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L.U.S.T.LINE

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

Setting Our Sights on Operational Compliance

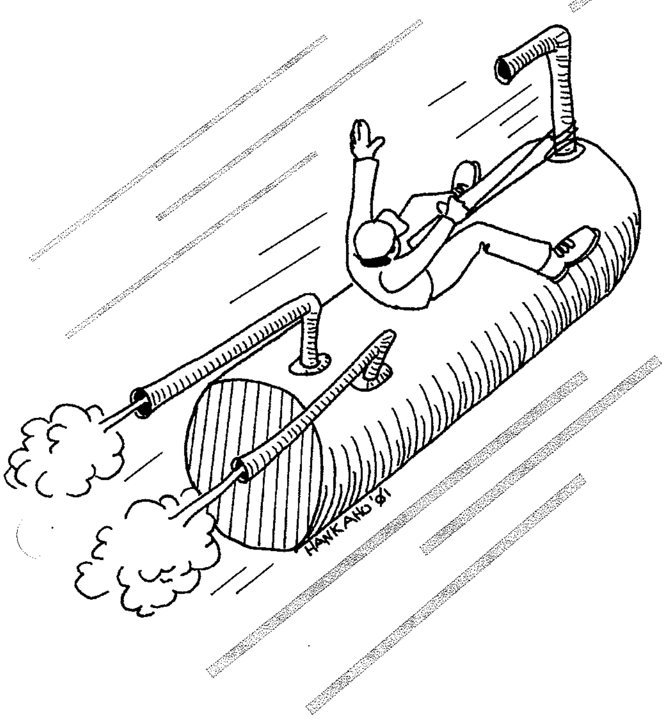
by Ben Thomas

Many regulators still define the universe of underground storage tanks (USTs) according to the erstwhile two-part model that focuses on those tanks that are upgraded and those that are not. Under that model, new or upgraded tanks are, more or less, resistant to failure. Conversely, nonupgraded tanks are an inherent risk to human health and the environment. Prior to December 22, 1998, this either/or model helped drive 1.5 million tanks into compliance or closure. However, two full years after the deadline, it's just not that simple any more.

Like it or not, UST programs are in transition from a simplistic model of the tank universe (upgrade) to a more complex and real-world model (operational compliance). The sooner states start doing the groundwork to move in this new direction, the better off both regulators and tank operators will be—not to mention the environment.

The "1998 deadline" had a fearsome and somewhat tantalizing aura and a nice, neat do-or-die endpoint, but it is history. Now regulators are tasked with energizing the UST program with a new long-term target that is fraught with behavioral implications for the UST operator—"Significant Operational Compliance."

I'd like to offer a recipe for how states can identify, achieve, and maintain this new target. The recipe contains the following key ingredients:



- **Forget the '98 deadline.**
- **Admit that operational compliance is a national problem.**
- **Define new goals, change old endpoints.**
- **Explore new incentives.**

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Forget the '98 Deadline

It may seem heretical to ask someone to disregard a historical marker like the 1998 deadline, but let's face it, some of us are still thinking of the UST program with a pre-1998 mind-set. This is dangerously short-sighted. From the big-picture standpoint, we can assume that basic equipment-based compliance is pretty much achieved. We must now set our sights on ensuring that those environmental safeguards function. Forever.

Not only is the '98 deadline irrelevant to our goal of preventing future fuel releases to the environment, it is actually getting in the way of how we look at the future of the UST program. I've seen this time-warp mentality manifested in a number of ways:

- A state regulator says his program is not ready to embrace operation and maintenance outreach efforts yet because of the number of non-upgraded tanks still in existence.
- A federal inspector speaking at a national conference belabors his concerns about pre-1998 leak detection methods that are no longer valid for most tank owners.
- A number of states have Web page headlines with outdated 1998 logos, deadline descriptions, and warnings.

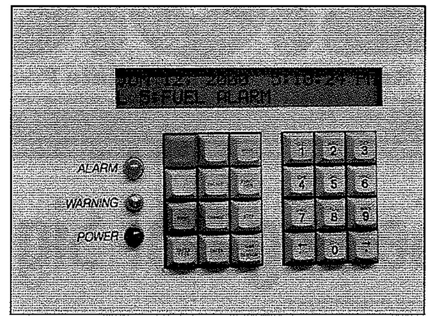
Not that all regulators are living in the past. How many of you, in the early winter months of 1999, were wondering where the program would go after the deadline? Some of you must have wondered: What happens after all the tanks are upgraded, after closures trickle down to the occasional, and when risk-based decision making brings the lion's share of the LUST sites under control?

Fear not, fellow visionists. For better or worse, the national spotlight on MTBE has raised some pretty pointed concerns about the fundamental effectiveness of the UST program as a whole. Sure we got rid of 60% of the nation's USTs. Sure there are 300,000 LUST sites with cleanup underway. And sure the nation's tanks are mostly upgraded. So why is MTBE showing up in water supplies?

Echoing the prophetic incantations of a number of astute UST aficionado are a number of excellent MTBE studies that ask some hard and fundamental questions.

- Does leak detection actually detect leaks?
- Do a majority of operators understand leak detection requirements at a basic level?
- Do operators know what to do if they suspect a release?
- Are the upgraded tanks being adequately maintained?
- What can we do to minimize future releases from "upgraded" tanks?
- How often must an UST system be inspected? And how thoroughly?
- What parts of the UST system are most susceptible to releases in the post-deadline world?

The biggest problem with the 1998 deadline is that we put so much effort into showcasing this important date that we failed to see that we were creating a perception that the program would be over after December 23, 1998. The deadline turned into an artificial endpoint, when, in fact, 1998 was only the beginning of the program.



An ATG in alarm mode during inspection, Haines, Alaska, June 2000.

We need to focus our efforts on a new level of detail. Instead of settling for the presence of an automatic tank gauge (ATG) on the compliance checklist, regulators need to be asking the salient questions concerning that gauge—Is the ATG currently third-party approved? Is the monthly test run for the proper time duration and with enough product for a valid test? Are there 12 months worth of records available to prove a history of leak detection? How does the ATG console indicate when a release occurs, and will the owner know what to do?

Operational Compliance

A November 2000 report prepared by the Alaska Department of Environmental Conservation (ADEC) shows that operational compliance is a major problem in the state. Expanded to a national level, we may have several hundred thousand malfunctioning or mismanaged USTs that are accidents waiting to happen. Industry representatives will tell you this scenario is not possible, but they can't prove operational compliance on a wide scale any more than most states can.

Enter the new mindset—significant operational compliance. U.S. EPA, working with states, developed a concept meant to be a yardstick by which states can measure problems and successes in the post-deadline

LUSTLine

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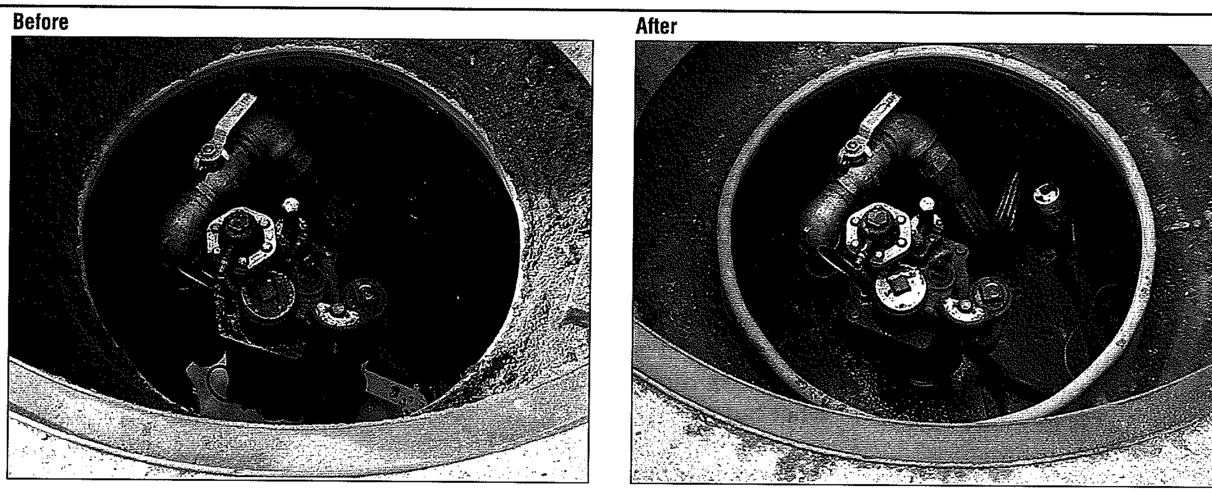


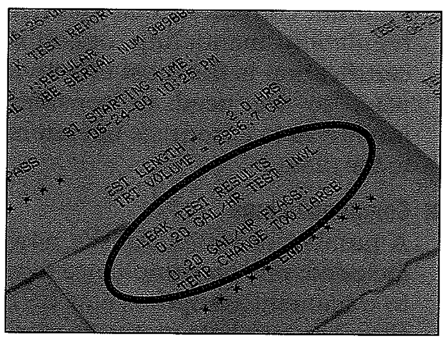
Pipe sump before and after rusty water was removed, Juneau, Alaska, August 2000.

world. Behind the concept is the need for states to prioritize prospective violations because, in reality, a state inspector can go to virtually any UST facility in America and find at least one violation.

EPA claims that 85% of UST systems in the United States are achieving operational compliance. This percentage is based on numbers that are handed over to the agency by each of the states. These numbers are based on projections, not systematic studies. I contend that most states have not taken enough of a representative sample to extrapolate to a meaningful percent. Also, we may never know the real national picture because EPA developed only a concept and not guidance. Essentially, EPA is allowing states to come up with their own definition of significant operation compliance.

Are all UST regulations of equal weight or significance? Is it realistic to try to enforce all regulations for all USTs equally? If not, what is the priority scheme? How do we determine which requirements are "mission critical" and which we, well, overlook for the time being? Having a consistent, national guidance on significant operational compliance would help us answer these questions.

Alaska, with its meager 1,100-tank population, completed its first- ever sweep of operational compliance in 2000 by having third-party inspectors inspect one-third of all the tanks. And, big surprise—most tanks failed significant operational compliance. Our finding is exactly opposite the delusional compliance rate that states are theorizing. And Alaska has achieved almost 100% with regard to equipment-based compliance, which means that a mostly new population of USTs is highly susceptible to operational compliance failure.



Invalid (INVL) test results from ATG at small service station in Juneau, Alaska, August 2000.

So how bad off is operational compliance in your state? Until you have done some systematic inspections, or until you mandate routine operational inspections, you may never know.

Define New Goals, Change Old Endpoints

While the federal UST regulations have been effective at helping tank operators achieve compliance, they are not necessarily effective at helping tank operators maintain compliance. What seem to be entirely absent from any tank program are protocols for addressing repairs, fixes, alterations, additions, or enhancements of UST systems. If you've ever tried to guide an operator through the requirements on repairing an UST system, you will know what I mean.

Getting unstuck from the 1998 deadline also means that regulators are forced to burrow into a deeper layer of unanswered questions that have persisted over the years but that have been relegated to the back burner. Until now. Will somebody please tell me:

- How often an UST system should be inspected for operational compliance?
- How do you assess compliance on UST systems with multiple or redundant leak detection types in place? Does the owner have to meet the requirements for one, some, or all?
- Does a double-walled, pressurized pipe need to have an automatic line-leak detector as well as a sump alarm?
- How does an owner document compliance with leak detection methods that produce no paper? For example, what do you tell the owner of an UST with continuously monitored double-walled piping who has no monthly print out of leak detection status? Does he have to upgrade to a printer? Is an "idiot light" enough?
- Why must automatic line leak detectors be tested annually for functionality and not flow rate? I have unnamed sources that say many ALLDs don't meet the 3 gph leak rate out of the box and may not be working.
- Does the "power on" light on an ATG console need to be working in order to be in compliance?

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■ Operational Compliance...
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- What is an acceptable national standard for performing a cathodic protection test?
- What standard do we use for adding sacrificial anodes to an existing STI-P3 tank that has low CP readings?
- Does an UST with double-walled piping that has a continuous sump-sensor alarm need monthly recordkeeping? Is monthly checking required if it is continuous?
- Is a piping sump alarm okay if the UST is an unstaffed, 24-hour station?
- What method do you use to test a spill bucket for tightness? Hydrostatic? Visual?
- How do you confirm that a ball float valve is both present and set to trip when the tank is 90% full?
- How do you test the functionality of a drop-tube overfill device once it is installed?

These questions must be answered as more and more states focus on the operational end of UST compliance. And if they cannot be answered easily in the OUST technical compendium, it may be time to open the hood of the UST regulations and make some changes. Many people are concerned that revisiting the national UST regulations is the environmental equivalent of Pandora's box, but I think the program will be forced to move in this direction eventually. We can approach it clearly and with intention, or we can be dragged to it kicking and screaming.

Explore New Incentives

In the big picture, we shouldn't fool ourselves into thinking that our problems are over—far from it. I believe that the real work of leak detection has not even begun. So what are the best incentives we can use to promote a continuous vigilance that will result in better release prevention? How do you promote a "release prevention attitude"?

Like UST specialist Marcel Moreau said at the EPA UST/LUST conference last year, tank operators are generally more interested in how potato chips are displayed than how to do monthly leak detection. This is because they know they make money on potato chips, but they don't see the economic return of release detection.

It helps to remember that we, regulators and regulated alike, all share a common goal of preventing releases to the environment from USTs. Some of you more weathered field inspectors may smirk at this lofty assessment but it's true: With a common goal we can continue to make common ground. So again, what can we all do better?

Here are some specific recommendations for states to consider.

- **Voluntary operator certification**
  Currently there is no method that states are using to test the competency of UST operators, although Florida and California are headed in this direction. I would like to see a method to promote education and testing of UST operators. I am not convinced that another regulation mandating operator certification is the most effective way, so we need to consider incentives to encourage operators to the plate.
- **Compliance tags**
  A number of states, Alaska now included, rely on compliance tags to document compliance at UST sites. The tags help motivate operators to think about compliance, especially in states that have fuel bans for noncompliant tanks. UST operators as well as the fuel-consuming public need a simple way to identify operational compliance. Compliance tags should not be an indication that a tank has met the 1998 deadline—they must indicate operational compliance and be renewed periodically.

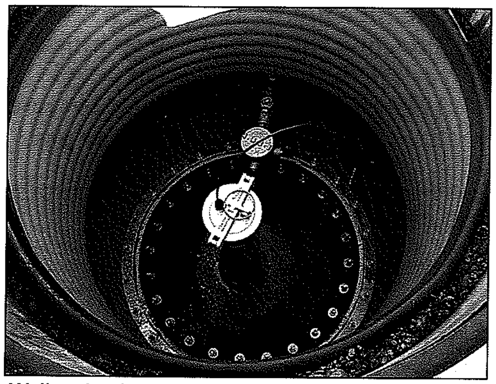
- **Frequent mandatory inspections**
  These are not a bad thing if they motivate tank operators to continuously assess and maintain their USTs. Alaska has used this method with great success over the past year.
- **Continuous training**
  Don't put away your training brochures yet. High operator turnover (400% at convenience stores) should be enough to tell us we need to plan on training operators as long as tanks lie beneath the ground. States need to develop a whole new repertoire of material to address operation and maintenance of UST systems. The more available the training, the more operators have an incentive to attend.
- **Rewards**
  Good prevention practices trigger behavior modification through rewards. Remember Pavlov's dog? Regulators need to think creatively on how to offer reward-like incentives to motivate employees to do a good job looking for problems.
- **Enforcement/Outreach blend**
  The big stick approach works sometimes, but it must be accompanied by a solid education and outreach effort by states.

New Programs Mean New Frontiers

In the future, a clean sump and a well-maintained sensor, such as the one shown on page 5, will be much more exciting to a regulator than an STI-P3 versus a fiberglass tank. As regulators we need to shift our focus to the more subtle and complex details of the UST program.

States are shifting or eventually will have to shift to compulsory programs that focus on operational compliance. Routine, mandatory inspections offer a great framework for tying lots of loose programmatic ends together.

The longer we wait to implement this new directive, the harder it will be for our UST operators to make the shift. In Alaska, we believe that our move to third-party inspections went smoothly because UST operators barely got through the rigors of the '98 deadline requirements before



Well maintained interstitial sensor sump, Juneau, Alaska, June 2000.

launching into the next campaign. UST operators will perceive any lag time between what the state expects before and after 1998 with suspicion and reluctance. "I spent all this money to upgrade my tank and now you want what?"

Let's avoid this trap and get busy working on a long-term plan to prevent another generation of leaking USTs. ■

Ben Thomas, Environmental Specialist for the Alaska Department of Environmental Conservation, developed and now administers the third-party UST inspection program in Alaska. He can be reached at **ben_thomas@envircon.state.ak.us**.

Leak Prevention

Privatizing UST Compliance Inspections

Alaska's Third-Party Inspection Program

by Ben Thomas

How do you protect groundwater, promote environmental responsibility, increase compliance to nearly 100%, and not hire any new staff? Simple, you privatize the inspection of UST systems. All USTs in Alaska must now be inspected every 3 years for operational compliance by a licensed third-party inspector and tagged in order to receive fuel. Between May 1 and November 1, 2000, one-third of the active USTs in the state were inspected in this manner.

Alaska is the third state to adopt third-party inspection regulations—the other states are Pennsylvania and Montana. Inspection includes examining, assessing, testing, and documenting leak detection, spill and overfill prevention, and corrosion protection systems. Our program is unique in that inspectors can also repair UST systems to bring them into compliance to pass inspection.

Results of the First Year

One-third (423) of Alaska tanks required inspection in 2000. By early November, 2000, 99%, or 419 tanks, were inspected. Alaska tank owners rose to the challenge of paying for and setting up third-party inspections. ADEC received no formal complaints from tank owners. The cost of inspections ran from around $300 to $1,200 per site. Any required repair work was an additional cost. Here's what we learned:

- Eight out of every 10 tanks had problems. Eighty-two percent of the USTs that passed inspection did so only after one or more problems were identified and corrected. Six hundred fifty-six problems were discovered and corrected at 317 tanks.
- While inspectors found a few cracked spill buckets, there were no "real" petroleum releases found in the summer of 2000. Or put another way, one-third of Alaska UST systems were not leaking this summer. Realistically speaking, this could mean: (a) inspectors are not documenting releases properly, (b) leak detection may not be working and some tanks are leaking, or (c) Alaska's UST population is in good shape at the moment.
- Over 60% of all problems found and corrected were associated with leak detection. One-third of all inspected UST systems did not have adequately documented proof of leak detection for the last 12 months.
- Most problems were not caused by the absence or failure of proper equipment. Eighty-seven percent of the problems identified were related to operations or recordkeeping. Thirteen percent were equipment-related problems.
- There were 397 individual leak detection problems noted, versus 92 spill/overfill problems and 167 corrosion protection problems. The types of leak detection problems vary widely. The high number of leak detection problems indicate that operators still don't understand leak detection very well. Or it is simply not working in the way it was intended.

Bill Tatsuda (left) receives Alaska's first UST Compliance Tag from Bob Fultz of the Alaska DEC, Ketchikan, Alaska, May 2000.

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■ Third-Party Inspection Program... *continued from page 5*

- While some spill and overfill devices were missing, the biggest problem was keeping spill buckets clean and free of debris and water. Inspectors also discovered a few UST systems that were reported to have spill/overfill devices but did not.
- The major deficiency for steel tanks was the lack of any history of CP testing. Roughly 85% of Alaska's USTs are steel. Many tanks received their first-ever CP test as a mandatory part of the third-party inspection.

Inspectors Performed Well

ADEC, with help from U.S. EPA, found no violations when auditing inspectors in the fall of 2000. Rigorous qualification requirements, training, and communication probably attributed to this achievement. We made our requirements difficult intentionally to avoid the hassle of attracting "fly by night" inspectors.

ADEC trained over 90 people in 1999 and 2000, 26 of whom became

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Elements of Alaska's Third-Party Inspection Program

- **Inspections are required every 3 years starting in 2000.**
- **One-third of all tanks are inspected each year.**
- **Licensed third-party inspectors perform the work.**
- **The inspection is a total UST system check for presence and functionality of leak detection, spill and overfill, and corrosion protection.**
- **The inspector can make repairs.**
- **Owners have 150 days to complete inspection, make corrections, and file paperwork.**
- **The Alaska Department of Environmental Conservation (ADEC) issues a permanent tag for all tanks that pass inspection.**
- **An UST may not receive fuel unless it is tagged.**

TABLE 1 TYPES OF PROBLEMS FOUND IN ALASKA'S SUMMER 2000 INSPECTIONS

Deficiencies	Leak Detection	Spill/Overfill	Cathodic Protection
No ATG documents	28		
Water in tank interstitial space	1		
ATG not rated for 20K tank, only 15	4		
Interstitial sensor alarm on or not working	9		
Doing IC+TTT but not allowed	10		
Check valve in wrong location on suction piping	2		
Not enough product in tank to run valid test	3		
ATG broken	3		
ATG in alarm mode	1		
ATG turned off each night	1		
No leak detection records	137		
Dispenser meter not calibrated	1		
Inventory Control and/or reconciliation not being done	4		
No Annual ALLD functionality test	23		
No annual line tightness test	25		
Fuel "dampness" in interstitial space	2		
No maintenance of interstitial sensors	62		
No documentation of interstitial sensors	62		
No ALLD present	4		
ALLD installed wrong	1		
ALLD Leak rate unknown	2		
ALLD not set to run 0.2/0.1 gph leak rate monthly	2		
Water in containment sump	3		
Product in containment sump, pipe loose	2		
Sump sensor positioned too high to detect a release. Product in sump.	3		
Sump sensor not working	2		
Overfill alarm not audible to driver or not working		3	
Overfill alarm disabled		1	
No Overfill device		10	
Spill bucket damaged, cannot hold liquid		13	
No spill bucket		4	
Spill bucket full of product or water or dirt		61	
CP failed			11
CP current low. Rectifier needed adjustment			3
Impressed current rectifier turned off			6
Records of last 6 mo./3-year tests not present			126
60-day log not present			21
Total	**397**	**92**	**167**

Leak Prevention

Tank-nically Speaking

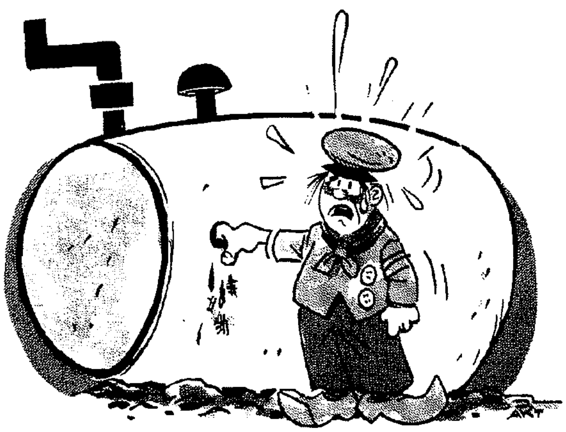
by Marcel Moreau

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 him know at* **marcel.moreau@juno.com**.

PLUGGING THE HOLES IN OUR UST SYSTEMS

I've just returned from an exhausting week spent representing the interests of a city whose water wells are threatened by a release of MTBE from a service station. The situation is similar to one I described a few years ago. (See "The Holes in Our UST Systems," LUSTLine *#30.) A "state-of-the-art" storage system was the source of significant MTBE contamination. The storage system owner claimed that there could not have been a release from the double-walled system, that some wayward customer must have caused the problem by spilling a few gallons of gasoline.*

My analysis of the situation included the possibility of customer spillage as a contributing factor but also pointed out the likelihood of vapor releases, overfills, and failure of the secondary containment to capture every drop of product.



One of the questions addressed to me by the city was, "What could be done to prevent any future contamination from this facility?" While it is clear to me that the only guaranteed way to prevent future discharges is to remove the facility, this seems to be an unacceptable alternative. Given that the facility is to continue operations, what requirements could the city impose to provide maximum protection to its water supply?

As I pondered the answer to this question, it occurred to me that over the next few years quite a number of communities may be seeking answers to this same question. What follows is a preliminary list of measures that I believe could be effective in minimizing contamination from UST facilities. These measures are intended to supplement double-walled systems. The first and most important measure to take if you have a single-walled system is to upgrade to secondary containment.

Clearly, not all measures would need to be implemented at all sites. A site-specific evaluation would be needed to determine which measures would be most effective for a given location. I present this list here to stimulate thought and promote discussion.

Some Leak Minimizing Measures

[NOTE: This list assumes that the UST facility is in full compliance with all existing regulatory requirements concerning corrosion protection, leak detection, spill containment, and overfill protection. The issue I am addressing is that regulatory compliance does not provide assurance that releases of gasoline will not occur from operating UST systems.]

■ Ensure that secondary containment is tight.

We learned long ago that primary containment systems do not remain tight forever, yet we blithely assume that this will be true for secondary containment systems. The integrity of secondary containment systems must be verified periodically. This includes the outer wall of tanks and piping as well as piping sumps and dispenser sumps. Florida and California have headed down this road and it is something that is well worth doing.

■ Ensure that secondary containment catches everything.

A facility I inspected recently showed evidence of a liquid release (staining) from vapor recovery piping in the dispenser cabinet. Following the trail of the stain, it became apparent that the liquid release flowed down into a crack between the dispenser containment and the concrete of the pump island into the soil. Secondary containment systems must be designed so that they reliably capture releases from both liquid and vapor handling components of the storage system.

■ Replace pressurized pumps with suction.

Though my evidence is admittedly anecdotal, I believe that pressurized pumping systems are responsible for better than 90 percent of the liquid releases that occur from newly installed, corrosion-protected storage systems. A simple change of technology could virtually eliminate this source of product releases. Arguments that suction pumps will not work in America are specious. Suction pumping systems are still dominant in Europe. If they can work in Europe they can be made to work here.

■ Replace permeable pipe with impermeable pipe.

An industry estimate of the likely releases due to permeation from flexible piping systems states that 8 grams per day (about a gallon per year) of liquid can escape from these

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■ Tank-nically Speaking...
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double-walled systems ("Compatibility and Permeability of Oxygenated Fuels to Materials in Underground Storage and Dispensing Equipment," Paul A. Westbrook, Ph.D., Shell Oil Company, January 1999). While this is a small quantity, it is sufficient to cause contamination when MTBE is present in the gasoline. Piping systems susceptible to permeation should not be allowed in sensitive areas.

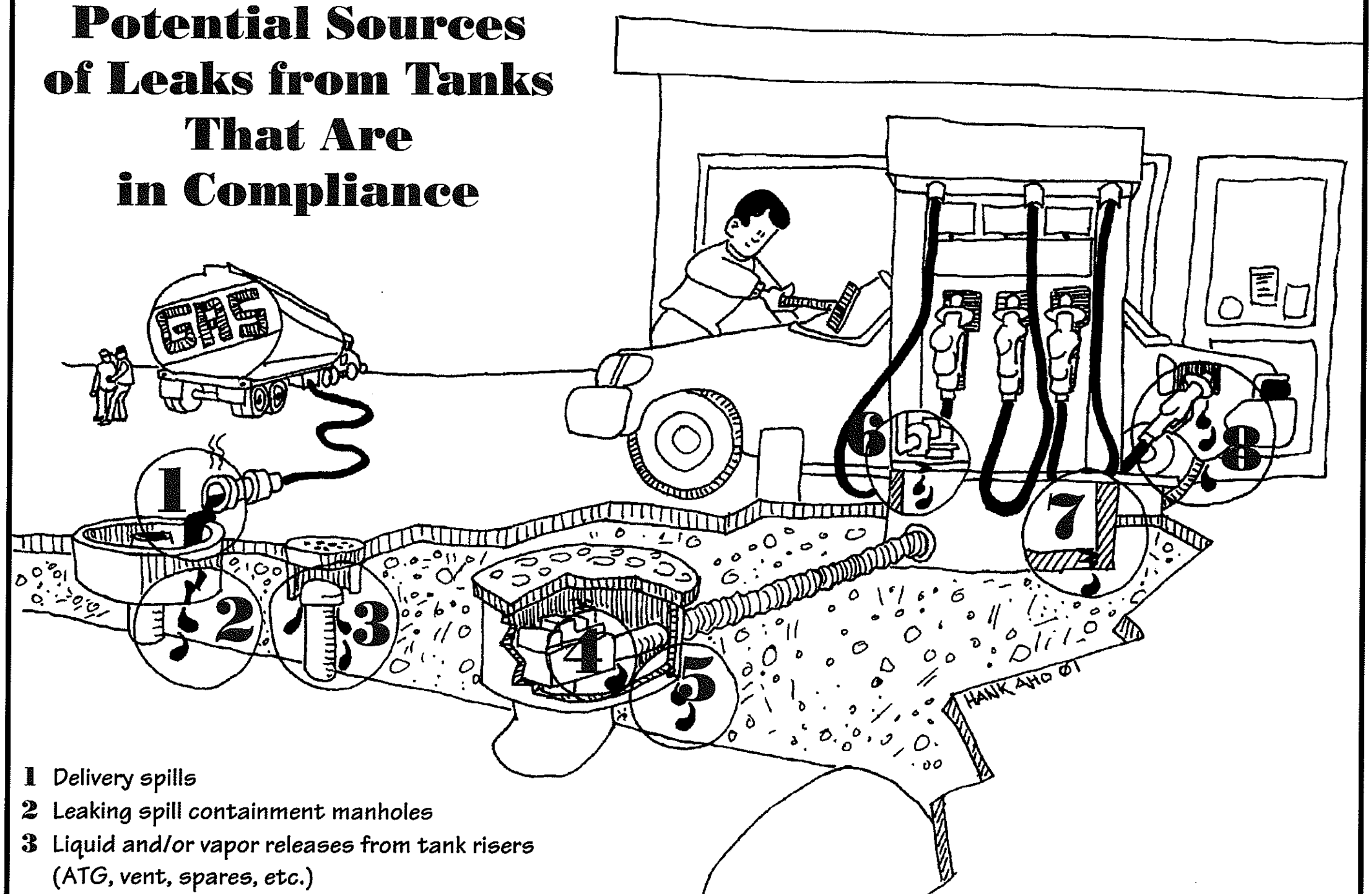
■ Provide secondary containment for vapor piping.
While Stage II vapor return piping handles vapors primarily, there is no question that it also carries small quantities of liquid product. Pressure decay tests that are conducted to meet air quality requirements are not sufficient to detect small defects in vapor piping. Secondary containment of this piping seems like the best way to assure that liquid and vapor releases do not occur.

■ Do not allow pressurization of the tank vapor space.
Vapor releases into the environment are exacerbated by vacuum-assist vapor recovery systems that pressurize the tank ullage and force product vapors out of the storage system. The California Air Resources Board (CARB) has recognized this weakness and will require that future vapor recovery systems maintain the pressure inside the storage tank at or slightly below atmospheric pressure. Until such technology is commercially available in this country, vacuum-assist Stage II vapor recovery systems should be replaced with the traditional balance Stage II systems.

■ Isolate tank backfill from ATG and Stage I vapor recovery risers.
Vapor releases and possible liquid releases resulting from overfill incidents that occur at automatic tank gauge (ATG) risers and Stage I vapor recovery risers typically pass directly into the tank backfill. The installation of spill containment manholes around these openings would provide a barrier to vapor and liquid penetration into the soil.

■ Video tape deliveries.
We desperately need to rethink our overfill prevention strategy (see *LUSTLine* #31, "Hmmm...If Only Overfill Prevention Worked!"), but this is not on the horizon as far as I can tell. As a stopgap measure, install video surveillance cameras to monitor the delivery process. Delivery drivers would need to be notified that their activities are being

Potential Sources of Leaks from Tanks That Are in Compliance



1 Delivery spills
2 Leaking spill containment manholes
3 Liquid and/or vapor releases from tank risers (ATG, vent, spares, etc.)
4 Leaking submersible pump manifolds and/or product piping
5 Leaking piping sumps
6 Liquid and/or vapor releases from Stage II vapor recovery piping
7 Leaking dispenser sumps
8 Customer spillage

watched and that their jobs depend on spill-free deliveries.

■ **Do not allow any exposed backfill around fill pipes.**
The backfill around the perimeter of some below-grade spill-containment manways is exposed, providing an all-too-convenient avenue for drips of fuel from the hose (or even an entire hose full of fuel) to enter the environment. Though these types of spill containment manways are effective in keeping precipitation out of spill buckets, as a contamination pathway they pose too much of a risk.

■ **Require 15- to 25-gallon capacity spill containment manways.**
Until such time as effective overfill prevention hardware is in place, install spill containment equipment that can hold the entire contents of the delivery hose in case of a tank overfill.

■ **Seal the pavement around the dispensers.**
To deal with customer spillage, seal the surface around the dispensers with petroleum-proof sealant, and grade the pavement so that all liquid runoff runs to an oil-water separator that discharges to a holding tank. The holding tank contents would need to be periodically and properly disposed of. The sealant would need to be maintained to ensure its effectiveness.

■ **Seal tank-top manway covers.**
If tank-top manways are in an area where surface spillage could occur, they should be slightly above grade or have liquid-tight covers to prevent surface runoff from infiltrating the tank backfill.

■ **Do not allow self-serve gasoline dispensing.**
Though messages on most dispensing nozzles warn against it, topping off when refueling automobiles is still a common occurrence that leads to spillage. By allowing only trained attendants to dispense gasoline, this problem could be reduced.

■ **Install automatic subsurface monitoring.**
Though it never proved popular for UST leak detection, a device was developed in the mid-80s that had the ability to sample soil vapors at numerous points on a daily basis and monitor for the presence of gasoline vapors. With today's communication technology, such a system could easily be monitored remotely. Such a system could provide early warning of releases from any portion of the storage system or even surface spillage and overfills. In conjunction with a preinstalled remediation system (see next item), subsurface monitoring could be very effective in detecting and intercepting contamination before it can migrate off site.

■ **Preinstall a soil-vapor extraction system.**
A preinstalled network of slotted pipe in a permeable backfill underlaying the dispensing area and overlaying the tank pit would make it possible for remediation efforts to begin within a very short time of the discovery of a release (via the automatic subsurface monitoring). Truck-mounted, self-contained vapor extraction and treatment units could simply drive up, plug in to the preinstalled piping, and deal with small releases in a few days or weeks time if releases are promptly identified and addressed.

■ **Implement periodic groundwater monitoring.**
Conduct monthly or quarterly groundwater monitoring in areas adjacent to storage system components to provide early warning of contamination. Monitoring well location and construction would have to be carefully considered so that the wells would provide effective early detection without posing the undue risk of becoming a conduit for contamination into the subsurface.

So...

Are all these measures necessary? Would any of these measures really be effective? Could a regulatory agency or municipality ever realistically impose any of these measures as requirements, either across the board or at specific facilities? Do you have better ideas? If you could implement any three of these measures, which would you pick? Why? Send your two cents to **marcel.moreau@juno.com.** ■

■ **Third-Party Inspection Program...** *continued from page 6*

certified UST inspectors. There was a ratio of about 17 tanks for every licensed inspector, which seemed to be sufficient. ADEC met with most inspectors after the 2000 season and discussed ways to improve reporting requirements.

Veteran regulators who pooh-pooh the mere concept of privatizing inspections are apt to worry that inspectors will fabricate problems in order to perpetuate business. Indeed, when I was a gas station attendant in 1982, I was told by my supervisor to get under the hood and sell as many engine fluid products as humanly possible.

What makes Alaska inspectors different from my situation is the fact that they are petroleum contractors by trade and can easily lose their license (i.e., professional livelihood) if they are caught cheating. Second, inspectors must review the inspection form with the operator, and both parties sign every page. This forces the inspector to explain everything he did, reducing the opportunity for hiding anything. Third, UST operators can and do contact the state if they want a second opinion.

Troubling Theme

One goal for our third-party inspection program was to simultaneously reduce enforcement while increasing compliance. Given the percentage of inspections completed and the high number of corrections made, this goal has been achieved for at least one-third of the state's USTs. However, the variety and number of problems found in 2000 all point to a troubling theme—that Alaska UST systems are not being adequately maintained, and without periodic, mandatory inspections, UST operators have no incentive to prevent further releases. ■

For more information about Alaska's third-party inspection program, contact Ben Thomas at **ben_thomas@envircon.state.ak.us.**

Leak Prevention

Tanks Down East

by W. David McCaskill

David McCaskill is an Environmental Engineer with the Maine Department of Environmental Protection. ***Tanks Down East*** *is a regular feature of* LUSTLine. *David can be reached at* **David.Mccaskill@state.me.us**. *As always, we welcome our readers' comments.*

Taking the Pulse of Maine's CP Tanks

There was a time when cathodic protection (CP) was relegated to preventing major engineering projects such as bridge pilings or interstate pipelines from rusting to pieces. On the consumer side, cathodic protection was used to prevent outboard motors or hot water heaters from rusting to pieces. The former CP systems were project-specific designs for high-risk projects, while the latter were pre-engineered systems for consumer uses. Major structures were usually monitored carefully by professionals over the life of the structure, while the consumer goods—let's face it—were sold, and that was that. In the case of cathodically protected USTs, we have some sort of CP hybrid—high-risk structures with pre-engineered systems that generally get little attention.

The Life and Times of CP in Maine

In Maine, we have 1,812 cathodically protected steel USTs—roughly one-third (31%) of our total population of 5,900 active USTs. Most of these tanks were installed with pre-engineered galvanic CP systems, where the number and size of the sacrificial anodes (zinc or magnesium bars that provide the flow of electrical currents around the tank and protect the tank from corrosion) have been selected and connected directly to the tank rather than installed in the field.

Galvanic CP systems are relatively simple in construction and operation, but it is widely acknowledged that their effectiveness must be monitored over time. This monitoring is relatively easy to accomplish by measuring the electrical potential (voltage) of the tank relative to a standard reference cell (usually a copper/copper sulfate reference electrode).

Since 1985, Maine has required that cathodically protected steel tanks be tested annually by certified tank installers (CTIs), who are required to demonstrate a minimal competency in CP by passing a certification exam that includes some questions concerning CP. (Corrosion professionals who are not CTIs but want to test tanks can obtain separate cathodic protection tester certification.) CTIs must periodically attend industry-sponsored refresher seminars on CP testing and troubleshooting as a part of maintaining their certification.

With our CP data suspect, our CP testing requirements suspect, and our CP compliance rate unknown, we decided it was time to stop the madness and take the pulse of our CP tanks and the way in which we assured compliance.

For the past six years, the Maine Department of Environmental Protection (DEP) has mailed annual CP test reminders to tank owners. This mailing includes a log sheet to help remind tank owners that records of their CP test results must be kept on file for a minimum of three years. Because tank owners are not required to submit the results of this monitoring to DEP, little data has been available to the agency on how the CP systems or the storage tanks were faring. However, as the tank owners got around to contacting the CTIs and having their CP systems tested, the DEP began to see some problematic trends.

Stop the Madness

For years we have grappled with a number of issues associated with cathodically protected tanks—continuity problems with leak detection devices and electrical conduits; CTIs looking all over the site for that elusive passing reading; and even plain old falsification of CP readings.

Finding a qualified and interested contractor has become a rarity. Many times the CTIs just aren't interested in getting involved with in-depth troubleshooting for a CP problem (or the owners aren't willing to pay for the work), or they don't feel that they have the expertise to properly troubleshoot failing systems. Added to this is our suspicion that a large number of tank owners, especially "consumptive use" tank owners, have never had their tanks tested.

With our CP data suspect, our CP testing requirements suspect, and our CP compliance rate unknown, we decided it was time to stop the madness and take the pulse of our CP tanks and the way in which we assured compliance. We hired an engineering consulting firm to test a sample population of CP tanks in the state.

We set out to answer the following questions:

- What is the compliance rate for the annual CP testing requirement?
- Are our current test procedures adequate to determine the CP status of these tanks?
- Are any categories of tanks (e.g., size, age, manufacturer) more prone to CP failure than others?
- Should the state's annual CP monitoring procedure be modified to improve its effectiveness?

The Methodology

From a practical point of view—travel, logistics, cost—we decided that testing 75 randomly selected sites would be "doable" in a single field season. As it turns out, the study involved a total of 134 tank tests at 73 facilities. In terms of tank types, we had 68% motor fuel, 30% fuel oil, and 2% new/used oil. Because most of these facilities did not have cathodically protected steel piping, the study was limited to CP tanks.

Our current regulations allow for a single-point CP reading. For the purpose of the study, however, we decided to evaluate the tanks using a multiple measurement protocol—taking a reading along the top of the tank at the middle and both ends. This method would provide a better measurement of the protective current around the whole tank and thereby address dead spots in the CP current.

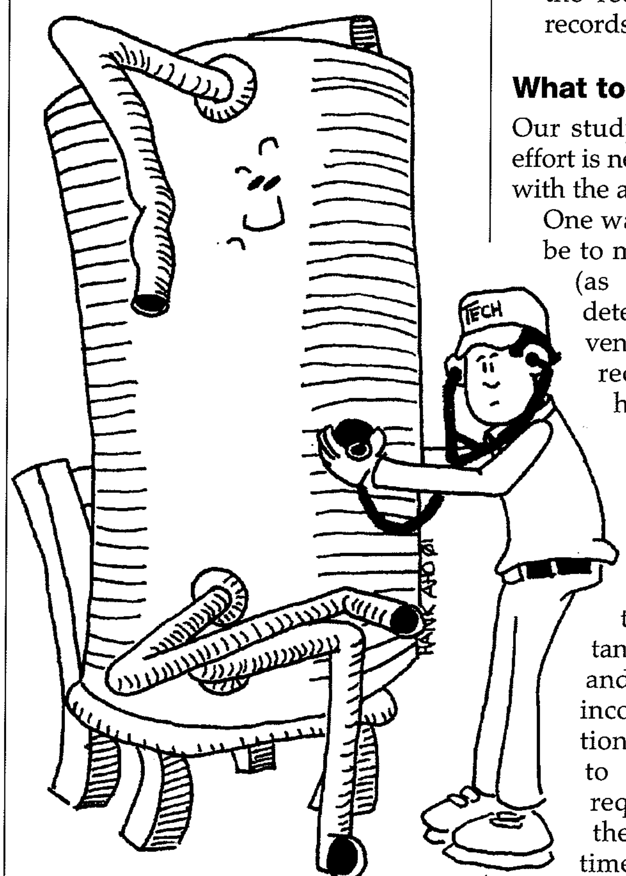
Past industry practice has been to take a single measurement in the middle of the tank over the centerline. This location is considered the most conservative because it is equidistant from the anodes on the end of the tank and thus the farthest from their protective current. However, recent information from trade journals and the National Association of Corrosion Engineers (NACE) suggests that multiple readings are a more prudent way of determining the adequacy of CP readings.

Multiple readings meant that our consultant had to find additional access to the soil over the tank. At times, small holes (½-inch diameter) would have to be drilled in pavement and concrete to access the soil (using a thin "pencil" reference electrode).

We've heard stories about contractors in other states, who when faced with the soil access problem, simply take a reading through concrete over the tank. Readings through the concrete pad, rather than the soil, almost always gives a false reading in favor of passing the tank.

The Results

- Of the 134 tanks tested, 78 tanks (58%) met the study criterion of three readings; 17 additional tanks (13%) met the less stringent DEP criterion of one passing reading. Thirty-nine tanks (29%) did not meet any criterion for cathodic protection.



- Using DEP's single-reading criterion, CTIs passed 91% of the tanks they tested. Using the same criterion, the pass rate for the study was only 71%.
- Many of the manufacturers of the tanks tested during the study were unknown, so no relationship could be drawn between CP performance and manufacturer.
- There was no significant relationship between the age of the tank and cathodic protection status.
- Only 44% of the tanks that passed the study criterion were 6,000 gallons or greater; 73% of tanks less than 6,000 gallons passed the study criterion.
- Limited electrical continuity testing was performed on 42 failing tanks. Thirteen (31%) of these tanks had continuity problems.
- As far as compliance is concerned, 20 (27%) tanks had no CP testing records, 14 (19%) had one year of records, 24 (33%) had two years of records, and only 15 (21%) had the required three years of CP records.

What to Do?

Our study made it clear that more effort is needed to ensure compliance with the annual CP test requirement. One way we could do this would be to make successful CP testing (as well as the annual leak detection spill and overfill prevention testing) a condition for receiving fuel. We currently have a bill in the legislature to address this. We'll see how far that goes.

Regarding testing requirements, we agree with the study recommendations that the three tests over the top of the tank (one reading on each end and one in the middle) be incorporated into our regulations. The next step would be to also include specific requirements that spell out the corrective actions and timetable for repair of tanks that have failed the CP test.

Regarding CP testers, the report recommends that those still interested in dealing with CP tanks go through a separate certification process with more rigorous training on testing, troubleshooting, and repairing CP systems. Training should be hands on.

One of our greatest concerns is what to do about the 29% CP systems lurking out there that are likely to fail the test. Some CP systems may be fixed easily by adding additional anodes (see STI publication #R972-98), but others may require the installation of an impressed current system to protect the tanks.

■ continued on page 12

■ **Maine's CP Tanks...**
continued from page 11

Because the price tag for an impressed current system could run up to $7,000, a financial package should be developed to assist mom and pop businesses faced with the sticker shock. We have already proposed a change to our statute that would allow the Finance Authority of Maine to make such loans for CP as well as leak detection, spill, and overfill repairs and retrofits.

Finally, the study recommends that we undertake a long-term study of CP tanks that are removed to perform, in essence, a tank autopsy. With more and more CP tanks being removed this could prove to be an interesting study. The implementation of this recommendation is still uncertain because of the logistical concerns.

What Did We Learn?

Our CP study provided us with the basis for making some key improvements in how we regulate and enforce our CP tanks. In a nutshell, this is what we learned:

- We need to tighten up compliance so that all CP tanks are tested routinely.
- We need to tighten up our testing protocol so that we can rely on the testing data.
- We need to teach CTIs more about CP testing, especially troubleshooting techniques, so that they can be more helpful to tank owners with failing tanks.
- Galvanic CP systems are relatively simple. If tank owners and CP testers are having trouble with these systems, we can only wince at the thought of them having to deal with impressed current systems, which may become more common as the galvanic systems are repaired. ■

The complete report can be found on our homepage at **http://janus.state.me.us/dep/rwm/publications/cpreport.htm**.

Leak Prevention

Getting a Hand on Facility Compliance Inspections

by Russ Brauksieck and David Bernstein

Without leaving his or her desk, the typical inspector is surrounded by information—tank registration applications, closure reports, site assessments, information request responses, spill reports, and (sometimes) self-audits. However, even with all this information available, the best single measure of the compliance status of a facility is a comprehensive, on-site inspection by a trained inspector. An on-site inspection is the best way to determine if the correct equipment is installed, operational, and used properly by the operator.

Yet, there are problems with site inspections:

- They are resource intensive and time-consuming.
- The inspector must travel to the site, document site information, and determine whether the tanks and associated equipment are in compliance with the requirements.
- The information gained from the inspection must be taken back to the office where an inspection report is generated from the raw data.
- After the inspection is completed and the report written, the inspector files the report with all of the other reports and tank-related documents—where it typically remains underutilized and sometimes forgotten or lost.
- Any effort to use inspection data beyond writing up the report relies on the tedious entry of the information into a database system—a task that wastes valuable inspector or support staff time and is subject to transcription errors. Meanwhile, the ability to analyze the data gathered from all those inspections might have provided the program as a whole with meaningful insight. It might have helped program managers track the progress of the program, identify trends and areas of concern, and determine where additional resources are needed in terms of additional inspections or outreach efforts.

An Easier Way

While little can be done to improve the resource-intensive and time-consuming nature of visiting a site to perform an inspection, overall improvements in efficiency are possible. With this goal in mind, the New York State Department of Environmental Conservation (NYSDEC) in conjunction with EPA Region 2 has initiated a project that will enable inspectors to collect inspection information on-site using a hand-held computer and transfer this information into a statewide database. This technology will provide managers and staff with up-to-date compliance statistics with a minimum of effort after the initial inspection.

The concept of using a computer for inspections is not new. UST inspectors in a number of states use computers in the field, most often laptops. There are, however, two major problems with this approach: (a) cost—a quality system can cost thousands of dollars for the equipment, software, and programming, and (b) true portability—it is easy to carry a laptop computer around in a carrying case; it is close to impossible to walk around and enter data into the laptop during an inspection.

The early hand-held computers were no better. Early handwriting recognition software did not work well, and the operating systems and software were not sophisticated enough to handle the detail required of a compliance inspection.

The introduction of the Palm Computing Platform changed all that. Finally, a system was developed that combined low cost, system stability, a usable handwriting recognition system, and development software capable of handling the demands of a compliance inspection.

With the NYSDEC project, we set out to streamline the inspection process in the following ways:

- Program a standard inspection form into the hand-held computer.
- Prior to going into the field, enable the inspector to download the basic facility information from the state database and use the hand-held computer to collect and enter the on-site inspection information.
- Once back in the office, upload the inspection information to the database, where it is analyzed for violations by the computer.
- Produce a computer-generated draft inspection report (notice of violation) that opens on the inspector's desktop computer, where it can be edited and finalized.

The Long- and Short-Term Benefits

NYSDEC's inspection streamlining project has been under development over the past several years. Although the hand-held computers have not yet been used in the field, we have already realized or will soon realize many benefits associated with this project:

■ Standardization

We developed and implemented a standard inspection checklist. As a prelude to implementing the hand-held computer systems, all inspectors were instructed to use the same form and ask the same questions at each inspection. Previously, inspectors used different inspection forms and asked different questions.

■ Trend Analysis

All of NYSDEC's inspection information is collected into a single database. This allows the state to analyze the data for trends, such as outdated or inappropriate release detection methods or types of equipment used. Once a particular trend is noted, we can then devise a plan to address that particular issue.

■ Compliance Analysis

Consistent information allows us to look at our database and assess overall compliance with our requirements. This is especially important in light of recent changes to EPA Performance Measures, requiring states to report operational compliance with the upgrading and leak detection requirements. The level of detail in our improved database allows us to show compliance rates for upgraded versus new tanks, or ATG versus interstitial monitoring systems.

■ Data Correction

When inspectors visit sites, they often discover that the owner registered the tank system using incorrect information or has modified the facility and failed to update the registration information. Using a hand-held computer, inspectors can make changes to the registration information in the field. This information is uploaded to the desktop computer, the facility is flagged as having incorrect registration information, and a letter is generated and sent to the owner requesting that an updated registration form with corrected information be submitted.

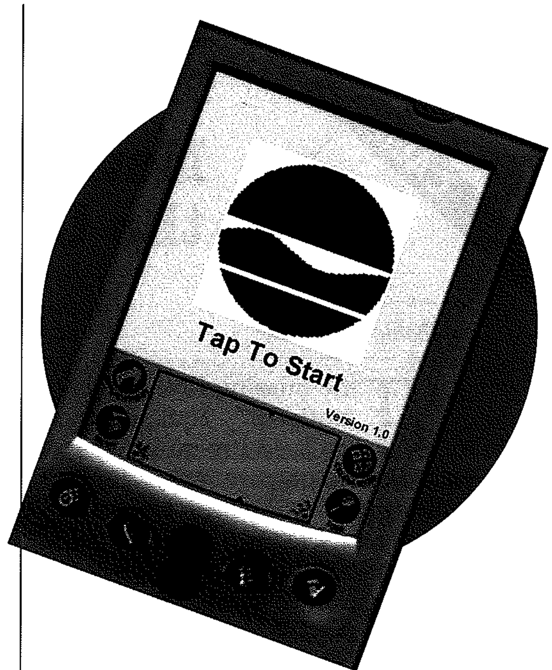
■ Task Automation

Our new system allows us to generate and automatically track inspection reports, notices of violation, other letters, and predesigned database queries. This automation allows the inspector to spend less time at the desk and more time in the field conducting inspections.

On the Horizon

There are additional enhancements to our system that are still being considered for the future. These include:

- Ask more detailed questions during an inspection to gather model-specific data. This can be done through linked drop-down lists designed so that data is gathered with little impact on inspection time. Information can also be added to prompt the inspector on what to look for during the inspection (e.g., reference information for all release detection systems).
- Use hand-held computers to download data off the Internet.



With registration and inspection databases available on the Internet, an inspector can download information while in the field. This gives the inspector flexibility to identify a facility for inspection in the field, download current registration information and previous inspection information for the facility, and perform the inspection. Information from other databases can also be downloaded (if available) and uploaded from the field so that the inspection report is waiting in the office upon the inspector's return.

- Use this application as a spill response and remediation staff tool. Staff can be in the field, be notified of a spill, and download the information on the site where the spill has occurred. Information on the facility, such as registration and inspection information, can all be useful during a spill event. ■

The Palm Pilot program has been developed in New York by the DEC and U.S. EPA Region 2. The program will be field tested this spring. Once it is operational in New York, a federal work group has been established to develop the program for use in enforcing federal UST regulations. For more information on this project, contact Russ Brauksieck, NYSDEC, at **rxbrauks@gw.dec.state.ny.us** *or David Bernstein, EPA Region 2, at* **bernstein.david@epamail.epa.gov**.

Leak Prevention

The Missing Link Can Be Found in Appendix D

New California Document Highlights the UST-LUST Connection

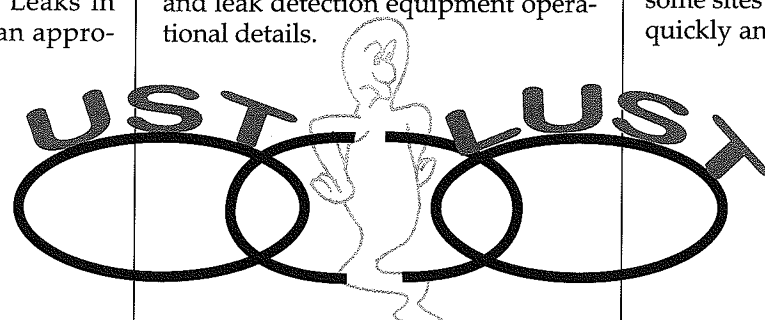
by Shahla Farahnak

"The missing link is finally noticed!" That thought crossed my mind when I was asked to prepare Appendix D of California's "Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates." The principal author of this document, Kevin Graves, Senior Engineer with the State Water Resources Control Board, explained to me that the purpose of the guidelines was to assist managers and staff at state and local regulatory agencies with the task of overseeing the investigation and cleanup of sites where there have been releases of MTBE-blended fuel. We talked about how an appendix with the title of "Finding Leaks in Tank Systems" would be an appropriate element of this document—and the work began. Many thanks to those, especially Marcel Moreau, who reviewed it and provided helpful comments.

What do I mean by "missing link"? I mean the communication and team effort between those who work on the leak prevention side of the UST programs and those responsible for the corrective action oversight. Traditionally, these two groups, whether working for the regulatory agencies or the consulting world, rarely get together and evaluate contaminated UST sites. In California, with the discovery of MTBE at new and upgraded UST sites, we have been forced to attempt to bridge that gap. Although the thought of doing so may elicit groans from both camps, the time for using teamwork in site investigation is long past due.

A Game of Clue

After all, isn't one of the key elements of site investigation finding the "guilty"? Yes, it's a game of "Clue"! There are many clues at an operating UST site that could lead to the source of a release. While these clues may not be apparent to the corrective action experts, they would be easily recognized by those intimately involved with UST system design and leak detection equipment operational details.



The purpose of "Finding Leaks in Tank Systems" is to identify potential activities that can be performed at suspected release sites to confirm and determine the source of a suspected release from an UST system. The appropriate level of effort for this task is interrelated with the results of groundwater monitoring, extent and type of the release, and other site-specific characteristics.

This investigation may be an iterative process, and it is important that all data and findings be maintained and properly documented. A team of cleanup and leak prevention staff must make a unified effort to oversee activities and analyze the findings. The subsurface contaminant distribution may point to a leak source (e.g., relatively clean tank pit but high contaminant levels around a specific dispenser or near specific piping joints).

Keep in mind, this document is not a flow chart, there is no start and end button. It is all inter-linked with the site investigation information you have gathered, the extent of the problem at the site, and the time factor. At some sites it may make sense to move quickly and perform an external full-system evaluation for vapor and liquid releases; at other sites you may want to start with the basics and work your way toward a full-system evaluation, if needed.

The theme here is to be proactive. Don't just continue to track quarterly groundwater monitoring data and wonder where the elusive "MTBE" will appear next, or hope that its concentrations will start going down at some point in time. Get in there and work with the UST experts to either rule-in or rule-out the existing UST system at the site of the source.

Finding Leaks in Tank Systems (Appendix D)

I. Preliminary Site Evaluation – The local inspector may perform these activities. All activities and findings should be documented item by item.

A. Conduct a visual evaluation and interviews.

- Check surfaces around UST systems for any visible signs of spills. Evaluate and document the condition of the concrete and asphalt—look for cracks, stains, etc. Pay particular attention to the area around fill pipes and dispenser islands.
- Interview the operators with respect to unusual operating conditions, known spills and leaks, inventory reconciliation, etc.
- Check monitoring equipment (e.g., all sensors, line leak detectors, ATGs) control panel for presence of alarm lights, trouble lights, and power lights. Power lights should be on; trouble and alarm lights should be off.

B. Review records.

- Review records of any water pumped out from the tanks.
- Review records of product or water removed from the sumps, spill containment boxes, and dispenser containment boxes.
- Review records of product spills by customers filling their gas tanks or gasoline delivery trucks and the action taken to clean up the spill.
- Review inventory records and the results of any Statistical Inventory Reconciliation (SIR) test reports. In the SIR reports, pay attention to the product-gain and inconclusive test results. A quick method of checking inventory records is to count the number of positive and negative daily variances in a month. The number of positives and the number of negatives should be almost equal (e.g., in 30 days of recording there should be 15 positives and 15 negatives; 18 of one and 12 of the other is suspicious; 10 of one and 20 of the other indicates a problem of some kind).
- Review any past tank and piping tests performed at the site. Verify that tests were conducted properly. Review the test results closely to determine if the tester did any system "fixes" (loose valves and connections and loose fill pipes) to make the test pass. Determine what follow-up action was taken at the site for reported fail results.
- Check the spill containment box for the presence or indication of product spills from product deliveries.
- Check all sumps for the presence of product, corrosion, or indication of product releases.
- Check under-dispensing piping for any visible signs of product releases (e.g., drips, tarnished piping). This check should be done both while the dispenser is idle and during dispensing.
- Dipstick the tank to check for water and product, allowing for at least a 24- to 48-hour time period. Use the tank chart and tank installation information to determine the rate of any losses or gains from the tank (same concept as manual tank gauging). The tank should be locked up and not used during this time. Note that the temperature should be stable and deliveries should not be allowed for a few days prior to the start of the test. The longer the test the better. A test should run for 48 hours unless the tank size is small. This test may not be appropriate if it significantly interferes with the daily operation of the facility.

What do I mean by "missing link"? I mean the communication and team effort between those who work on the leak prevention side of the UST programs and those responsible for the corrective action oversight.

- To the extent possible, document the type, model, and brand of all major UST system components. This information should be reviewed and compared with any data on manufacturer recalls or any other frequently reported manufacturer defects.

II. Detailed Site Evaluation and Data Collection - A qualified and authorized contractor should perform these activities with oversight of the local inspector. All hands-on work on equipment must be performed in accordance with the manufacturer's instructions and test procedures, findings should be documented in detail, and all system reports printed.

A. Check for potential overfill events.

- Check the overfill prevention device and report whether it is functional.
- If the tank is equipped with an automatic tank gauging (ATG) system, have the contractor check the system for overfill alarms, review product delivery records, and cross check deliveries with ATG system inventory records for consistency to verify proper deliveries.
- If possible, contact the company that delivers product to the facility to find out if there were any overfills (this may be just a nice try!). The ATG may also have a record of overfills. If delivery invoices are available, check to see if they contain before and after stick readings. Look for after delivery readings that are above the tank 95 percent level. Document results and file.

B. Check functional equipment.

Verify that leak detection equipment is functional before reviewing past test reports and using the equipment to test the UST system components. All work must be performed in accordance with the manufacturer's instructions provided in the equipment maintenance manuals.

- Print and check system set up for any programming errors.
- Verify that all monitoring equipment and sensors are functional by testing all sensors.
- Review the system diagnostic information to identify any system problems.
- Perform a quantitative test on line leak detectors (mechanical and electronic) to determine that they can detect a leak of at least 3 gallons per hour. This is a test where the contractor simulates an artificial leak and the system response to that leak rate is evaluated and compared with the system requirements and the setup information.

C. Check alarm history, system failure history, and leak test history reports.

- Review the history of system alarms including system functional alarms.
- If the tank is equipped with an ATG, review the records of in-tank water and the history of high water alarms.
- Review the history of leak tests performed by continuous in-tank leak detection systems (CITLDS), ATG systems, and electronic line leak detectors. Analyze the test results closely by comparing the test information with the test method specifications listed in the National Work Group on Leak Detection Evaluation's "List of Leak Detection Evaluations for UST Systems" (NWGLDE's List).

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■ UST-LUST Connection...
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D. Test all secondary containment.

- Perform a hydrostatic test of the spill containment box. (This is a very crude test method that is currently only performed at the time of installation.) The containment box is filled with water, then the water level is marked or measured and checked again in 24 hours to verify that the box is liquid-tight. Document the results.
- Perform a hydrostatic test of all sumps (see above) and document the results. Also verify that all sensors are functional.
- Check all piping penetrations and fittings for proper seal, verify secondary containment piping terminates in the sump, and verify that any potential releases from the primary piping into the secondary piping will drain into the sump (i.e., see that the reducer that was used to isolate the secondary piping during the installation tightness test has been removed or if a drain port was installed, that the outlet is not plugged).
- Conduct a tightness test on the secondary piping and the interstitial space of the tank using an approved test method.
- If there is dispenser containment present, perform a hydrostatic test (see above) and verify that the leak-sensing mechanism is functional.

E. Activate leak detection tests using on-site equipment.

- Put the ATG system in a leak test mode (preferably 0.1 gph mode if available) and review the test result. Note that there should be no product dispensing from the tank until the test is completed. Evaluate the test results, not just for pass/fail. Review the measured leak rates and, if needed, extrapolate the number to a full-tank leak rate to determine if there may be a release from the tank. Also, make sure that in-tank water is recorded before and after the test and look for water ingress during the test.
- Activate the mechanical line leak detector test mode (3gph) and electronic line leak detector test modes (3.0 gph, 0.1 gph, and 0.2 gph), review the test results, and make note of any alarms or slow-flow or product pump shutdowns. Note that there should be no product dispensed from the piping system until the test is completed.

III. Tank and Line Tests - These tests must be performed by a licensed tester.

A. Have the product lines tightness tested by a licensed tank tester, using an approved test method.

Be present during the test if possible. Compare the test information with the test method specifications in the NWGLDE List. Make sure the tester performs the test before doing any repairs or system fixes. If the test fails, any fixes should be done before a second test is conducted. All activities, including any repairs need to be documented and reviewed.

B. Have the ullage space of the tank tightness tested by a licensed tank tester, using an approved test method.

C. Have the product-filled portion of the tank tested, using an approved test method.

Do not require the addition of any product to the tank for this test. In the event that the tank is leaking, the contamination may get worse if more product is added to the tank. Evaluate the test results, not just for pass/fail. Review the measured leak rates and if needed, extrapolate the number to a full-tank leak rate to determine if there may be a release from the tank. Also make sure that in-tank water is recorded before and after the test and look for water ingress.

IV. External Full-System Evaluation for Vapor and Liquid Releases - Perform an external evaluation. ■

Shahla Farahnak, P.E., is a Senior Engineer with the California SWRCB. She can be contacted at **farahnas@cwp.swrcb.ca.gov**. *The read the entire "Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates," go to* **www.swrcb.ca.gov** *and click on the MTBE link.*

From Our Readers

A note from Dennis Rounds, Executive Director of the South Dakota Petroleum Release Compensation Fund.

Thank you for the many terrific articles in the November 2000 issue of *LUSTLine*. In particular, I appreciated the timely GIS article "The Future is Coming." It contains good, basic information on GIS and many examples of its applications. The author, Ann Carpenter, also addressed many of the up-front issues that managers should be aware of when considering the use of GIS in environmental applications.

Those readers of *LUSTLine* who are interested in GIS may want to know that ASTM subcommittee E50.01 has initiated action on the development of a new guide for the use of GIS in environmental applications. The purpose of this guide will be to address the crucial factors that should be considered when developing, constructing, and maintaining a GIS for environmental applications. It may also provide guidance for determining the applicability of GIS for an environmental project.

ASTM is the world's largest voluntary consensus standards organization. Anyone interested in working on the development of this new GIS guide or other ASTM standards can contact me for information. ■

Dennis can be reached at (605) 773-3769, or **dennis.rounds@state.sd.us**.

Washington UST Owners Urged to Check Tanks After Earthquake

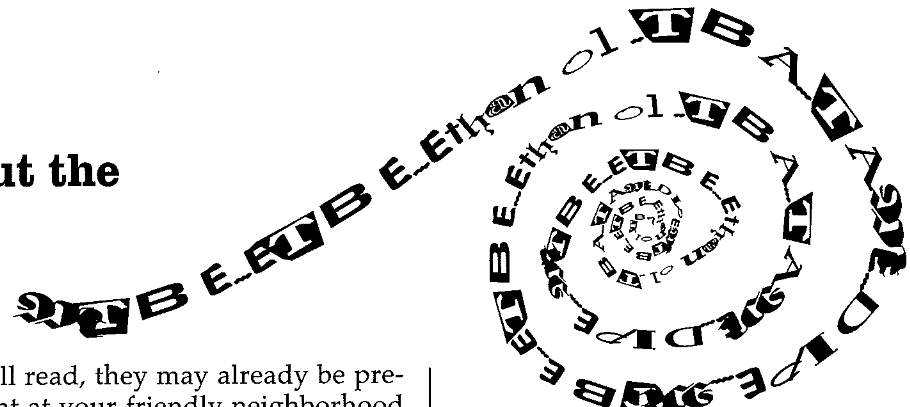
The Washington Department of Ecology wasted no time getting information out to tank owners after the recent earthquake in the Seattle area. Ecology prepared a one-page inspection checklist for owners of underground tanks. It is available over the Internet at *http://www.ecy.wa.gov/programs/tcp/cleanup.html.* Check it out, because... ya never know.

Oxygenates

A Circle Vicious

What Do We Know About the Other Oxygenates?

by Patricia Ellis



On January 18, 2000, then-Acting Director of EPA's Office of Underground Storage Tanks (OUST) Sammy Ng wrote to regional and state UST/LUST program managers urging them to "begin monitoring and reporting of MTBE and other oxygenates in groundwater at all UST release sites nationwide." He also recommended that if MTBE or other oxygenates are detected during monitoring activities, that states take "immediate and aggressive remedial action to address the contamination."

Ng went on to state that, while MTBE has received most of the publicity recently, it is by no means the only chemical of concern for which states should be monitoring and reporting. Tert-butyl alcohol (TBA) can be both a degradation product and a fuel additive in its own right. It is also potentially more toxic than MTBE. States were urged to consider assessing for other oxygenates, such as tert-amyl methyl ether (TAME), diisopropyl ether (DIPE), ethyl-tert-butyl ether (ETBE), ethanol, and methanol.

According to results of the NEIWPCC survey conducted in August 2000, most states were not assessing for the presence of fuel oxygenates, other than MTBE (42 states require sampling and analysis for MTBE in groundwater at LUST sites, and 29 require such sampling in soil). Maybe in the time since the NEIWPCC survey was completed, this picture has changed. Maybe the majority of states are now looking for all of the oxygenates, as OUST strongly urged. Riiiight, and if you believe that, I've got a nice bridge to sell you. Kudos to the 4 or 5 states that are looking for most of the oxygenates most of the time.

I'd like to propose that we all start paying a bit more attention to the other oxygenates, because as you will read, they may already be present at your friendly neighborhood LUST site. And, because I get this uncomfortable feeling that history is threatening to repeat itself.

A recent abstract by Andrew Gray and Anthony Brown for the National Ground Water Association Petroleum Conference in Anaheim, California neatly sums it up: "Many within the petroleum industry have suggested that it was overemphasis on benzene in the 1980s and early 1990s that caused them to neglect MTBE. It appears that we may not have learned from this oversight, and the pattern may be repeating itself. Where there is now an emphasis on MTBE, in many places they are not looking for or evaluating the potential impact from the other fuel oxygenates."

So let's take a glance at what we know or don't know about the other oxygenates within the contexts of health effects, risk-based corrective action (RBCA), natural attenuation, remediation and treatment, and analytical techniques. Since we do know a bit more about ethanol than TBA, ETBE, and TAME, I'll provide a brief synopsis on what we know about that substance.

Health Effects

According to a 1996 study by the Health Effects Institute, little or no information is available for ETBE, TAME, and DIPE; not enough information is available on the toxicity of ETBE and TAME to evaluate their potential health effects, but more research is being planned; no information is available on the toxicity of DIPE. The report recommended that a comprehensive set of studies be undertaken to determine levels of personal exposure to oxygenates using standardized protocols.

"Although more information on MTBE is needed," states the report, "the need is particularly great for assessing exposure to ethanol, TBA, and TAME, because these compounds are currently in use (or may be soon) and the resulting exposures have not been adequately assessed."

MTBE has been described as one of the most studied chemicals on earth, yet many studies have concluded that there is "not sufficient evidence" to declare it a human carcinogen even though animal studies show it to be a probable carcinogen. (Where will we be with some of the less-studied chemicals that occur in gasoline?)

Health effect studies are currently underway by industry and EPA to understand more fully the comparative risks associated with exposure to fuels both with and without oxygenates. Although the majority of the research is focused on inhalation-related health effects, the results should help us better understand the human health risks associated with exposure to fuels by any route.

TBA is a major metabolite of MTBE, regardless of the route of exposure. From a toxicological point of view, exposure to TBA elicits both noncancer and systemic toxic responses, as well as evidence of carcinogenicity. Animal testing of TBA in drinking water produced carcinogenic effects at high levels of exposure. Additionally, formaldehyde, also a metabolite of MTBE, is a respiratory irritant at high levels of human exposure and is currently considered by EPA to be a probable carcinogen (Class B1) by the inhalation route and, with less certainty, via ingestion (Blue Ribbon Panel Report, 1999).

Studies of groundwater from the City of Santa Monica's Charnock and Arcadia well fields in California

■ *continued on page 18*

■ Other Oxygenates...

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revealed the presence of four non-MTBE fuel oxygenates—TBA, ETBE, TAME, and DIPE (Gray and Brown, 2000). The California Department of Health Services (CDHS) is particularly interested in TBA because of its increased mobility in groundwater and the difficulties in treating the chemical.

CDHS has established a Drinking Water Action Level of 12 µg/L for TBA. (Health-based advisory levels are established by CDHS for chemicals for which primary MCLs have not been adopted.) In September 1997, New Jersey issued an Interim Specific Groundwater Criterion of 100 µg/L for TBA. New Jersey lowered the concentration that it recommends as a goal for groundwater cleanups and for guidance in situations where groundwater is contaminated with TBA from 500 to 100 µg/L, based on the National Toxicology Program's TBA drinking water study on rats and mice (Linder, 2000).

RBCA

Regulatory policy has evolved in the last decade toward the increasing use of risk-based corrective action (RBCA) as a basis for making LUST site remediation decisions. The rise in RBCA-type programs paralleled and was assisted by an increased understanding of the role of natural attenuation and intrinsic bioremediation in limiting the migration of dissolved hydrocarbon plumes. Because of their chemical properties, modeling fate and transport of the oxygenates can be more difficult.

RBCA, however, focuses on health risks, and little information is available for most of the oxygenates. MTBE has been shown to present aesthetic (i.e., taste and odor) problems at relatively low levels, and alternative RBCA guidance may need to be developed to adequately address those types of environmental concerns. (See Table 1.)

Then again, how many state RBCA programs can take aesthetics into account, rather than strictly health? There are only a few states where secondary standards are enforceable for public water systems. Both TAME and ETBE have even

TABLE 1 TASTE AND ODOR THRESHOLDS FOR BENZENE AND OXYGENATES IN GASOLINE

	Benzene	MTBE	Ethanol	ETBE	TAME	TBA
Taste threshold in water (µg/L)	500	20-40	–	47	128	–
Odor threshold (ppm)	0.5	0.053	49	0.013	0.027	21

From Blue Ribbon Panel Report (1999).

lower odor thresholds than MTBE (but the taste thresholds for both are higher than for MTBE). At least you may be able to smell them sooner.

In contrast, TBA does not have a low taste or odor threshold, so it is possible to be exposed to high levels without noticing it. Likewise benzene—you can be exposed to unhealthy levels in drinking water without being able to smell or taste it. Thus the two chemicals that are unhealthier for you are the ones that you can be exposed to more easily without realizing it.

Both New Hampshire and California have secondary drinking water standards that are lower than the primary standard for MTBE. Do we need to do the same thing with ETBE and TAME?

Natural Attenuation

RBCA programs have been able to take advantage of the fact that the BTEX components of gasoline tend to naturally attenuate with time and with distance from a source area. MTBE and the other ether oxygenates (probably to a lesser degree) are thought to be more recalcitrant to biodegradation in the environment.

A recent BP/Amoco study (Kolhatkar, Wilson, and Dunlap, 2000) looked at 74 sites in Pennsylvania, New Jersey, New York, Florida, Indiana, Maryland, and Washington, DC to determine whether natural biodegradation of MTBE under anaerobic subsurface conditions at some sites may control migration of MTBE and TBA plumes. (TBA is a known intermediate of MTBE biodegradation, it is present in some gasoline-grade MTBE, and it was also used as a gasoline blending component circa 1975-85.)

Groundwater samples were collected and analyzed for VOCs (MTBE, TBA, alkylbenzenes, including benzene, toluene, ethylbenzene, and the xylene isomers, and three trimethylbenzenes) and a suite of geological parameters, including dissolved oxygen, dissolved methane, ferrous iron, total organic carbon, sulfate, nitrate, alkalinity, and pH. First order biodegradation rate constants were estimated for MTBE, TBA, and benzene at a number of the sites.

Data suggest that natural biodegradation of MTBE and TBA under anaerobic conditions at some sites may control migration of MTBE and TBA plumes. There appeared to be a good correlation between strongly anaerobic plume geochemistry and natural MTBE biodegradation in the subsurface in the methanogenic area of the plume caused by BTEX degradation. Unfortunately, because the study was designed to address the biodegradation of MTBE (along with TBA), other oxygenates were not included in the list of analytes.

In the study, biodegradation rate constants for MTBE, TBA, and benzene were estimated using the approach of Buscheck and Alcantar (1995). Natural biodegradation could be demonstrated at only four of the 74 sites, because the statistical method required the existence of at least five monitoring wells along the centerline of the plume. Three of the sites (where there was statistical evidence for degradation) were where the geochemical environment was methanogenic and sulfate depleted; one site was weakly methanogenic with available sulfate. An additional 44 other sites fell into those geochemical categories and thus were thought by the authors to also have environments conducive to biodegradation.

The authors believe that natural MTBE biodegradation was occurring at many of these sites, but it could not be demonstrated by the statistical methods used in this study. Rates of anaerobic biodegradation of MTBE and TBA were comparable to benzene.

At the sites, the concentrations and frequency of TBA occurrence in groundwater were comparable to those for MTBE. There was little difference in the relative concentrations of TBA and MTBE in groundwater between the sites where MTBE biodegradation was apparent and sites where it was not. The relative concentrations of TBA and MTBE alone may not be a reliable indicator of in-situ biodegradation potential.

TBA was detected in groundwater samples from all six states and DC. The highest TBA concentration was 223,000 µg/L; 10 samples exceeded 50,000 µg/L; and 29 samples were in the 10,000-50,000 µg/L range. The MTBE:TBA ratio was nearly 1:1. With numbers as high as these, it seems fairly obvious to me that we should always be looking for TBA in our groundwater samples, even when we aren't trying to determine whether MTBE is degrading to TBA.

It is doubtful that many of these sites have been investigated thoroughly in a three-dimensional manner. The statistical method used required that there be at least five monitoring wells located along the centerline of the plume. No mention was made as to whether any of the sites had been characterized using any form of multilevel groundwater sampling that would detect whether any of the plumes were "diving."

A similar problem exists with both the California, Texas, and Florida MTBE plume studies (Happel, Beckenbach, and Halden, 1998; Mace, 1998; and Integrated Science and Technology, 1999). Plume lengths were determined (to a specific concentration of MTBE) based on monitoring well data. Monitoring wells for these sites were likely screened in the traditional manner for gasoline sites, at the top of the water table. It is unlikely that monitoring included multilevel sampling designed to detect a "diving" plume, therefore plume lengths measured may not represent the "true" plume lengths for the sites. What effects would this additional information have on the findings of the natural attenuation study?

A recent study by Kramer and Douthit (2000) was performed to determine whether the presence and widespread occurrence of TBA in groundwater could be explained as a degradation product of MTBE, or whether TBA was originally present in significant quantities in gasoline as an impurity or as an oxygenate. Literature reports (e.g., Salanitro, 2000) indicate that natural MTBE biodegradation is a relatively slow process.

The study involved mixing experiments in the laboratory, where gasoline samples from five New Jersey gasoline stations were mixed with water to determine the types and concentrations of oxygenates detectable. The solubility of each of the oxygenates is related to the pure compound solubility in water and the mole fraction of the oxygenate in the mixture.

All gasoline/water mixture samples showed TBA in the water phase at approximately 83% of the dissolved MTBE concentration. The average MTBE concentration in the water samples was 1,638,000 µg/L, and the average TBA concentration was 1,356,000 µg/L. In addition, all samples contained methanol in concentrations ranging from 26,000 to 51,000 µg/L. One sample contained 17,300 µg/L ethanol, and the average TAME concentration was 4,370 µg/L (one sample contained 153,000 µg/L TAME). DIPE, ETBE, and TBA were not detected in any of the five samples. Total BTEX concentrations were about 0.75% of the total oxygenate concentration.

Kramer and Douthit caution that the wide occurrence of TBA at similar concentrations to MTBE indicates that care needs to be taken in drawing conclusions about potential biological decay under field conditions using TBA as an indicator. There are significant differences in the solubility of MTBE and TBA. The solubility of pure MTBE in water is approximately 48,000 µg/L; the solubility of MTBE at 11% by volume in gasoline is approximately 5,000 ppm, while TBA is totally miscible in water. A relatively small percentage of TBA in MTBE could result in a significant concentration in the water-soluble phase.

Treatment/Remediation Systems

Before you can remediate groundwater contamination, you need to fully delineate the plume—area, analytes present, concentrations, and variations with depth. Characterization of a site includes both vertical and horizontal delineation. Because of the tendency of MTBE to move deeper into the aquifer in some environmental settings, you must also focus on identifying its three-dimensional characteristics, searching vertically for its presence through direct-push sampling, clustered short-screen monitoring wells, and the like.

When you think you are at the end of your plume, you should look deeper, to make sure that it isn't sneaking below the bottom of your well screen. Too often, I fear, we set about characterizing our LUST sites wearing blinders, hoping not to discover too much.

After all, ignorance is Bliss! Harmful by-products created during one of the oxidation processes? Not to worry. Didn't even know about the possibility! And let's face it, the more we find, the greater the cleanup cost.

Table 2 summarizes some groundwater monitoring data from one of my LUST sites in Delaware. The three sampling locations are along the centerline of the plume. Several months prior to these analy-

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TABLE 2 GROUNDWATER MONITORING DATA FROM A LUST SITE IN DELAWARE (Concentrations in µg/L)

Contaminant	Tank Field	30 Feet Downgradient	100 Feet Downgradient
Benzene	330	1,150	<5
Toluene	472	6,070	<5
Ethylbenzene	1,870	1,950	<5
Xylenes	2,720	14,600	11
MTBE	46,100	3,120	650
TAME	10,900	51,500	31
TBA	29,500	782	2,420

■ Other Oxygenates...
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ses, the MTBE concentration in the tank field was 310,000 $\mu g/L$.

The consultant for the project considered using an advanced oxidation technology (AOT) for groundwater treatment. Based on predicted flow rates and contaminant concentrations, the vendor provided equipment cost estimates for a UV/peroxide system ($167,000 for equipment and $5.00/1,000 gallons treated) and for a UV/Ozone system ($375,000 for equipment and $2.32/1,000 gallons treated). The vendor indicated that BTEX and MTBE could be treated to less than 5 $\mu g/L$, but that TBA and TAME effluent values were "to be determined."

According to the vendor, the oxidation of MTBE will form a series of intermediates—acetone, acetic acid, t-butyl formate and t-butyl alcohol are the most predominant. A portion of these intermediates are oxidized in the AOT process. Residual intermediates are readily biodegradable. A biological oxidation system can be attached to the treatment train if necessary to meet permit requirements. Discharge limits for the various oxygenates present must be determined.

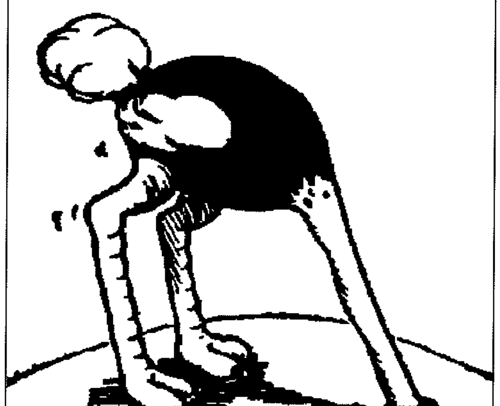
Blah, blah, blah. I think I'd be happier only knowing about the BTEX and MTBE (and I still don't know whether ETBE, DIPE, or ethanol might be present at this site). My point is that it is certainly frustrating and costly to deal with yet another contaminant of concern.

In pilot tests conducted at Santa Monica's Charnock well field (Linder, 2000), using Calgon's UV-peroxide technology, samples spiked with 1,000 $\mu g/L$ MTBE and 400 $\mu g/L$ TBA required 40% more energy to treat than water spiked with 1,000 $\mu g/L$ MTBE alone. I don't know whether the cost estimates for my site took into account these potentially higher costs for destruction of several different oxygenates.

Analytical Techniques

Unfortunately, EPA's memorandum recommending monitoring and reporting of MTBE and related oxygenates in groundwater for LUST sites comes without specific guidance on measurement techniques to be employed. EPA Method SW-846, applicable to LUST sites, does not contain a validated protocol for MTBE analysis.

Although this lack of protocol may change in the future, an approved or required method is still unlikely because EPA's waste program favors a performance-based approach that leaves the choice of methodology to project managers and analytical chemists. Accordingly, monitoring of fuel oxygenates may be performed by any method suitable for accurately measuring the constituents of concern in the matrix of concern at the action level of concern.



Too often, I fear, we set about characterizing our LUST sites wearing blinders, hoping not to discover too much. After all, ignorance is Bliss!

Halden and others (2001) recently published an evaluation of the standard methods for the analysis of MTBE and other fuel oxygenates in gasoline-contaminated groundwater. Consistently good results were obtained with EPA Method 8240B/60B (mass spectrometry) and ASTM Method D4815 (flame ionization detection). EPA Method 8020A/21B (photoionization detection) was unfit for monitoring of TBA and frequently yielded false-positive and inaccurate results when ether oxygenates were monitored in aqueous samples containing high concentrations of TPH (>1,000 $\mu g/L$).

If we're going to get out and analyze, let's get good data! Numerous state studies have been now been completed to identify the extent of the MTBE problem and yes, it is a big problem. MTBE has been added as an analyte at LUST sites in most states, and larger public water systems must now monitor for it as an unregulated contaminant.

The Maryland Department of the Environment (MDE, 2000) recently finished compiling information on the occurrence of MTBE in community water systems and has compiled a database of impacted domestic wells. The Maryland MTBE Task Force has recommended that MDE continue its effort in the coming year to determine the extent of MTBE and TBA contamination. Now states need to determine whether similar problems exist with any of the other oxygenates.

What About Ethanol?

We are on somewhat firmer ground with respect to predicting how ethanol should behave in the environment and how certain remedial technologies are expected to perform. Ethanol is infinitely soluble in water, and its low K_{ow} (octonal-water partition coefficient) indicates that it has a very strong affinity for dissolution into water. These data suggest that ethanol in residual phase will be leached out more readily than other compounds and can potentially reach higher aqueous concentrations.

Cosolvency effects of ethanol with benzene (and other hydrocarbons) may be an issue, particularly if neat ethanol is spilled in an area where there has been a hydrocarbon spill, such as at a terminal where neat ethanol is blended with gasoline prior to distribution to retail gasoline facilities (Powers, Rice, Dooher, and Alvarez, 2001).

The vapor pressure of ethanol is moderately high from free-phase gasoline, indicating that soil vapor extraction, air sparging, and air stripping could be effective in removing ethanol from pure product. However, ethanol has an extremely low volatility from dissolved-phase to vapor-phase, as indicated by its low Henry's law constant; therefore, once dissolved into groundwater, ethanol is unlikely to volatize significantly under ambient conditions and can also be difficult to remove from water by air stripping.

Sorption characteristics influence the movement of a compound in groundwater and the effectiveness of water treatment using carbon adsorption. The low organic carbon partition coefficient (K_{oc}) for ethanol indicates that it will sorb poorly to organic carbon, therefore ethanol is not expected to be significantly retarded as groundwater moves downgradient, and carbon is not expected to perform well as a treatment technology.

Ethanol appears to biodegrade readily under most aerobic and anaerobic conditions. However, because it is preferentially consumed by microbes, the biodegradation of BTEX compounds may be inhibited.

Although ethanol's chemical properties are well known, and it should be possible to predict its fate and transport properties and response to various treatment technologies, there is a general lack of ethanol monitoring data in the literature.

Ethanol groundwater monitoring is scarce, at least in part, because most regulatory agencies do not require ethanol analysis. Furthermore, it appears that no state agencies have as yet set concentration limits for ethanol in groundwater or drinking water.

Creek and Davidson (2000) could not locate any ethanol remediation sites. The extent of any current possible problem and cost associated with cleanup are unknown.

The Blue Ribbon Panel recommended the lifting of the oxygenate mandate that forces the use of an oxygenate in gasoline. Unfortunately, politics, rather than sound science, will probably be the driver as to whether ethanol will take the place of MTBE, or whether refineries will be permitted to blend oxygenate-free gasoline.

Is There a Lesson Here Somewhere?

A recent article by Franklin and others (2000) reminds us of some of the ways that got us where we are today—faced with a national MTBE problem. They point out that policy makers only belatedly realized the environmental ramifications of increased levels of MTBE in gasoline. The policy process that led to MTBE's predominance was flawed, since no systematic attempt was made up front to evaluate all possible implications of MTBE's widespread use.

The policy process that led to MTBE's predominance was flawed, since no systematic attempt was made up front to evaluate all possible implications of MTBE's widespread use.

The history of MTBE in the United States illustrates several typical, but problematic, features of environmental policy making. It reveals how the scale of chemical usage directly impacts environmental effects. It highlights how institutional factors constrain policy makers through statutory mandates, regulatory agency organizational structures, and the strong influence exerted by politics and economics even in supposedly "technical" debates.

Finally, the MTBE case reveals barriers to effective scientific and technical communications among policy makers, regulated industries, special-interest groups, and the public. Will we just be substituting another chemical name for MTBE?

An article by Erdal and Goldstein (2000) discusses lessons for environmental policy that we should have learned as a result of choosing MTBE as a gasoline oxygenate. They identified 14 government initiatives during the 10-year period from 1989 to 1999 in which the potential adverse consequences of MTBE were considered, and a nearly identical research agenda was proposed. More research is needed, not further reviews of research already completed.

What are some of the lessons that should have been learned from MTBE?

- Research should precede rather than follow environmental health policy decisions.
- The extent of potential human and environmental exposure should be an important criterion in determining the amount of information needed before making an environmental policy decision.
- The boundaries between various EPA program offices should be as fluid as the boundaries between the environmental media. Air, water, and waste programs should all be working hand-in-hand.
- It is more difficult to remove a chemical once it is in commerce than it is to prevent its use. (The Bush administration requested that EPA's proposal to ban MTBE under TSCA be withdrawn, at least at the present time.)
- Replacing MTBE with other, less well-studied oxygenates, such as TAME or ethanol, is poor environmental policy.

Those who remember the MTBE story on CBS "60 Minutes" in January 2000 may remember this exchange between EPA's Bob Perciasepe and CBS:

CBS: Have there been studies done on the health effects of MTBE in the drinking water?

Perciasepe: Not enough. Not enough.

CBS: But any? I mean, have any been done?

Perciasepe: "I'm not aware of any specific studies that have been done on that."

CBS: "What are you doing about the problem? Right now. I mean, what has been done since this first memo in 1987? What's been done?"

Perciasepe: "Not enough."

Will some future EPA official be answering questions about the other oxygenates the same way in a few years? EPA's Blue Ribbon Panel Report summarized impacts of MTBE to ground and surface water resources in the U.S. It also stated that the body of information available to evaluate impacts of other gasoline oxygenates on water resources is significantly more limited. It's time to start looking at the extent of the problem. ■

[NOTE: References for this article can be found on page 23.]

Pat Ellis is a hydrologist with the Delaware DNREC UST Branch and was a member of EPA's Blue Ribbon Panel. She can be reached at **pellis@dnrec.state.de.us**.

Oxygenates

Is MNA Appropriate for Remediating MTBE?

Discussion and Dialogue from the Petroleum Hydrocarbon Conference, 2000

by Matt Small

Monitored natural attenuation (MNA) has been recognized as a remedy that can effectively achieve remedial goals for groundwater, within a reasonable time frame at some petroleum release sites. MNA relies solely on naturally occurring physical, chemical, and biological processes to reduce contaminant concentrations. It has proven most effective at gasoline release sites where there is a low potential for receptor impact and chemical contaminants have low mobility and are readily biodegraded (e.g., benzene, toluene, ethylbenzene, and xylene (BTEX)).

However, at an increasing number of gasoline release sites groundwater is contaminated with significant concentrations of methyl tertiary butyl ether (MTBE). Because MTBE is more mobile and less likely to biodegrade than the BTEX compounds, there may be a higher potential for receptor impacts.

The Question

So the question arises, "is MNA appropriate for remediating MTBE?" The National Research Council has said that natural attenuation is a proven technology for BTEX compounds but that it is not well established as a treatment for other common groundwater contaminants (NRC, 2000). The ASTM *Standard Guide for Remediation by Natural Attenuation* specifically cautions against applying natural attenuation for the remediation of recalcitrant compounds such as MTBE (ASTM, 1998). The EPA policy directive on MNA also cautions against application of MNA to recalcitrant compounds (EPA, 1999).

With all of these cautionary statements, are there any situations or scenarios where natural attenuation could be appropriate as a remedial alternative for MTBE? This question was discussed at the 2000 Petroleum Hydrocarbon Conference in Anaheim, California. The discussion included brief presentations by a panel of UST regulators, scientists, and oil company representatives, followed by input from attendees.

The Discussion

The following ideas regarding criteria for appropriate application of MNA at MTBE release sites were put forth during this discussion. These criteria are a mix of state policy, scientific investigations, and personal opinions and should not be taken as a coordinated approach or guidance document, but rather as an ongoing dialogue and brainstorming session on this contentious issue.

Panel Presenters' Criteria for Potential Use of MNA for MTBE:

- MNA may be applicable in some situations when the MTBE content in the gasoline is low, the source mass is small, and the impacted groundwater is not currently used or planned for use in the future. Use restrictions must be maintained until remediation is completed or, if groundwater usage changes, MNA must be re-evaluated.
- Source size and distance to potential receptors are critical elements for assessing potential risks and the potential application of MNA for MTBE.
- The applicability of MNA for MTBE must be considered on a site-by-site basis.
- The source must be located greater than ¼ mile from any receptors. A one-mile "radius protection zone" should be imposed for public wells in the vicinity of a release that fits the state's profile for migrating plumes. Also, the use of the water supply, potential for vertical migration, options for blending MTBE-contaminated water with clean water to lower concentrations, and other site-specific criteria must be considered.
- The hydrogeologic context (groundwater flow rate), available electron acceptors (oxic or anoxic), and the presence or absence of co-contaminants (e.g., BTEX) must be understood and considered.
- Sufficient site characterization is required to support the decision for MNA. Most sites evaluated for active remediation are under-characterized for such evaluation.

Attendee Comments on Potential Use of MNA for MTBE:

- Geochemical footprints should be examined in addition to plume stability.
- Demonstration of stabilized and shrinking plumes is sufficient, assuming site characterization is adequate.
- MNA secondary lines of evidence should be required for MTBE (20% of audience agrees).
- Permeability of the vadose zone should be considered along with the concentration profile in the saturated zone to examine site-specific volatilization and the potential presence of MTBE above the water table.
- Funds should be reserved for additional site cleanup if MNA is unsuccessful.
- Long-term exposure management and contingency plans with well-defined criteria for triggering additional action or remediation must be combined with land-use planning and public information.
- Source control should be completed prior to considering MNA for MTBE.

- The appropriateness of field conditions for MTBE biodegradation must be evaluated. The presence of BTEX consumes the available dissolved oxygen at many sites creating an anaerobic environment that is not conducive to degradation or attenuation of MTBE.
- Natural attenuation is a component of all remedies. If MNA is treated the same as other remedies, no additional investigation or requirements are needed.
- MNA decisions should be based on good science and a sound conceptual model.

The Answer

In summary, the answer to the question of whether MNA is appropriate for remediating MTBE is "maybe and in certain circumstances." The panel presentations indicated that MNA may be appropriate for remediating MTBE in some cases. However, the potential for plume migration and the subsurface conditions that may encourage biodegradation of MTBE must be well understood. This means that the site must be fully characterized to support MNA decisions. In addition, MNA may be a more appropriate option for MTBE remediation when source/release mass is small and the potential for impact on receptors is low.

Some attendees agreed generally with the presenters, others felt that MNA was appropriate for MTBE with no extra requirements beyond those typically imposed at BTEX release sites, still others (about 20% of attendees) felt that additional investigation such as geochemical footprints and secondary lines of evidence should be required for evaluating the application of MNA at MTBE release sites.

One attendee pointed out that the biodegradation of BTEX at gasoline release sites creates an anaerobic environment that is not favorable for biodegradation of MTBE and may limit the application of MNA. Other attendees expressed a desire to see contingency planning and long-term management incorporated into any use of MNA at MTBE release sites.

Overall this was a positive exchange of ideas in the continuing debate over appropriate application of MNA to remediation of gasoline releases containing MTBE.

Thanks to Ravi Arulanantham of the California Regional Water Quality Control Board, Sanjay Garg of Equilon, Greg Hattan and Bill Reetz of the Kansas Department of Health and Environment, Jeff Kuhn of the Montana Department of Environmental Quality, Jim Landmeyer of the U.S. Geological Survey, and Jim Weaver of the U.S. Environmental Protection Agency for providing panel presentations. Thanks to Bill Reetz for compiling comments. Thanks to all attendees of the 2000 Hydrocarbon Conference who participated in the discussions. ■

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■ Other Oxygenates... *continued from page 21*

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from the editor

Gasoline Oxygenates and Private Wells

Many observers would agree that with the closure of Santa Monica's Charnock well field in 1996, that city became the "poster child" for the ban MTBE movement. Because of the substantial political power wielded by California water purveyors and their trade group, activities aimed at banning MTBE rapidly escalated.

Protecting municipal water systems and the thousands/millions of customers they serve is an extremely important consideration for UST regulators. However, it might be fair to say that if we are concerned about exposures to MTBE (or other common drinking water contaminants), especially at levels above MCLs or other health-based limits, then we should be especially vigilant regarding potential impacts to private drinking water wells.

In some states, concerns about private wells have been the catalyst for legislative efforts to ban MTBE. Incidents on Long Island and upstate New York, for example, were frequently cited during the MTBE legislative debates in that state. In what remains the best study on this topic, the 1998 Maine Department of Environmental Protection's study found MTBE in 15.8% of the 950 private wells they sampled.

The U.S. Census Bureau statistics indicate that in 1990 over 15 million households (around 42 million people) received their water from private domestic wells. Five states have almost ⅓ of these wells—Michigan has over 1.1 million private wells; Pennsylvania, North Carolina, New York, and Florida all have over 800,000.

A recent article in *Environment Science and Technology* (ES&T) noted that 73 million Americans live in areas where MTBE is used in RFG and estimates that about 6.4% live "near" a gasoline station. Most private wells draw from shallow unconfined aquifers that are susceptible to contamination from a multitude of sources, including USTs.

Little Is Known About Private Wells

A 1997 EPA report on the nation's drinking water infrastructure noted that "very little is known about the degree of contamination at private wells." EPA has just released a follow-up report that states "A lack of monitoring data prevents a comprehensive assessment of the quality of water supplied by private wells."

The 1997 report notes that such wells at best are only tested immediately after they are installed and that 24 states do not even require that level of testing. Few studies have been conducted of private well water quality. Those studies that have been undertaken typically find disturbingly high occurrences of contaminants.

Most private wells draw from shallow unconfined aquifers that are susceptible to contamination from a multitude of sources, including USTs.

For example, a 1994 Center for Disease Control study of over 5,000 randomly selected private wells in nine Midwestern states showed that over 13% of the wells had nitrate levels above the U.S. EPA MCL. Atrazine, a common herbicide used in corn-growing areas, was found in 13.4% of the wells and above the MCL (3 μg/L) in 0.2%. Similar results were observed in a U.S. Geological Survey (USGS) study of wells in the Delmarva peninsula area of the mid-Atlantic states of Delaware, Maryland, and Virginia (Environmental Health Perspectives, 1997).

A 1997 Government Accounting Office report on private wells and community water supplies in California, Illinois, Nebraska, New Hampshire, North Carolina, and Wisconsin found that up to 42% of private wells were contaminated with coliform bacteria at levels in excess of the MCL (as opposed to 3 to 6% of community systems), and that up to 18% exceeded the MCL for nitrate. Limited data were available for chemical pollutants such as pesticides, metals, and volatile organic compounds. The report indicated that contamination with those compounds is rare—only 1 to 2% of wells tested reported concentrations above federal MCLs.

Several recently published studies provide interesting details about the private well side of the drinking water impact issues. The February 1 issue of *ES&T* featured an article (**http://pubs.acs.org/subscribe/journals/esthag-a/35/i03/html/02mackay.html**) that describes an approach for predicting impacts to wells using the concepts of contaminant-dissolved mass flux.

The authors note that given the limited amount of contaminant mass in a dissolved plume (e.g., a "typical" UST release site might leach about 10-100 grams of dissolved MTBE daily from the residual gasoline source area), coupled with the massive volume of water typically withdrawn by large wells (e.g., 400-900 gallons per minute), that dilution will frequently reduce MTBE concentrations to levels below analytical detection limits and/or below levels of concern. They caution that "...if an impact is defined by the concentration of contaminants in the extracted water, small, private water wells may more often be at greater risk than large municipal systems pumping hundreds to thousands of liters a minute."

In early February the state of New Jersey released its report on the environmental impacts of MTBE. That report noted that they have been monitoring for MTBE in municipal systems for over 15 years and that MTBE (at 0.5 – 20 μg/L) was present in 15% of those systems; there were no findings over 20 μg/L.

The report summarizes USGS studies of MTBE detections in domestic wells in four separate sampling areas (about 30 wells sampled in each). MTBE was present in 43%, 28%, 7%, and 93% (yes 93%!) of those wells. Almost all detections were relatively low, however, as the median concentration detected in each study area was no greater than 1.16 μg/L.

Regarding the study area with 93% detections, it was around a lake that received heavy watercraft use, and where the lake water during summer months contained as much as 20 μg/L or more MTBE due to the discharges of two-stroke engines.

Because the wells around the lake drew from the water table that was in intimate hydrologic contact with the lake, it is easy to see why so many wells had some MTBE.

In the recent NEIWPCC survey of state experiences with MTBE issues, all but 10 states responding indicated that they had less than 40 private wells impacted. Collectively, the 10 states with more than 40 impacted wells estimated that about 2,300 private wells had been impacted. Maine observed that extrapolating its 1998 data to the entire state population of private wells would mean that between 37,000 and 50,000 wells would have MTBE at more than 0.1 μg/L.

This survey of UST personnel can not be considered an accurate assessment of private well impacts but perhaps does give an indication that most states do not routinely characterize or track the impacts to private wells from UST releases, even though there may be many wells impacted.

In an article soon to be published in *ES&T* (Lince et al., 2001), the authors tried to determine if private wells are more likely to be impacted in areas where reformulated gasolines are used. The New York Department of Health conducted a survey of 71 private wells near 21 randomly selected gas stations. Forty wells were sampled in conventional gasoline areas, and 34 wells were sampled in RFG areas. Eight wells (20%) in the conventional gas areas and 13 wells (38%) in the RFG areas had MTBE at more than 1 μg/L. The authors note that given the small sample size of their study, "statistically definitive conclusions are limited," but they also note that their findings are generally consistent with the Maine and USGS studies that show lesser impacts to drinking water in non-RFG areas.

The USGS's National Water Quality Assessment program is preparing a summary report on about 1,700 private wells in 35 states that have been sampled over the last decade as part of its comprehensive evaluation of shallow groundwater quality. They will summarize data on the occurrence of 55 VOCs in those wells. The results should be available by late fall (J. Zogorski, personal communication, 2001).

Who's Looking Out for the Private Wells?

Who speaks for the universe of households using private wells? The EPA Blue Ribbon Panel had a member representing public water suppliers, but no one really represented the concerns of private well owners. While the EPA Office of Ground Water and Drinking Water (OGWDW) has an extensive program to address community water systems, there is no federal authority for private wells. The OGWDW Web site has very little information on private wells or any related activities (**http://www.epa.gov/safewater/pwells1.html#more**).

The National Ground Water Association (**http://www.ngwa.org**) represents the drillers who install private wells and has established the National Well Owners Association (**http://www.wellowner.org/index.htm**). There is also a National Rural Water Association (**http://www.nrwa.org/**).

As noted earlier, MTBE is just one of a long list of common contaminants in private wells. Perhaps the increased attention paid to MTBE will help raise awareness of all these threats. Absent a strong political voice, however, it may be awhile longer before there is resolution to this long simmering private well issue.

As *LUSTLine* was going to press, we learned that the New Jersey legislature has sent a bill to the Governor for signature that would require the private wells at dwellings being sold or leased to be tested for VOCs and other contaminants. The bill also provides funding for a public education program. This is clearly a step in the right direction. ■

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NEIWPCC Prepares Report on Ethanol as an Alternative to MTBE

As state and federal moves to eliminate or reduce the use of MTBE have gained momentum nationwide, ethanol has emerged as the most likely oxygenate replacement for MTBE. Recognizing that it is important that the Northeast states be in a position of having evaluated potential alternatives to MTBE with regard to health effects and potential environmental issues, the New England Governor's Conference (NEGC) Committee on the Environment called for the states to work as a region to evaluate alternatives to MTBE.

As an organization concerned primarily with water quality issues in the New England states and New York, the New England Interstate Water Pollution Control Commission (NEIWPCC) was asked to address oxygenate alternatives with respect to water impacts. (The Northeast States for Coordinated Air Use Management is preparing a report from an air perspective.) In response, NEIWPCC organized an Alternative Fuels Subcommittee made up of staff representatives from state health, UST, and site remediation programs to address tank-related MTBE and alternative oxygenate (ethanol) concerns.

While there may be many possible alternatives to the use of MTBE as an additive in gasoline in the Northeast, the subcommittee focused its evaluation on the potential environmental impacts of a release of ethanol and ethanol-blended gasoline because, in the near-term at least, it will likely be more widely used in this region and throughout the country. Alternative oxygenates other than ethanol were reviewed briefly with an eye toward the possibility of a more thorough evaluation at a future date.

The subcommittee divided into focus groups to work on the key areas of concern associated with ethanol—Health Effects, Aquatic Impacts, Storage and Handling, Environmental Impacts, and Other Alternatives. A draft report has been completed and reviewed by state agency personnel and outside experts. NEIWPCC expects to complete the report in late spring. ■

E-Commerce at the Dispenser
Another Thing to Worry About?

by Sheldon Schall

E-commerce is a relatively new term for a relatively new technology—electronic merchandizing via the Internet. E-commerce is appearing everywhere—television screens, computer monitors, cell phone screens, and now the gasoline dispenser. But unlike television and computer screens, the dispenser island is a place that involves the handling of gasoline, the comings and goings of vehicles, and the activity of people getting in and out of those vehicles. In short, e-commerce at the pump adds an element of risk.

Wisconsin's preinstallation plan review for UST systems includes specific information relating to the dispenser. Our concerns regarding e-commerce at the dispenser were sparked when a petroleum equipment installer contacted our office prior to submitting a plan for a dispenser island upgrade. The modification to the island equipment included the installation of dispensers that would be performing an e-commerce sales function.

The installer brought this to our attention assuming that the new dispenser concept would have an impact on the plan review process, and he was hoping to prevent anything from slowing down the process. He was correct in that assumption. After discussing the concept and reviewing a manufacturer's promotion manual our concern was heightened even more.

At Issue

The strategy behind the concept is obviously meant to capture more business and generate more sales. More sales either through purchases initiated at the dispenser with the transaction completed at the counter, or Point-of-Sale (POS) credit card transactions at the dispenser. The dynamics of these *limited* e-commerce sales transactions appear to have little potential to increase the fire-safety risk at the dispenser. However, some of the expanded applications, such as ATM and lottery functions, have the potential to change the dynamics of the dispenser environment significantly, particularly with regard to risks associated fire, human safety, and accidental fuel spills.

Currently there is some debate regarding the distractions caused by a simple video display screen on a dispenser. Indeed, it is possible that a video display that is limited to a promotional function may aid in keeping some customers close to the dispenser. However, displaying sports events or news broadcasts may become a distraction by shifting a patron's attention from operating a dispenser nozzle to watching an event or story being broadcast. Add to that the expanded commerce function of the dispenser island.

Now you've got the potential risk of accident and injury from the changing dynamics of vehicle and pedestrian traffic patterns as people move about to access the pop dispenser or ATM machine adjacent to the dispenser on the island—we've heard several stories of minor accidents involving the Speed Pass concept. Furthermore, it is not too much of a stretch to believe that a customer approaching a dispenser island solely to use the ATM will not have the same consciousness about the cigarette hanging from his/her lips as the person approaching to dispense gas.

Clearly, owners or operators who have made the decision to install dispensers with e-commerce capabilities are focused on the potential for generating more sales and are not realizing the potential risk. The attendant or c-store operator is expected to have a reasonable visual oversight of the fuel dispensing areas. The e-commerce dispensers are wider than the traditional dispenser and adding goods dispensers (e.g., pop or snacks) or ATM machines to the island reduces the visual contact with activities in the dispensing area.

Are We Ready?

In the process of assessing our regulatory position on the application of e-commerce dispensers, I distributed a survey question to the states through the Association of State and Territorial Solid Waste Management Officials e-mail distribution network. Few respondents were aware of the concept, but most respondents agreed that there are fire and safety concerns associated with the dispenser island application.

Several respondents indicated that e-commerce dispensers were appearing in various applications, from placing a food counter order to providing ATM access. Interestingly, a number of respondents representing state UST regulatory programs did not have regulatory authority over the dispenser, so they could not address the issue if they wanted to.

Missouri appeared to be the most proactive in this regard, already having a rule that states "Installation of equipment and devices, such as vending machines and ATMs, that may produce safety hazards by distracting the customer from the dispensing operation, limit ingress and egress to the dispensing area or from electrical components of the equipment or device, or limit visibility to vehicle refueling on islands utilized for the dispensing of petroleum products regulated by Chapter 414, RSMO is prohibited."

Because the regulatory community tends to be more reactive than proactive I expect the trend will be well established before the regulatory community has an opportunity to effectively address it. It will be interesting to see how the insurance industry approaches this concept. As one regulator responded, "I guess nothing will happen until the minivan full of kids burns up."

How are we handling it in Wisconsin? We are working on revising the current regulation to develop a restriction similar to Missouri's. In the meantime, we are communicating to the installation industry that we will use our state regulatory authority to protect the public welfare by conducting a site-specific assessment of any e-commerce dispenser application beyond the promotional or in-store sale of goods function. ■

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NEIWPCC's MTBE Survey Sheds Light on Where States Are and Where They Aren't

by Ellen Frye

By now, many *LUSTLine* readers may have perused the New England Interstate Water Pollution Control Commission's (NEIWPCC's) survey of state experiences with MTBE on the Commission's Web site (**www.neiwpcc.org/mtbe main.html**). The 34-question survey, to which all 50 states responded, was designed to determine how MTBE contamination is affecting state LUST programs and the cleanup of contaminated sites. It was I who conducted the survey and then tallied the results for NEIWPCC. As I received each completed (or incompleted) state response and entered the results onto the master tally sheet, I became more and more fascinated by how much this survey was telling us about what we don't know.

The survey provided a fairly comprehensive snapshot of state experiences with MTBE, as of September 2000, and also revealed sizable gaps in our collective knowledge of the various issues associated with MTBE in the environment. For many questions, the "don't know" response was quite common. But this was not so surprising.

We knew, as we developed the questions (and we had the help of several state and consulting MTBE aficionados) that we needed to ask the questions that would provide a complete MTBE/oxygenate picture. Deep down inside, we knew a sizable amount of white space would remain on the canvas. We hoped, however, that by conducting this survey, more states would begin to seek answers to questions such as these so that, in time, we would all better understand the nature of the MTBE beast as it finds its way into the groundwaters of America.

But alas, we have a long way to go. The survey tells us what states are or are not doing with respect to MTBE. It tells us what states think they know about MTBE's presence, absence, or extent in the environment. But when we take the state responses and attempt to compare them, we end up with MTBE hodgepodge—a mixture of dissimilar ingredients.

Let's Begin with the Standards

We divided the survey into six categories: MTBE Standards, Analysis, Site Assessment, Remediation, Other Oxygenates, and Other (GIS, information needs). The answers to the very first question in the survey—Does your state have action levels, cleanup levels, or drinking water standards for MTBE? Yes or No?—set the stage for what was to follow. Thirty-eight states responded to the question in the affirmative.

But wait, were these standards for soil? for groundwater? action levels? cleanup levels? primary drinking water standards? secondary drinking water standards? All? Some? One? Two?

> ***The survey tells us what states are or are not doing with respect to MTBE. It tells us what states think they know about MTBE's presence, absence, or extent in the environment. But when we take the state responses and attempt to compare them, we end up with MTBE hodgepodge—a mixture of dissimilar ingredients.***

Of the 38 states, 20 have soil action levels, 28 have soil cleanup levels, 26 have groundwater action levels, 32 have groundwater cleanup levels, 8 have primary (health-based) drinking water standards, 6 have secondary (taste and odor) drinking water standards, 8 use the EPA advisory (20 $\mu g/L$) drinking water standard, and 12 use a state or some other advisory. Right off the bat, we've established that states are looking for MTBE in different ways and at different detection limits.

Some of the standards and levels are enforceable and some are not. Eight states indicated that all of the levels they use are enforceable while six indicated that none are enforceable. The remaining states that answered stipulated an assortment of variations on the theme.

An MCL for MTBE might move the states in the direction of a common denominator. Thirty-six states indicated that a federal MCL for MTBE would affect their state's remediation process. Many of the states, particularly those that do not currently have a cleanup standard for MTBE, felt that an MCL would lead to the adoption of that standard and hence more protracted and costly cleanups, other states said that they might have to adjust their existing standards up or down, depending on the established MCL. In many states, a numerical federal MCL for MTBE would effectively be adopted by the state.

Keeping our vastly disparate standards in mind, let's take a peek at MTBE analysis. Forty-three states require sampling and analysis for MTBE in groundwater at LUST sites. Twenty-nine states require such sampling and analysis in soil.

Of the states that require sampling and analysis of MTBE in groundwater, 14 do so for all suspected releases and 30 do so for gasoline releases. Of the states that require such sampling and analysis in soil, 10 do so for all releases and 22 do so for gasoline releases.

States that require testing for MTBE were asked when that requirement was initiated. That spectrum ranges from Maine in 1986 right on up to Washington in 2001. When asked approximately how many sites were closed before MTBE analysis was required, many states indicated that significant numbers of sites had been closed before analysis requirements took effect.

A Matter of Dimension

Need I say more? I've gotten as far as question 5e, and it's clear we have an

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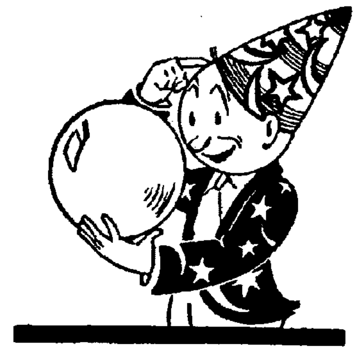
State Funds

Life Beyond the Fund

After Exploring Its Options, Iowa Transitions from State Fund to Marketer-Owned Insurance Company



by Pat Rounds

Since the early 1990s, state cleanup funds have served as the primary means for many tank owners to comply with the federal financial responsibility (FR) requirements—out of 47 states with some kind of petroleum release cleanup fund, 42 programs serve as the FR mechanism for the owners. Collectively, state assurance funds raise almost $1.2 billion annually to help pay for cleanups, some of which, especially those of historical releases, might not have occurred had these funds not been created.

With technical regulations that require that all USTs meet minimum upgrade and operating requirements, most historical releases should have been discovered at operating locations by the 1998 technical upgrade deadline. Thus, UST systems that are in use today should be less prone to releases than those of the past. Owners and operators who have clean sites (or are addressing past releases with assistance from state assurance funds) and upgraded tanks should now be able to obtain coverage for their sites for a reasonable price through private insurance.

Many private insurers are offering FR coverage for less than $1,000 per site. Several states never provided FR coverage through a state-funded program. Other states including Texas, Florida, West Virginia, Iowa, and Maryland are examples of states that have successfully transitioned their UST owners from state fund FR coverage to private insurance FR coverage.

The question today is not whether private mechanisms can address the FR requirements, but whether there are states that are ready to exit from the financial assurance business. If that answer if "yes," then the question becomes one of how to exit successfully.

Considering a Transition

When considering whether to end a state FR program, many program issues must be evaluated to determine if the program is achieving its goals. If the program has achieved its goal or if it is unable to achieve its goal, then a transition may be worth considering. An objective evaluation of transition goals should be undertaken to ensure that the transition process itself does not have a negative impact on the decision to end the program. The following issues should be addressed:

- Determine what tasks the state fund addresses today. The transition decision cannot be fully evaluated unless all state fund duties and responsibilities are quantified. Is the fund responsible for regulatory inspections? Managing cleanup? Evaluating other FR mechanisms? Does the fund pay for releases from sources other than active, regulated USTs? The decision makers must understand what the fund does before they modify the program.
- Determine what role, if any, the state fund will play in the future. Will the fund be a cleanup solution for sites that do not comply with FR requirements? Will the fund be responsible for determining if owners are in compliance with the FR requirements?
- Determine who pays for cleanup today and who will pay tomorrow. If the cost of FR is hidden in per gallon fees collected on all fuel, the UST owner may not want to start paying for FR in the form of site-specific premiums. Many times it is easier to understand reluctance to change when you determine who will pay for the change.
- Identify the goal of the transition. This may appear simple, but it is probably more complex than it seems. A goal may be to decrease state expenses or reduce state employees. It may be to reduce the cost to the taxpayer or reallocate the cost to the insured. Promoting private enterprise may be a goal. Other goals may involve creating environmental incentives, expediting cleanup, promoting individual responsibility, tapping the expertise of the private sector (e.g., claims handling, underwriting, inspections, policy issuance, limiting appeals), or having the opportunity to reallocate state resources to focus on another state concern. The goal should dictate the transition plan.
- Determine what to do with remaining money after the transition—a problem every state fund administrator would like to face. Leftover money may not appear possible, but it may happen and should be addressed up front.

Evaluating Alternatives

For most UST owners there are only two methods for demonstrating FR: (1) state funds and (2) private insurance. However, when combined, these alternatives create numerous possibilities for creative mechanisms to address each state's specific needs. Just as funds vary from state to state, financial assurance alternatives can evolve as fund/insurance hybrids that are tailored to fit individual state temperaments. I'll discuss the smorgasbord of alternatives in a future article. Right now, let's look at how we might want to evaluate any alternative.

First of all, facts and knowledge should replace anecdotal stories and fears. If fund managers are going to explore the alternatives they should consider the following issues when comparing any financial assurance mechanism with the current operation of their fund. (For simplicity's sake, I'll refer to the "mechanism" in lieu of the "financial assurance mechanism.")

- Will the mechanism meet the federal and state requirements?
- How will we know that every site has FR coverage?
- Will the mechanism cover an old release?
- How will the mechanism determine if a release is old or new?
- What if the assurance mechanism won't pay?
- What if there is a delay in payment?
- What if the assurance mechanism can't pay?
- What if the policy conditions are unreasonable?
- What happens if the owner does not comply with the coverage requirements?
- Is there an appeal process if a claim is denied?
- What if the tank owner can't afford coverage?
- What if the assurance rates increase later?
- Are deductibles reasonable?
- How do we know the tank owner can pay the deductible?
- Will environmental protection concepts be promoted?
- Will there be incentives to promote proper tank management?
- Will there be incentives to discover and report leaks?
- Will cleanups be addressed in a timely manner?
- Will cleanups be addressed effectively?
- Will the coverage protect the public?
- Will costs be allocated in the most equitable manner?
- Will the overall cost associated with UST FR and cleanup decrease?
- Will the assuring mechanism have the expertise to understand UST operation and cleanup?

Just as we can't easily summarize or generalize how every state fund would respond to these questions, we also cannot easily summarize how every insurance carrier would respond. Furthermore, with unique program designs and varying program expectations, all of the issues raised should be answered objectively and specific to the state program being evaluated. All of the questions call for an independent, impartial analysis based on each state's current status and program goals. Iowa is an example of how one state addressed transition concerns.

The question today is not whether private mechanisms can address the FR requirements, but whether there are states that are ready to exit from the financial assurance business. If that answer if "yes," then the question becomes one of how to exit successfully.

The Iowa Transition

The Iowa UST cleanup fund was created in 1989. By 2000 it was providing assistance to over 4,000 LUST sites and providing FR for nearly 2,300 active UST sites. The cleanup side of the program, funded at a rate of $0.01 per gallon, was solvent and able to pay all claims within 30 days. The FR or insurance side, funded by owner premiums, had over $30 million accumulated and was collecting premiums of approximately $2.5 million annually from the nearly 2,300 participating sites. All active USTs were upgraded.

Iowa provided assistance for past cleanups under its remedial program, guaranteed loans for upgrade assistance, and provided FR for releases that occurred after October 1990, if owners chose to pay premiums for FR coverage. When Iowa created its program it was designed to be interim only. As soon as private mechanisms were available, the insurance portion of the program was designed to end.

In 1995, the Iowa UST Fund board decided to determine if it was time to end the "interim insurance program" and transition the liability for future releases from active USTs to the private insurance market. Obviously the cleanup fund would continue until historical releases were all "closed," but the question was, could FR come from somewhere else?

In essence, the state program took stock of itself by addressing the following questions:

- Current state tasks? The state fund provides cleanup benefits and FR coverage. The state manages FR claims similar to an insurance company. The state licenses UST installers and inspectors and groundwater professionals.
- Continued functions? The state would continue to oversee and fund all cleanups of historical releases until those LUST sites were closed. In addition the state would continue to license UST installers and inspectors and the groundwater professionals who work at LUST sites. The state, of course, would continue to handle all regulatory issues.
- Who pays? Iowa collects $0.01 per gallon to fund the cleanup program for historical releases. Site-specific premiums for FR coverage are paid by UST owners. Owners who self-insure or use other mechanisms (approximately 700 of 3,000 active sites) are not required to pay into the insurance fund. Transitioning the insurance program to the private market will not change the burden for paying premiums.
- Transition goal? The Iowa program was designed to be interim, only until other mechanisms were available for the UST owners. The transition should end state liability while allowing UST owners to comply with FR and technical operating requirements. The UST owners must have a reliable source of funding if new releases occur. There should be no lapse of coverage.
- Remaining money? The insurance fund only contains money that was paid by owners in the form of annual premiums. The insurance fund had accumulated approxi-

■ *continued on page 30*

■ Life Beyond the Fund...
continued from page 29

mately $30 million. That money could go into the historical cleanup fund, or it could be returned to the owners who paid into the insurance fund.

Private Insurance Options

The Iowa UST Fund Board commissioned a study of the private insurance market in the state. The study indicated that private insurance could address the FR needs of the UST owners in Iowa. It determined that insurance was available, affordable, and that private insurance market incentives would address environmental concerns. A sunset of the program was recommended.

After reviewing the privatization study, petroleum marketers and some legislators still had some concerns about private insurance. Although private insurance was readily available at affordable rates, many UST owners remembered the dilemmas they faced in the 1980s when insurance coverage was not available or not affordable. They also had concerns about a lapse of coverage between the state fund and private insurance. UST owners wanted additional protections. Legislators did not want the problem to resurface.

Iowa UST owners had a good record of successful tank management. The premiums they paid over the years exceeded the costs of cleanup associated with the insurance program. They wanted their history of successful tank management to count for something and suggested using the remaining money in the insurance fund to help alleviate their insurance concerns.

The legislature determined that it was time to transition out of the FR business, and private insurance was the answer. To protect the UST owners' long-term interests with respect to insurance premiums and payment of claims, they would participate in the ownership and management of the insurance company. The legislature agreed to a plan that authorized the transfer of the assets and liabilities of the state insurance fund to a private company made up of the insureds, but only if the following requirements were met:

- The company must be an independent nonprofit entity;
- It must provide long-term insurability based on competitive rates for insureds who are in compliance with technical regulatory requirements;
- It must eliminate any lapse of coverage between state coverage and private coverage;
- It must provide ease in transition from state requirements to private insurance requirements;
- It must allow participation of insureds in underwriting, application, claims, and premium determinations;
- It must continue to be an acceptable FR mechanism; and
- "Poison pill" provisions were established to recover all assets if the company ceases to exist, ceases to meet the listed requirements, or is purchased by another entity.

In 1998, with support from the Petroleum Marketers of Iowa, legislation directed the Iowa UST Fund Board to transfer all assets and liabilities of the insurance fund to the Petroleum Marketers Mutual Insurance Company (PMMIC)—owned and operated by the insureds. The transfer was to be completed when specific statutory requirements were met.

On November 8, 2000, pursuant to a memorandum of understanding with the UST Fund Board and in accordance with previously adopted administrative rules, all assets and liabilities of the insurance fund were transferred to PMMIC—an admitted insurance company in the state of Iowa. PMMIC now provides insurance coverage to nearly 2,300 UST locations. The company has approximately $35 million in assets with under $5 million in reserves for open claims. PMMIC picked up the retroactive date of coverage for all sites that transferred from the state fund.

The Iowa solution is unique, but the plan can be followed in other states. The three keys to Iowa's successful transition were: (1) an objective evaluation of the fund before transition options were selected, (2) an objective study of the goals to be accomplished, and (3) an objective consideration of the options available to address the goals. In Iowa's case, the state eliminated long-term liabilities for future UST releases, while the UST owners accepted their responsibility for future liabilities and now control their own insurance company. ■

Pat Rounds is President of PMMIC. He can be reached at **pjr@roundsassoc.com**.

■ MTBE Survey...
continued from page 27

amazing and colorful mixture of dissimilar ingredients that could well have a tantalizing affect on the outcome of many of the subsequent state responses regarding site assessment, remediation, and other oxygenates. In short, what we know about MTBE or any other contaminant in the environment is based on how diligently we choose to look for it.

In site assessment, for example, if state policy is to analyze for MTBE only in situations where there have been gasoline releases from USTs, then MTBE occurrences from any other sources remain undocumented. If one state's MTBE detection limit is 10 ppb and MTBE plumes are characterized three dimensionally, and another state's detection limit is 70 ppb and plumes are characterized two-dimensionally, the resulting characterization for the same release could be quite different. Of course, if you're not looking for MTBE at all, then you won't find it!

A Treasure-Trove

All that being said, the survey yielded a trove of information of where states were regarding MTBE, as of last fall. Many states took the time to explain their answers in careful detail. Inasmuch as this survey was designed to capture information from the states for the states, we particularly hope that state UST/LUST program personnel will use this information to learn from each other.

We urge you to go to the NEIWPCC Web site and read over the summary and examine the state response data compiled on the questionnaire. You may find, as I did, that the more intriguing story lies not in the statistics but in the complexity of the life and times of MTBE in 50 states.

■ *continued on page 31*

■ **MTBE Survey...**
continued from page 30

Changes will continue to take place with regard to MTBE standards and site assessment and cleanup policies. New discoveries of MTBE in public and private wells may catapult some states to greater vigilance. As alternatives to MTBE, such as ethanol, come into focus, there will be changes in the way some states address these potential environmental threats. And who knows, come the next survey (did I hear someone scream?), there will be quite another story.

We thank all who took the time to respond to this survey. ■

■ **Gasoline Oxygenates and Private Wells...** *continued from page 25*

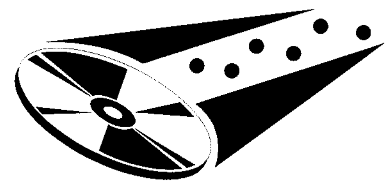
- Hamilton, Pixie and Robert J. Shedlock. 1993. *Are Fertilizers and Pesticides in the Ground Water? A Case Study of the Delmarva Peninsula, Delaware, Maryland, and Virginia.* United States Geological Survey Circular 1080. U.S. Government Printing Office.
- Government Accounting Office. June 1997. Information on the Quality of Water Found at Community Water Systems and Private Wells. GAO-RCED-97-123.
- Swistock, B.R., W.E. Sharpe, and P.D. Robillard. 1993. *A Survey of Lead, Nitrate and Radon Contamination of Private Individual Water Systems in Pennsylvania.* Journal of Environmental Health 55(5):6-12.

Tuthill A., D.B. Meikle, M.C.R. Alavanja. 1998. *Coliform Bacteria and Nitrate Contamination of Wells in Major Soils of Frederick, Maryland.* Journal of Environmental Health 60(8):16-20.

At Last, An Expedited Site Assessment CD

Expedited Site Assessment: the CD is now available from the Connecticut Department of Environmental Protection (CTDEP). While in development, the CD was shown at the all states UST/LUST conference in Long Beach, California and won best presentation at the State Fair. The CD provides technical guidance on investigating fuel releases at underground storage tanks sites in a multimedia format. It is packed with slide presentations, animations, simulations, and videos (as well as some really great original music) and includes spreadsheets for data collection and analysis.

The CD emphasizes the use of direct-push sampling methods, multilevel groundwater and soil sampling, and three-dimensional field screening. It is a great training tool and even has a real-world exercise where you, as a project manager, drive a direct- push drill rig around a site to find the source and configuration of contamination. For the experienced environmental professional, the CD is an excellent reference that covers a wide range of topics, including MTBE, biodegradation, purging, installation, and hydraulic testing of multilevel samplers.



The CD was developed for Peter Zack, CTDEP LUST program, by Professor Gary Robbins at the University of Connecticut. Although elements of the CD are Connecticut specific, most of the technical guidance is generic. ■

***To order copies of Expedited Site Assessment: the CD, contact the DEP STORE, Connecticut Department of Environmental Protection, 79 Elm Street, Hartford, CT 06106-5127. Phone: (860) 424-3555 or (860) 424-3692. For more information about the CD go to* www.esacd.uconn.edu.**

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

EPA to Propose Secondary Drinking Water Standard for MTBE

by Rachel Sakata

The U.S. EPA intends to propose a National Secondary Drinking Water Regulation (NSDWR) for MTBE, based on taste and odor in 2001. NSDWRs were established to control contaminants in drinking water that primarily affect the aesthetic qualities relating to public acceptance of drinking water. These secondary levels represent reasonable goals for drinking water quality but are not federally enforceable. Rather, they are intended as guidelines for states, although states can choose to adopt this standard.

This standard will pull from the existing information presented in EPA's 1997 Drinking Water Advisory and analyze additional information to determine an acceptable taste and odor level for MTBE. Because MTBE is a growing concern that the Agency takes very seriously, EPA wants to provide States and water systems with more direction concerning this contaminant. ■

Rachel Sakata is with the U.S. EPA Office of Ground Water and Drinking Water.

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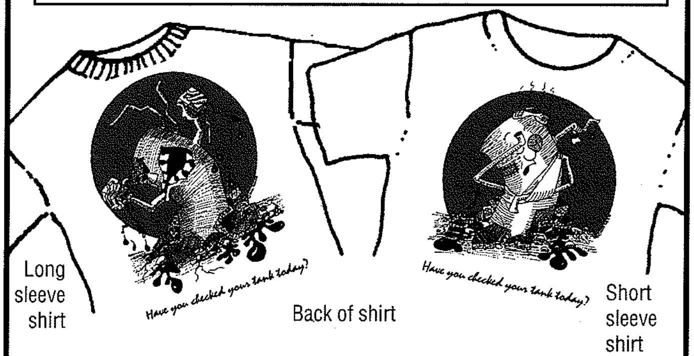

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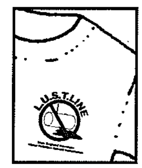
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