances to a tank yard.

Monitoring the Atmosphere

To determine if the tank is safe to handle and the site is safe for working, the air, both inside and outside the tank, must be monitored. Monitoring is often the place in the vapor control procedure where tank workers take shortcuts. It can't be emphasized enough, however, that proper air monitoring is the only way to determine if atmospheric hazards exist. The concentration of vapor cannot be determined by odor.

■ *continued on page 4*

■ Command and Control of Vapors at UST Sites *from page 3*

There are two types of measurements, depending on whether the tank has been purged or inerted: lower explosive limit (LEL) and oxygen concentration. Both can be measured by using a combustible gas indicator, or detector, which has separate sensors that read oxygen and LEL (and sometimes other substances) independently. Oxygen is measured based on the percent by volume in air. Normal air has approximately 21 percent oxygen. Levels below 11 percent oxygen will not support combustion.

Explosimeters should never be used to measure oxygen when a tank is being inerted. Keep in mind that 11 percent oxygen is needed for an explosimeter to work. If oxygen is reduced because carbon dioxide or nitrogen have been added, the meter will not work properly.

The LEL is based on the flammable range of the substance. For example, gasoline has a flammable range of 1.4 to 7.6 percent by volume in air. The LEL on the combustible gas indicator is based on 0 to 100 percent of the bottom of the flammable range, so for gasoline 10 percent of the LEL would be 0.14 percent by volume in air. This would translate to 1,400 parts of gasoline per 1 million parts of air. According to the OSHA standard, the safe level for tank work is below 20 percent of the LEL. Many contractors do not consider a tank safe to work with until readings are are 10 percent of the LEL. The API recommended practice 1604 (1996 edition), *Closure of Underground Petroleum Storage Tanks,* requires readings of 10 percent of the LEL for tank work.

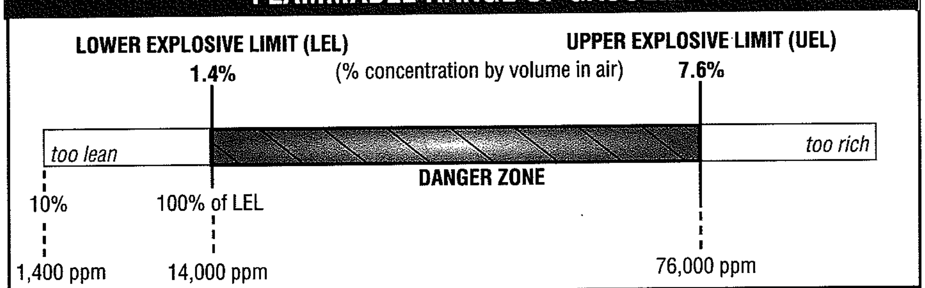
Tank workers are often confused about which meter to use for purging or inerting, oxygen or LEL. The key is to remember which element of the fire triangle is affected. For purging, the fuel concentration is reduced. This means that the air monitoring measurement should test for flammable vapor levels in the tank. The LEL sensor on the combustible gas indicator will test for vapor concentration. This level needs to be below 20 percent. Some contractors will continue purging until the LEL is below 10 percent. If workers must enter the tank, the LEL must be below 10 percent according to the OSHA confined-space entry standard.

Inerting, on the other hand, deals with removing the oxygen element of the fire triangle. Therefore, to determine if the tank is safe, you must measure for oxygen. Most contractors will inert a tank until the oxygen level is 0 to 8 percent by volume in air.

The combustible gas indicator needs to be calibrated every day prior to its use. Between readings on the site, move it away from the vapor hazard area to fresh air in order to clear the instrument. Do not use the combustible gas indicator to test a tank that is full of gasoline because doing so will poison the LEL sensor and damage the instrument.

Although it is not recommended, moving a tank to a remote site in an overrich condition for cleaning is sometimes done. If so, a different meter is needed to determine if the concentration in the tank is above the upper explosive limit (UEL). This meter is a type of combustible gas indicator called a Gascope. It reads the flammable vapor levels in percent by volume. For gasoline, the UEL is 7.6 percent. The safe level for transporting a tank in an overrich condition has not been documented. If done, however, be sure that the tank is at least 15 percent by volume in air prior to transport.

FLAMMABLE RANGE OF GASOLINE



Looking Ahead

Working with underground storage tanks can be dangerous, but there are procedures that can make the process safer. Control of ignition sources, control of flammable vapors, and use of proper air monitoring equipment are important tools for achieving a successful tank removal. Other hazards, such as exposure to chemicals, confined-space entry, and accidents associated with careless use of heavy equipment also need to be understood. We'll touch on more of these topics in future issues of *LUSTLine.* ■

Deborah Roy, MPH, RN, COHN-S, CET, ASP, is President of SafeTech Consultants, Inc., in South Portland, Maine. For more information, contact Deborah at (e-mail) info@stci.com.

For More Information About Safety During UST Removal...

OSHA Standards

- 29 CFR 1919.120 *Hazardous Waste Operations and Emergency Response.*
- 29 CFR 1910.146 *Permit-Required Confined Spaces.*

American Petroleum Institute (API) Recommended Practices

- *Safe Entry and Cleaning of Petroleum Storage Tanks,* API 2015 (May 1994). Price: $70.
- *Closure of Underground Storage Tanks,* API 1604 (1996). Price: $40.

Order from: American Petroleum Institute, Order Desk, 1220 L Street, N.W., Washington, D.C. 20005. (202) 682-8375.

Tank Closure Without Tears—An Inspector's Safety Guide (Video and Booklet)

Developed to train inspectors, this video provides a general overview of safety procedures and issues associated with tank closure, including what causes fires and explosions, preparing a safe workplace, preparing the tank, getting rid of flammable vapors, cleaning out sludge, closing in place, and tank disposal. The video is 30 minutes long; the booklet is 20 pages. Price: $35 for video and booklet; $15 for loan; $30 for video; $5 for booklet.

Order from: New England Environmental Training Center, 2 Fort Road, South Portland, ME 04106. (207) 767-2539.

From Out of the Depths...

Aboveground Fuel Storage Systems Take Off Running

by Wayne Geyer

Much of *LUSTLine* has centered on the subject of leaking underground storage tanks. Over the past six years or so, however, we have noted an increasing use of aboveground storage tanks (ASTs) to store hazardous and combustible liquids. AST systems have been the choice at many government facilities, military bases, schools, hospitals, and private fleet fueling facilities, and for storing chemical/industrial liquids.

The ASTs to which I refer are not those clusters of vertical tanks often seen at bulk storage facilities, isolated far away from buildings and human activity. Rather, today's most common AST applications consist of one or two horizontal tanks placed within 25 feet of important buildings, property lines, or public ways.

While many of these horizontal ASTs are cylindrical, some have more rectangular configurations. The flat tops of rectangular tanks provide more flexibility in locating the numerous fittings and components required for safe and proper operation. Maintaining these components is easier, as is accessing the fill opening, because the awkwardness of climbing ladders and balancing on catwalks is alleviated.

Most of these tanks are small—2000-gallon capacity or less. Steel Tank Institute (STI) statistics over the past several years indicate that the average tank size is approximately 3,500 gallons. This is significantly smaller than the 10,000- to 12,000-gallon UST typically installed at retail service stations.

Our statistics also show that Class II combustible liquids (e.g., diesel fuel) account for nearly two-thirds of the AST applications. The least common AST application, retail service stations, accounts for less than 3 percent of AST purchases from STI Members.

The Fire Code Wake-Up Call

Using ASTs to store motor vehicle fuel at private fueling facilities has, without a doubt, been the most significant new trend. Prior to 1992—prompted by several catastrophic fires back in the 1960s and early 1970s—the fire codes either restricted or prevented this type of usage, except in the case of smaller tanks in rural areas. Also, ASTs were occasionally overfilled, increasing the likelihood of a surrounding pool fire. Furthermore, if the tanks were not properly equipped with emergency vents, the flammable liquid would quickly vaporize inside the tank during a fire, leading to overpressurization. Because these tanks were designed for atmospheric pressure only, excessive pressure could cause the tank heads to eject outward, like a missile.

As media attention focused on LUSTs, release detection, tank testing, and expensive soil and groundwater cleanup efforts, aboveground storage provided an attractive alternative.

Nevertheless, in the early 90s, tank owners seeking alternatives to underground tank storage began installing more aboveground tanks—even with the code limitations. As media attention focused on LUSTs, release detection, tank testing, and expensive soil and groundwater cleanup efforts, aboveground storage provided an attractive alternative. Tank owners could visually examine their storage system for releases, without the additional worry of UST financial responsibility. Some states began to consider legislation that would allow ASTs at fueling facilities in an effort to balance both tank owner and environmental concerns.

This wave of interest in ASTs was the wake-up call in the fire code arena; fire prevention associations sought to follow the same track in writing codes for aboveground storage tanks as they did for underground installations.

Code Evolutions

The National Fire Protection Association's (NFPA's) Automotive and Marine Service Station Committee modified NFPA 30A with a Tentative Interim Amendment (TIA) in 1992. The TIA provided code language for the safe installation of ASTs in a concrete vault or room. Each vault, whether below or above grade, enabled detection of liquids and vapors, allowed personnel access for physical inspection of the tank walls, and provided means to remove water and flammable liquids. For more hazardous Class I liquid (gasoline) storage, the code required a ventilation system within the vault.

By 1993, both the Uniform Fire Code and NFPA 30A had expanded or created means for aboveground storage of motorized fuels, in capacities of up to 10,000 or 12,000 gallons. The Building and Officials Code Administration's National Fire Prevention Code and the Southern Building Code Congress International's Standard Fire Prevention Code followed suit shortly thereafter. The Uniform Fire Code, which strictly prohibited this type of usage prior to 1993, added Appendix II-F to provide local jurisdictions with the option of allowing ASTs for fueling vehicles. The UFC required tanks be secondarily contained and insulated to meet a 2-hour fire rating. The NFPA allowed single-walled tanks in dikes, secondary contained tanks, or fire-resistive tanks. The fire-resistive tank could be installed closer to a building than the traditional UL

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■ ASTs *from page 5*

142 tank. NFPA has also increased the allowable AST storage capacities to 20,000 gallons at nonretail diesel dispensing facilities.

The codes have a number of requirements designed to prevent releases from ASTs—secondary containment is one consideration. However, because fire prevention is best addressed by simply eliminating the chance of a release, preventing overfills during deliveries was a high code priority. Obviously this concept is not much different from the philosophy of preventing releases from UST systems. The codes generally require three controls: 1) a gauge on the tank, 2) an audio and/or visual high-level alarm, and 3) an automatic shut-off device.

The codes also require antisyphon devices, openings only at the top of the tank, thermal expansion relief devices, and emergency venting of the primary tank and all secondary containment areas. As stated earlier, the emergency vent is the most important device should a fire occur, regardless of whether the tank is fire-protected. Tank owners must make sure that both emergency and normal vents are operable and maintained...always!

By the way, the goal in pointing out these code changes is give you an idea of how the industry has evolved and continues to evolve in terms of accommodating ASTs. If you really need to know the specifics about a particular code, you'll need to roll your sleeves up and dig into the code itself.

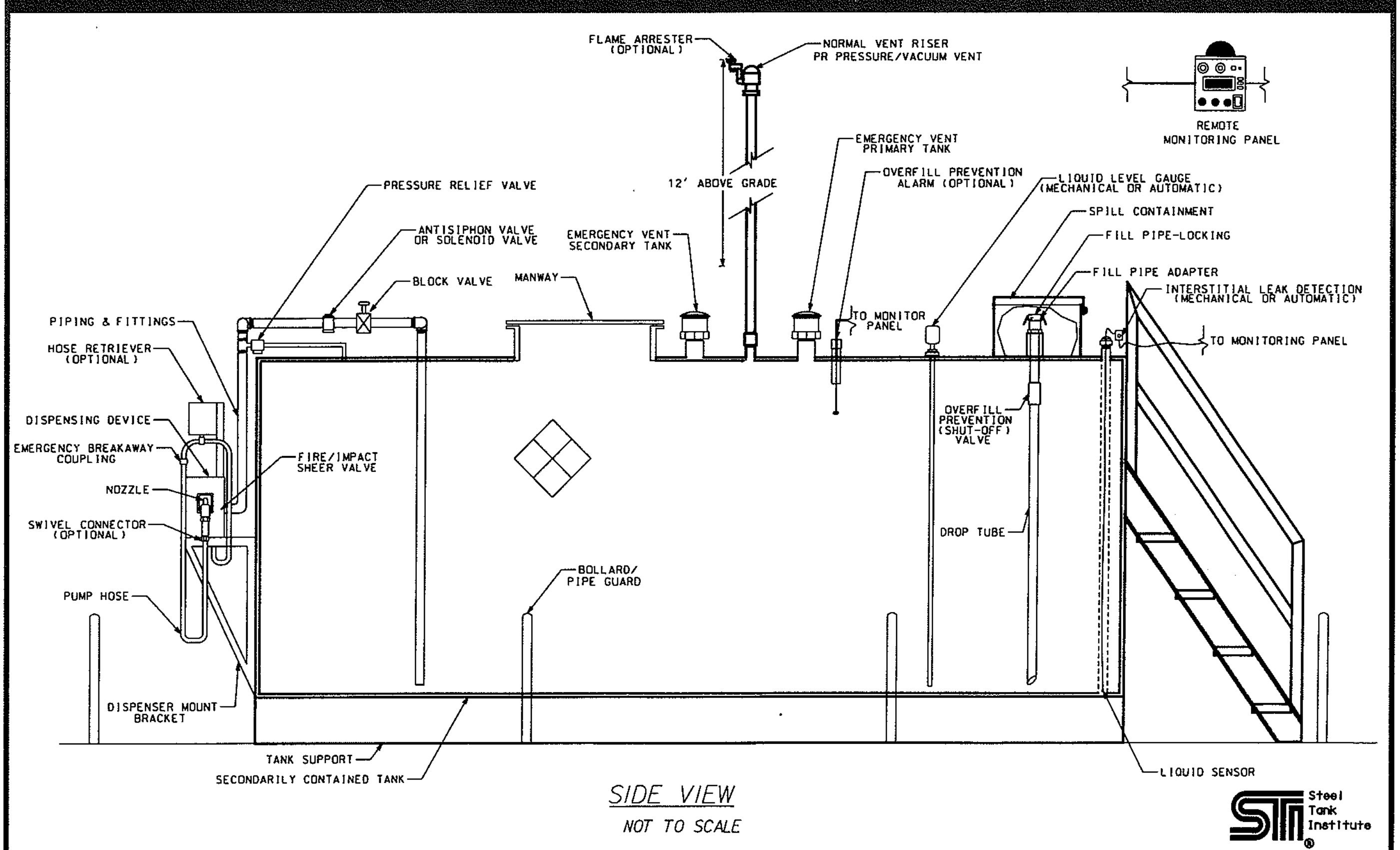
New Fabrication Standards

Along with the code changes, fabrication standards also experienced significant activity. Underwriters Laboratories increased the length of its UL 142 standard covering storage of flammable liquids in aboveground tanks by two- or threefold. New language to cover secondary containment tanks, steel-diked tanks, and rectangular tanks was added. UL also introduced a new standard for insulated tanks in December 1994. The standard covered 2-hour fire testing of both UFC-mandated "protected tanks" and NFPA-optioned "fire-resistant tanks." On December 30, 1997, UL released the second edition of UL 2085 for protected tanks only and a UL 2080 outline for fire-resistant tanks. In addition, UL has issued an outline UL 2245 for below-grade vaults.

Insulated tanks come in various forms, but presently three designs are the most common: one that places the insulation between two walls of steel; one that places a steel tank within a concrete encasement; and a third that places a plastic membrane over the steel tank and encases the entire assembly in concrete.

The most recent standard development came in October 1997, when UL provided its first two listings to a new UL standard—UL 2244. This standard covers complete factory-assembled AST systems. In other words, all important core components of a tank used for motor vehicle fueling, aviation fueling, generator tanks, and so on are evaluated

MOTOR VEHICLE FUEL DISPENSING SYSTEM TOP FILL AND WITH SIDE-MOUNTED DISPENSER



Today's AST is no longer just a simple steel cylinder. A properly engineered system includes a great many environmental and safety components.

by UL at the factory prior to shipment. The goal is to remove the concerns that authorities having jurisdiction (AHJs) might have about missing emergency vents and other accessories that prevent releases and system failure during fires. After all, what good is a 2-hour fire-rated tank if important components are not attached? The merits and drawbacks of a systems concept are still being debated.

The Steel Tank Institute has also developed several important new AST standards over the past several years: the F911 steel dike AST, the F921 double-walled AST, and the F951 protected aboveground secondary containment tank (called "Fireguard"). STI statistics show a tremendous growth rate in F921 and Fireguard tank installations. In 1997 alone, the 64 shops eligible to build Fireguard tanks increased their production by approximately 40 percent over 1996.

The inclusion of secondary containment for ASTs has justifiably received a great deal of attention lately. In 1991, EPA proposed an amendment to the SPCC (Spill Prevention Control Countermeasure Plan) requirements for ASTs suggesting that secondary containment be impermeable for 72 hours. This proposal, coupled with the fire code activity, has created a tremendous demand for aboveground tanks with built-in secondary containment. These tanks can take the form of integral dikes, double-walled construction, or insulated tanks with secondary containment. The NFPA Flammable and Combustible Liquid Code, NFPA 30, allows any tank 12,000 gallons and under with overfill prevention devices and emergency venting devices to be secondarily contained, as an alternative to a traditional dike. Today, nearly one-third to one-half of STI member-labeled ASTs are being built with secondary containment. Compare this to 10 years ago, when that statistic was closer to 0 to 5 percent.

Other Considerations

Finally, I should mention some basic installation requirements. Tanks must be installed on a firm foundation. In areas prone to flooding or earthquakes, tanks may require further anchoring (or seismic considerations) in accordance with local fire or building codes. When tanks arrive at a site, the NFPA 30 code requires that both primary and secondary containment tanks be tested to ensure that tank system integrity has remained intact throughout shipment.

Piping considerations are another big factor. Many AST motor vehicle fueling facilities do not require underground piping, as the dispensers are mounted directly atop or to the side of the protected tank. While eliminating another cause of release common to old UST systems, aboveground piping must be protected against potential damage by vehicular impact at fueling facilities.

Aboveground tanks do have their pitfalls, however. More maintenance is required to keep the tank aesthetically acceptable, such as painting steel or patching cracks in the concrete. Evaporation and condensation are a bigger factor in aboveground storage tanks. The operator needs to check for water at the bottom of the tank on a monthly basis, and all water should be removed. Also, Stage II vapor recovery can sometimes be a problem.

Spill prevention plans are required for aboveground storage tank systems larger than 660 gallons that are located such that a release into a navigable waterway can potentially occur. Also, the tanks must be protected from vehicle impact. Extra security measures (e.g., a fence enclosure) are necessary to guard against vandalism.

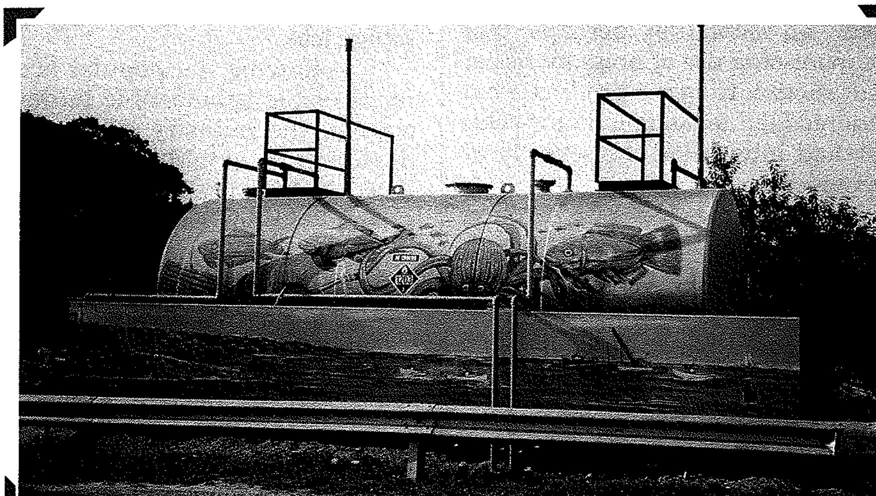
In Summary...

Motor vehicle fuel storage systems are no longer confined to the underground. Existing model fire codes have been changed to allow aboveground fuel storage. A number of third-party listed AST construction options exist for dispensing motor vehicle fuels. Secondary containment and other important environmental and safety appurtenances are now incorporated into tank designs.

As with any growing market, new technologies and new listings are being introduced to expand safe and environmentally-friendly options available to buyers and users at retail operations. The nonretail sector of tank system operators who store motor vehicle fuels has chosen ASTs over USTs because of convenience, cost, and the ability to see the tank at all times. ■

Wayne Geyer is Executive Vice President for the Steel Tank Institute. For more information about ASTs, contact Wayne at (847) 438-8265 or at wgeyer@interaccesses.com

SNAPSHOTS FROM THE FIELD



An AST imparts a marine ambiance in coastal Maine.

If you have any UST/LUST-related snapshots from the field that you would like to share with our readers, please send them to Ellen Frye c/o NEIWPCC.

Leak Prevention

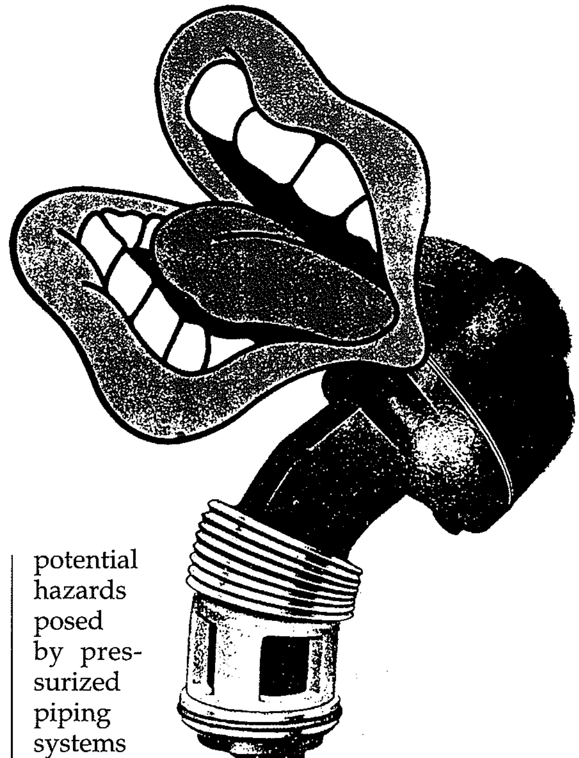
Tank-nically Speaking

by Marcel Moreau

*Marcel Moreau is a nationally recognized petroleum storage specialist whose column, **Tank-nically Speaking**, is a regular feature of **LUSTLine**. As always, we welcome your comments and questions. If there are technical issues that you would like to have Marcel discuss, let us know.*

Of Blabbermouths and Tattletales

The Life and Times of Automatic Line Leak Detectors



Automatic Line Leak Detectors = Devices that alert the operator to the presence of a leak by restricting or shutting off the flow of a substance through piping or by triggering an audible or visual alarm. According to the federal rule [40CFR280.44(a)], a device used to meet this requirement must detect leaks of 3 gallons per hour at 10 pounds per square inch line pressure within 1 hour. An annual test of the operation of the leak detector must be conducted in accordance with the manufacturer's requirements.

An Antidote to Pressurized Piping Leaks

With a history going back to the late 1950s, the automatic line leak detector (ALLD) is probably the grandmother of all the "continuous" type of leak detection devices on the market today. ALLDs were developed not too long after submersible pumps began to be commonly used—an indication, perhaps, that the increasing use of pressure rather than suction to move product from underground tanks into motor vehicles had intensified the severity of piping leaks.

While line leaks in suction pumping systems certainly existed, they tended to be self-limiting; if the leak got too bad, the pump would cease to function. Even small leaks would cause noticeable interference with the fuel delivery operation and thereby alert the operator.

Although pressurized pumping systems had operational advantages, such as simplified piping and the absence of vapor lock (see *LUSTLine* #10, "Pumping Product—The Push Ups vs Pull Ups of Product Delivery Systems—Implications for Environmental Health"), they had a definite downside in terms of leaks. Because the piping operated under 25 to 30 pounds of pressure, leak rates from even small holes increased substantially over those in suction pumping systems. To compound the problem, there were no indications of a problem at the dispenser, so the operator had no way of knowing (except through inventory control) that there might be a piping leak.

Following the popular acceptance of the submersible pumping system, the industry developed a device that would automatically detect leaks in pressurized pumping systems. In one early ad, this new device was dubbed the "blabbermouth" because it would quickly "snitch" on a leaking pipe.

Over the years, a few refinements to the leak detector were introduced that shortened the time it took to complete the test of the piping from 5 seconds to 2 and added a chamber to help compensate for thermal contraction effects, but the basic operation of the mechanical device has remained unchanged to this day.

Meanwhile, back at the fire station, the fire codes recognized the potential hazards posed by pressurized piping systems and began mandating the use of line leak detectors long before they became an EPA requirement. The codes included a requirement that the devices be tested at least annually to ensure that they were functioning properly. Despite this requirement, ALLDs were often absent from pressurized pumps; most owner/operators did not test for proper operation on an annual basis. The inclusion of these requirements in the federal rule, however, resulted in significantly increased use of ALLDs...and many are even tested on an annual basis.

The Mechanics of a MALLD

The mechanical ALLD (MALLD) is basically a pressure-operated valve. The top of the MALLD contains a piston or diaphragm that is connected to a rod that controls the flow of product by operating a valve mechanism at the bottom of the device. The valve has three positions: wide open (full flow), test (flow limited to 3 gallons per hour), and restricted flow or "tripped" position (flow limited to 3 gallons per minute).

A spring inside the stem of the MALLD pushes down on the control rod, continually attempting to move the valve into the restricted flow position. Pressure produced by liquid in the piping system pushes against the piston or diaphragm inside the top of the MALLD, compressing the spring and keeping the valve open. Inside the MALLD, there is a continual tug-of-war going on between the spring that wants to close the valve and the liquid pressure that wants to keep the valve open. Let's look at who wins this tug-of-war under various operating conditions.

What happens when all is well?
In a pressurized piping system, the pump develops about 25-30 pounds per square inch when it is operating and delivering fuel. When the pump motor is turned off, pressure in the line is reduced to the "catch" pressure of a pressure relief valve that is incorporated in the submersible pump. If the piping is tight, the catch pressure is maintained in the pipe until the pump is turned on again. In this case, the liquid pressure wins the tug-of-war, the spring stays compressed, and the valve remains open.

What happens when there is a leak?
In a leaking pressurized piping system, the pressure in the piping will continue to drop below the pressure relief valve "catch" pressure as product leaks out of the piping. The rate of pressure decline depends on the size of the hole, but it is also a function of how rigid the piping system is. A steel piping system is quite rigid, so a small loss of liquid from inside the pipe will produce a large pressure drop.

Flexible piping systems are generally much more "stretchy" than steel. As the flexible piping is pressurized, it stretches, and as pressure is reduced, the flexible piping tends to contract—much the same way (although to a lesser degree) as a balloon expands when air is blown in and contracts when air is removed. When liquid leaks out of flexible piping, the piping contracts somewhat, maintaining some of the pressure in the pipe.

Thus, for a given leak rate, the pressure will drop precipitously in steel piping and more slowly in flexible piping. The point is, however, in both cases the pressure will drop to very low levels if the piping is not liquid-tight. This sets the stage for the spring to win the tug-of-war and move the valve mechanism to the restricted flow position.

How the MALLD responds...
When the pressure in the piping drops below a threshold pressure, the spring in the MALLD takes control and moves the valve past the test position and into the restricted-flow position. Different manufacturers of MALLDs have different threshold pressures, but they are all in the range of a few pounds.

The MALLD stays in this restricted-flow, or "tripped," position, waiting for the next customer to come along and turn on the pump. When the pump is turned on, the flow through the MALLD is restricted to about 3 gallons per minute. Unless there is a leak in the piping that is greater than 3 gallons per minute, this flow into the piping system will increase the pressure in the line. This increase in pressure will press against the piston or diaphragm of the leak detector and begin to move the control rod that activates the valve mechanism. At about 10 pounds per square inch of pressure in the line, the control rod will have moved the valve mechanism into the "test" position. In the test position, the flow into the piping system is reduced dramatically to 3 gallons per hour.

...To a false alarm.
If the leak detector has been tripped because of a false alarm (see below) and the piping is tight, this small flow of liquid into the piping will continue to increase the pressure in the line. At a few additional pounds of pressure, the valve mechanism moves past the test position and into the wide-open position, where the dispensing of product can proceed unimpeded. The time required to go from the tripped position through the test cycle and into the open position is about 2 seconds.

...To a leak of 3 gallons per hour or more.
If the piping has a leak of greater than 3 gallons per hour, the 3 gallons per hour of liquid flowing past the leak detector into the piping will flow out of the pipe as fast as it is coming in. The pressure in the piping will not increase, and so the valve mechanism will not move out of the 3-gallon-per-hour test position.

Now, keeping in mind that the reason the pump was turned on in the first place was to dispense fuel, we turn to the customer, who opens the nozzle in anticipation of pumping some product at a flow rate of 10 gallons per minute. If the leak detector is still in the test position, however, this will not happen. With the nozzle open, whatever pressure was in the piping is now lost, the leak detector valve returns to its restricted-flow position, and the customer receives a flow of 3 gallons per minute. It is this reduced flow rate that is supposed to be noticed by the customer and reported to the station attendant (assuming a self-service type of operation).

...To smaller leaks.
For leaks of less than 3 gallons per hour or for flexible piping systems, the time required for the leak detector to go through the test phase and reach the wide-open flow position will be longer than 2 seconds. But if enough time is allowed, the piping should be able to build enough pressure to move the leak detector into the wide-open flow position. Whether a customer experiences restricted flow will depend on the length of time between when the pump is turned on and when the customer opens the nozzle.

A Few Rubs

A number of factors can cause MALLDs to restrict flow when a leak is not present (i.e., false alarm):

- **Malfunctioning check valves**
  The valve mechanism in the submersible pump that retains product in the line between the times when customers pump product can leak. This is not a leak into the environment; rather, the product merely returns to the underground tank. The loss of product in the line, however, will cause the leak detector to trip, and it may take many seconds to refill the line, greatly increasing the likelihood that the customer will have opened the nozzle and, thereby, set the MALLD in the restricted flow position.

■ continued on page 10

■ Tank-nically Speaking *from page 9*

- **Thermal contraction**
  In cold climates, the ground temperature around the piping is often significantly colder than the ground temperature around the tank. As a result, relatively warm product flows into the piping. When it is allowed to sit, especially overnight, it cools and contracts. This reduction in temperature can reduce the pressure in the line and trip the ALLD.
- **Air pockets**
  Air pockets in the piping introduce "springiness" into the piping system, because the air is very compressible. As a result, it will take more product (and therefore longer time) for the MALLD to move from the tripped to the open position.

There are also some factors that can cause MALLDs to miss leaks:

- **Excessive height of the piping**
  In order to move into the tripped position, the pressure at the MALLD must drop to a threshold pressure that can be as low as 1 pound per square inch. A column of product about 3 feet high is sufficient to produce a pressure of about 1 pound per square inch at the bottom of the column.

  Let's say, for example, there is a 4-foot height differential between the MALLD and the dispenser shear valve. In order for the MALLD to trip and conduct a leak test, the height of the product would have to drop about 1 foot below grade. If the leak is at the shear valve, however, the piping below the shear valve will remain full of product, the hydrostatic pressure at the MALLD will never go below the trip pressure, and the leak will never be detected. In the old days, deep burial of tanks was quite uncommon, but now that we are paying more attention to piping slope, particularly with Stage II piping, MALLD burial depths can sometimes be well below 3 feet.
- **Mechanical wear**
  The tolerances in the valve mechanism of the MALLD are quite fine, but as the device wears, these tolerances tend to become less fine (i.e., greater). The result is that as the MALLD ages, the minimum-size leak that it will detect tends to increase.
- **Sticking**
  Because the MALLD is mechanical, it relies on the physical movement of parts to detect the leak. If piping is tight and pressure is always maintained in the line, the mechanism of the MALLD may move little or not at all for months or even years on end. Deposits can build up on moving parts, tending to lock them in place. The result is that when a leak does develop, the MALLD fails to respond.
- **Satellite dispensers**
  In this era of self-serve gasoline dispensing, there is a remotely operated solenoid valve located in the dispensers and controlled by the cashier. This valve is often programmed to remain closed until after the MALLD has completed its test to prevent false alarm when a customer opens the nozzle while the MALLD is still looking for leaks. As a result, leaks downstream of the solenoid valve are invisible to the MALLD. In normal dispensers, such "invisible" leaks are not a big problem, because all of this piping is above ground, and leaks can be discovered visually.

  However, many large truck fueling facilities have what are known as satellite dispensers that allow the driver to fuel tanks on both sides of the truck at the same time. The satellite dispenser is essentially another hose that is routed from the master dispenser to a nozzle about a dozen feet away. The routing of this "hose" is typically underground, and typical piping materials (e.g., FRP, flexible pipe) are used.

  In older model satellite dispensing systems, the piping that branches off to the satellite dispenser is typically downstream of the solenoid valve. Because of this, leaks in piping that goes to the satellite dispenser are not detected by the MALLD. A possible solution to this problem is to add a dispenser-mounted electronic line leak detector to monitor just the satellite piping.

  Newer model master/satellite dispensers incorporate two solenoids—one in the master and one in the satellite. In this configuration, the satellite piping branches off from the master dispenser at a point that is upstream of the solenoid in the master dispenser. This dual solenoid system does allow the satellite piping to be tested by the line leak detector.
- **Lack of pump cycling**
  In the vast majority of fueling facilities, the pump motor is turned off most of the time and operates only while fuel is being dispensed. This cycling of the pump motor is essential to the operation of the MALLD. However, there are a few facilities that I've heard about where, for various reasons, the pump motor is on continuously for long stretches of time. At this type of facility, the MALLD fails to meet the regulatory criteria for detecting a leak within 1 hour, because the pump may be on continuously for days or weeks; until the pump is turned off and then restarted, any leak of any magnitude will not be detected by the MALLD.
- **The human element**
  Historically, the restriction of flow produced by the leak detector was often dismissed as a problem with the leak detector, because the problem went away when the leak detector was removed (and, all too often, not replaced). Even today, knowledge of the meaning of restricted-flow rates is not universal.

  For example, I was fueling up in northern New Mexico not too long ago and noted that it took a very long time to complete my purchase. When I mentioned this to the attendant, his response was, "Oh yeah, that pump always runs slow." Admittedly, clogged fuel filters in dispensers, malfunctioning pumps, and partially closed shear valves can all produce symptoms of restricted flow, so this condition is not a conclusive indication of a leak, but it is also not a condition that should be accepted as normal.

The Electronics of EALLDs

Over the past decade, the emphasis on leak detection in piping created by the federal rule has spurred the development of a new breed of line leak detectors that are electronically, rather than mechanically, based. This new breed of electronic automatic line leak detectors (EALLDs) usually incorporates a microprocessor to enable the EALLD to make more informed decisions about the data that it is receiving as well as to run more sensitive tests on the piping. Typically, but not always, EALLDs control power to the pump. Very often, the EALLD microprocessor is incorporated into an automatic tank gauge console.

Most EALLDs use a pressure transducer (a device that converts changes in pressure to variations in voltage) to monitor pressure in the piping. Except for the fact that both MALLDs and EALLDs monitor pressure in the piping, they have little else in common. The EALLD usually checks for a leak after the pump motor has been turned off. As with MALLDs, when the pump motor is turned off, the pressure in the piping is allowed to drop to some "catch" pressure determined by the pump's pressure relief mechanism. The EALLD then monitors the pressure in the system to see if there is a continuing precipitous drop in pressure. If such a pressure drop is detected, most devices will cut off the pump power and not allow power to be restored by the mere push of a button. A knowledgeable technician must reset the unit to restore power to the pump, presumably after he or she has determined the cause of the pressure drop.

This leak detection feature of the EALLD is fairly straightforward and works well as long we are looking for a leak in the 3 gallons per hour range. However, in addition to 3-gallon-per-hour tests, many EALLDs also have the ability to conduct 0.2-gallon-per-hour and sometimes even 0.1-gallon-per-hour tests. Leak detection at this level is somewhat more challenging because of thermal effects, piping resiliency, air pockets, and the effectiveness of system hardware such as check valves—but that discussion will have to wait until another issue of *LUSTLine*.

There are a few EALLDs that work on a slightly different principle—by taking over control of the pump motor and leaving the pump motor running for a brief period after the fuel dispensing operation is completed. With the piping system at operating pressure, an electrically controlled valve near the pump closes and a small alternate flow path from the pump side of the valve to the dispenser side of the valve opens. As long as the pressure on both sides of the closed valve is equal, there will be no flow through the alternate flow path. However, a hole in the piping on the dispenser side of the valve will cause the pressure to drop, thus allowing product to flow through the alternate flow path. The flow rate is then measured, and if it exceeds the threshold leak rate for the device, a leak is declared.

The new breed of electronic automatic line leak detectors (EALLDs) usually incorporates a microprocessor to enable the EALLD to make more informed decisions about the data that it is receiving as well as to run more sensitive tests on the piping.

Several EALLDs incorporate "wireless" technology to transmit information from the pressure or flow sensor located near the pump to a control unit that is typically located near the pump power supply. This means that the sensor signal is sent through the same wires used to power the pump, thus avoiding the cost of running new wires for the EALLD. A number of EALLD devices can also be installed in the same opening as was used for a MALLD. These features make retrofit of EALLD on existing installations relatively straightforward.

Keep in mind that the UST rules do not distinguish between MALLD and EALLD with regard to annual testing. Whatever device is used to meet the 3-gallon-per-hour leak detection requirement must be tested annually for operation according to manufacturer's instructions.

A Few Rubs

EALLDs have their own problems when it comes to software. Most EALLDs complete a 3-gallon-per-hour leak test in a matter of seconds after the pump is turned off. I am aware of at least one model, however, that requires three consecutive failed tests conducted at 5-minute intervals before declaring that piping is leaking. Thus, the detection of a leak requires a minimum of 10 minutes, during which no fuel can be dispensed. To meet the regulatory standard of detecting a leak within 1 hour, this device would require 10 minutes with no fuel dispensing every hour. There are a good many facilities where 10 minutes of downtime will happen only in the wee hours of the night. It seems to me that devices such as this one do not meet the standard for ALLDs set by the federal rule.

Note that EALLDs work when a pump is cycled from on to off, as opposed to MALLDs that test the piping when the pump is cycled from off to on. EALLDs still require that the pump be cycled to conduct a test and do not meet regulatory requirements on systems where the pump motor is on all or most of the time.

EALLDs have the same issues as MALLDs with regard to satellite dispensers. Pressure-based EALLDs may have false alarms from malfunctioning check valves, and flow-based EALLDs have moving parts that can get clogged, but the other problems mentioned above with MALLDs have largely been overcome.

Future ALLDs

After several decades of stability, ALLDs have experienced an explosion of technical development since the emergence of the federal rule. These developments are continuing with the introduction of more sophisticated pumps that feature automatic adjustment of pump motor speed according to the number of nozzles that are open. This allows the pump to operate more efficiently and to rapidly fuel a greater number of customers. At least one manufacturer of these intelligent pumps monitors the pressure in the line to determine the pump motor speed. This same pressure monitor is then used after the pump is shut off to look for pressure drops in the piping that may indicate a leak. Leak detection for pressurized piping has at last become an integral part of the pump design rather than an afterthought. It's about time. ■

Investigation and Remediation

Communicating Environmental Risk

It's Tuesday evening, and you have to do a presentation to a group of tank owners and operators on your state's revised underground storage tank cleanup regulations. The revised regulations incorporate risk-based decision making into the corrective action process, particularly with respect to identifying necessary and appropriate action. You are introduced. You stride to the podium and begin your presentation. Fifteen minutes later, a polite but restive audience applauds your effort, but before the applause wanes, the first hand goes up.

"You say I don't have to clean up my site to what it was before the contamination, because you're going to put some kind of deed restriction on it. But how am I supposed to sell this property if it has contamination on it or if the deed is restricted? Why are you doing this? It doesn't sound right to me."

You have just entered the world of risk communication, which often takes place within the context of emotional stress, fear, uncertainty, and a mishmash of competing facts and perceptions. It doesn't matter whether your stakeholders are your colleagues, your management, tank owners and operators, legislators, bankers, environmentalists, or the general public—your ability to effectively communicate risk-based programs and messages is crucial to the success of your program.

You may already be applying the principles of risk communication routinely in your day-to-day work—maybe without even knowing it. You may already be working hard at honing your risk communication skills...at times with frustration. Aye, effective risk communication is a divine skill worthy to be wrought. That being said, we'll try to cover risk communication in *LUSTLine* with a certain amount of persistence. For starters, we've asked Susan Brown, a risk communication trainer with Brown Training Associates, to introduce the subject and explain some of the basic principles being taught today.

Risk Communication = The exchange of information among interested parties about the nature, magnitude, significance, or control of a risk. It is an interactive process that involves the communication of multiple messages about the nature of risk and other messages that express the concerns, opinions, or reactions of the stakeholders.

Three DOs

by Susan Brown

Risk communication and its principles became popular in the late 1980s in response to the passage of a number of environmental regulations that made public participation a prominent feature. Environmental regulators were suddenly faced with an emphatic mandate stating that the public had a right to be included in decisions about risk and that regulators had better get busy including them. Public involvement was a novel approach to environmental regulation, and both government agencies and private industry found themselves wondering: But how?

Some turned to the risk communication pundits, who spoke of risk messages, public perceptions, and gaining trust and credibility. Dr. Vincent Covello from the Center for Risk Communication at Columbia University asserted that perception is equal to reality—"What is perceived to be real is real in its consequences." Dr. Peter Sandman from the Environmental Communication Research Program at Rutgers University spoke of "hazard versus outrage," saying that "the public pays too little attention to hazard; the experts pay absolutely no attention to outrage." Slowly, the principles of risk communication began to take their place in today's environmental arena.

As the public has become more involved in environmental issues and the decisions that are made to safeguard human health and the environment, risk communication has begun to play a critical role in the effective exchange of information.

But where do you begin?

There are three fundamental steps that you need to take as you begin to apply risk communication principles to your public involvement strategy:

1. **Involve yourself in your public involvement strategy.**
Form and be part of an interdisciplinary team to implement your public involvement strategy—an action team, so to speak. Organize the team in the very initial stages of the public involvement process and define the roles and responsibilities for each member. Select team members who include staff from your legal department and public affairs office, as well as your environmental technicians, engineers, and scientists. Ensure that this group functions as a team throughout the risk communication process.

   As a team member, take your role seriously. Engage in brainstorming sessions to determine the best way to communicate your efforts. Review fact sheets and documents in a timely manner and with due diligence. Volunteer to meet with individuals or groups to exchange information with them. Be committed to meet with the public at every opportunity.

And speaking of the public, define your public in the broadest sense. Do you mean the neighbors at the site of concern? Local elected officials? State and federal elected officials? Environmental organizations? Business leaders? Bankers? Real estate agents? Once you have defined all of your public, identify each group's interests. Neighbors will more than likely be interested in the health and safety of their family and pets. But what else? Property values? Business leaders or elected officials will have other kinds of concerns that are specific to their interests. Document these interests for each group that you've identified as your public.

1. Involve yourself in your public involvement strategy.

2. Remember that public involvement means more than public meetings.

3. Develop messages that are focused, understandable, and consistent.

2. Remember that public involvement means more than public meetings.
"But," you say, "the regulations only require one (or two) public meetings." This may be true. But ask yourself: What, in fact, is the right thing to do? How can you reach the greatest number of people? Have you had great success at getting people to attend your public meetings? If not, why? Is it because your public isn't interested? Is it because they think meetings like this are a waste of time, because no one ever listens anyway? They'll do what ever they want anyway. Why bother?

Chances are you have a preferred method for exchanging information. Some of you have no problem standing in front of the microphone making comments in front a group of 50 or 100 people. Some of you would rather exchange information in a more informal, one-on-one environment. Some of you would rather gather all the information you can, review it, and then talk about it. Just as you have your information exchange preferences, so do the many individuals who make up your public.

So, you and your interdisciplinary team members need to put yourselves into the shoes of your public and strategize. Brainstorm all of the different methods of exchanging information and communicating your message. Then, implement the strategy!

3. Develop messages that are focused, understandable, and consistent.
Over the years, I have heard many people say, "This is what I want to tell them." ("Them," meaning their public.) My question to these people is, "Is that where their interests lay?"

Develop your messages to respond to your public's interests. Keep in mind that what you want to tell them may not be of concern to them. Focus your messages on your public's concerns.

Also, structure your language to ensure that the words you use are understood by the receiver. Remember that each person has his/her own individual experiences—some may be similar to yours, and some may not. You might be an engineer, but you are talking with a banker. You might be a biologist, but you are exchanging information with a teacher. If you use words that may be outside that person's area of expertise, explain your terminology with easy to understand phrases.

Consistency of message is crucial if you want your message to be heard and remembered—especially in situations where anger, fear, and mistrust have clogged a normally open mind. In those cases, it is very important to be consistent, clear, and concise. So, repeat your message(s), using the exact same words (12 or less, by the way), between 2 to 4 times in a dialogue.

If you plug these three risk communication principles into your public involvement strategy, you will be on the path to opening the lines of communication, creating a level playing field, and giving yourself the opportunity to partner with the public. A great beginning for future exchanges! ■

For more information, contact Susan Brown at browntа@aol.com.

Investigation and Remediation

Aesthetic Criteria for Drinking Water Contaminated with MTBE—The Angst Factor

by Jeff Kuhn

In December 1997, the EPA issued a drinking water advisory for MTBE that recommend levels not to exceed 20-40 micrograms per liter (μg/L) in drinking water. The advisory is based on aesthetic criteria—taste and odor thresholds—for MTBE. It states that although extensive studies have not been undertaken to determine the variability of human response in tasting or smelling the chemical, studies do indicate that "keeping the concentrations in the range of 20-40 μg/L will likely avert unpleasant taste and odor effects, recognizing that some people may detect the chemical below this." Unfortunately, however, many states may not be equipped with the legal means to enforce drinking water standards for chemicals based on taste and odor criteria alone.

There is a great deal of confusion regarding whether aesthetic criteria can be enforced by state agencies. These standards are typically referenced as "secondary standards" by most state drinking water programs. More and more frequently, however, state UST/LUST programs are called upon by the public to enforce aesthetic criteria that may be lower than current maximum contaminant levels (MCLs) or other risk-based numbers used to address contamination in groundwater used for drinking water purposes.

The nationwide recognition of the MTBE problem has brought this issue more clearly into focus in many states. The same issue is also universally recognized with TPH constituents, but it has not raised the same level of concern or garnered the same level of attention as MTBE.

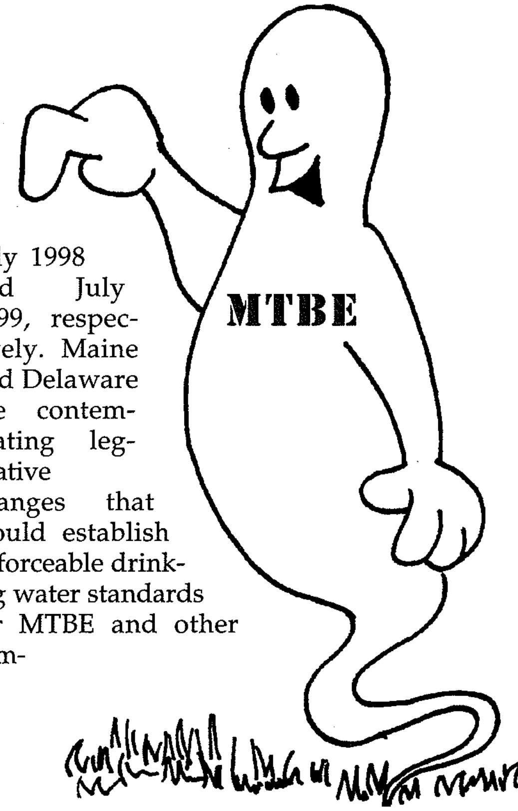
Over the years, regulatory agencies have become more aware of the real concerns of the public and find themselves having to balance how they respond to the conflicting issues of supporting risk-based numbers for chemicals in drinking water with the reality of public sentiment when a water supply has a petroleum taste or odor that renders it undrinkable. How can we come to grips with these two issues and still protect the health and welfare of the public from unwanted chemicals in their drinking water? How do we explain that, although contaminants may be present in private or public drinking water supplies, they do not exist at levels that require removal?

EPA/State Discussions

At the March 1998 EPA UST/LUST Conference in Long Beach, California, participants in the MTBE session noted the difficulty they face in enforcing the drinking water advisory limit and called for EPA to complete the necessary toxicological testing to determine the carcinogenicity of MTBE. EPA representatives indicated that the results of such testing might not be completed for 2 to 4 years.

This waiting period creates a problem for most states: How can they require cleanup of MTBE from drinking water supplies if they have no regulations regarding the cleanup of other compounds that commonly create taste and odor problems in public and private water supplies (e.g., iron, manganese, or sulfur)?

Preliminary results from a recent University of Massachusetts survey indicate that only 15 states currently have a drinking water standard for MTBE. These standards range from 20 to 240 ppb. Those states adopted their drinking water standards for MTBE by rule, statute, or policy. California recently legislated secondary and primary drinking water standards for MTBE, a reactive measure to prevent another catastrophe such as the Santa Monica well field contamination. Those standards will be implemented in July 1998 and July 1999, respectively. Maine and Delaware are contemplating legislative changes that would establish enforceable drinking water standards for MTBE and other compounds currently viewed as "noncarcinogens." New Jersey has an enforceable interim specific criteria standard (primary MCL) for MTBE of 70 ppb. Vermont requires provisions for alternate drinking water for wells that have any detectable concentration of MTBE.



Protecting the Public from Potential Risk

Frequently, in public meetings, we are asked "How many parts per billion of BTEX or TPH constituents (or MTBE...) would you let your children drink?" The response of most regulatory folks I know is, "I don't want it in my drinking water, period." Be that as it may, it may be very difficult for regulators to require cleanup of water with contaminant levels that are below legally enforceable standards, even though, as far as the public is concerned, the water is undrinkable.

Once groundwater that is used for drinking water, bathing, or cooking has been impacted by a petroleum product, most people will choose not to continue using the water and will seek an alternative source of clean water. Even though concentrations of petroleum constituents may be below state or federal drinking water standards, state regulators may choose to require provisions for an alternative water supply. The reasoning in most cases is that the affected party has lost the use of the water supply simply because it is "contaminated."

Until more in-depth studies of the cancer and noncancer effects of MTBE (i.e., kidney, neurological, reproductive, and developmental) are completed, states have three choices: do nothing, follow the EPA drinking water advisory recommended levels (20-40 ppb), or adhere to a different level (e.g., the 1991 California action level of 35 ppb). Regulators are often forced to take a conservative approach that acknowledges the loss of the use of the water but that also protects the public from unknown risks from "potential carcinogens."

The Range of Sensitivity to Taste and Odor

A presentation by Dr. Steven Book, California Department of Health Services, at the 10th Annual UST/LUST Conference in Long Beach, summarized much of the current taste and odor research completed to date. One study (Young et al., 1996) found that four out of nine panelists tasted MTBE at 40 ppb. In the same study, three out of nine panelists sensed an odor at 15 ppb. Another study completed by the Metropolitan Water District (Dale et al., 1997) found that four panelists sensed MTBE odor as low as 21 ppb and taste as low as 2 ppb. Still another study completed by the Orange County Water District (Shen et al., 1997) indicated that some panelists were able to sense an odor as low 2.5 ppb in 7 out of 16 test runs.

One obvious conclusion that can be drawn be from these studies is that some individuals are extremely sensitive to the taste and odor of MTBE. EPA's drinking water advisory recognizes that some people may detect the chemical below 20 to 40 micrograms per liter (µg/L). Based on the lack of data on humans from MTBE-impacted drinking water and lack of exposure of laboratory animals to the contaminant in drinking water, the advisory states that "there are significant uncertainties about the degree of risk associated with human exposure to low concentrations (of MTBE) typically found in drinking water."

Additional taste and odor studies are currently under way through a unique partnership forged between the Association of California Water Agencies (ACWA*), the Oxygenated Fuels Association (OFA), and Western States Petroleum Association (WSPA). Preliminary results of odor testing, using a large consumer-based group of panelists, are pending.

Given the uncertainties associated with this chemical, states need to consider what level of MTBE in drinking water represents an unacceptable risk.

Decisions, Decisions

Given the uncertainties associated with this chemical, states need to consider what level of MTBE in drinking water represents an unacceptable risk. Some states may choose not to wait for EPA to promulgate an MCL for MTBE and may instead start by enforcing a secondary drinking water standard based on taste and odor criteria. Other states may want to consider using the advisory level as an interim standard within the allowable framework of their state drinking water regulations.

The City of Santa Monica, California, made an active decision to shut down municipal wells that were impacted by MTBE in the Charnock and Arcadia well fields. As a result, the city now imports 70 percent of its drinking water from the Los Angeles Metropolitan Water District at a cost of about $1 million per year. The city is currently evaluating treatment options that will bring its wells back on line.

* For information regarding the status of the ACWA research, please contact Krista Clark at (916) 441-4545.

Although this scenario is extreme in terms of costs, recent visitors to the site [participating in a field trip sponsored by the Association of State and Territorial Waste Management Officials (ASTSWMO)] were impressed by the magnitude of the problem and the overwhelming support of the public to address the contamination.

Contamination of the Santa Monica well fields resulted in the recent enactment of several state legislative bills to establish primary and secondary drinking water standards for MTBE in California and to complete additional research to evaluate MTBE remediation options.

The Sampling Conundrum

Another exasperating aspect of our regulatory frustrations with MTBE is the "now you see it, now you don't" factor. Most project managers are aware that groundwater conditions can fluctuate radically at different times of the year. Low concentrations of some contaminants that may be detected at low concentrations and by odor in one sampling period may not be detected with standard laboratory analysis in a subsequent round of sampling. At times we are forced to ask ourselves whether the problem really exists at all.

In my experience, the olfactory senses of most impacted parties are generally correct. With most gasoline products, impacted parties are able to smell constituents at very low concentrations that may not be detected through standard lab analysis—and this may be true for MTBE as well. Volatilization is an ongoing problem in sampling for low levels of volatile constituents (e.g., benzene, MTBE). Sampling procedure may be a significant factor as to whether we detect the constituent at all. Therefore, sampling procedures should be strictly adhered to in order to minimize loss of the contaminant.

Seasonal groundwater fluctuation may also play a significant role. We are frequently asked to consider closure of sites that show an overall trend of decreasing contaminant levels (two to three consecutive sample rounds). Most site workers typically see an annual spike of BTEX concentrations as spring run-off raises the

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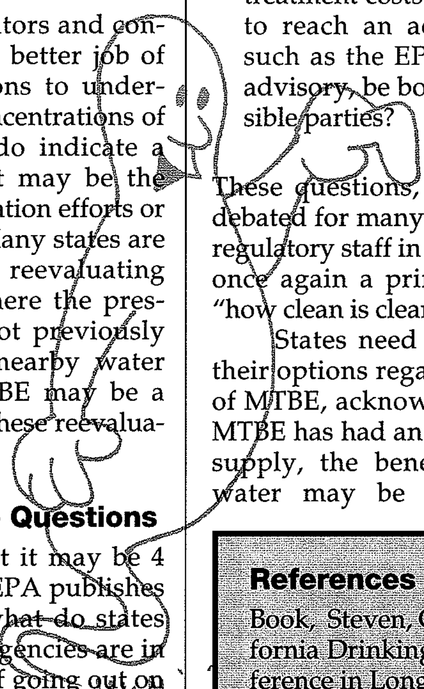
■ Drinking Water *from page 15*

water table and sends another load of BTEX "down the pike."

The fact is that groundwater samples collected at the wrong time of the year may underestimate worst-case concentrations of constituents in groundwater. Thus, premature closure of a site may occur if a longer time period for groundwater monitoring is not allowed. An even more discouraging aspect of MTBE is the chance that the chemical mass has moved off-site, potentially impacting downgradient receptors long after the source area is allegedly cleaned up and closed.

Both state regulators and consultants need to do a better job of defining site conditions to understand whether low concentrations of contaminants really do indicate a decreasing trend that may be the result of active remediation efforts or natural attenuation. Many states are already considering reevaluating closed LUST sites where the presence of MTBE was not previously questioned. Testing nearby water supply wells for MTBE may be a good place to start in these reevaluations.



Grappling with the Questions

So, given the fact that it may be 4 years (if ever) before EPA publishes an MCL for MTBE, what do states do? State regulatory agencies are in the tenuous position of going out on a limb to protect public health from the possible carcinogenic and noncarcinogenic effects of exposure from drinking low concentrations of MTBE-contaminated water. Until further research is completed by the EPA, state regulators may be forced to take the most conservative approach to protect human health in communities with MTBE-impacted water supplies. Although this may lead to legal challenges from responsible parties, failure to respond may also result in legal challenges from impacted communities.

Regulators are left to grapple with a number of weighty questions:

- Should we expect the public to continue drinking water that may be "clean" by current federal standards but that contains petroleum products that affect the taste and odor of the water, have unknown toxicity, and ultimately render the water unfit for consumption?
- Should states use the EPA drinking water advisory range as an interim standard or do nothing until EPA publishes an MCL or an additional health advisory?
- What are the costs of protecting the public from the unknown risks of specific chemicals that either appear in our drinking water supplies at concentrations below MCLs or, as in the case of MTBE, do not have an MCL?
- If treatment is required, should treatment costs deemed necessary to reach an aesthetic standard, such as the EPA drinking water advisory, be borne by the responsible parties?

These questions, which have been debated for many years by technical regulatory staff in the TPH arena, are once again a primary topic of the "how clean is clean?" debate.

States need to consider all of their options regarding the cleanup of MTBE, acknowledging that once MTBE has had an impact on a water supply, the beneficial use of the water may be temporarily lost. Indeed, states may be forced to take a more proactive approach toward protecting water supplies to prevent the taste and odor of MTBE from rendering their water undrinkable. The public may demand it in the absence of an MCL.

In my opinion, in the absence of detailed toxicological studies, states need to consider limiting their liability regarding possible carcinogenic and noncarcinogenic health effects of MTBE by requiring treatment for impacted water supplies. State LUST programs also need to more aggressively manage MTBE plumes to prevent off-site migration that may have an impact on water supplies in the future.

We must manage sites with the goal of protecting the public's health and not wait until the damage is done. However, if drinking water supplies are impacted, the issue must be addressed. We owe it to the public. More specifically, most of us would choose not to let our children drink water containing MTBE. ■

Jeff Kuhn is with the Montana DEQ Petroleum Release Section and is a member of the ASTSWMO MTBE Work Group.

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Investigation and Remediation

Oh Henry! (a constant)

by Blayne Hartman

[*Editor's Note: This is the first in a series of articles that review some of the physical/chemical properties that are commonly used in environmental assessment and remediation.*]

Okay, here's a question that, when I ask it, over 75 percent of the people answer incorrectly. See how you do.

Suppose I fill a closed container with water until there are equal amounts of air and water. Then I spike 100 molecules of benzene into the container, and shake it until the benzene distributes itself between the air and water. Where will the benzene end up?

(a) Mostly in the water.

(b) Mostly in the air.

(c) Equal amounts in the air and water.

(d) It sinks to the bottom as a DNAPL.

Got the answer?

Well you know it's not (d), because benzene is lighter than water and would float as a free product. (DNAPL refers to dense non-aqueous-phase liquid—a liquid heavier than water.) It's not (c), because there is a preferred phase for all compounds, including benzene. So, do you choose (a) or (b)?

Some hints:

- Benzene has a relatively high vapor pressure and is considered to be a volatile compound.
- Although benzene is considered the most soluble of the aromatics, the solubility of all of the aromatics in water is relatively quite low.
- Very few regulatory agencies (in fact, none that I know of) consider benzene data from water samples that contain air bubbles valid, because of concerns about the loss of the benzene to the bubbles.

Do these hints convince you that (b) (mostly in the air) is correct? If so, you're wrong. The correct answer is (a). The benzene prefers to stay in the water! Surprised? Well, welcome to the 75 percent club.

The distribution, or partitioning, of a compound between air and water is given by the Henry's law constant and is defined as

$$H = C_{air} / C_{water}$$

where C_{air} and C_{water} are concentrations of a compound in the air and water phases, respectively. The units for the air and water concentrations are the same (i.e., µg/L).

Dimensional vs. Dimensionless

Henry's law constants are derived empirically (i.e., by measurement in the laboratory) and are commonly tabulated in two forms: dimensional and dimensionless. While both forms are useful, the dimensionless form is the easiest form to work with for the inexperienced user.

The dimensionless form can be thought of as the number of molecules or mass of a compound that exists in the air versus the number of molecules or mass that dissolves into the water. If the dimensionless Henry's constant for a compound is greater than one ($C_{air} > C_{water}$), then the compound prefers to be in the air phase. In contrast, if the Henry's constant is less than one ($C_{air} < C_{water}$), then the compound prefers to be dissolved in the water. This partitioning ratio will hold until a compound has reached saturation in either the air or water.

The dimensional form of the Henry's constant is typically given in units of atm-m^3/mole and can be computed from the dimensionless constant using the ideal gas law by multiplying by the universal gas constant times temperature (0.082 times the temperature in degrees Kelvin, which is equal to 22.4 at 0° C, and 24 at 20° C).

Day-to-Day Applications

So, how do you apply Henry's constant to day-to-day LUST situations? Well, for one thing, you can use it to predict the likelihood that a compound exists in the soil vapor or headspace. For example, consider the alkane and aromatic hydrocarbons. For the lower alkanes (methane through hexane), the dimensionless Henry's constant ranges from 30 to 70 (let's use 50 as an average). For a system at equilibrium with equal volumes of soil vapor and water, 50 molecules of these alkanes will exist in the air for every 1 that dissolves into the water.

In contrast, the Henry's constant for the four common aromatics (benzene, toluene, ethyl-benzene, and xylene) is approximately 0.25. At equilibrium, 1 molecule will exist in the air for every 4 that dissolve into the water. Thus, the alkanes will partition into the air approximately 200 times more than the aromatics (50/0.25).

When measuring air samples for fuel-related hydrocarbons (e.g., soil vapor surveys, screening soils and waters using a head-space technique, exhaust from a vapor extract system), sample analysis with a flame ionization detector (FID) instrument has a far greater chance of detecting the contamination than one with a photo ionization detector (PID), because FIDs detect all alkanes whereas PIDs are relatively insensitive to alkanes.

You can use Henry's constants to compute the equilibrium concentration of a compound in the air or water from the other phase. Rearranging the expression for the Henry's constant gives:

$$C_{air} = H * C_{water}$$

For example, if the groundwater concentration was 10 µg/L for both

■ *continued on page 18*

■ Oh Henry *from page 17*

methane and benzene, the equilibrium soil vapor concentration above the water would be:

For methane (H = 30):

$$C_{sg} = 30 * 10 \mu g/L = 300 \mu g/L$$

For benzene (H = 0.25):

$$C_{sg} = 0.25 * 10 \mu g/L = 2.5 \mu g/L$$

It is very important to remember that Henry's constants assume that equilibrium exists between the air and water phases and that the compound's solubility in the air or water has not been reached (i.e., below saturation). These conditions are often not met in the real environment, so values computed from these constants are approximations that can be used for predictive purposes, but should be used cautiously for quantitative conclusions.

Now Back to the Original Question...

Benzene has a Henry's constant of approximately 0.25, meaning that for every 1 molecule of benzene that partitions into the air, 4 molecules partition into the water. So, the correct answer is (a). Remember, our example assumed equal volumes of air and water in the container. If the air/water volumes are not equal, then the actual distribution also depends upon the ratio of air to water. In other words, in a water sample where air bubbles make up 10 percent of the total container volume, the distribution of benzene would be roughly 1 molecule in the air bubble for every 40 molecules in the water (only 2.5 percent of the total). The startling conclusion here is that a few bubbles in a water sample don't significantly change the water concentration, depending upon the compound's Henry's constant. Oh Henry!

Got it? Now go ask the question to your co-workers. (P.S., I get 10 percent of any winnings). ■

Blayne Hartman is a regular contributor to LUSTLine. This article is taken from a presentation on physical/chemical properties that he gives as part of a course on geochemical training. For more information, contact Blayne at bh@tegenv.com or check out his Web page at www.tegenv.com.

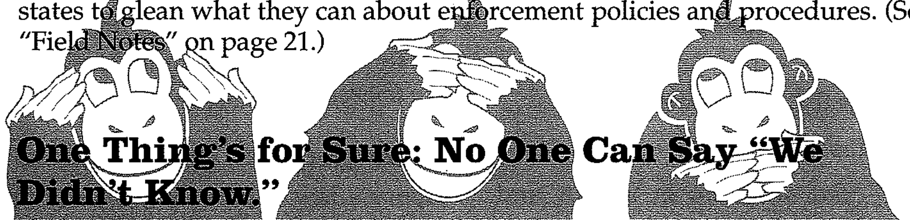
Prevention

Enforcement Strategy Samplers '98 Deadline

The December 22, 1998 deadline for upgrading, removing, or replacing USTs will call for a concerted enforcement effort on the part of EPA and the states. What's the game plan, so far?

Well, EPA's draft of its strategy for enforcement of the 1998 UST requirements, which was distributed to the states in February, was discussed in some detail at the National Conference in March. Earlier, about half the states had sent written comments to the agency. EPA is now in the process of revising the document. EPA staff say the revised version will be responsive to the states' concerns. The timetable for getting it out is uncertain. So, more from EPA later.

As for the states and territories, some strategies are pretty much nailed down, while others are still in the final throes of completion. To give you some idea of what states are planning, we plan to run samplers to describe enforcement strategies in selected states. In this issue, those states are South Carolina and Michigan. Also, six trade associations plan to conduct a survey of the states to glean what they can about enforcement policies and procedures. (See "Field Notes" on page 21.)



One Thing's for Sure: No One Can Say "We Didn't Know."

South Carolina

"Through April 1998, about 57 percent of operating UST systems were confirmed to be in compliance with the upgrade requirements," says Bob Hutchinson, Director of the Regulatory Compliance Branch at the South Carolina Department of Health and Environmental Control, Division of Underground Storage Tank Management. "This means that some 7,000 USTs will need to be upgraded, replaced, or abandoned. The smaller retail, nonretail, and government-owned facilities lag behind the compliance rate set by the national marketers."

During the past year, the division's field inspectors surveyed a significant portion of tank owners to determine their intentions regarding the 1998 standards. Only about 10 percent of the tank owners did not have a plan to comply. For planning purposes, the results were extrapolated against the total UST population that does not meet the 1998 standards, and the following conclusions were developed:

- Approximately 2,520 USTs are expected to close prior to the deadline. Some of these closures may be temporary in order to meet the compliance deadline. In doing so, the tank owner or operator can legally delay permanent closure or upgrading for one year.
- Approximately 3,360 USTs will be upgraded (spill, overfill, and corrosion protection) prior to the deadline. The division will not accept any contractor scheduling problems as an "industry excuse" to continue to operate beyond the deadline.
- Approximately 1,120 new USTs will be installed. During the past 2 years, between 400 and 500 new USTs were installed annually.

Outreach Is Key

"Our inspectors have met every tank owner, face to face, at least once," says Hutchinson. "We've had an aggressive outreach program since 1993 and plan to continue on well beyond the 1998 deadline. We feel that outreach is a vital ingredient to a successful UST program. No tank owner or operator in this state can say, 'We didn't know.'"

"The division will continue to publish a quarterly newsletter, send personal letters to UST owners, meet with individual owners or operators, make presentations to related businesses, and use various media to ensure that the regulated community is aware of our requirements."

During the second quarter of 1998, the division's field staff met with each owner/operator whose tank systems do not meet upgrade standards and explained once more all of the requirements and consequences of noncompliance.

The list of noncompliant USTs will be published and distributed to fuel distributors in North Carolina, South Carolina, and Georgia during the third quarter of 1998. Suppliers will also receive information about potential enforcement actions should they introduce product into improperly registered tanks. In addition, the department's Freedom of Information Office is providing both industry and the general public with a list of UST facilities with nonupgraded USTs.

In January, the division provided an annual report to the state legislature to update members on the status of the program. "For the most part, we've had great support from the legislature, our commissioner, our board, the petroleum marketers, and the suppliers," says Hutchinson. "We've provided owners and operators with the tools to go down the pathway of compliance, and I think everyone appreciates this."

Prohibition of Fuel Delivery a Powerful Incentive

"Our UST registration decal renewal requirement will play a significant role in our overall compliance strategy," say Hutchinson. The fiscal year 1999 renewal decal (issued in July 1998) will have an expiration date of December 21 (midnight), 1998, for facilities that have not met upgrade requirements. The expiration date will appear on the decal, and the owner will be advised of the expiration date in a letter that will accompany the decal when it is issued.

Petroleum suppliers who are found placing product in an UST that does not have a valid registration will be subject to enforcement as authorized by the State Underground Petroleum Environmental Response Bank (SUPERB) Act. Hutchinson expects that this prohibition of fuel delivery will become a powerful incentive for owners and operators to comply with the upgrade requirements.

Compliance Tie-In With State Fund

Another incentive for compliance ties in with the SUPERB Account and the SUPERB Financial Responsibility Fund. An UST owner or operator who has a release from a nonupgraded UST that is operating after the deadline will not be able to access the SUPERB Account or the Financial Responsibility Fund for damages resulting from that release. "Part of our outreach effort during this year has been to emphasize this loss of coverage for violating the deadline," explains Hutchinson.

Post-Deadline Inspection Strategy

"We now believe that our compliance staff will be able to visit every noncompliant site during January 1999," says Hutchinson. If the nonupgraded USTs have been rendered inoperable and are temporarily out of service (TOS), the owner or operator will be reminded that he or she is required to empty the tanks and secure all fill and dispenser piping before March 22, 1999 (90 days after the deadline). The inspector will also provide an explanation of the options available to remain in compliance:

- Upgrade the system before December 22, 1999.
- Permanently abandon the system before December 22, 1999.
- Conduct a site assessment and request an extension for TOS status before December 22, 1999.

If the nonupgraded USTs have not been rendered inoperable, the inspector will issue a notice of violation on which enforcement action will be taken. The inspector will advise the owner/operator to immediately place the tanks in TOS status. Owners and operators will be required to supply the division with documentation that this action has been taken.

After March 22, 1999, follow-up inspections will be conducted at facilities where proper documentation was not provided. If the USTs continue to hold product, the inspector will issue a notice of violation for failure to properly maintain TOS systems, and the matter will be referred to the Enforcement Section.

Enforcement

On December 22, 1998, the division's Enforcement Policy will be expanded to include penalties for operating nonupgraded USTs beyond the deadline. The penalty range for this violation will be $500 to $5,000 per tank, levied via consent order, against the owner or operator. Penalties may be lowered for those who swiftly remove all product and place the substandard tanks into TOS status. During the time of temporary closure, the owner or operator will be allowed to upgrade the tanks to the 1998 standards and resume operations.

If the conditions of temporary closure are violated, the division may pursue injunctions to stop operation or obtain the same end result through the use of Administrative Orders and higher civil penalties.

Michigan

Over the life of Michigan's UST program, about 52,691 tanks have been closed or removed. The Department of Environmental Quality's Underground Storage Tank Division (USTD) is now focusing on the status of the remaining 29,000 active tanks. "Currently, two-thirds of our active tanks are out of compliance," says Art Nash, Chief of the UST Division. "By December 22, 1998, we expect that only about one-third of the active tanks will still be out of compliance—and that's a worst-case projection."

A recent survey conducted by the USTD found that 45 percent of the owners and operators of active tanks say they will close, 51 percent say they will upgrade, and the remaining 4 percent aren't sure what they will do.

"Our official position regarding the 1998 deadline," says Nash, "is that owners and operators cannot operate substandard tanks after

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Coast to Coast
from the ASTSWMO Tanks Subcommittee

Coast to Coast is provided as a regular feature of LUSTLine to update state and federal UST, LUST, and cleanup fund personnel about the activities of the Association of State and Territorial Solid Waste Management Officials' (ASTSWMO) Tanks Subcommittee. If you want to learn more about the Tanks Subcommittee, contact the Subcommittee Chair, Scott Winters (CO) at (303) 620-4008, or Stephen Crimaudo (ASTSWMO) at (202) 624-7883.

ASTSWMO's Tanks Subcommittee Issues Its Report Card on the Federal UST/LUST Program

In 1996, the ASTSWMO Tanks Subcommittee decided that some kind of "report card" was needed to document the scope and effectiveness of the federal UST/LUST program nationwide, as well as to measure the projected workload to meet the 1998 technical standards. This type of report could also serve as a resource for states to use to compare their programs with national trends and other state programs. The subcommittee ran with the idea, gathering compliance and other historical data for a program review and then assessing the accomplishments of the program to date. The report card was completed in January 1998. Data in the report were gathered in early 1997.

Major Findings

The following are some of the subcommittee's major findings:

- Since the inception of the regulations in 1988, 65 percent of the regulated tanks have been removed or upgraded.
- There is a ten-to-one benefit-to-cost ratio associated with leak prevention. This means that a $100,000 investment in state/federal compliance/enforcement work, along with private sector investments in leak prevention and detection, will save $1 million in government oversight cleanup costs.
- It has cost society an estimated $17 billion to clean up spills to date. About $11 billion more will be needed before the job is completed.
- The UST program has shown unprecedented success in both pollution prevention and cleanup. However, program staffers have been so busy achieving these results that they have not had the time to fully educate the public and decision makers about the successes of the program. One way of communicating this message is through the "Report Card on the Federal UST/LUST Program."
- Nationally, the vast majority of USTs have been registered with state UST programs. From 1991 through 1997, approximately 347,000 unregistered USTs were registered with state UST programs. Projections made in the report show that from 1998 through 2003, only 32,000 currently unregistered USTs will still need to be registered.
- As of early 1997, only 29.7 percent of all active USTs were in full compliance with the 1998 upgrade deadline requirements. Although this percentage has since increased, this statistic shows the enormous workload that remains to ensure compliance with the standards.
- Since the inception of the UST program in 1985, over 50 percent of all USTs that were in the ground have been closed; just under 15 percent are still active and in compliance with the upgrade requirements; and almost 35 percent are active and out of compliance. Based on this trend (if future trends hold to this one), as many as 50 percent of currently active USTs may end up being removed in order to comply with the 1998 deadline.

State Views on EPA's Future Role

One of the most intriguing parts of the report is Section 7, "Current and Future Issues." In an effort to facilitate discussions concerning the future of the UST program at both the state and national levels, states were asked what they thought EPA's role should be in the UST program after disinvestment. Some state managers commented that EPA should not disinvest in the UST program because that would send the message to the regulated community and potentially state legislatures that the UST program had completed its task and that there was no need for a program at any level. (Note: EPA does not have any plans to disinvest in the UST program.)

States were concerned about the future of federal funding. Continued funding by EPA is essential for states to complete their cleanup and compliance tasks and to prevent the abrupt cessation of the environmental gains documented in the survey. A number of states felt that EPA's ongoing role in the UST program should be to provide technical resources, serve as an information

■ *continued*

Field Notes

from Robert N. Renkes, Executive Vice President, Petroleum Equipment Institute

Trade Associations Embark on a National Survey of UST Enforcement Strategies

As the December 22, 1998 compliance deadline for upgrading, replacing, or removing USTs nears, companies affected by EPA's regulations are beginning to turn their thoughts to how these regulations will be enforced. Tank owners, UST manufacturers, and UST service providers all have important decisions to make by the end of the year (or sooner), and enforcement is one of the issues they must consider.

Over the years, trade associations representing tank owners, UST manufacturers, and UST service providers have been asked by their members to provide copies of UST-related regulations and guidance documents made available by the states. One of the more recent items association members have requested is information on how the states and territories plan to enforce the UST regulations that they've had on the books for a decade or more.

Six trade associations—American Petroleum Institute, National Association of Convenience Stores, Petroleum Equipment Institute, Petroleum Marketers Association of America, Society of Independent Gasoline Marketers of America, and Steel Tank Institute—have gathered forces and resources to survey state and territorial UST programs about their enforcement policies and procedures. The survey will be drafted in June and mailed to the program managers by July 1. Responses by the UST program managers will be made available to interested parties as the participating trade associations see fit.

There are several benefits in surveying UST program managers at this time. First and foremost, the associations participating in this program are in the business of providing information of interest to their members. Up until now, enforcement plans and procedures have not been available to all members of the regulated community. Second, by developing one survey and soliciting one response from UST program managers, the task of supplying this vital information should not be overly burdensome on the UST program managers. Third, the availability of one comprehensive national survey will make it easier for all interested parties to compare program strategies. Fourth, the responses to the survey can be quickly, uniformly, and cost-effectively made available to interested parties. Finally, UST program managers can benefit by having access to the enforcement policies and procedures developed by their colleagues in other jurisdictions.

Readers of *LUSTLine* who are interested in the information provided by the UST program managers should read the next issue to find out the best way to access the responses. ■

■ **Coast to Coast** *continued*

clearinghouse, set standards, organize and maintain statistical analyses, and research and evaluate emerging technologies and technical issues.

Some state program managers responded to this question by stating what EPA should not do. For example, some felt that EPA should relax its oversight of state programs, including not making enforcement actions in a state without concurrence from the state and deferring all programmatic decisions to the states.

Other areas where state program managers believed EPA could play a vital role include:

- Pushing for standardized reporting practices from the states, including using environmental indicators.
- Taking enforcement actions that would lead to court cases. Court rulings at the national level are needed to clarify ownership as well as other UST issues.
- Providing projections on future funding after the 1998 upgrade deadline. Future funding projections are important to states that are trying to develop long-term strategies for compliance.

EPA is taking all these suggestions under advisement as it plans for the future of the UST/LUST program in the 21st century.

Much Accomplished, Much to Be Done

The report card, which was prepared by Paul Sausville of New York, Kathy Stiller of Delaware, Richard Spiese of Vermont, Pat Jordan of Wyoming, and Steve Crimaudo of ASTSWMO and presented by Scott Winters of Colorado and Chair of the ASTSWMO Tanks Subcommittee, was written in an attempt to provide a snapshot of the UST/LUST program. The results show that while much work remains to be completed, much has also been accomplished. This program demonstrates that effective communications and sharing of experiences among states, EPA, and ASTSWMO can provide for a successful environmental program. The Tanks Subcommittee of ASTSWMO welcomes your comments on this report. Comments may be given to any of the authors of this report, or to any Subcommittee member. For copies of this report, contact Steve Crimaudo at ASTSWMO at (202) 624-5828.

EPA HQ UPDATE

New Publications from OUST

- *Getting the Most Out of Your Automatic Tank Gauging System* (EPA-510-F-98-011) was released in March. The audience is UST owners and operators using automatic tank gauging systems to comply with federal leak detection requirements. This leaflet provides UST owners and operators with a basic checklist they can use to make sure their automatic tank gauging systems work effectively. As a compliance assistance tool, the leaflet focuses on what actions the UST owner and operator must take to comply with leak detection requirements and prevent significant cleanup problems. Like OUST's other leaflets, this one urges readers to check with state and local regulatory authorities for additional or more stringent requirements.

- *Catalog Of EPA Materials On Underground Storage Tanks* (EPA-510-B-98-001) was released in March. Its target audience is state and regional UST programs, UST owners/operators, UST contractors, UST trade and professional associations, and members of the general public who are interested in UST-related issues. The catalog provides an annotated list of UST materials and includes ordering information. Many of the informational leaflets, booklets, videos, and software items listed are designed to provide UST owners and operators with information to help them comply with the federal UST requirements. (Note that these materials frequently urge readers to check with state and local regulatory authorities for additional or more stringent requirements.) Some materials provide state and regional UST programs and UST contractors with more technical information regarding such matters as building state programs and conducting corrective action. Most materials are available at no cost. Note that the catalog replaces the September 1994 "Guide to EPA Materials on USTs" (EPA-510-B-94-007). If you still have copies of the old "Guide," please recycle them.

- *Underground Storage Tank Program: Regional and State Contacts* (EPA 510-F-98-014) was released in April. This listing includes the names, addresses, phone, and fax numbers for all of the regional program managers and the addresses (street and electronic) and phone and fax numbers for all of the state UST/LUST programs. You can download this publication from www.epa.gov/OUST/ and you can link from there to many state and regional home pages.

- *Leak Detection Fact Sheet #1 for Some USTs, Inventory Control "Expires" December 22, 1998* (EPA-510-F-98-012) was released in May. The audience is owners and operators of certain older UST systems (installed before December 22, 1988); they will no longer be able to use a combination of inventory control and tank tightness testing to meet federal leak detection requirements. The fact sheet identifies the affected UST systems, explains the requirement to change leak detection monitoring for these tanks, and notes that owners and operators should check with their implementing agencies for additional guidance.

To obtain the information listed above:
For hard copies, call NCEPI at (800) 490-9198 or EPA's RCRA Hotline at (800) 424-9346. You can use the Internet to download a copy (in WordPerfect 6.1 format) by going to OUST's World Wide Web home page at www.epa.gov/OUST/ and selecting "OUST Publications."

EPA Issues List of Integrity Assessment Evaluations

EPA has released a list of vendors whose procedures to assess the integrity of bare steel tanks have been evaluated and certified by qualified, independent third parties to meet specified criteria. So far, three procedures have been evaluated and certified: MTCF® (Mean Time to Corrosion Failure®) from Corrpro Companies, Inc. and Warren Rogers Associates, Inc.; Tank Environmental Profiling® (TEP) from International Lubrication and Fuel Consultants, Inc.; and Petroscope® from Tanknology-NDE, Inc. (one of four assessment parts).

Federal UST rules require that existing steel tanks that do not have corrosion protection be assessed for structural integrity before cathodic protection can be added to meet corrosion protection requirements. Assessment can be accomplished either through human-entry internal inspection or by other "alternative" integrity assessment procedures. State implementing agencies may or may not allow the use of alternative procedures.

In making decisions about alternative integrity assessment procedures that can be used to comply with December 1998 upgrade requirements, most states are following recommendations released by EPA last July, whereby states agencies allow only those procedures that either conform to a valid national code of practice or have been evaluated by a third party to meet certain performance standards. Since there is no such national code of practice, the third-party evaluation is the only alternative to human inspection.

EPA will update this List of Integrity Assessment Evaluations for Underground Storage Tanks as additional evaluations are completed. This listing will be posted on EPA's UST Web site at www.epa.gov/swerust1/altasses.htm, or you may contact EPA's RCRA Hotline at (800) 424-9346.

■ **Enforcement** *from page 19*

1998. We have been diligent in preparing the regulated community for the deadline so that no one could say, 'I didn't know.'"

Getting the Word Out

Besides the usual outreach methods, such as mailings and seminars, last spring, USTD inspectors visited and inspected all UST facilities that were installed prior to December 22, 1988, when the UST regulations became effective. The inspections revealed that many of the tanks had already been closed but had not been properly abandoned.

At the time of these initial inspections, owners and operators received a packet with information that explained what they had to do to meet regulatory standards. Last fall, inspectors began another round of inspections to these facilities, this time, giving each owner or operator a "report card."

The USTD will permit USTs to be upgraded or closed after December 22, 1998; however, the tank will not be allowed to remain in service. Even if owners and operators have contracts or purchase orders for which upgrade work is scheduled, they will still not be allowed to operate their UST if it is substandard.

"By the deadline we will have inspected all noncompliant facilities," says Nash. "We have had good cooperation from the industry. We meet with our stakeholders workgroup just about every month."

Red Tags—The Strategy of Choice

Michigan's primary method of enforcing the upgrade requirements will be though the use of red tags, which will be affixed to the fill pipes of USTs that are found, upon inspection, to be out of compliance. Tanks that have been red-tagged will be considered to be out-of-service and must either be closed or upgraded within 12 months. Red-tagged tanks can dispense fuel until they are empty. Anyone who knowingly fills a tagged tank will be committing a misdemeanor.

"We have been using this method of enforcement for leak detection violations," says Nash, "and have found it to be the most effective and efficient use of our staff resources." The USTD has 21 inspectors throughout the state.

How Enforcement Will Work

The USTD will forward a letter to all owners and operators who, according to the database, have not complied with the upgrade requirements, informing them of the deadline and of USTD's intention to red-tag all tanks that are out of compliance after December 23, 1998.

"We have a tracking system and will distribute the names of the red-tagged facilities to our district offices," says Nash. "We'll also place the names and locations of red tagged facilities on our home page, which is updated weekly, so that suppliers and other interested parties can easily obtain this information without creating an undue burden on our staff."

If red-tagging a facility like an emergency generator tank for a hospital creates a life safety hazard, the USTD will work with the facility to secure an alternate fuel supply. USTD inspectors will also let local officials know if they are going to shut down the only fueling facilities in a community.

Other enforcement methods, such as criminal arrest and civil penalties, may be considered for owners and operators of facilities where the red tag proves to be an ineffective method of ensuring that tanks are no longer in use. ■

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EPA's SW-846 (Final Update III) Protocols Spark Uncertainty in the Field

EPA's publication, SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, is the Office of Solid Waste's (OSW's) official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the RCRA regulations. SW-846 functions primarily as a guidance document that sets forth acceptable, although not required, methods for the regulated and regulatory communities to use in responding to RCRA-related sampling and analysis requirements.

SW-846 is a multivolume document that changes over time as new information and data are developed. It has been issued by EPA since 1980 and is currently in its third edition. Advances in analytical instrumentation and techniques are continually reviewed by OSW and incorporated into periodic updates to SW-846 to support changes in the regulatory program and to improve method performances and cost-effectiveness. The updated and fully integrated manual contains approximately 3,500 pages.

EPA's newest version of SW-846 (Final Update III) includes a number of changes in the collection, preparation, and analysis of soil samples for volatile organic compounds (VOCs). Analytical methods 8010 (halogenated hydrocarbons), 8020 (aromatic hydrocarbons), and 8240 (volatiles by GC-MS) have been eliminated and replaced by methods 8021 (halogenated and aromatic hydrocarbons) and 8260 (GC-MS). Samples for VOCs may be prepared for analysis by a variety of techniques, including headspace (Method 5021), conventional purge and trap (Method 5030), and a new, closed-system purge and trap method (5035).

The new methods also include protocols for sample collection and sample preservation in the field that are designed to minimize volatile loss from collection to analysis. While methanol preservation of soil samples for VOC analysis is not new (see *LUSTLine* #28), the sampling, collection, and preservation procedures in Final Update III contain a number of new protocols that have created some confusion among regulatory, laboratory, and consulting community. Consequently, many states are refraining from implementing the new methods until the confusion is resolved. EPA plans to issue an announcement sometime this summer to clarify some of the concerns. In the next issue of *LUSTLine*, we'll examine these new methods and try to bring you up-to-date on what is happening.

How to Obtain a Copy

- An electronic copy of the complete SW-846 manual is expected to be available this June from the OSW Web site: www.epa.gov/epaoswer/hazwaste/test/sw846.htm.
- The National Technical Information Service (NTIS) offers copies of the current, fully integrated manual (PB97-156111GEI, $239.00) and the individual copies of Final Update III (PB97-156137GEI, $150.00).
- NTIS also offers SW-846 on CD-ROM. It is compatible with both Windows and Macintosh operating systems. The CD-ROM utilizes Adobe Acrobat, with a powerful text search engine and the means to electronically jump to selected methods via hypertext links. Version 2 of the CD-ROM includes the entire, official version of SW-846, Third Edition, as amended through Final Update III.

To order either the paper version or the CD-ROM, contact:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(800) 553-6847

Prices are subject to change. To receive a fax with the latest information about copies of SW-846 from NTIS, call (703) 487-4140 and enter publication number code 8698. ■

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