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L.U.S.T. LINE

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

WHEN PUSH COMES TO SHOVE

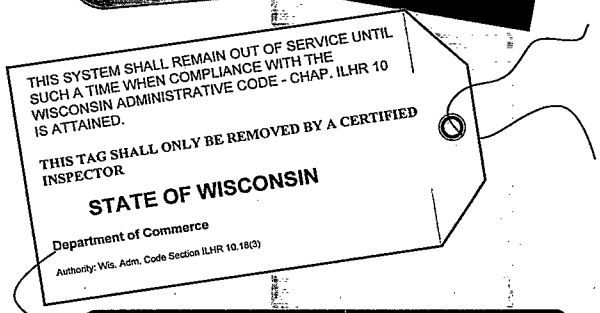
by Ellen Frye

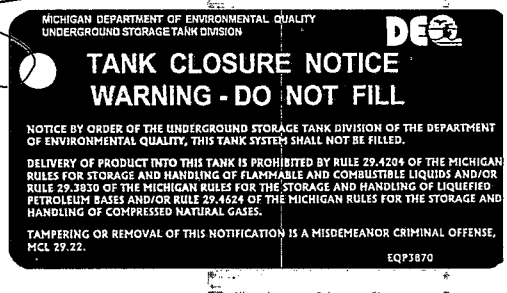
There comes a time when, as the song goes, "Something's gotta give!" As far as UST regulators are concerned, December 22, 1998, the deadline for upgrading, replacing, or closing substandard underground storage systems, will be that time. The time to get out and enforce! The time to see to it that substandard UST systems are eliminated...once and for all.

While tens of thousands of UST owners and operators have already brought their systems in line with '98 deadline standards or have closed their tanks, and while UST regulators have worked diligently at getting the word out to the regulated community, there is always the reality factor. As sure as day follows night, UST nirvana will not come to pass without a certain amount of regulatory pushing...and even shoving.

"Looking at the big picture, they've had 10 years, or 3,652 days, to do this," says Louis Sass, Enforcement Coordinator for EPA Region 5. "It only takes 3 to 5 days to upgrade a tank and 7 to 14 days to replace one.

"But there will be tank owners who will wait until the eleventh hour and then complain that they can't find a contractor to do the work by the deadline," says Sass. "I think procrastination is at the heart of the matter—like waiting until April 14th to find a tax accountant. Even after a 3,652-day heads-up, there will still be folks out there who will, in essence, ask us to please allow them to continue to pollute. Our answer is that substandard systems must be taken out of service in a proper and timely manner if they are not going to be upgraded."





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The Delivery Prohibition Thwack

One effective way to grab the attention of owners and operators with

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substandard USTs is to prohibit product delivery into those tanks. Several states have provisions that prohibit deliveries into unregistered USTs. Some states have applied or linked this authority to tank systems that are out of compliance with the state's UST performance standards, and as the '98 deadline approaches, more states are taking steps to incorporate delivery restrictions into their enforcement strategies. Presently, about 20 states (see list on page 4) have some kind of delivery prohibition provision that is tied to the 1998 deadline. Others are currently considering it.

In general, states are taking two types of approaches to delivery prohibition:

- **"Red tags"** - a noncompliant tank system is tagged, usually at the fill pipe, indicating that it is out-of-service and that deliveries should not be made into the tank; or
- **Compliance certificates/tags** - a placard indicating that a tank system is in compliance is displayed in a prominent location so that fuel suppliers can easily see that it is okay to make a drop.

"It works," Sheldon Schall, Chief of Wisconsin's Bureau of Storage Tank Regulation, says of the state's red tag program. "People know we will shut the system down."

"For me," says Barry Selden, Enforcement Unit Chief for the Michigan Department of Environmental Quality's Storage Tank Division, "red tagging, without question, is the most effective tool we have for getting tanks into compliance, especially the larger facilities with high volume. When you shut them down, it's a lot of lost revenue."

"For me to get one fine levied could take anywhere from two weeks to a month," says Juan Sexton, UST Coordinator for the Kansas Department of Health and Environment. "Even then, the violator can still fight it in court and go on operating a substandard facility. On the other hand, if I can shut their flow of fuel off, then they're more interested in getting into compliance in order to get back in business."

> ***"For me, red tagging, without question, is the most effective tool we have for getting tanks into compliance, especially the larger facilities with high volume. When you shut them down, it's a lot of lost revenue."***
>
> **Barry Selden**

"Delivery prohibitions get the job done quicker than conventional enforcement routes," says Andy Tschampa, EPA Region 5 UST Program Manager. "In terms of EPA enforcement, we don't have the ability to prohibit delivery; we'd have to go to court, where the judge might or might not agree with us that the facility needs to be put into closure.

"EPA's role will be to complement the states in situations where the state does not have adequate enforcement authority and ability," explains Tschampa. "For example, a state that doesn't have an Administrative Procedures Authority might ask to use our Administrative Order Authority to deal with a difficult enforcement situation. As we ascertain which of our states are able to implement delivery prohibitions effectively, it will help us figure out where to direct our enforcement resources."

Variations on the Theme

In Vermont, there is a brand new provision on the books that prohibits delivery to any tank that is not upgraded. According to the statute, the Department of Environmental Conservation (DEC) must visibly designate on the premises the compliance status of each regulated tank.

Industry representatives in the state liked the red tag idea, but because the statute called for the display of a compliance placard, the DEC, in cooperation with the marketers, came up with a multicolored system. If all tanks at a facility are in compliance, then the facility gets a green sticker. If some tanks are in compliance, the facility gets a yellow sticker, and the fuel delivery driver needs to look for tanks that have red tags, which indicate that a tank doesn't meet the standards and that delivery is prohibited. If a facility has no sticker, the DEC advises distributors not to deliver and to double-check with the UST program to determine the compliance status. The DEC will also maintain a listing of compliant tanks on its Web site.

"This is going to make it easier to enforce the deadline," says Ted Unkles, UST Program Coordinator for the Vermont DEC. "Even if somebody intends to violate, he will find it difficult, if not impossible, to find somebody to deliver the product."

In Utah, tanks that are in compliance receive a different color tag each year, which allows delivery drivers to quickly assess the status of the tank. If a drop is made into an untagged tank, both the owner and the distributor are fined $500 per drop. The tags are currently made of a plastic laminate. However, the state will soon begin issuing a sturdier, metal tag.

Montana will be issuing compliance tags and certificates that are tied into registration. If suppliers do not see a tag, they should not deliver. At

LUSTLine

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the suggestion of distributors in the state, each tag will have a serial number that corresponds to a specific tank at a specific site. Distributors were concerned that multitank owners would move the compliance tags around from facility to facility in order to have fuel delivered to untagged, noncompliant tanks.

Kansas can fine distributors up to $10,000 per incident if they deliver to a facility that does not have an annual operating permit. The distributor receives one courtesy call from the state to notify him or her not to deliver to a nonpermitted facility. "Our typical fine is $2,000," says Juan Sexton. "This gets their attention, but it's not steep enough to cause them to hire an attorney. It's been extremely effective. As soon as an owner/operator gets a 'no more fuel delivery' call from the distributor, the owner/operator calls us to find out what needs to be done."

In Nebraska, the State Fire Marshal's office carries out the UST program. Clark Conklin, Manager of the Flammable Liquid Storage Tank Division, explains that his division can write an order (not a notice of violation) to the owner of a noncompliant UST system to empty the tank(s) and not operate the system or store product until it is upgraded.

"Whenever we write an order," says Conklin, "that is a formal enforcement action that is enforced by the court." In this case, while red tags or compliance certificates are not involved, Nebraka's UST authorities can effectively shut down a noncompliant system and enforce against the owner or operator, not the distributor, if the system is operating illegally.

Supply-Side Enforcement

In states with delivery prohibition provisions, deciding whether to deliver fuel to a facility should be a "no brainer." In states without such provisions, however, fuel suppliers will have to decide what to do. "More and more, suppliers and distributors are asking us to verify that tanks are in compliance," says Kris Ricketts, Tanks Section Chief with the Missouri Department of Natural Resources, which does not have a delivery prohibition provision. "We are still considering our options. We will put compliance information on the Internet, and we are considering a nonregulatory delivery restriction approach."

> ***"There are few environmental programs that give the regulated community, in this case tank owners, 10 years to comply. The marketers whose tanks are in compliance have no sympathy for noncompliance and would like to see aggressive enforcement—with no slack cut."***
>
> **Jeff Leiter**

The widely circulated "Exxon letter" to the company's distributors, retailers, and customers drives home the concerns of many suppliers about potential liability where deliveries are to be made to USTs that have not been upgraded. The letter to the distributors states that Exxon has made a policy decision that it will notify those customers who own their USTs that product will not be delivered into any UST after December 22, 1998 if it has not been upgraded. The UST owner will have to provide Exxon with a copy of the UST registration and certify that the UST has been upgraded.

Many oil companies and distributors are considering whether to make similar decisions. "Suppliers have some obligation to ascertain whether they will need to make some changes in the way they do business," says Jeff Leiter of the law firm Collier, Shannon, Rill, and Scott, and Environmental Counsel to the Society of Independent Gasoline Marketers of America (SIGMA) and the National Association of Convenience Stores (NACS). "There is the issue of whether the supplier is negligent if he delivers to a substandard system after December 22, 1998.

"Anyone supplying product needs to determine, first of all, if there is a regulatory prohibition in a given state," says Leiter. "If there isn't, then he or she needs to determine what to do as a supplier. How do suppliers determine if a tank system is in compliance? How do they ensure that they have acted with due diligence? What is the supplier's duty?"

Leiter says that many of his clients are also concerned about supplying volumes of product to state and local agencies with USTs that are not upgraded. "If they choose not to upgrade," asks Leiter, "what do suppliers do? If they don't deliver, do they get in trouble for breach of contract? The supplier is in an awkward spot. The state environmental agencies need to talk with suppliers about what should be done in such situations."

The Marketers' Point of View

Petroleum marketers who have already spent the money to upgrade or replace their UST systems are, understandably, anxious to see the deadline enforced so that the playing field is more level with respect to the economic advantage of noncompliance. As one owner of multiple facilities who has made the investment said, "If they don't enforce, I'm at the head of the suckers line."

"There are few environmental programs that give the regulated community, in this case tank owners, 10 years to comply," says Jeff Leiter. "The marketers whose tanks are in compliance have no sympathy for noncompliance and would like to see aggressive enforcement—with no slack cut. If nonretailers, for example, can't manage to operate their USTs according to standards, they have fueling alternatives, such as wet hose fueling, aboveground storage tanks, and fleet cards."

Most state program managers in states that have instituted delivery prohibitions say that they have worked closely with their state petroleum marketers associations. The marketers have been very supportive of delivery prohibitions and have often testified to their legislatures on the UST program's behalf.

"Marketers are behind us 100 percent," says Juan Sexton. "In fact, some of them would like to see us out there enforcing on Christmas Eve."

In many states without delivery restrictions, marketers continue to push for some means to this end. At the coaxing of the state's oil marketers, for example, the Texas Natural Resource Conservation Commission is considering the possibility of instituting an annual self-

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certification process that would require owners and operators to certify that they are in compliance with all standards. Certified facilities would receive a decal or certificate that they would post conspicuously, and a fueling restriction would be placed on facilities without certificates.

This spring, five national marketers associations—PMAA, API, SIGMA, NACS, and SSDA—joined together to send a letter and a packet of information, including EPA's handbook, "Don't Wait Until 1998," to members of Congress, to bring their attention to the importance of supporting the 1998 deadline and EPA's efforts to enforce it.

The letter, dated June 2, 1998, states: "Our industry hopes that Members of Congress recognize this commitment of resources already made by the vast majority of underground storage tank owners and operators and oppose any effort to extend the...deadline. We also request your support of the Agency, as they make a concerted effort to ensure timely compliance by all affected parties. Finally, we ask that you help inform constituents that may contact your office of where they can receive information and compliance assistance with regard to UST regulations."

When all's said and done, states have been hammering home the tank compliance message for years, and as of December 22, 1998, something's gonna hafta give.

Other Enforcement Hammers

While many state UST program managers acknowledge that fuel delivery restrictions would make their lives easier in terms of enforcing the deadline, this option is not necessarily available to them. States must have specific legal authority to allow them to restrict fuel delivery. There is no such equivalent authority under federal law.

While some UST regulators groan at the thought of relying on notices of violation or administrative orders as their sole means of enforcing against recalcitrant owners and operators, others have found that this approach can get the job done expeditiously. Herb Meade, Chief of Compliance with the Maryland Department of the Environment, says the administrative enforcement route works well in his state, mostly because the Oil Control Program has the support of two attorney generals who are assigned to the program. "If I present them with a case, I can have an Administrative Penalty in the responsible party's hand within eight days.

"If I get a really bad actor," explains Meade, "I can turn the case over to the crimes unit, where the violations are both civil and criminal. If the violator doesn't comply, then it becomes willful, and the crimes unit pursues the matter as a criminal case. That usually scares people. If it's a real emergency, like a threat to human health and the environment, we can get a court injunction to shut down the facility in a day or two."

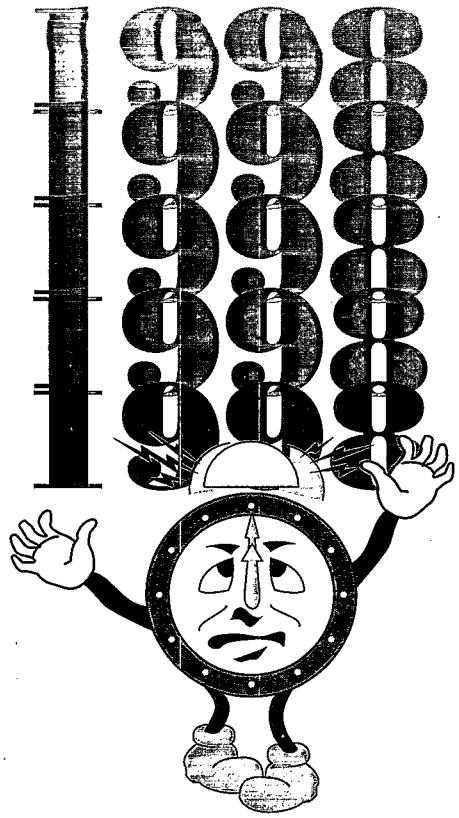
State cleanup funds can also have a great deal of enforcement clout. Many have played and will play a major role in moving the compliance agenda along, primarily by tying fund eligibility to compliance. The Iowa UST Fund, for example, actually moved its upgrade deadline up by almost four years. To qualify for financial responsibility coverage provided by the fund, UST systems had to be upgraded, replaced, or closed by January 1, 1995. That date was eventually rolled back to to December 1998; however, those who did not meet the 1995 deadline have to pay a much higher premium—more than double. No tank system that is out of compliance will be eligible for coverage after December 1998.

When All's Said and Done

When all's said and done, it's been 10 years, and the word has been sent out to tank owners and operators in a variety of forms and fashions—direct mail, seminars, meetings with marketers, on-site visits, TV spots. Between EPA's Office of Underground Storage Tanks, the states, and the trade associations, more than 2 million compliance assistance materials have been distributed to

STATES WITH DELIVERY PROHIBITIONS TIED TO COMPLIANCE WITH THE 1998 DEADLINE

State	Red Tag Restrictions	Compliance Certificates/Tags
Alaska (regulations pending)		X
California		X
Georgia		X
Illinois		X
Iowa		X
Kansas		X
Louisiana		X
Massachusetts	X	
Michigan	X	
Minnesota	X	
Montana		X
Nebraska (issue order to owner/operator to empty tanks and not to store product or use until upgraded)		
North Carolina		X
Oklahoma	X	
Oregon		X
South Carolina		X
Utah		X
Vermont	X	X
Washington		X
Wisconsin	X	



the regulated community. More than 750,000 copies of the popular EPA publication, "Musts for USTs" have been printed.

"We've been in ongoing communication with our tank owners," says Sheldon Schall. "This July, we sent letters to owners of noncompliant tanks telling them, once again, about the upgrade requirements. We identified each of their tanks according to its registration ID number, the tank's contents, the facility's name and ID number, the street address, the municipality, and finally, the upgrade features that, according to our records, were missing. These tank owners know what they must do.

"Clearly, many of the the owners who are not bringing their tanks into compliance have no intention of staying in business after 1998," says Schall. "Most nonretailers are realizing that they had better get rid of their tanks or go aboveground. Right now, we are seeing that the procrastinators are experiencing an inability to get contractors to do the work. They are also having difficulty in getting UST system components, such as tanks."

When all's said and done, states have been hammering home the tank compliance message for years, and as of December 22, 1998, something's gonna hafta give. ■

'98 Deadline Enforcement Strategy Samplers

The December 22, 1998, deadline for upgrading, removing, or replacing USTs will call for a concerted enforcement effort on the part of U.S. EPA and the states. This sampler covers the U.S. EPA and Kansas enforcement strategies.

U.S. EPA

Will Continue Enforcement in Partnership with States

In early August, EPA's Office of Enforcement and Compliance Assurance and Office of Underground Storage Tanks published EPA's *Strategy for Enforcement of Regulatory Requirements Applicable to Underground Storage Tank (UST) Facilities.* This strategy emphasizes EPA's major messages:

- EPA will NOT extend the deadline.
- States and EPA fully intend to enforce the deadline.
- States will continue to be the primary implementing agencies.
- EPA will continue to assist and augment the state efforts.

States Will Have the Primary Enforcement Responsibility

The philosophy that has guided the UST program since its inception is that states have the primary responsibility for implementing and enforcing UST regulations (except in Indian Country). EPA has devoted a major share of its resources to supporting and strengthening state programs and will continue to do so.

Accordingly, EPA expects states to take the lead in securing compliance with the 1998 deadline, including working before the deadline to monitor and enforce existing requirements, to continue reminding UST owners/operators of their regulatory responsibilities, and to develop plans for postdeadline compliance/enforcement. Following the deadline, EPA expects states to identify noncompliant facilities expeditiously and require them to promptly upgrade, replace, or close their USTs. States will use a variety of enforcement tools to ensure compliance, including administrative orders, judicial action, and prohibition of fuel delivery for noncompliant tanks.

When EPA Will Take Action

While EPA will inspect facilities throughout the country, the agency intends to concentrate its efforts in states that have less active compliance/enforcement programs. EPA will also try to be responsive to state requests for assistance with specific facilities or categories of facilities (e.g., federal facilities). EPA regional offices will continue to work with states to identify where federal activity is most needed.

EPA regional offices will continue to work with states to identify where federal activity is most needed.

How EPA Will Deal with Noncompliance

EPA intends to bring enforcement actions against noncompliant facilities to ensure prompt compliance and to assess monetary penalties for any period of noncompliance. It does not intend to allow continued operation of substandard systems. EPA's position is that noncomplying systems should be temporarily closed until the work necessary to upgrade, replace, or permanently close them is complete. In cases where states have the authority to shut down facilities without initiating administrative or judicial proceedings, EPA may refer the matter to the state implementing agency.

EPA intends to use all of the enforcement tools available to it, including administrative orders,

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■ **Enforcement Strategy Samplers** *from page 5*

field citations, requests for judicial action requiring injunctive relief, and information request letters.

Temporary Closure

In its enforcement strategy, EPA clarified that temporary closure is a valid compliance option and that it is permissible to upgrade, replace, or permanently close an UST during the period of temporary closure. Before a substandard tank can be legally operated, however, it must be upgraded or replaced. Substandard tanks are required to permanently close within 12 months of entering into temporary closure, unless they are subject to a site assessment and receive an extension from the implementing agency (the implementing agency is not obligated to provide such an extension).

EPA also clarified that substandard USTs that are placed into temporary closure after the deadline should not remain in temporary closure after December 22, 1999, without an extension. As indicated earlier, such USTs would be subject to a penalty for their period of noncompliance.

Indian Country

EPA is the primary implementing agency in Indian Country and will continue to monitor and enforce UST compliance in those areas. Facilities that are not owned by Native American tribes will be subject to enforcement action in the same manner as facilities located elsewhere, consistent with EPA's enforcement strategy. Tribally owned and operated facilities will be subject to enforcement action in accordance with existing EPA guidance.

Additional Information

The full text of EPA's strategy is available on the agency's Web site at http://www.epa.gov/swerust1/1998/index.htm. EPA's Web site is also an excellent reference point for obtaining a variety of compliance assistance materials and for links to state UST/LUST programs. EPA's RCRA Hotline ((800) 424-9346) is also available to answer regulatory questions or to provide copies of the enforcement strategy and other publications.

Kansas

Permit Cycle Adjustment That's More than Just a Blip

Since 1991, Kansas has had a compliance enforcement process that involves an annual permitting cycle that runs from August 1 through July 31. In deference to the 1998 deadline, the timing of this cycle will be temporarily modified. Here's how it will work. This past July, the Kansas Department of Health and Environment (DHE) issued a 1998 operating permit with an expiration date of February 28, 1999, for USTs in compliance with predeadline requirements. A second operating permit will be issued in February 1999 for USTs in compliance with all of the UST requirements.

> ***"We focus our inspection efforts on facilities that don't have permits and these permits are contingent on compliance. For this abbreviated 1998 deadline cycle, we will follow the same enforcement process that we do during a normal cycle."***
>
> **Juan Sexton**

In January 1999, warning letters will be sent to owners of USTs that are not in compliance, informing them of their options. Inspections of facilities with noncompliant USTs will begin in March and civil penalties will be assessed against anyone found operating a noncompliant UST, as well as any transporter or supplier who places product into one of these tanks. On August 1, 1999, the annual permitting cycle will return to normal.

Hammering Home the Message

Kansas' enforcement process is geared toward "cutting to the chase" and leveraging limited resources. "We hammer, hammer, hammer constantly," say Juan Sexton, UST Coordinator for the DHE. "We focus our inspection efforts on facilities that don't have permits and these permits are contingent on compliance. For this abbreviated 1998 deadline cycle, we will follow the same enforcement process that we do during a normal cycle."

In the normal cycle, the process moves along in the following way. In March of each year, registration renewal forms are sent to UST owners, who are expected to review the form for changes and submit a third-party verification of changes in compliance with UST regulations where needed. By June, notices of noncompliance are sent to owners with USTs that do not fully meet the requirements. These notices detail the compliance deficiencies for each tank and inform owners that an operating permit will not be issued until DHE receives documentation of compliance.

In August, new UST operating permits must be posted at each facility. DHE recommends that owners send copies of the permits to their suppliers each year. Notices of noncompliance are sent to owners who did not receive permits for each UST, informing them that they must discontinue use of noncompliant USTs and that the status of the USTs will be changed to temporarily out of service if the department does not receive documentation of compliance within 30 days.

DHE staff perform targeted inspections and gather evidence to issue civil penalties in cases where USTs are being operated without permits. Staff also give a "courtesy call" to fuel suppliers of facilities that are discovered to be operating without a permit to inform them that further deliveries will result in the issuance of a civil penalty to the supplier.

"This effectively cuts off the fuel supply," says Sexton. "So effectively that, so far, we have obtained compliance without issuing many administrative orders."

Throughout the remainder of the cycle, the DHE sends out notices to owners with noncompliant USTs advising them that their tank status has been changed to "temporarily out of service" and letting them know what they have to do. DHE also provides extensive educational outreach to all tank owners. ■

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

Joint Industry Survey of UST Enforcement Strategies Available on PEI's Home Page

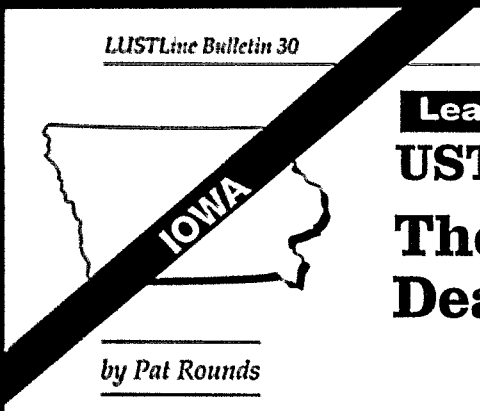
Those of you who read this column in the June issue of *LUSTLine* know by now that six trade associations gathered forces and resources over the summer to survey state and territorial UST program managers about their enforcement policies and procedures. The survey, which was mailed on August 10 to all UST program managers, asked these questions:

- What is the size of your state's registered underground storage tank population?
- What percentage of your active tank population currently does not meet the 1998 requirements?
- Does your state regulate heating oil USTs? If yes, are these tanks subject to the 1998 deadline requirements?
- What are the compliance deadlines in your state?
- How many full-time equivalent staff (e.g., inspectors, office personnel) will be enforcing the 1998 requirements?
- Will any of your enforcement work be carried out by state personnel other than employees from your department (e.g., weights and measures, fire marshal's office)?
- Will any of your enforcement work be carried out by personnel other than state employees (e.g., licensed professionals)?
- If your state has a cleanup fund, will releases from noncompliant tank systems be eligible for reimbursement after the 1998 deadline?
- What are your plans for continued outreach to the regulated community?
- What methods will you use to identify compliance/noncompliance?
- Do you have a strategy for prioritizing noncompliant facilities for enforcement?
- If you intend to prioritize noncompliant facilities, indicate who/how you will target.
- Have you set up a post-12/22/98 strategy for making site visits to facilities that your data show are out of compliance?
- Have you set up a post-12/22/98 strategy for making site visits to facilities that your data show are in compliance?
- When you inspect a facility after 12/22/98, what will you look for?
- Once you have determined that a facility is out of compliance, what will the state do?
- What are the financial consequences of noncompliance with the December 1998 requirements?
- What options do noncompliant owners/operators have after 12/22/98?
- Will information on enforcement actions be available to the public?
- How will you verify that a facility has come into compliance after an enforcement action has been taken?
- How many inspections do you intend to perform in 1999?
- In the long term, how frequently do you anticipate that regulated facilities will be inspected in your state?
- Does your state have a plan that is designed to deal specifically with government-owned tanks?

The Petroleum Equipment Institute (PEI) is one of six trade associations that developed the survey. Since PEI serves petroleum marketing equipment manufacturers, distributors, and installers, in addition to their customers, the association decided to make the survey responses available to everyone via the Internet. To access responses to a particular survey, first click on the *UST Enforcement Survey* link on PEI's home page, (www.pei.org) and then click on the state or territory that you are interested in reviewing. PEI has already posted completed surveys from more than three dozen states and territories, and more are being added to the site weekly.

PEI expects some enforcement procedures to change after they are included on its Web site. PEI will amend the response to reflect the jurisdiction's most current enforcement policy as soon as it is notified of the change by the UST program manager.

If a state or territory is not included on the PEI site, it is because the program manager elected not to respond to the survey. Please contact that state directly for the information you need—do not call PEI. ■



Leak Prevention

UST System Management: The Key to the Success of the 1998 Deadline

by Pat Rounds

After 10 years of advance notice, the 1998 deadline for terminating substandard UST systems is only weeks away. But complying with the tank standards is only a starting point for what should be an ongoing process for the long-term safe operation of UST systems. The long-term goal should be proper system management and the elimination of future releases. Without good UST system management, system upgrades and replacements may provide little or no long-term environmental protection.

In Iowa, to qualify for financial responsibility coverage, UST systems were required to be upgraded, replaced, or closed by January 1, 1995. In an effort to understand how well the deadline will address future environmental pollution, the Iowa Underground Storage Tank Fund has taken a closer look at some of the UST systems that were upgraded prior to the federal deadline.

Through our investigations, we found several causes for concern that could jeopardize UST system integrity into the future:

- **Leak Detection** Many owners who used to keep careful inventory records have abandoned inventory recordkeeping in favor of automatic tank gauges (ATGs). While this move should be a positive step toward effective leak detection, it may be just the opposite. All too often, the facility owner or operator fails to understand the basic operating principles of the ATG as a leak detection device. He or she is lulled into a false sense of security. This situation is a recipe for disaster.

  We had cases where installers wired "around" line leak detection systems when the alarms began sounding immediately after UST systems were placed into operation. Assuming there was a problem with the line leak detectors, not the piping, they bypassed the leak detection systems and then turned the UST system back on. The rest is history. Corrective action continues today.

- **Integrity Assessment** Vendors utilized methods under an emergency ASTM standard to determine if cathodic protection could be applied to tanks more than 10 years old. However, many of the evaluations did not comply with the regulatory requirements. Therefore, the tanks were not properly upgraded.

- **Cathodic Protection** Sixty-four percent of Iowa's insured tank population consists of steel tanks. Eighty-three percent of these tanks required the addition of some form of cathodic protection or internal lining to meet upgrade standards. Seventy-five percent of these tanks added cathodic protection alone, 8 percent relied on internal lining alone, and approximately 17 percent utilized both cathodic protection and internal lining. On sites where cathodic protection was added, the following major concerns were discovered:

  - Field crews installed cathodic protection systems by drilling through the spill catch basins to install portions of the system. The process rendered the spill catch basins useless.
  - Field crews failed to properly insulate buried electrical connections, resulting in rapid failure of anode lead wires and loss of cathodic protection for the UST systems.
  - Field crews installed improperly engineered systems. Systems were installed that were both under- and over-sized. As a result, the systems were not provided with adequate cathodic protection. A mass-marketing approach of selling "one size fits all" systems seems to have brought about this situation. Repair and replacement continues today.
  - Impressed current cathodic protection systems have been found turned off or set at incorrect levels. In some situations, systems were found hooked up to power sources that are turned off each night, rendering the cathodic protection systems operational only during business hours.

- **Internal Lining** Of the steel tanks that needed to be upgraded, approximately 25 percent were upgraded using internal lining. Based on a video inspection of the interiors of 55 tanks with linings ranging from 2 to 12 years old, and based on two separate reviews, as many as 24 of the 55 tanks indicated possible problems with the linings. Additional physical inspections are planned for the future. (See sidebar on page 9.)

- **Spill/Overfill Prevention** In some instances, spill buckets, or catch basins, are being used to hold the overfill contents of a delivery hose. Spill buckets are designed to catch drips—many are only five gallons in capacity—and they cannot adequately contain a spill. If a delivery hose must be emptied into a spill bucket, then the overfill prevention system is not working properly.

  Overfill devices may not be working properly because transporters have tampered with them. Many owners use overfill equipment that involves a tank shut-off valve in the fill tube. Owners have discovered that transporters have removed the overfill equipment to expedite their fuel drop. As a result, the tanks no longer have overfill prevention.

- **Double-Walled Piping** Vendors attempted to replace flexible primary lines while leaving secondary lines in place. The secondary lines were damaged during the process and no longer provided secondary containment. To correct the problem, complete repair or replacement of the secondary line and secondary-line tightness tests were required.

Lessons Learned

Although meeting the minimum federal requirements should both reduce the number of system leaks and increase early detection of those leaks, some systems will still leak. Numerous problems can occur with both new systems and retrofitted systems—ATGs not gauging the entire volume of the tank; leak detection methods that are improperly applied; catch basins filled with water and having no capacity for spills; damaged or removed overfill devices; interstitial spaces of double-walled lines filling with water and then freezing and cracking primary piping; failed cathodic protection systems; failed linings; and ordering more fuel than tank capacity.

All such problems can result in a product release. Proper tank installation and management can eliminate many, if not all, of these potential problems. Here are a few tips for the tank owner that we picked up in our travels.

Tips for the Tank Owner

- When an automatic tank gauge or electronic line leak detector indicates there is a problem, believe it! Shut the system down and have it checked out. Although false alarms are possible, ignoring such alarms can result in catastrophic releases.
- Be sure your installer is licensed in your state (if applicable) and certified by the manufacturer of the equipment he or she is going to install. Out-of-state, "here today, gone tomorrow" contractors may leave you with less than you anticipated.
- Use the services of a third-party inspector for all installation procedures. A little extra money spent at the time of installation may help identify an improper installation procedure and allow the installer to fix the error before the system is paved over and turned on.
- Inspect cathodic protection systems on an annual basis. Although this testing interval is more frequent than that required by federal law, such inspections are not expensive and will provide the owner with more rapid identification of a system that is not fully protected.
- Recognize that lining is a temporary upgrade. Be sure to review your warranty and have the lining inspected before the warranty expires—every 5 years is desirable.

Owners need to be educated on the proper management of their UST systems. The education can come in the form of system manuals, industry newsletters, seminars, and regulatory newsletters directed at helping owners troubleshoot potential problems and manage their UST systems appropriately. Failure to manage a system properly should result in enforcement action.

Compliance Is a Business Issue

UST standards are minimum requirements. If an owner or operator cannot meet minimum federal requirements, even after a 10-year window during which owners had the opportunity to finance the necessary upgrades, then most likely he or she cannot afford to properly manage and maintain the systems. It also stands to reason that society should not be subject to the potential harms caused by these systems.

Ron Marr, Executive Vice President of the Petroleum Marketers of Iowa, maintains that the savvy petroleum marketer will go a step further than minimum compliance. He believes that the majority of his members look at compliance as a business issue, where a tank replacement or upgrade is part of an environmental program, not a regulatory program.

"The savvy owner will surpass the minimum requirements and install a system that makes the business more valuable and easier to sell in the long term," says Marr. Combining upgrades with pump island relocation and store-front "facelifts" increases the value of the business and gives the owner a marketing asset.

The 1998 upgrade deadline is only a starting point. Compliance with the UST standards is, indeed, a long-term business issue and not just another regulatory requirement to install hardware that can then be ignored and forgotten. Proper tank management and unceasing vigilance are the keys to maintaining long-term environmental protection and a profitable business. ■

Pat Rounds is Administrator of the Iowa UST Fund. For more information, contact Pat at pjr@williams.com.

Iowa's Tank Lining Study

The Iowa UST Fund Board conducted video inspections of 55 tanks at 39 sites across Iowa. The tanks ranged from 4 to 43 years old. The ages of the linings ranged from 2 to 12 years. Tanks with and without cathodic protection were evaluated.

Based upon reviews conducted by two contractors, possible concerns were identified with 24 of the 55 tanks inspected. Concerns ranged from minor irregularities in the thickness of the lining, to discoloration and cracks, to areas where the lining had completely delaminated from the side of the tank.

National Leak Prevention Association (NLPA) standards require that lining material be inspected by way of manned entry into the tank. Although video inspections do not meet this criteria, investigators felt that catastrophic failure of the lining and possible lining flaws could be determined through the video inspections. We do, however, plan to conduct follow-up manned entry inspections to determine the status of the linings that appear to fail the standards. Upon completion of these inspections, a final report will be available.

For more information on the Iowa tank lining study, contact Patrick Rounds, Administrator, Iowa UST Fund, 1000 Illinois St., Suite B, Des Moines, Iowa 50314.

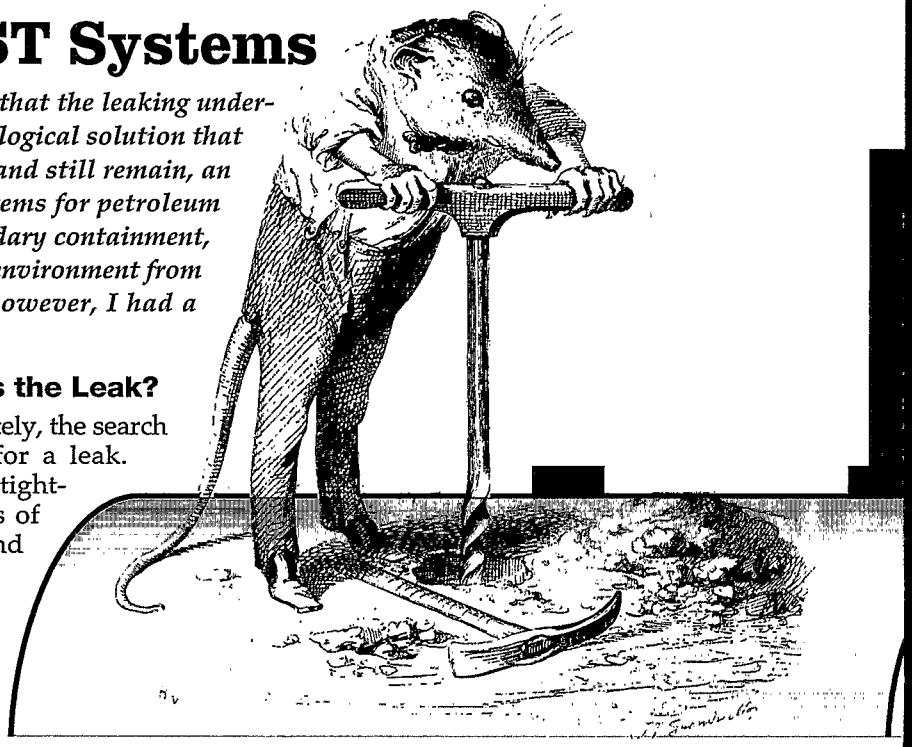
Leak Prevention

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.*

The Holes in Our UST Systems



I used to sleep soundly at night. I used to believe that the leaking underground storage tank (LUST) problem had a technological solution that could overcome human frailty. I have long been, and still remain, an ardent proponent of secondary containment systems for petroleum storage. I have for a long time thought that secondary containment, though not perfect, would adequately protect our environment from petroleum contamination. A few months ago, however, I had a rude awakening.

A Troubling Case

The newspaper headlines announced bluntly that MTBE (methyl tertiary-butyl ether) had been found in a monitoring well located between a gas station and a public water supply well that serves several thousand people. The news reports indicated that a new convenience store/gas station facility, barely 10 months old, had reported that MTBE had been found in an observation well in the tank backfill.

The site had no previous history of gasoline storage. The storage facility was state-of-the-art, with double-walled fiberglass tanks and flexible piping, dispenser sumps, tank top piping sumps, and spill containment and overfill prevention. Only the Stage I vapor recovery riser and Stage II vapor return piping were single-walled. Sensors continuously monitored the piping sumps and tank interstitial spaces for evidence of releases.

As part of a due diligence investigation associated with a property transfer, samples that had been taken from the facility's observation wells tested positive for MTBE. Because of this, a monitoring well some 1,000 feet away that was halfway between the convenience store and the public wells was also sampled. This well also tested positive for MTBE. Soon low levels of MTBE appeared in the nearby public water supply well. As a result, that well was closed, and an alternate well a few hundred feet farther away was put into operation.

Where's the Leak?

Immediately, the search was on for a leak. Multiple tightness tests of tanks and piping showed nothing. Interstitial spaces of tanks and piping were dry. Was it a vapor leak? (See "The Great Escape..." on page 18.) A helium test, where the storage system is filled with helium and then a helium detector is used to check for leakage, was conducted and, at first, indicated a positive result. Helium levels in the area over the tank, as measured through holes in the concrete cover pad, were higher than expected.

To pinpoint the leak, the concrete mat over the tanks was sawed into large blocks and then carefully lifted off and removed. The gravel backfill over the tanks was vacuumed away so as to leave the piping as undisturbed as possible.

With the tank top and piping exposed, the helium test was repeated. This time, the helium detector was placed right up against the joints and the piping so that the exact location of the leak could be identified.

Quite a few interested parties were watching, including the state environmental agency, the tank installer, and several representatives of the tank owner. But no leak was found. A dead end again.

Spillage Perhaps?

A review of inventory records provided a clue. There were four instances where the records provided strong indications that the regular tank had been overfilled. This was evidenced by a shortage of several hundred gallons in the regular product inventory, while the premium product showed an overage of similar magnitude. The most likely scenario was that more regular product had been ordered than could fit into the tank, so the excess was delivered into the premium tank. This is known in the trade as "cross-dropping."

The reason excess product had been ordered was perhaps because the fuel manager failed to recognize that the "10,000-gallon tank" had an actual maximum capacity of 9,728 gallons. This volume was further

reduced by a float vent valve that had been set conservatively at 18 inches below tank top, yielding an actual tank capacity of only 8,459 gallons.

Given the operational characteristics of float vent valves (see *LUSTLine* #21), it seems likely that the delivery person would have to have dealt with a hose full of product and that some spillage could have resulted.

By What Route?

The spill containment manholes at this site were below-grade models, which is good in terms of keeping surface water out, but leaves some gravel exposed around the rim of the spill container. Product could have infiltrated this backfill area. But then why was there no significant presence of any other gasoline constituents in the groundwater in the tank excavation and no evidence of contamination in the gravel backfill around the fill pipe?

For this scenario to be credible, we must assume that the other gasoline constituents volatilized and biodegraded, while the MTBE was carried by precipitation down to the groundwater. Because the backfill was clean and well aerated, and the investigation of the site occurred about five months after the last clear indication of an overfill incident in the inventory records, this scenario seems somewhat plausible.

Another possible route for MTBE contamination is being explored by Dr. Gary Robbins at the University of Connecticut. Robbins is finding that MTBE is appearing in groundwater beneath dispensing areas, apparently originating with spillage during vehicle fueling. Because of its solubility, MTBE can be transported by rainwater to groundwater while other gasoline constituents are attenuated or volatilized. It is possible that surface spillage at the dispensers could have contributed MTBE contamination to our mystery spill as well.

A Bit of History

Until the publication of the EPA's tank testing study in 1988, a leak rate of 0.05 gallon per hour had been the longstanding industry standard for leak detection accuracy. This number apparently originated with a study that concluded that leaks of 0.05 gallon or less assimilated naturally and did not pose a significant contamination threat.

While the actual magnitude of a "no-adverse-effect leak rate" could be debated at great length, I think the presence of MTBE in today's motor fuels would add a new dimension to the equation. The incident cited above, as well as several others that I am aware of involving significant MTBE contamination resulting from automobile accidents, where limited amounts of fuel were spilled, casts a new light on the significance of gasoline spillage. Volumes of spilled gasoline that previously would have had no adverse effects can cause significant damage when MTBE is present.

While the official EPA position is that there is no "allowable" leak rate, the evaluation protocols for the various leak detection methods determine threshold leak rates below which a storage system is assumed to be tight. The nagging question is whether a leak detection standard of 0.2 or 0.1 gallon per hour is adequate to protect human health and the environment when MTBE is present.

What Does the Future Hold?

While we are no doubt better off from a leaking storage system perspective today than we were 10 years ago, we are not out of the woods yet, and probably never will be. In the next decade we will likely still be paying for some sins of the past decade, will still be dealing with the foibles of human nature, and will be facing an ever more prevalent chemical specter with the initials MTBE.

So what possible routes of escape might gasoline and its constituents (MTBE in particular) find in our future fueling systems? Here are some working hypotheses that I think are worth keeping in mind:

■ There are holes in our UST systems, but they are below the detection threshold for leak detection technology.

One of my favorite stories involves a double-walled fiberglass tank. During a routine regulatory inspection, the regulator discovered that the interstitial sensor had been disconnected. A subsequent investigation revealed that the interstitial space was half full of product, which explained why the sensor had been disabled. The owner insisted that there was no problem, suggesting that a delivery had mistakenly been made into the interstitial space and pointing to several tightness tests with "tight" results.

The product was pumped out of the interstitial space, yet a small amount of product, about a gallon every couple of days, kept reappearing. This was initially explained as residual product draining from inside the ribs of the tank, but the product continued to mysteriously accumulate.

The owner insisted that everything was fine, but the environmental agency was suspicious. Finally a dye was introduced into the product in the tank, and a few days later, the dye appeared in the product that was being removed from the interstitial space. Subsequent internal inspection uncovered a pry bar lying in the bottom of the tank at the fill opening, and a small impact fracture just beyond the edge of the striker plate in the bottom of the tank.

A likely scenario is that a delivery driver, in the process of chopping ice out of the spill container (after removing the fill cap), had slipped and dropped the bar down the fill pipe. The point is that this leak would never have been detected had it not been for secondary containment (the leak rate was less than 0.1 gph), but clearly could have resulted in the release of a significant amount of product over time.

In another recent case, a tank gauge had apparently failed to detect a leak that had gotten into some underground utilities. Review of the automatic tank gauge (ATG) test records indicated a small, consistent loss—evidently not enough to exceed the leak threshold for the device and fail a leak test.

■ There are holes in our UST systems, but we are not looking in the right places for them.

Leaks of petroleum vapors from UST systems have not been a traditional target of leak detection efforts, and it may well be that historically the magnitude of these releases has been

■ *continued on page 12*

■ **Tank-nically Speaking** *from page 11*

below the "no-adverse-effect leak rate." Although I do not yet know of any instance where a vapor release has been the source of an environmental problem, theoretical considerations indicate that it could be a possible origin for MTBE contamination. (See "The Great Escape..." on page 18.)

The potential magnitude of vapor releases has been increased by the widespread use of pressure/vacuum vents that maintain a small pressure on the vapor space of the tank, thus increasing the rate of vapor emissions from any holes near the top of the tank.

Of the leak detection tools at our disposal, only full system tightness testing and soil vapor monitoring are likely to detect vapor leakage from storage systems. Soil vapor monitoring is rarely used and tank tightness testing will be phased out with inventory control. Storage systems that are subject to Stage II vapor recovery regulations are subject to periodic tightness testing of the vapor space, but these are a relatively small percentage of the tank population at this time. So, for a great many storage systems, the tightness of the tank ullage space and the piping that handles only vapors is never determined.

Other storage system components that escape routine testing are the piping sumps on top of tanks and dispenser sumps. While sumps that contain some amount of water are a fairly common sight, I always wonder whether the sumps that don't contain water are dry because no water is getting in or because whatever water is getting in is also leaking out.

As sumps age and are subject to frost action, possible tank movement, and assorted maintenance activities, it would seem reasonable that, at some point, they could develop holes that would compromise their leak detection role. Yet sumps are not routinely evaluated for liquid tightness.

■ There are holes in our UST systems, but the technology to detect them is not being installed properly.

Recently, I heard of a case where secondary containment piping had been installed, but leaked product failed to make its way back to the piping sump where the sensor lay in wait to detect it. If leak detection technology is not properly installed, it may not operate properly. This problem, of course, can result in undetected leaks.

■ There are holes in our UST systems, and they are being detected, but no one is paying attention.

The routine disregard of alarm signals by facility personnel is a problem of epidemic proportion. I recently heard of a facility where the ATG recorded that an alarm indication had been turned off 47 times in 28 days. This problem is twofold in that false alarms that result from poor equipment design or installation occur too frequently, and facility personnel have not been made sufficiently conscious of the potential significance of an alarm going off.

■ There are no holes in our UST systems, but product is being spilled during deliveries.

As illustrated by the story at the beginning of this article, spill events associated with deliveries continue to occur and can result in significant environmental problems, especially when MTBE is involved. A number of factors contribute to this problem, including the owner's lack of awareness of actual storage tank capacity, the ineffectiveness of the overfill prevention technology we commonly use (see *LUSTLine* #21), and the delivery personnel's financial incentive to be quick rather than careful (especially those who are paid by the truckload, not by the hour).

■ There are no holes in our UST systems, but product is being spilled during dispensing.

The possibility that routine spillage of gasoline by the end user is a significant source of gasoline releases is very disconcerting. Since talking with Gary Robbins about his research, I have begun to notice that evidence of gasoline spillage is everywhere—concrete mats around dispensers, fast-food restaurant parking lots, and on-street parking areas all display ample evidence of how often end users spill gasoline. (Did you ever stop to think why the area around dispensers is paved with concrete and not asphalt? Because we learned long ago that asphalt is rapidly degraded by spillage during fueling.)

Historically, this spillage may have been of little consequence because of volatilization and biodegradation, but again, the introduction of MTBE has changed this picture.

The mathematics of consumer spillage look something like this: In 1997, we, as a nation, dispensed about 126 billion gallons of gasoline. If we assume that the consumer purchases an average of 10 gallons per fuel dispensing event and that one in 1,000 fueling operations results in the spillage of one cup of gasoline (that's an individual driver spilling one cup about every 19 years if you fill up once a week), then about 750,000 gallons of fuel are spilled every year at fueling facilities alone. Is this a number we can live with? Is this a number we can live with if MTBE is part of the picture?

The Watchwords

So here are some watchwords we should keep in mind for the next decade:

- **Out of sight must not be out of mind.**

  Tank management must be an active and ongoing process on the part of tank owners and operators.

- **Do it right!**

  Proper storage system installation and maintenance work is more important than ever.

- **Early retirement is not an option.**

  The tank regulator's job is far from over.

I'm also considering the possibility that the most intractable part of the underground petroleum storage problem may prove to be sociological rather than technological: Can we complete 15.75 million underground tank filling operations and 12.5 billion automotive fueling operations each year without spilling a drop? ■

State Cleanup Funds

Fraud and Abuse

What State Cleanup Funds Can Learn from Medicare

by Bob Cohen

This June, the lobby of the hotel where state cleanup fund administrators met for their annual conference was humming with chronicles of contractor fraud and abuse. The stories contained intrigue, politics, cunning, and, often, a sad ending—the bad guys got away with it. Few fund administrators discuss the matter publicly for fear of personal reprisals via lawsuits or increased internal scrutiny by zealous inspector-generals. Fund administrators often find themselves in a lose/lose situation.

Losses resulting from fraud and abuse affect the larger LUST community in the following ways:

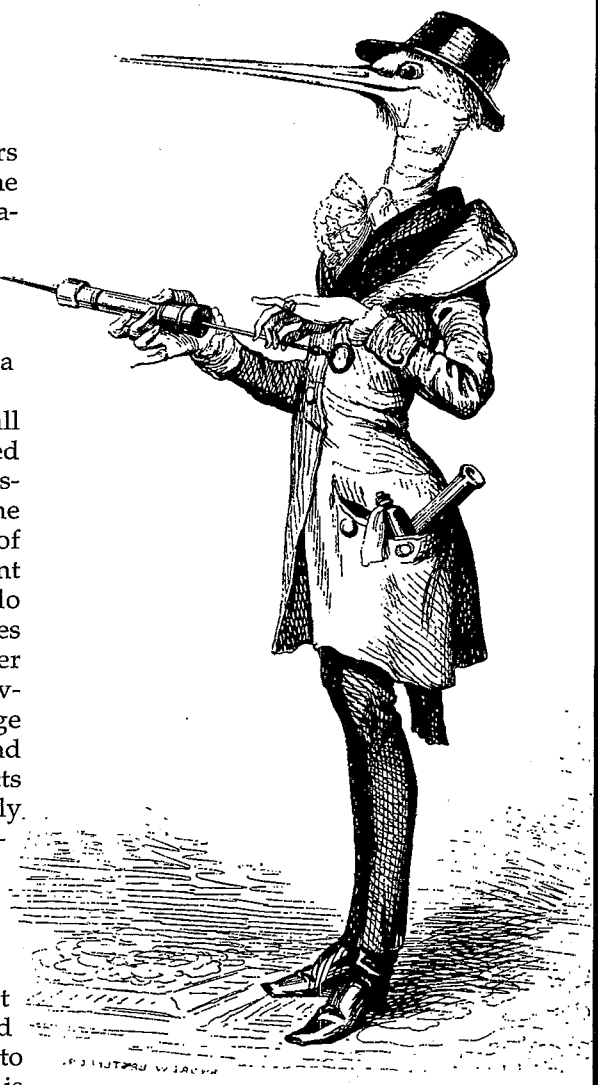
- Fund administrators have fewer dollars available, which leads to solvency issues and endless complaints.
- EPA must deal with the issue of insolvent funds as financial assurance mechanisms.
- Major oil companies, which are likely to clean up releases with or without the fund, are taking the risk that money will not be there for repayment.
- Marketers, who are less likely to clean up until compelled to or until funds are available, risk the liabilities of contaminated property.
- Financial institutions/insurance companies are likely to be left with significant financial responsibilities.

It is in every stakeholder's interest to be aware of and use proactive measures to deal with fraud and abuse.

Dealing with the Problem

With the formation of an ad hoc Cleanup Crime/Fraud Task Force at the 1997 State Fund Administrators Conference, fund administrators, attorney generals, and regulators from several states began giving the issue serious attention and coordination. I became involved because I had been working on the Florida Auditor General's $5 million abuse and fraud audit of the billion-dollar Florida LUST fund.

It is difficult to estimate overall losses due to fraud and abuse. Based on conversations with fund administrators, losses may well be in the range of 20 to 40 percent. Abuse of the system can happen to different degrees. While most contractors do an honest job, few actually close sites in an expedient manner. A smaller percentage engage in abusive behavior and an even smaller percentage in criminal fraud. Yet these few "bad apples" can have devastating effects on fund solvency while generally lowering the standards of acceptable behavior.



The Medicare Analogy

Fortunately (or unfortunately), state fund administrators are not alone. The Medicare fund has had problems that have clear analogies to the state funds, and the good news is that the Medicare program has come up with some tools to detect and deter abuse. Some of the tools that have been used successfully in Medicare fraud prevention and detection can be applied to state cleanup funds.

What do we mean when we speak of fraud and abuse? As it happens, the definitions of fraud and abuse used in Medicare are appropriate for state cleanup funds:

Fraud - " a matter of intentional, flagrant violations of Medicare rules—deliberate deception, a misrepresentation of facts for unlawful gain from the Medicare program."

Abuse - "a lesser offense. It refers to: incidents and practices that directly or indirectly cause financial losses to the Medicare program or to beneficiaries and their families, and practices inconsistent with accepted and sound medical or business habits. Abuse is typically a matter of excessive charges or unnecessary costs to the Medicare program with improper billing practices."

In this article, I use "fraud" and "abuse" interchangeably, because there is often a fine line between them. I also use the terms "contractor" and "consultant" interchangeably.

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■ Fraud and Abuse *from page 13*

Abusive Behavior

State cleanup funds vary in structure, from reimbursing the tank owner directly to paying the contractor, based on preapproved prices. Depending upon the fund's structure and controls, some abuses may be more prominent than others. The significant point here is that *all* funds are subject to some measure of fraud and abuse.

Here is a list of some abuses that are common to both Medicare and LUST funds. All of these abuses are not applicable to every state cleanup fund.

- **Upcoding -** Medicare billings are based on a complex system of numerical codes used to designate various diagnoses and procedures. Abusive physicians will charge Medicare for more complex tasks than actually performed. LUST site contractors may upcode by billing for more expensive services than required—for example, billing for a pump test instead of a slug test. Recently, a former cleanup contractor confessed to me that her former employer abused Florida's preapproval program by upcoding. In this case, highly paid engineers' prices were charged for tasks performed by entry-level technicians.
- **Unbundling -** Medicare has special reimbursement rates for groups of procedures, such as a series of blood tests. Some health care providers will increase billing and profit by unbundling the group and billing individually. Similarly, LUST programs often bundle various items in unit price schedules. Unbundling occurs when individual items, generally included in overhead, are billed separately.
- **Gang Visits -** In gang visits, a single patient visit is billed as multiple visits with various subtasks assigned to each visit. The LUST equivalent occurs when contractors visit multiple sites on one trip and bill each visit as a separate trip originating from the home base.
- **Fraudulent Billings for Services Not Rendered -** Much of the fraud that has resulted in successful cost recovery involves billing for services not rendered. Recently in Florida, a contractor claimed from the trust fund $12 million for work that was never performed. He bribed a government employee to adjust the database to show the work was completed. Fortunately, the scheme was exposed before the funds were dispersed. The abuser is currently serving jail time.

After billions of dollars spent on fraud and abuse, Medicare administrators have developed both simple and sophisticated tools for detection and prevention. These tools have clear applicability for state cleanup funds. In many cases, the implementation of these tools will require supporting statutes as well as investments in software and personnel. Medicare's experience suggests a cost recovery ratio of at least $10 for each $1 spent on abuse investigation. The savings from prevention are even greater.

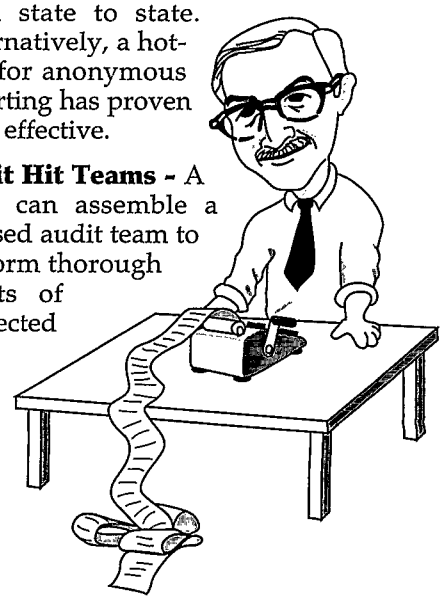
- **Ping-Ponging -** This abuse can be complex and devious. In ping-ponging, unnecessary services are rendered through referrals. They are often accompanied by under-the-table kickbacks. For example, a health care provider may send a patient to the lab for unnecessary tests and in turn be provided a rebate. The kickbacks can be very subtle and not necessarily paid in traceable cash. There are cases where LUST contractors have arranged extensive and elaborate cleanups for ordinary LUST sites. In one such case, the remediation equipment was ineptly used on sites in several states, resulting in large costs with very little cleanup. The motivation was an inappropriate relationship with the equipment vendor. In each case, the vendor was the driving force with apparent kickbacks to the consultant.
- **Overutilization -** Services are provided that are of questionable value. The services might include testing, physical exams, or even surgery. It is not rare to see the excess use of monitoring wells or pump tests at LUST sites.

Combatting Fraud and Abuse

After billions of dollars spent on fraud and abuse, Medicare administrators have developed both simple and sophisticated tools for detection and prevention. These tools have clear applicability for state cleanup funds. In many cases, the implementation of these tools will require supporting statutes as well as investments in software and personnel. Medicare's experience suggests a cost recovery ratio of at least $10 for each $1 spent on abuse investigation. The savings from prevention are even greater.

Detection and Prevention Tools

- **Whistleblowers/Abuse Hotline -** The federal program for whistleblowers is found in the False Claims Act, a Civil War era statute. This law allows private citizens to share in the recovery of false claims. With the normal turnover of employees, abusers will have to be more careful and less egregious in their nefarious acts if whistleblowers are to share in the recovery. The whistleblower laws vary widely from state to state. Alternatively, a hotline for anonymous reporting has proven to be effective.
- **Audit Hit Teams -** A state can assemble a focused audit team to perform thorough audits of suspected



abusers. This team will review claims with more detail than the normal claims processor. LUST audit teams are able to review level of effort with a better level of detail. Properly chosen audits are valuable tools that no program should be without.

- **Global Tracking Software and Pattern Detection Software -** A common technique of abusive health care providers is to bill for more activities than can realistically occur in a given time period. Since Medicare claims and LUST fund claims are each reviewed individually, this abuse can only be exposed by way of a global look at a service provider's activities.

  In my work with the Florida Auditor General, we have found this technique to be particularly effective. We have discovered some personnel who have billed 30-hour days by combining time sheets from several sites—the doings of unscrupulous consultants who have figured out that claims are handled site by site. Padded hours on sites are often difficult to detect. Looking at a particular consultant's total scope of LUST efforts within a given time frame can yield dramatic examples of fraud. Medicare has developed software that tracks patterns of abuse, such as repetitive procedures. Some LUST consultants will regularly perform excessive testing. On individual sites, this move may be justified as a judgment call; however, in the larger picture, an excessive pattern may become manifest.

- **Database of Norms -** Medicare has certain norms for costs based on symptoms. The patients whose total costs exceed these norms are flags for the audit hit team to begin its review. In LUST funds, the average cost of tasks is usually well known. A database of norms allows abuse investigations to focus on cases where the norm has been exceeded. Using proper sampling techniques, databases can be developed at reasonable costs. In the Florida Audit General project, the audits were more or less randomly selected, resulting in a very poor cost recovery ratio. This would have been dramatically enhanced by focusing on the outliers.

Abuse of state cleanup funds can be reduced IF there is a concerted effort by the various stakeholders to prevent, deter, and detect. Fortitude, statute, rules, and personnel are all necessary. Communication is of critical importance in convincing legislators, attorney generals, inspector-generals, and responsible parties about the seriousness of the problem.

- **Interstate List of Abusers -** Medicare regional administrators exchange the names of known abusers. This strategy curbs the temptation for abusers to simply move to another state. Such an exchange of information would be very useful for LUST funds—a sort of Megan's Law for fund abusers. Obviously, liability considerations could minimize this tool.

- **"One Strike and You're Out" -** This option is one of the *more* effective tools. For a period of several years, health care providers who have abused the fund are forbidden to collect any funds from Medicare. Such a deterrent is needed for the LUST funds. The Florida Pay for Performance program has such a provision for consultants who walk away from an uncompleted cleanup.

- **Expanded Penalties for Fraud (Go directly to jail. Do not pass go.) -** Recent legislation has expanded the penalty for Medicare fraud. Similar laws for state cleanup funds will help attract the attention of prosecutors.

- **Fixed-Fee Services/Pay for Performance -** Fixed-fee services, where the health care provider receives a fixed payment per patient to cover all services rendered, have greatly reduced Medicare abuse. In a similar way, Pay for Performance (PfP) remediation eliminates many of the incentives for abuse. In PfP cleanups, the contractor is paid prenegotiated fees at cleanup milestones. Since the contractor is paid only upon demonstrable remediation progress, not only is the abuse minimized, but the site is also likely to be cleaned up faster, resulting in overall cost savings and an improved environment.

Prevent, Deter, Detect

Abuse of state cleanup funds can be reduced IF there is a concerted effort by the various stakeholders to prevent, deter, and detect. Fortitude, statute, rules, and personnel are all necessary. Communication is of critical importance in convincing legislators, attorney generals, inspector-generals, and responsible parties about the seriousness of the problem. One way to accomplish this goal is to start using the terms of Medicare. Medicare's terms of fraud mentioned earlier are common knowledge and can be easily understood. An Internet search of the terms "Medicare" and "fraud" turned up over 750,000 hits. If those of us in the LUST arena would use these common terms, our communication would be more potent and focused.

Finally, stakeholders need to acknowledge the fraud and abuse problem and encourage deterrence, detection, and prosecution. Clearly, much more awaits to be written on this subject. ■

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State Cleanup Funds

The Good, the Bad, and the Ugly

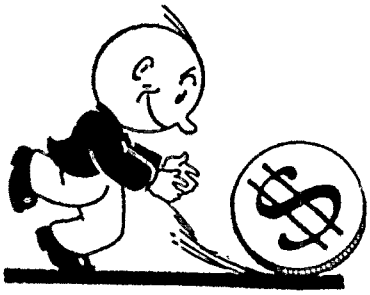
Tips for Managing Your State Cleanup Fund

by Mary-Ellen Kendall

As is often the case in real life, there is no one, single fund-related problem that turns the job of a state cleanup fund administrator into a nightmare. Every fund manager starts out with the best of intentions and the drive to succeed, but in the line of duty, obstacles have been known to rear their ugly heads and create problems for state funds. The problems that develop can vary in magnitude from minor annoyances to insolvency.

The evolution of a state fund is dependent on many factors:

- The statutory authority in each state code;
- State politics;
- The availability of funds and funding sources;
- Constitutional restrictions;
- The strength of the petroleum marketer/tank owner lobby in the state;
- The level of coordination and teamwork between the state technical environmental staff and the fund staff;
- Resource allocation within state government;
- The state's success in creating and implementing attainable cleanup goals;
- The state's success in drafting clear and understandable reimbursement regulations and procedures; and



- The staff expertise/background in the legal, accounting, scientific, insurance, engineering, banking, and business principles that are needed to run a state fund.

Each state has developed a fund program that reflects its own unique combination of factors. But no matter how hard the fund staff may have worked to anticipate and prevent problems before they occur, there is no way to eliminate fund management problems.

The Wisdom in War Stories

It is often said that those who fail to learn from the mistakes of the past are doomed to repeat them. This is especially true for state fund managers. There is a daunting learning curve associated with administering a state fund. A "good" fund manager learns to adapt to changing conditions and to recognize/solve problems as they appear.

Although no two state funds are alike, there are many similarities. Lessons learned in one state can be instructive to another. As fund managers become more experienced, they can learn to recognize the common threads and associated problems that states share and can develop innovative solutions that work within the context of their own state's constraints.

Each year, fund managers get together at the State Fund Administrators Conference to share their experiences and insights. One of the goals of this year's conference was to assist fund managers in identifying potential problems and finding solutions. *LUSTLine* is a vehicle that allows us to continue to share and learn throughout the remainder of the year.

In the following paragraphs, I'll identify several difficult problems that fund managers face and, using examples from Vermont, Virginia, South Carolina, and South Dakota, present steps that can be taken to resolve these problems and improve fund management.

Raids on Funds - A few state funds have been raided by the state legislatures. The Vermont legislature, for example, has taken over $4.5 million from the fund since its inception. This kind of loss hurts the integrity and reputation of the fund. One way to protect the fund against raids is to incorporate provisions in state law that limit how fund monies can be used and that allow monies to roll over from one fiscal year to the next.

Claims Appeals - The Vermont fund started out by settling its claim appeals very quickly rather than getting involved with litigation. It didn't take too long before the regulated community got the idea that the state would automatically settle any and all appeals without much argument, which encouraged the proliferation of appeals. Vermont addressed this problem as part of its overall effort to establish clear guidelines for the fund by establishing appeals procedures. Written guidelines with forms, reimbursement and appeal procedures, and rate schedules were created to give notice of program rules and interpretations of statutory and regulatory provisions for both the fund staff and the public. Clear, consistently applied guide-

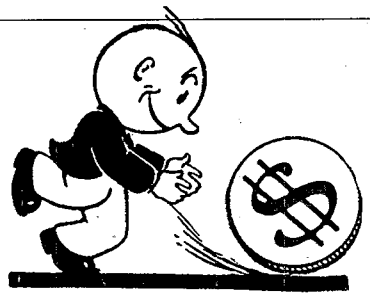
lines have given the fund stability and a better chance of winning appeals.

Claim Limits - Virginia began processing claims in 1991. At the time, there was no limit on the number or dollar amount of claims that could be filed for reimbursement. South Carolina had a similar problem, because claimants were allowed to submit monthly bills of $100 or more. This caused an influx of claims, made tracking more difficult, and sometimes resulted in processing costs per claim that exceeded the amount of the claim. Both states developed ways to reduce the number of claims so as to permit more efficient, less costly claim processing.

Virginia requires claimants to file all of the costs associated with a single cleanup phase (e.g., initial abatement phase, site characterization phase) on one claim. This simple solution has lowered the number of claims received and helped to prevent double billing for the same work in later claims.

South Carolina's solution requires tank owners to obtain approval from the fund prior to performing any work at the site. Open communications between the claimants and fund personnel before monies are spent have benefited both parties. The fund manager uses the cost information to forecast expenditures and to maintain fund solvency. At the same time, the claimant is assured that the money needed to reimburse cleanup costs will be available when a claim is submitted.

Forecasting and Planning - Like South Carolina, Virginia had problems in forecasting and planning because of a lack of information about the number and cost of ongoing cleanups. Claimants also had a problem trying to determine if the cleanup work they were doing would be eligible for reimbursement. To solve the problem, Virginia instituted a preapproval program in which claimants are required to get written approval for cleanup activities from the state before beginning work at the site. In conjunction with the preapproval program, Virginia developed and published a rate schedule to give claimants guidance on the amount of reimbursement that they could expect to receive for preapproved cleanup activities.



These two changes have given the state more control over cleanups while reducing the number of claim reviews. Claimants now receive upfront guidance on their cleanups and are given the dollar amount they will be reimbursed for cleanup activities.

In Vermont... written guidelines with forms, reimbursement and appeal procedures, and rate schedules were created to give notice of program rules and interpretations of statutory and regulatory provisions for both the fund staff and the public.

Cleanup Standards - South Dakota realized early on that the question of "How clean is clean?" had to be answered. The fund needed cleanup standards on which to base reimbursement rates. Dennis Rounds, South Dakota's Fund Manager, was instrumental in drafting ASTM's Risk-Based Corrective Action (RBCA) standard, which is now used in some form in many states. Once again, a written guideline has been helpful, both for administering the fund and for communicating the cleanup requirements to claimants. The RBCA process has also allowed states to perform environmentally sound, cost-effective cleanups.

Program Development - After identifying problems and issues in program development, Vermont fund personnel began a dialogue with their stakeholders to increase the likelihood of finding a solution that worked for everyone. Stakeholders helped identify problems and also contributed ideas for solutions. This communication process has helped the fund provide better service to its customers and increased customer satisfaction with the program. It has also increased stakeholder awareness of fund management issues.

Claims Management - *The South* Dakota fund developed a sophisticated, comprehensive database and a well-organized filing system to manage claims more efficiently. The staff also developed policy memos that they use to document their reasons for reimbursement decisions. This process of justifying each claim payment decision has provided a basis for consistent claim processing. It has also shifted the burden of justifying a reimbursement from the fund to the appeals process, which, in turn, has reduced the number of claim appeals as well as the number of issues that have to be addressed on appeal.

These are just a few of the issues that state fund administrators face. In future articles I'll look at other unique problems/solutions and provide examples from other states. If you have suggestions about techniques that worked or failed in your state, please let me know.

If you have any questions or would like additional information on the problems/solutions discussed in this article, you can contact:

- Stan Clark in South Carolina at clarksl@columb26.dhec.state.sc.us,
- Dennis Rounds in South Dakota at dennisr@crpr1.state.sd.us,
- Chuck Schwer in Vermont at chucks@dec.anr.state.vt.us, or
- Mary-Ellen Kendall in Virginia at makendall@deq.state.va.us. ■

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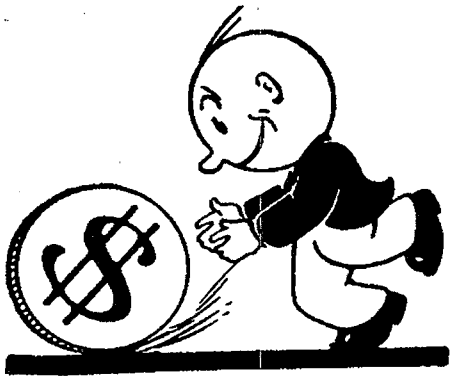


Investigation and Remediation

The Great Escape (from the UST)

by Blayne Hartman

[Editor's Note: This is the second in a series of articles reviewing some of the physical/chemical properties that are commonly used in environmental assessment and remediation. This article will focus on the property of vapor pressure and how to use it for estimating vapor concentrations in the vadose zone.]

Based on the enthusiastic responses I received to the quiz in the last article on Henry's law, let's start with another quiz:

A site with USTs that contain gasoline has MTBE contamination in the underlying groundwater; however, the cause of the groundwater contamination is not clear. No liquid spills or releases have been recorded or detected, no soil contamination has been detected, and no upgradient sources of MTBE exist. You conduct a soil vapor survey to look for potential vapor-phase MTBE contamination and find nothing. What do you advise your client (a potential buyer of the property) to do?

(a) There are no on-site MTBE sources of groundwater contamination, so the contamination must be from somewhere else. Buy the property.

(b) Tell the client not to buy the property and then buy it yourself.

(c) Question the accuracy of the soil vapor data.

(d) Retest the soil vapor for different compounds.

Need a hint? Well, it's probably not (a) or (b) because then I would have nothing to write about. Need another hint? It has something to do with vapor pressure (the topic of this article).

To choose the correct answer to this quiz, we need to know the answers to a couple of key questions regarding the potential source of the MTBE contamination in the soil vapor and the potential for MTBE vapor to contaminate groundwater:

- What is the concentration of the MTBE in vapor escaping from an UST containing gasoline?
- What would be the resulting groundwater concentrations if that same vapor contacted groundwater and reached equilibrium with the groundwater?

Step 1 – Determine the Vapor Pressure of MTBE in the Tank Headspace

Since the concentration of MTBE in the escaping vapor will be the same as the concentration of MTBE in the vapor in the tank above the gasoline, the first thing we need to do is compute the concentration of MTBE in the tank headspace. To perform this calculation, we need to consider the vapor pressure of each compound, which gives us a perfect reason to review the concept of vapor pressure.

Vapor pressure is the pressure that a compound exerts in the airspace above the pure compound. Stated another way, vapor pressure is a measure of how a compound distributes, or partitions, itself between its pure form (solid or liquid) and the airspace above it. The higher the vapor pressure, the more a compound prefers to be in the vapor phase (i.e., the more volatile the compound). Some compounds have such high vapor pressures that they evaporate before our eyes (e.g., acetone, or gasoline on warm days). Generally, when we speak of volatile organic compounds (VOCs), we are referring to compounds with vapor pressures that exceed 1 millimeter (mm) of mercury (Hg) at temperatures that are normally encountered (15°C to 20°C).

Vapor pressures have been measured empirically (i.e., in the laboratory) for a wide variety of compounds and are tabulated in many reference books. They can be expressed in many different units. The most common are atmospheres (atm), inches of mercury (in. Hg), or millimeters of mercury. For your reference, there are 760 mm Hg to 1 atm and 30 in. Hg to 1 atm.

For a mixture of compounds such as gasoline, the pressure of each compound in the overlying vapor (e.g., MTBE, benzene, hexane) is equal to its fraction in the mixture multiplied by its individual vapor pressure:

$$P_i = VP * MF$$

where: P_i is the pressure of a compound in the overlying vapor;

VP is the vapor pressure of the pure compound; and

MF is the mole fraction of that compound in the mixture.

Step 2 – Convert Pressure into Concentration

The next step is to convert the amounts of a compound in the vapor from pressure units to concentration units. To make this change, we have to go back to a fundamental concept that we all learned (or were supposed to learn) in freshman chemistry, the good ol' ideal gas law:

$$PV = nRT$$

where: P is pressure (in atm);

R is the universal gas constant (0.0821 L-atm/°K-mole);

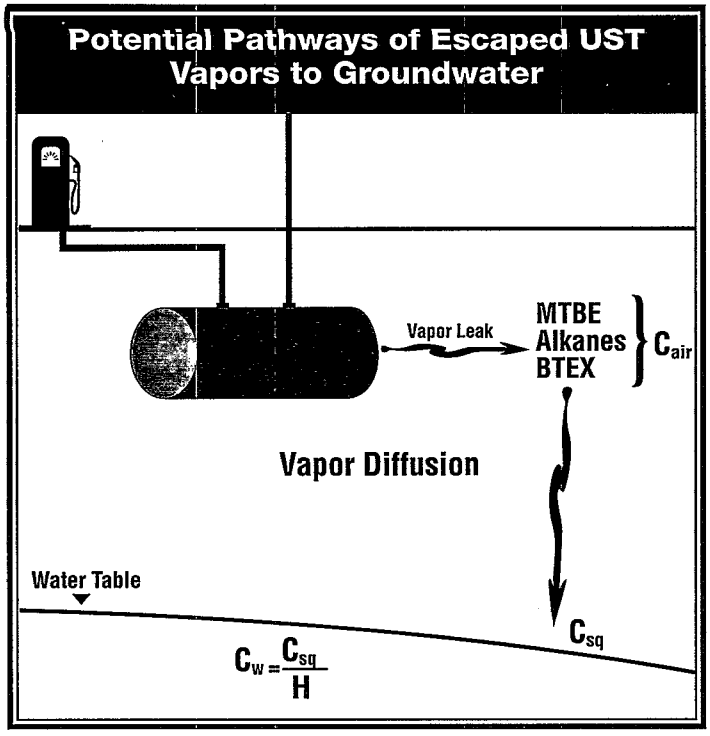
T is temperature in °K (°K = °C + 273);

n is moles of a compound; and

V is volume in liters.

By rearranging this expression, we can convert pressure into concentration:

$$P/RT = n/V$$



Note that moles (n) multiplied by the molecular weight of a compound gives mass (in grams) and V is volume, so the ratio (n/V) is equivalent to concentration.

Putting it all together, the concentration of a compound in the headspace can be computed from its vapor pressure, molecular weight, and mole fraction as:

Concentration in the headspace (C_{air}) = VP * MW * MF/RT

where: C_{air} is in units of grams per liter (g/L);

VP is the vapor pressure of the pure compound (in atm);

MW is the molecular weight of the compound (in g);

MF is the mole fraction of the compound in the mixture; and

RT is the universal gas constant times temperature (~24 L-atm/mole at 20°C).

Using the above equation, the concentrations of various compounds in the headspace (C_{air}) in an UST that contains gasoline can be easily calculated (Table 1). You can see that the headspace is dominated by the alkanes and MTBE, but benzene, due to its lower mole fraction and vapor pressure, makes up a relatively small fraction.

Table 1. Summary of relevant physical properties and calculated airspace concentrations of various compounds in gasoline. Mole fractions of the various compounds were selected to represent an "average gasoline." An average molecular weight was used for the lower alkanes (C4–C8). Vapor pressures have been rounded off for simplicity.

	VP (atm)	MW	MF	C_{air} (µg/L)
Benzene	0.1	78	0.025	7,800
MTBE	0.3	88	0.125	130,000
Lower alkanes	0.2	100	0.50	400,000

The key point to recognize from the values in Table 1 is that if there are vapor leaks from an UST—from loose bungs, loose fittings on vapor return lines or vent pipes, or pinhole leaks—the concentration of the vapor in the vadose zone immediately outside the tank (i.e., the soil vapor) will contain large amounts of alkanes and MTBE, but relatively small amounts of benzene (I'll leave it to you to calculate the relative amounts of the other common aromatics).

Step 3 – Determine the Equilibrium Groundwater Concentration

Now let's allow the escaped vapor to impinge on groundwater. What's the resulting groundwater concentration? Well, flush with your knowledge after reading the article on Henry's law in the last issue, you know that the resulting equilibrium groundwater concentration can be easily computed from the vapor concentration using the dimensionless Henry's constant:

$$H = C_{air}/C_{water} \text{ or } C_{water} = C_{air}/H$$

Table 2 summarizes the calculation of the groundwater concentration in equilibrium with the escaped vapor.

Table 2. Equilibrium water concentrations for several compounds in contact with vapors escaping from an UST with gasoline. Values for Henry's constants and resulting water concentrations have been rounded off for simplicity.

	C_{air} (µg/L)	H	C_w (µg/L)
Benzene	7,800	0.2	40,000
MTBE	130,000	0.02	6,500,000
Lower alkanes	400,000	50	8,000

Taken alone, the numbers shown in Table 2 indicate that enormously high concentrations of MTBE could be created in the groundwater because of escaping vapor. Don't panic! The fact that this calculated value is so much higher than values we observe in groundwater is proof that our simple calculation is not representative. Why?

Keep in mind that these calculations assume that equilibrium between the phases exists. While equilibrium concentrations may be likely for the partitioning of compounds from the gasoline into the tank vapor, they are extremely unlikely for the partitioning of compounds into the groundwater from the vapor because of the extremely slow process of contaminant transport into groundwater (as discussed in the *LUSTLine* #28 article, "The Downward Migration of Vapors").

In addition, these calculations assumed that the concentration of the vapor impinging on groundwater was identical to the concentration of the tank headspace. This scenario is extremely unlikely because processes operative in the vadose zone (e.g., dispersion, sorption, biodegrada-

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■ **The Great Escape** *from page 19*

tion) are likely to create significantly lower vapor concentrations as the vapor travels from the tank leak to groundwater.

The more reasonable conclusions to be drawn from these calculations are that if a vapor leak from an UST containing gasoline exists:

- The lower alkanes (C4 through C8) will remain in the soil vapor.
- If water is around, MTBE will preferentially partition into the water (i.e., soil moisture or groundwater).
- Benzene will exist in both the soil vapor and water but will not be the major contaminant in either phase.

In areas with shallow groundwater, high rainfall, or other sources of flowing water in the vadose zone (e.g., irrigation), MTBE vapor could be a contributor to groundwater contamination. In areas with deep groundwater and not much rainfall, the MTBE transfer rate from the vapor is likely to be too slow to cause an appreciable effect.

Now Back to the Quiz

Since no MTBE was detected in the soil vapor, and no other sources for MTBE were detected on the site, it appears that choice (a)—buy the property—would be the correct answer. But wait—if a vapor leak does exist, MTBE, due to its high affinity for water, might have already "left the scene of the crime" (the leak), while its companions in the escape (the alkanes), are still around. If all you did was measure the soil vapor for the MTBE, it is possible that a vapor leak exists, but that it was missed, because you failed to measure for the alkanes.

So what was the correct answer to the quiz? Choice (d)—retest for different compounds. You need to measure the alkanes in addition to MTBE to ensure the detection of tank vapor leaks and interpret the MTBE values (or lack thereof). Because all of the compounds escape together from the tank, high levels of alkanes in the soil vapor mean that MTBE must be escaping as well, even if it was not detected. If no MTBE is detected in the soil vapor at the same location where high levels of alkanes exist, it indicates that MTBE is being preferentially lost once in the vadose zone. For this scenario, vertical profiles of the soil vapor with depth to groundwater, as well as knowing the concentration ratio of MTBE to the alkanes in the soil vapor, will aid in the determination of whether MTBE vapor has impacted groundwater.

One last point to remember if you elect to measure the soil vapor. MTBE is often measured on a photoionization detector (PID) by EPA method 8020. While they are plenty sensitive to MTBE and the aromatics, PIDs are not particularly sensitive to many of the lower alkanes. So analysis of the soil vapor for the alkanes should be done with a flame ionization detector (FID) to ensure sufficient sensitivity.

Did you get the correct answer? This quiz was a tricky one, but I hope you enjoyed it. ■

Oops... In last issue's article titled "Oh Henry," the text describing the conversion from the dimensionless to dimensional form was incorrect. The conversion given was for computing the dimensional Henry's constant in units of atm-L/mole, not units of atm-m^3/mole as printed. To compute the dimensional Henry's constant in units of atm-m^3/mole, multiply the dimensionless Henry's constant by the universal gas constant (0.000082 atm-m^3/mole-°K) times the temperature in degrees kelvin, which is equal to 0.0224 at 0°C and 0.024 at 20°C. ■

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 training course on environmental geochemistry. For details on the course, either e-mail Blayne directly at bh@tegenv.com, or check out the information on his Web page at http://www.tegenv.com.

MTBE Work Group Working Hard to Keep Up with New Info

The ASTSWMO LUST Task Force's MTBE work group has issued three newsletters since its inception in 1997. A fourth newsletter is currently in progress and will be issued in mid-September. The membership of the work group continues to grow as states continue to express a strong interest in the MTBE problem. Many states are trying to determine just how to take a second look at sites that may have been closed under an earlier closure process that did not consider the presence of MTBE.

Other MTBE-related issues that were not originally anticipated during the founding of the work group have come to the forefront (e.g., the degree to which MTBE breaks down in the environment; the toxicity of breakdown products, such as TBA and formaldehyde; atmospheric deposition from rainfall; contamination in drinking water reservoirs from two-cycle engine exhaust; and the presence of MTBE at UST sites where no releases have been documented). These are just a few of the issues that are gaining an increasing amount of attenuation on the state level.

While concerns about the widespread impacts of MTBE on air, surface water, and groundwater are of pressing importance in California, most states are still quite early in diagnosing the severity of impacts from MTBE and struggling to determine just what should be done in the absence of national MTBE standards for soil, groundwater, and drinking water. Some state UST/LUST programs have addressed the immediate question of cleanup levels by including MTBE as a chemical of concern within the context of RBCA. Still others may prefer to use a strict numeric approach based on toxicology.

A large amount of research is currently under way through the American Petroleum Institute (API), U.S.

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Investigation and Remediation

A Layman's Guide to the New EPA Methods for VOC Analysis

by Blayne Hartman and Rob Hitzig

Since the promulgation of Update III of EPA's SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, the document's new methods for volatile organic compound (VOC) analysis have created apparent confusion throughout much of the environmental community. In response to this confusion, EPA released a memo on August 7 to clarify some of the issues. In this article, we'll address some of the key issues of concern and conclude with recommendations to help you to decide which protocols to follow or enact.

To understand the pros and cons of the new VOC methods, let's review the most salient changes in the new update.

Changes in Analytical Methods

In Update III, several obsolete packed-column gas chromatographic (GC) methods have been deleted and replaced with capillary GC methods. Specifically, analytical methods 8010 (halogenated hydrocarbons by GC), 8020 (aromatic hydrocarbons by GC), and 8240 (VOCs by GC/Mass Spectrometry (MS)) have been deleted. They have been replaced by methods 8021 (halogenated and aromatic hydrocarbons by GC) and 8260 (VOCs by GC/MS). The elimination of these analytical methods does not create significant changes in the quality or type of data received from laboratories, because most laboratories have been using the capillary methods for several years.

There are, however, two significant factors that you should be aware of in the new analytical methods:

- Soil values are reported on a dry-weight basis.
- Calibrations must be performed for every 10 samples rather than for every 20 samples.

The first factor should not be overlooked by regulators, because, in some states, soil values are customarily reported on a wet-weight basis. Depending on the water content of a sample, use of dry versus wet weight could change reported values by a factor of 2. As a result, we recommended that you ask your laboratory to state clearly in its reporting whether the results represent dry-weight or wet-weight values.

Changes in Sample Preparation Methods

Prior to Update III, there were essentially three methods for preparing solid samples for volatile analysis:

- Solvent extraction and direct injection (typically done as a microextraction of soils or concentrated wastes in a VOA vial with methanol) for high-concentration samples;
- Direct purge-and-trap preparation (EPA method 5030) for soils with low concentrations; and
- Methanol extraction, dilution into water, and purge-and-trap (also by EPA method 5030) for medium- to high-concentration samples.

The purge-and-trap preparation methods offered much lower detection levels than the direct-injection method and were more commonly used for VOC analysis that required low (<50 μg/kg) detection limits. For soils, samples were either mixed with water and added directly to the purge-and-trap device (direct soil sparging for low-concentration samples), or, for higher-concentration samples, they were extracted with methanol, and an aliquot of the methanol (typically 10 μL to 100 μL) was added to the purge-and-trap device.

Update III includes seven sample preparation procedures:

1. Solvent extraction and direct injection
2. Headspace analysis (method 5021)
3. Purge-and-trap preparation (EPA method 5030B) for soil extracts
4. Closed-system purge-and-trap for soils (method 5035)
5. Vacuum distillation
6. Azeotropic distillation
7. Hexadecane dilution-direct injection for VOCs in waste oil

It is important to realize that VOC results can vary, depending on the preparatory method used (e.g., high-concentration methods may not work for low-concentration samples, and vice versa). Because there are now seven different preparatory methods, it is much more important that the end users of the VOC data understand which method was used to prepare individual samples and which method applies to which type of sample and analyte.

An Overview of the Sample Preparation Methods

Let's briefly review these sampling methods. Because methods 5, 6, and 7 are not commonly used, we will not discuss them in this overview.

1. **Solvent extraction and direct injection.** This method is extremely reliable and allows the reanalysis of the extract as many times as possible. For fuel-related aromatic compounds (e.g., BTEX, naphthalene, trimethylbenzenes) and MTBE, detection levels of 25 μg/kg to 50 μg/kg can be obtained. This method is the best to use for higher-concentration samples (greater than 200 μg/kg), because there is little potential for carryover between samples.

2. **Headspace analysis by method 5021.** Prior to Update III, EPA considered this method to be useful for screening purposes only, primarily because of the limitations of available equipment. However, because it is a relatively easy and fast method, many laboratories, particularly mobile laboratories, have used it for many years. These days, reliable data are readily achievable with automated instruments, especially for compounds with relatively high Henry's law constants, pro-

■ *continued on page 22*

■ Layman's Guide to VOC Analysis *from page 21*

vided the headspace conditions are kept constant (e.g., amount of sample, time of heating, temperature of heating). This is particularly true for fuel-related sites—data for aromatic hydrocarbons generated by this method should be fine. However, this method is not suitable for MTBE or ethylene dibromide (EDB) because both have low Henry's law constants. It is necessary to collect more than one sample for reanalysis in the event that VOC concentrations exceed the instrument's calibration range.

3. **Purge-and-trap by method 5030B.** This method is the same one used in earlier versions of SW-846, except for one key difference: It no longer allows the soil itself to be added directly to the purge-and-trap device (direct-soil sparging). To analyze soils by this method, the soil must be methanol-extracted; an aliquot of the extract is then added to the purge-and-trap device. This approach allows for detection levels in the low microgram/kilogram range (<10 μg/kg) for most fuel-related hydrocarbons and slightly higher levels (25 μg/kg to 50 μg/kg) for some halogenated compounds.

4. **Closed system purge-and-trap by method 5035.** This method is designed to minimize the loss of VOCs from soil. Soil samples are sealed in a gas-tight vial in the field and then analyzed without ever opening the vial. This method has an advantage over methanol preservation in that it allows for extremely low detection limits (<1 μg/kg) for all VOCs (including halogenated solvents); however, VOC concentrations exceeding 100 μg/kg to 200 μg/kg exceed the instrument's working range, depending on the compound. Since VOC concentrations this low are difficult to estimate prior to analysis, and the sample can be analyzed only once, it is necessary to collect more than one sample for reanalysis in the event that concentrations are high.

Changes in Soil Sample Collection, Preservation, and Storage

The most significant change in the new update is the addition of protocols that describe field preservation and storage of soil samples for VOC analysis. The purpose of these protocols is to provide for minimal loss of volatiles from samples caused by both volatilization and biodegradation from the time of collection to the time of analysis. The most effective way to do this is to preserve or analyze samples shortly after they have been collected.

The sample preservation protocols have introduced considerable confusion, because they differ for each preparation method and, in some instances, are contradictory within the same method. For example, method 5021 (headspace) describes on-site sample preservation using phosphoric acid; however, the method also allows for off-site preservation in the laboratory—which, in effect, defeats the purpose of the new protocols.

As another example, method 5035 (closed-system purge-and-trap) offers four on-site handling options from which the field sampler can choose. One of these options calls for the use of bisulfate solution as a preservative, a second option involves on-site methanol extraction, a third option is to collect the sample in a headspace-free, gas-tight sampler (e.g., EnCore), and a fourth option allows for off-site sample preparation.

Which method 5035 option you choose depends on a multitude of factors, including the concentration of VOCs in the soil (which you don't know at the time of field collection), the type of soil (e.g., percent carbonate), the method the lab uses, and whether you are shipping the samples.

What do all these options do for field sampling personnel? They create confusion and add an extra burden to their already demanding list of tasks. The consequence: an increased potential for errors in VOC data because of the variations in how samples are handled in the field.

What to Do?

The introduction to the new EPA methods, which was restated in the August 7 memo, clearly states that the SW-846 methods are meant to be guidance only, not requirements. EPA encourages local agencies to adopt sampling methods that they feel are most applicable to their specific problems and needs. EPA encourages agencies to provide for performance-based flexibility and modifications that will meet the specific requirements of a project. So what protocols should you follow to ensure the most representative data?

First, let's begin with the presumption that most of the confusing issues and potential problems will be circumvented if samples are analyzed on-site. Because on-site analysis allows samples to be analyzed within hours rather than days, acid and methanol preservation should not be necessary. Mobile laboratories that are capable of conducting SW-846-quality analyses are available in most locations throughout the country.

EPA's Office of Underground Storage Tanks (OUST) has encouraged the use of field analytical methods for many years because of the advantages gained by having on-site data to make real-time decisions. (For more information on the use of field analysis in conducting site assessments, check out *Expedited Site Assessment Tools For Underground Storage Tank Sites*—EPA 510-B-97-001.)

As an alternative to on-site analysis, on-site methanol and/or on-site water preservation offer the most advantages, depending on the VOCs you are measuring.

- **Methanol/Water Preservation for Fuel-Related VOCs**

  For fuel-related VOCs, on-site methanol preservation is much easier, more flexible, and more cost-effective than the other preservation options described in methods 5035 or 5021. Detection limits of 5 μg/kg are obtainable for the aromatic compounds and 20 μg/kg for MTBE.

  A number of states (most notably Wisconsin) have been using this technique successfully for a number of years. In fact, Wisconsin has specifically stated in the spring 1998 edition of its *LabNotes* that EPA method 5035 will not be used in Wisconsin.

There are a few potential pitfalls with methanol preservation. First, because the shelf life of methanol is short, there is the possibility that the methanol could be contaminated. So, you need to be sure that your batches of methanol are fresh and analyzed for blanks just before the date of use. Second, detection levels using methanol extracts could be higher, depending on a lab's protocols, so there is the possibility that you may not achieve necessary quantitation limits. Third, there are potential shipping restrictions. Methanol is classified as a RCRA hazardous waste, regardless of whether the soil is contaminated.

An alternative to methanol preservation that is less confusing than method 5035 is to allow soils to be preserved on-site in water and analyzed by method 5030. Because the aromatic hydrocarbons and MTBE have low Henry's law constants (i.e., they prefer to remain in the water), they will not be lost by volatilization once in the water solution. However, to minimize possible biodegradation, the water-preserved sample should be capped, kept cold, and analyzed within a relatively short period of time (e.g., within 36 hours from the time of collection). If a TPH analysis for gasoline is required, then the preservation container should have no headspace, because of the high Henry's law constants of the alkanes in gasoline.

The water preservation alternative offers a few advantages over methanol in that detection limits are lower, the risk of contamination is less (pure, uncontaminated water is readily available at any convenience store, usually for less than $1 per bottle), and the samples can be shipped as nonhazardous waste.

- **For Halogenated Compounds**

In this case, the optimum preservation choice depends on the required detection limits. For some VOCs, methods 8021 or 8260 will reach only 25 to 50 $\mu g/kg$ detection limits using methanol extracts. If these detection limits are sufficient, then methanol preservation is an easy and cost-effective option.

If lower detection limits are required, water preservation and analysis by method 5030 can reach 5 $\mu g/kg$ detection limits while offering a less confusing alternative to method 5035. Because the halogenated VOCs are not readily biodegradable and have low Henry's law constants, they will not be lost by biodegradation or volatilization once in the water solution. To ensure minimal contamination during storage, the water-preserved sample should be capped, kept cold, and analyzed within a reasonable amount of time (e.g., within 72 hours from the time of collection).

Advantages

Methanol and water preservation with subsequent analysis using method 5030 offer the following advantages over methods 5021 and 5035:

- Potentially large errors resulting from the variety and multitude of field preservation steps are eliminated because the field personnel can use one or two simple on-site procedures that are not too burdensome.
- Laboratories can use existing methods (e.g., purge-and-trap by 5030) with existing equipment. Thus, they will not be forced to buy a lot of new equipment, and reported VOC data will be more consistent from lab to lab, because fewer analytical methods will be used.
- Increased costs of analysis (e.g., new analytical equipment, special gas-tight samplers, shipping of hazardous wastes) are eliminated. ■

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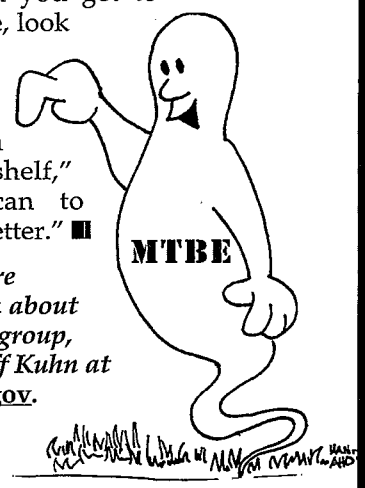
■ MTBE Work Group *from page 20*

Geological Survey (USGS), and the EPA Office of Water. Research updates and preliminary results are reported through the MTBE newsletter as they become available. The workgroup is also trying to stay on top of the never-ending list of Internet sites on which state regulators can look for MTBE information. Pat Ellis from Delaware is an excellent source of information for avid Web browsers (pellis@dnrec.state.de.us). Her updates on Web sites are included at the end of each newsletter.

Other work group members are providing case incident studies, rule changes to MTBE standards, and legislation contemplated to address MTBE in their states. API's Bruce Bauman continues to provide updates on API research efforts that are under way through grants to universities. Recently, John Zogorski, who leads MTBE research through the USGS NAWQA Program, also volunteered to participate in the work group.

Although the group's focus will continue to be on the release of MTBE from LUST sites, it is already finding a great deal of information is available through the efforts of other state and federal agencies. The group hopes to continue an open dialogue with states that are grappling with MTBE issues by providing a forum for discussion, transmittal of research findings, and exchange of regulatory approaches.

The *MTBE Work Group Newsletter* can be accessed on the ASTSWMO home page at http://www.astswmo.org/astswmo1.htm. When you get to the home page, look on the left side for "publication," click on that and then go to "bookshelf," and then scan to "MTBE newsletter." ■



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Investigation and Remediation

ASTM Task Group Seeks Input on Remedial Action Decision Standard

The American Society for Testing and Materials (ASTM) E50.01 subcommittee is developing a standard for making remedial action decisions (RADs) at chemical release sites. The guidance is based on a nonprescriptive, logical decision-making procedure with the ultimate goal of site cleanup. It incorporates a screening process that allows the user to sift through remedial options quickly and cost-effectively to obtain the best-fit technology or combination of technologies for a specific release site. When necessary, this decision-making approach will allow the user to distinguish between final target cleanup goals and intermediate, "technically achievable" goals, recognizing that ultimate target goals may not always be readily attainable through the use of active mass-reduction technologies alone.

The guidance is consistent with the concepts of risk-based corrective action and allows the user to give consideration to innovative technologies, institutional controls, and remediation by natural attenuation as well as more conventional remedial technologies. It also incorporates an iterative approach to evaluating remedial technology performance to help fine-tune operation and maintenance and determine when to adjust the remedial system, modify operational parameters, switch technologies, augment treatment by adding other technologies, or discontinue operation.

How RAD Fits In

Once complete, the RAD standard could prove useful to environmental professionals, regulatory agencies, and the consumer (user of professional services). The environmental professional may find the standard to be useful as a framework for a structured and consistent decision-making process for evaluating remedial options. It may also improve the timeliness of this process by reducing the unknowns, such as target goals and acceptability of certain options. The RAD standard may also increase confidence in promoting innovations.

The consumer should find the RAD standard useful, particularly as a possible tool in developing pay-for-performance contracts or time and material contracts with environmental professionals. Regulatory agencies may also find the standard useful. By adopting a consistent logic for making remedial action decisions, oversight could be reduced and technical soundness and accountability could be increased.

The guidance is consistent with the concepts of risk-based corrective action and allows the user to give consideration to innovative technologies, institutional controls, and remediation by natural attenuation as well as more conventional remedial technologies.

Here are some of the unique elements that the proposed RAD standard can provide:

- A sifting process that allows remedial options to be screened on the basis of time, surety, and cost;
- A logical order for screening remedial options, based on the effort and cost to evaluate a given technology;
- A method for determining the most effective combinations of treatment technologies;
- A requirement that target cleanup levels be established before remedial options are screened;
- A logic that differentiates between "final target cleanup levels" and "intermediate, technically achievable goals";
- An iterative approach for constant evaluation of technology performance; and
- A flexible, open architecture that allows for professional judgment and innovation, while assuring accountability.

The RAD task group was formally established in October 1997. It has met three times since then and has held numerous conference calls. In June 1998, members of the task group met in Washington, D.C., with representatives from the EPA Office of Solid Waste and Emergency Response (OSWER), including OUST, the Technology Innovation Office, and Superfund to seek participation and input.

The first draft of the standard is expected to be balloted within ASTM this winter. The task group is seeking input from anyone who may be interested.■

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Investigation and Remediation

Two MTBE Plume Length Studies Are Completed

Or, Will Reformulated Gasoline Reformulate Our Approaches to UST Plume Management?

by Bruce Bauman

It is widely accepted that the benzene "plume-a-thon" study by the Lawrence Livermore National Laboratory (LLNL) published in November 1995 was the "piece de resistance" in national efforts to demonstrate the natural attenuation of UST gasoline releases. This study of several hundred California UST sites concluded that almost all dissolved benzene plumes will travel less than 300 feet from the source before they "stabilize" and eventually begin to shrink back toward the source. A similar study of over 600 Texas UST sites published in January 1997 by the University of Texas Bureau of Economic Geology (UT-BEG) came up with similar conclusions.

Inasmuch as both efforts were initiated before the recent heightened concern regarding the gasoline additive, methyl tertiary-butyl ether (MTBE), neither addressed MTBE plume length. The good news is that both groups have been hard at work pulling together new information that includes MTBE and have recently released their results. In this article, I'll discuss briefly the results of the two studies and provide exerpts from the conclusions of these reports.

Plume Length

Both research groups found that for most sites studied in their respective evaluations of UST sites in Texas and California, MTBE plumes were usually not much longer than the companion benzene plume (i.e., usually less than 300 feet long). To most of you with even a marginal understanding of MTBE fate and transport, these results might seem counterintuitive. You have likely heard that MTBE is not as biodegradable as benzene and that there are some very long MTBE plumes. Therefore, you would expect that MTBE plumes would always be much longer than benzene plumes.

Both groups caution against overinterpretation of the existing data, and both note that given the apparent difference in the biodegradability and mobility of MTBE and benzene, it is likely that at least some MTBE plumes may continue to migrate past the edge of a stabilized benzene plume.

Also, be aware that the two studies employed different approaches to defining the downgradient "edge" of a benzene or MTBE plume. LLNL compared 1 ppb benzene plume length to 20 ppb MTBE, because 1 ppb is the maximum contaminant limit (MCL) for benzene, and 20 to 40 ppb is the current EPA "consumer acceptability advisory" for MTBE. The UT-BEG study compared equivalent plume concentrations (10 ppb benzene versus 10 ppb MTBE).

Both studies observed that characterizing plume length or "stability" is an inherently more difficult process for MTBE than it is for benzene. For example, it is almost never possible to know when a release of gasoline with MTBE occurred and whether there might have already been a release of non-MTBE gasoline at the site. Under this scenario, an MTBE plume might be shorter than the benzene plume, but only because it is "younger"—it may eventually become longer than the benzene plume.

The concentration of MTBE in gasoline can also vary substantially—from less than 1 percent to as much as 15 percent—and may have varied during the interval of the release. In contrast, benzene concentrations in gasoline have almost always been between about 1 and 3 percent, and benzene is much less soluble than MTBE. Because of these factors, the relative "source strength" of benzene and MTBE (i.e., the maximum dissolved concentration near the residual, immobile gasoline phase) may vary substantially among the existing population of UST sites.

Finally, it is difficult to find sites that have sufficient monitoring data over time that would allow a conclusive assessment of the relative stability of an MTBE plume to a companion benzene plume.

The Threat to Groundwater?

Whether this potential for greater migration translates into a greater perceived threat to shallow groundwater quality will probably ultimately depend on the groundwater cleanup standard for MTBE. EPA has "advised" that a value between 20 and 40 ppb is likely to be an acceptable level in drinking water, and most states have standards or action levels that vary between 20 and 240 ppb.

California, however, has recently promulgated a draft secondary drinking water standard of 5 ppb that is based on taste and odor considerations. It will likely be a few more years before much of a consensus is reached regarding the appropriate level of concern for MTBE. EPA may develop a MCL for MTBE, but it would not be promulgated until at least 2001.

The Role of Hydrogeology

Perhaps the most important "take-home message" from these two studies may be insights into the role that hydrogeology may play in MTBE plume development. For example, you might suspect that California and Texas do not have identical geology, and therefore you would expect

■ *continued on page 28*

EXCERPTS FROM THE EXECUTIVE SUMMARY OF THE LAWRENCE LIVERMORE NATIONAL LABORATORY REPORT

The authors of the LLNL report summarized their report by offering the following conclusions:

- MTBE is a frequent and widespread contaminant in shallow groundwater throughout California. There are presently 32,409 leaking underground fuel tank (LUFT) sites recognized in the state, 13,278 at which hydrocarbons are known to have impacted groundwater. A minimum estimate of the number of MTBE-impacted sites in California is greater than 10,000.
- MTBE plumes are more mobile than BTEX plumes. Although our results using 1995–1996 data indicate that, at the majority of sites, individual MTBE plumes were nearly equivalent or shorter than their corresponding benzene plumes (defined by action levels of 20 and 1 µg L -1, respectively), our results predict that at a portion of these sites, this relationship will change over time as the contaminant plumes gradually dissociate.
- The primary attenuation mechanism for MTBE is dispersion. Observed attenuation of BTEX and MTBE compounds at downgradient monitoring wells suggests that MTBE is not significantly degrading in existing monitoring networks. Thus, MTBE may be regarded as recalcitrant under site-specific conditions. MTBE concentrations leaving these networks were greater than those of BTEX compounds at a significant portion of LUFT sites. Assuming resistance of MTBE to biodegradation, these plumes will eventually attenuate to regulatory concentration goals due to dispersion, although in contrast to BTEX compounds, the mass would not be depleted and significantly longer distances and time frames would be required.
- MTBE has the potential to impact regional groundwater resources and may present a cumulative contamination hazard. To date, impacts of MTBE to public water systems have been limited and were similar in frequency to those of benzene. Based on historical data, future impacts of aromatic hydrocarbons, such as benzene, to water supplies is not expected to be common, due to retardation and relative ease of biodegradation. In contrast, MTBE contamination may be a progressive problem due to the chemical's apparent recalcitrance and mobility.

  With a compound that appears both ubiquitous and recalcitrant, water resource management on the regional scale will become increasingly relevant. For example, the potential long-term accumulation of mass resulting from dispersion of MTBE plumes may be a key consideration for management of specific regional groundwater basins. Therefore, leak prevention is a critical requirement for the continued use of MTBE to ensure future protection of drinking water resources.
- The authors have identified two major areas of uncertainty in their results. First, presently available MTBE data are limited. Second, the issue of recalcitrance of MTBE has not been resolved.

  Ideally, time-series data from hundreds of LUFT sites representing all hydrogeologic regions of California should be utilized to characterize the behavior and impact of MTBE plumes. Analyses of an expanded data set are important to confirm the study's initial findings regarding the mobility and recalcitrance of MTBE at California LUFT sites. Further time-series analyses are necessary for predicting future MTBE impacts to groundwater resources and assessing the vulnerability of drinking water resources.

  A number of laboratory-cultured microorganisms isolated from various environments can degrade MTBE, yet there is no convincing evidence to date that this destructive process occurs quickly and/or commonly in the field. While future research is warranted to address these issues, it is appropriate to manage groundwater resources with the assumption that MTBE is both mobile and recalcitrant relative to benzene, until proven otherwise.

EXCERPTS FROM THE UNIVERSITY OF TEXAS PAPER

The purpose of the UT-BEG study was to quantify the spatial and temporal variability of dissolved MTBE plumes resulting from leaking petroleum storage tank (LPST) sites in Texas. Based on a database of 609 LPST sites that had at least one measurement of MTBE, the major conclusions of the study are as follows:

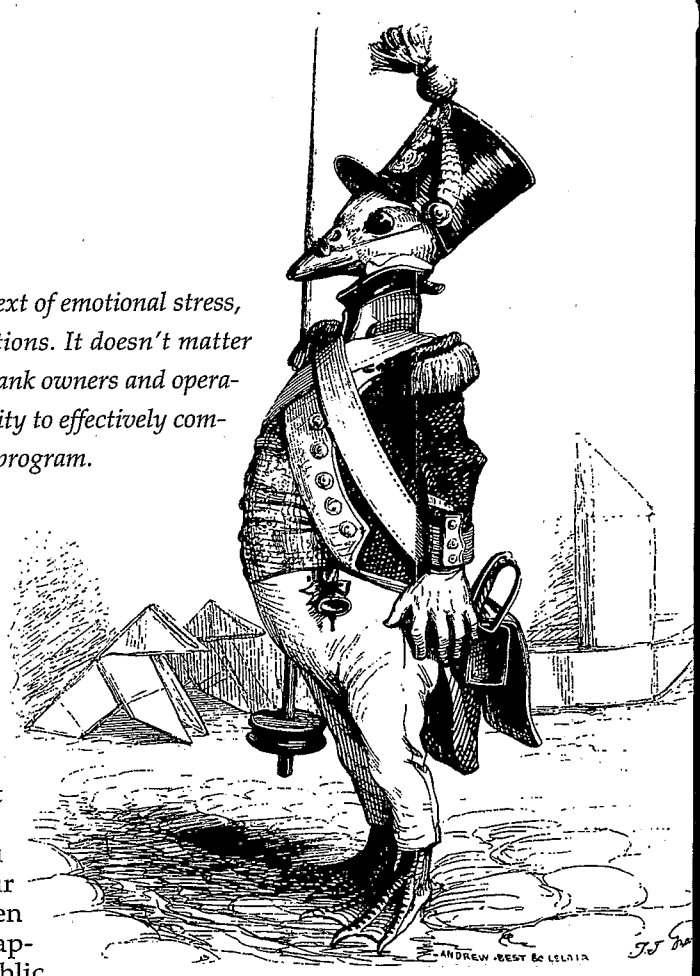
- MTBE is detected in shallow groundwater beneath LPST sites in most parts of the state. Although reformulated gasoline is required only in the Houston-Galveston and the Dallas-Fort Worth areas, MTBE is detected at 93 percent of LPST sites and is found in shallow groundwater in most areas of the state. In 79 percent of monitoring well sampling events, MTBE concentration is greater than benzene concentration.
- Most sites have MTBE concentrations that exceed the EPA advisory level and the protective concentration level proposed for Texas. The median maximum concentration of MTBE measured at the sites is 1,600 ppb, the 95th percentile occurring at about 100,000 ppb. Approximately 85 percent of the sites have maximum concentrations that exceed 20 ppb (the lower limit of the EPA MTBE advisory), and 80 percent of the sites have maximum concentrations that exceed 40 ppb (a proposed protective concentration level for Texas). Maximum MTBE concentrations are more likely to be higher at sites having shallow depth to water (<5 feet) than sites having deeper depth to water (>20 feet).
- MTBE plumes are, on average, about 27 feet longer than benzene plumes. Based on plumes defined at 89 sites for MTBE and 289 sites for benzene, geometric mean plume lengths for MTBE and benzene at a concentration of 10 ppb are 182 and 155 feet, respectively. MTBE plumes are longer than benzene plumes at 56 percent of LPST sites. MTBE plumes are longer in sandy formations than in clayey formations and are also longer at deeper depths to water than at shallower depths to water. MTBE plumes extend beyond the edge of the monitoring well network at about 10 percent of the 89 investigated sites.
- MTBE plumes may be naturally attenuated at many sites in Texas: (a) Many wells (83 percent) have stable, decreasing, or no detection of MTBE concentration; (b) the co-occurrence of MTBE with benzene has remained steady over the past seven years; (c) many sites investigated in detail show evidence of plume stability; and (d) many MTBE plumes are similar in size to the benzene plume at the same site. The similar size of the MTBE and benzene plumes and stable MTBE concentrations and plume length may be direct evidence of the intrinsic biodegradation of MTBE at many LPST sites in Texas. However, there will still be sites where MTBE plumes are mobile and much longer than their companion benzene plumes.
- The behavior of MTBE plumes over time needs more study. Although our results suggest that MTBE plumes may be naturally attenuated in Texas, direct measures of MTBE plume behavior over time are limited to only several sites. As MTBE concentrations are collected from more monitoring wells, many more plumes should be characterized to support the conclusions of this study. Additional data will allow the estimation of more current MTBE plume lengths and the quantification of the relative fraction of sites that have stable, growing, or receding plumes.

Investigation and Remediation

Risk Communication
Trust and Credibility

by Susan Brown

Communicating environmental risk 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.



In the last issue of *LUSTLine*, we discussed the importance of developing a public involvement strategy. This strategy, whatever it may be, will be successful ONLY if you are perceived as being trustworthy and credible in the eyes of your public.

Common sense, you say? If so, then why are so many people in decision-making positions today not trusted? Let's look at the government, for example. Are representatives of the federal government or your state government trusted when they make commitments? Do your stakeholders believe that these commitments are real? Or do they sense subterfuge, cover-ups, or misleading statements? Do your stakeholders believe that you are sincere, candid, and honest? If so, good for you! Keep up the good work! If not, what can you do to change this perception?

Do You Care Enough . . .?

Dr. Vincent Covello, of the Center for Risk Communication in New York City, identifies four factors that affect the public's perception of trust and credibility: empathy and caring, dedication and commitment, honesty and openness, and competence and expertise. Covello states that your ability to show empathy and caring contributes 50 percent to your overall trust and credibility in the eyes of your stakeholders. In other words, the decision I make about whether you are trustworthy is highly influenced by your ability to show me that you care, that "you can relate to my concern," that you are listening.

Ask yourself these questions: Do you care? Are you able to put yourself in the shoes of those with whom you are communicating? Do you understand why they are upset?

I will suggest to you that if you are unable to care, if you cannot relate, or if you do not understand your stakeholders' concern, then perhaps you have been inappropriately cast in the public interaction arena. Perhaps that job would be better suited to someone else. Time and time again, we see examples of emotion being discounted with the stating of facts. But we must realize that before the facts can be heard, the emotion must be acknowledged.

> ***The decision I make about whether you are trustworthy is highly influenced by your ability to show me that you care, that "you can relate to my concern," that you are listening.***

The other factors—dedication and commitment, honesty and openness, and competence and expertise—are each equally important in forming the whole trust and credibility circle. Staying power, accessibility, and knowing what you are doing—along with showing it—are important to your stakeholders as they judge for themselves your trustworthiness.

Specific Actions

So what do you do, exactly, to establish trust and credibility? First of all, your language, both verbal and nonverbal, helps to create an atmosphere of trust. Using words that are understandable and using body language that portrays openness send the message that you are credible.

To show empathy and caring:

- Say that you care.
- Share the other person's frustration.
- Take concerns seriously.
- Maintain eye contact.
- Involve your stakeholders early.
- LISTEN!!!

■ *continued on page 28*

■ Trust and Credibility
from page 27

To show dedication and commitment:

- Arrive at public interactions early.
- Be the last one to leave.
- Know your stakeholders' interests.
- Be accessible.
- Stay in touch.
- FOLLOW UP!!!

To show honesty and openness:

- Be proactive in communication.
- Admit mistakes.
- Avoid technical jargon and acronyms.
- Avoid physical barriers.
- Use open, positive body language.
- TELL THE TRUTH!!!

To show competence and expertise:

- State your credentials.
- Relate relevant experience.
- Avoid debates.
- Refer to credible sources that agree with you.
- Use clear and concise language.
- BE PREPARED!!!!

Look Out for the Traps

What do you need to look out for as you are working to establish trust and credibility? The jargon, humor, and negatives traps.

- **Limit your use of jargon.** Remember, your technical expertise may very well be like a foreign language to people outside of your field. So use language that can be understood by those with whom you are communicating.
- **Do not use humor.** Remember, the subject you are discussing is of a serious nature. Your stakeholders' concerns are serious concerns. During interactions where emotions surface, humor is inappropriate. So don't try to cover nervousness with a joke; don't try to "lighten up" the situation with a humorous story. If you are in a situation where you must employ risk communication skills during the interaction, then leave the humor at home.
- **Avoid negative words.** Research has found that individuals tend to focus on the negative during emotionally laden interactions. Therefore, repeating negative allegations, using words that have negative connotations, or using words such as "no," "not," "never," "nothing," and "none" will work to diminish, instead of increase, trust. Instead, use positive words and phrases while you focus on the present and future.

The moral of this story? Be diligent in your efforts to establish and maintain trust and credibility. Your efforts will result in improved interaction and a true sharing of information and ideas! ■

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■ MTBE Plume Length Studies
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some differences in "typical" shallow hydrogeology at UST sites in the two states. Eighty-eight percent of the sites studied in the LLNL study were in alluvial sediments, while most of the sites in the Texas study were in lower-permeability sediments that are common in the Gulf Coast states. Presumably the average groundwater velocity for the California sites would have been higher than for the Texas sites, which might translate to longer MTBE plumes.

First Steps in a Long Journey

These differences and uncertainties aside, the findings of these two new studies provide a valuable and informative snapshot of MTBE plume behavior and will help direct future research and regulatory decision making regarding management of MTBE-impacted sites. Both reports contain a lot of other interesting observations—from assessments of analytical procedures to detailed case studies. They do not, however, provide definitive answers to predicting the long-term impacts of MTBE at UST sites. If you read these reports (and all *LUSTLine* readers interested in this topic owe it to themselves to do so), you may wind up with a longer list of questions than when you started! You may also find your interpretations differ from the authors, but you most certainly will obtain a better understanding of the complexities of characterizing MTBE releases from USTs. ■

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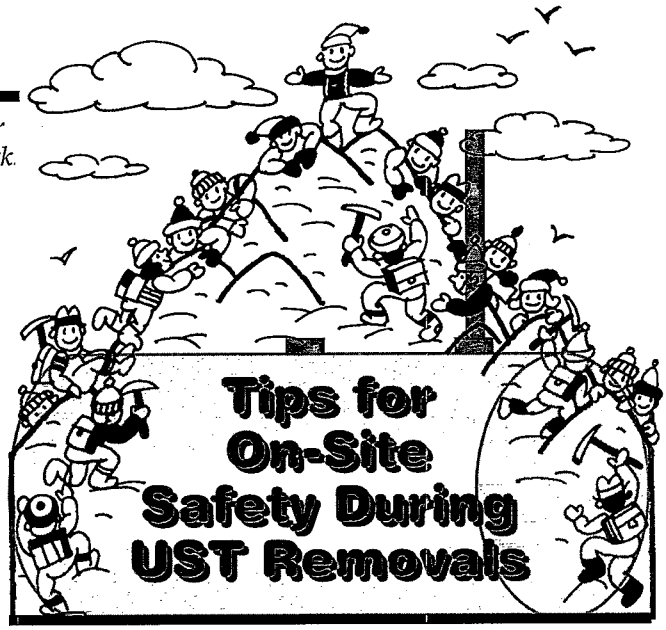
Health and Safety



As promised in the last issue of LUSTLine, we are continuing our campaign to keep safety at the forefront of your UST-related work. When removing tanks or inspecting in tank areas, there are some procedures that make the business safer. The following tips, which are based on OSHA requirements, were prepared by Deborah Roy of SafeTech Consultants, Inc.

Trenching and Excavation

✓ Shore up the sides of the tank excavation when workers must enter by installing braces, jacks, or shields, such as a trench box.

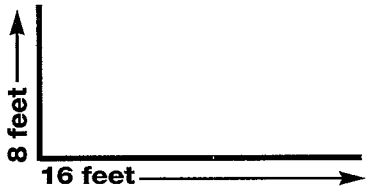
✓ Alternatively, slope the sides of the cut to the "angle of repose"—the greatest angle above the horizontal plane at which material will lie without sliding. The "competent person" on your job should determine the soil type and make the recommendation for the correct angle to use. For Class C soil, the angle is 1.5:1.

✓ Make sure that any excavated material is placed at least 2 feet from the edge of the cut.

✓ Test the atmosphere of any excavation that is greater than 4 feet in depth. If a hazardous atmosphere exists, ventilate or use respiratory protection to prevent exposure and have appropriate rescue equipment (e.g., safety line and harness) on site.

✓ If you enter a trench that is greater than 4 feet deep, make sure that you have a means of exit (e.g., a ladder) within 25 feet of lateral travel.

✓ If an excavation has a vertical wall, workers must remain double the distance of the height of the wall away from the wall, or must use a shoring system. (See example at right.)



Electrical Practices

✓ Use only explosion-proof equipment around tank environments that contain flammable vapors or are suspected of containing chemical contaminants.

✓ Install and use ground fault circuit interrupters on portable generators, electrical equipment, connectors, and tools.

✓ Use only three-pronged, grounded electric extension cords. DO NOT use a cord that has cuts or abraded areas in the outer covering, even if it has been "repaired" with electric tape. Damaged cords can heat up and burn, and, beyond the injury and explosion potential, OSHA will cite you!

✓ For gasoline or other flammable liquid tanks, use only nonsparking tools to expose tank fittings and prepare for vapor-freeing procedures. Nonsparking tools are usually coated with brass.

✓ Lock out or tag out equipment such as fuel pumps at gas stations prior to servicing or repair to prevent the unexpected start-up of moving parts or the release of stored energy.

✓ Monitor weather conditions when working outdoors and suspend work during electrical storms.

Personal Protective Equipment and Site Safety

✓ Evaluate potential physical and chemical hazards, determine the proper personal protective equipment (PPE), and use it! This means hard hats for flying metals or overhead hazards, safety glasses with side shields or goggles for dust and small particles, and chemical gloves for contact with tank contents such as petroleum products.

✓ Require and use safety vests when working in an area where there is vehicular traffic or heavy equipment.

✓ Control access to the site, especially the area of excavation, by use of barriers, cones, or hazard tape. Protect tank-site workers from vehicular traffic and protect the public (including children) from the tank excavation.

✓ Keep your workplace clean and hazard-free.

More next time. ■

EPA HQ UPDATE

Enforcement Strategy for 1998 UST Deadline Released

On August 10, EPA's *Strategy for Enforcement of Regulatory Requirements Applicable to Underground Storage Tank (UST) Facilities* was released. The document can be accessed on EPA's Web site at www.epa.gov/swerust1/1998/index.htm. See page 5 for more details.

Popular UST Compliance Assistance Publication Updated

The EPA Office of Underground Storage Tanks (OUST) has revised and updated the leaflet *Ordering Information on Underground Storage Tanks* (EPA 510-F-98-016, August 1998), a very useful tool for alerting UST owners and operators that they can easily obtain a wide variety of free compliance assistance materials from EPA.

OUST Reprints Automatic Tank Gauge Leaflet

After having distributed over 9,000 copies of the leaflet *Getting the Most Out of Your Automatic Tank Gauging System*, EPA has reprinted the publication. The leaflet provides UST owners and operators with a basic checklist for making sure their automatic tank gauging systems work effectively, and focuses on what actions must be taken to comply with leak detection requirements and prevent significant cleanup problems.

OUST Documents Now Available Through EPA Fax-on-Demand Service

Over 220 OUST documents, including OUST's most frequently requested publications, such as *Musts for USTs*, are now available to any user who has access to a fax machine. By dialing (202) 651-2098 from a fax machine and following the voice prompts, users can immediately obtain copies of OUST guidance documents, brochures, booklets, lists of state program contacts, notification forms, fact sheets, and more. For users who do not have access to the Internet, this option is an alternative way to obtain needed UST program information quickly. Documents are available free of charge; the requester pays only the telephone charges for the fax service.

Effects of MTBE Releases on State LUST Programs Reported in Article

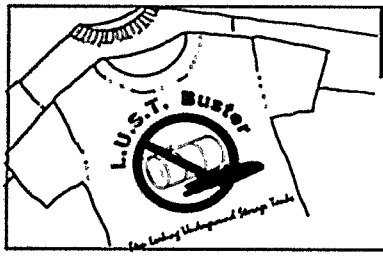
An article titled "Study Reports LUST Programs Are Feeling Effects of MTBE Releases" appears in the August/September 1998 issue of *Soil & Groundwater Cleanup*. The article, which was written by Robert Hitzig of OUST and Paul Kostecki and Denise Leonard of the University of Massachusetts (UMass), reports on the results of a survey of state LUST programs conducted by UMass and funded by OUST. The survey was designed to gauge the impact of MTBE on state LUST programs and to determine and evaluate any effective methods for dealing with MTBE that states have developed. Some results of the survey include the following:

- For most state programs, the detection of MTBE is common, and because the behavioral characteristics of MTBE differ from those of BTEX, MTBE may contaminate groundwater in unexpected locations and in unexpected ways (e.g., at diesel fuel sites or as a result of surface spills of small amounts of gasoline).
- LUST programs have reported that existing remediation technologies for both soil and groundwater can be successful in removing MTBE from the subsurface.
- Releases of gasoline containing MTBE can significantly increase the cost of remediation, particularly when a release contains high concentrations of MTBE.

The study indicates that state LUST programs should be conscious of the potential for MTBE contamination when investigating all kinds of petroleum releases, anywhere in the United States, regardless of whether reformulated gasoline is used in the area of investigation. For more information about the survey, contact Maureen Lewison at (703) 603-7143.

To obtain copies of many of OUST's publications:

Call NCEPI at (800) 490-9198 or EPA's RCRA Hotline at (800) 424-9346. Or, go to OUST's World Wide Web home page at www.epa.gov/OUST and select "OUST Publications."



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Gasoline Overfill Spill

Inferno Kills Five and Critically Injures One in Mississippi

What happened at 1 A.M., August 9 on a street in Biloxi, Mississippi, should never have happened—no way, no how. It happened when over 700 gallons of gasoline overflowed from an UST at a Texaco service station and streamed onto U.S. Highway 90.

As two vehicles waited at a stop sign at the intersection where the fuel was flowing, a pickup truck approached. In a flash, heat or a spark ignited the fuel on the ground, setting off an explosion and fire that reached 60 feet into the night sky and engulfed the three vehicles. Two victims were pronounced dead at the scene, three others died soon after, and one remains in critical condition. Some of the fuel spilled into the sewer system and eventually into the Mississippi Sound, touching off secondary explosions.

According to reports, the driver of the tanker truck was inexperienced and may have been delivering the fuel to the wrong facility. "The tank he was about to fill was apparently near capacity," says Kevin Henderson, Chief of Compliance with the Mississippi Department of Environmental Quality. "Based on our initial investigations, we suspect that when he stuck the tank, he didn't replace the cap on the gauge opening properly. He then went over to the remote fill, connected the hose, began filling the tank, and left the area for what we surmise to be approximately five minutes."

According to Henderson, the tank was equipped with a ball float valve overfill spill prevention device. The valve appeared to be functioning correctly, and all of the ancillary fittings on top of the tank were tight. So why did the fuel overflow? Well, there was the matter of the unsecured cap at the gauge opening where the driver stuck the tank.

For a float vent valve to work, the tank top must be air-tight—everything from gauge fittings to risers to drain mechanisms on spill buckets—and able to hold the pressure created when the tank fills and the ball floats upward and blocks the vent pipe opening. When the vent is closed, no more fuel should be able to enter the tank. In this case, however, a 4-inch riser used to gauge the tank was left open, and the fuel began to flow out of that opening.

"The remote fill is the key here," says Henderson. "Under normal circumstances the driver sticks the tank and then connects the delivery hose to the same riser opening, thereby ensuring a tight tank top. With a remote fill, the potential for this type of catastrophe is there. Also, any tank with a drop tube device or ball float valve must have a 'tight fill adapter,' which allows the delivery person to hook the tight fill device on his hose to the tank's and make a tight connection."

While there are federal regulations for owners and operators to ensure that spills and overfills do not occur, Henderson says that, as far as he knows, in most states, the act of making a fuel delivery is not regulated, "and this is where we are going to have continuing problems with fuel spills. A tragedy like this should call attention to the seriousness of this problem."

For the foreseeable future, fuel deliveries will be made by people, and people can make mistakes—big mistakes. Maryland is the only state that we know of that requires fuel delivery drivers to be certified. ■

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We welcome your comments and suggestions on any of our articles.

National Leak Detection Performance Study Gets Under Way—Participants Welcome

In response to concerns about the effectiveness of leak detection methods under field conditions, EPA's Grants Administration Division is funding a national study to analyze data collected by state and local inspectors during tank closure or release investigations.

The study will be conducted by Dr. Thomas Young at the University of California, Davis (UCD). The first phase of the project is to identify state and local implementing agencies that are willing to participate by completing a simple, one-page form for each site investigation. The exact design of the data collection form will be addressed in the second phase by the participating agencies and the project team.

Once the form has been designed and disseminated, participants will collect the data and submit them to UCD for analysis. The data will be used to:

(1) Compile a database that will be made available electronically to state agencies and others,

(2) Prepare a final report, and

(3) Communicate results about leak detection effectiveness in a future *LUSTLine* article.

A pilot project that is following this approach is currently being conducted by the California State Water Resources Control Board and UCD. The results of that study will be used to help design the new effort.

The success of this study will depend upon the active participation of implementing agencies—more data points help strengthen conclusions about which brands and methods of leak detection are most effective. A small investment in time spent by a large number of agencies will lead to information that will help both regulators and tank owners improve their approaches to leak detection. ■

For more information about the study, contact Tom Young by email (tyoung@ucdavis.edu) or phone (530) 754-9399. If you are interested in participating in the study, contact Tom as soon as possible. ■

Coast to Coast

State Cleanup Fund Administrators Powwow in Austin

This June, the Association of State and Territorial Solid Waste Management Officials' (ASTSWMO) Tanks Subcommittee State Fund Cleanup Task Force held its Seventh Annual State Fund Administrators Conference in Austin, Texas. Each year, the conference agenda is packed with sessions that address the many issues that state fund administrators across the country have in common. Copies of the conference proceeding are available from Steve Crimaudo (ASTSWMO) at (202) 624-7875.

Awards for the best State Fund Success Stories were presented to four states for four different categories. The winners—Florida for Financial Success, Iowa for Policy Innovation and Productivity, Missouri for Success with Stakeholders, and Colorado for Best Overall Getting the Job Done.

Two products of the State Fund Cleanup Task Force, the annual *Summary of State Fund Survey Results* and a *State Fund Success Stories Compendium*, third edition, were disseminated at the conference. At the close of the conference, the co-chair baton was passed from Dan Neal (Texas) to Lori Baker (Kentucky). Lori and George Matthis (North Carolina) will co-chair the task force during the 1998–1999 year.

For more information about the State Fund Cleanup Funds Task Force, contact Lori Baker at (502) 564-5981 or George Matthis at (919) 733-1332. To learn more about the ASTSWMO Tanks Subcommittee, contact the Subcommittee Chair, Scott Winters (Colorado) at (303) 620-4008, or Stephen Crimaudo at (202) 624-7883. ■

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