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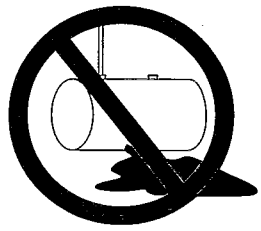


A Report On Federal & State Programs To Control Leaking Underground Storage Tanks

FR Stands for What??

by Arthur Zontini

The camera zooms in on host Rigid Philpipe.

"We're back! I'm here with Mr. Itza Gonnacarroda from the State of Confusion, who's going for the million-dollar coverage. Mr. Gonnacarroda, I understand you own and operate a gas station."

"Rigid, I've owned a gas station for 40 years."

"Hey that's great! Are you ready to go for the million-dollar coverage?"

"I'm ready, Rigid!"

"Okay, the acronym FR stands for: a) French Riviera, b) Franceso Rinaldi, c) Financial Responsibility, or d) Franco Roman."

Gonnacarroda ponders the question as the sweat runs down the back of his neck. "What I could do with a million bucks," he thinks, "double-walled fiberglass tanks, piping, third-party remote tank monitoring, my very own C-Store."

He's stumped, but determined to continue. "Rigid, I'm going to use my final lifeline and phone a friend. I'd like to call Reggie Regulator."

"All right, AT&G, please call Mr. Regulator."

"Reggie, its Itza, we have 30 seconds to answer the following question: the acronym FR stands for a) French Riviera, b) Franceso Rinaldi, c) Financial Responsibility, or d) Franco Roman."

Reggie emits some audible moans and groans. Finally, he responds, "Um, um...that would be financial responsibility, C!"

In a state of panic Gonnacarroda screams... "How sure are you?"

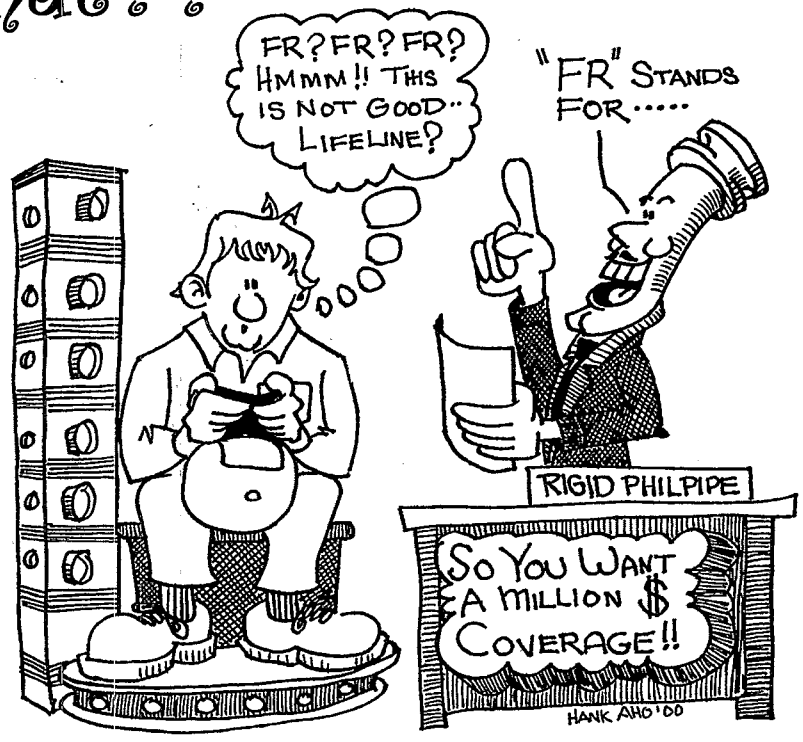
As time runs out Reggie blurts out, "I'm 99 percent sure!"

"Well, Mr. Gonnacarroda?" says Rigid.

Itza sighs and takes a deep breath. "I'm gonna go with Reggie's answer. It's C, financial responsibility, and that's my final answer!"

"He's right! You've done it! You've just won a million-dollar coverage!"

■ *continued on page 2*



Inside

FR Stands for What? *from page 1*

I Was Just Thinking...

Why is it that Financial Responsibility (FR) does not immediately come to mind for many regulators? More importantly, do tank owners and operators (O/Os), such as Mister Gonnacarroda, fully understand what FR means to them?

The Gonnacarrodas of the world need to understand the need for and benefits of FR. They need to know—and I think all of us in the UST program need to know or remind ourselves—that FR is more than just producing a piece of paper when the UST inspector arrives. Furthermore, those of us who work in states that have cleanup funds need to understand that having a state fund doesn't mean never having to say "FR."

FR is mandatory whether your state has a fund or not. As regulators, our inquiry into FR does not stop because tank owners can demonstrate that they have a piece of paper that shows they have one of the seven acceptable FR mechanisms.

The federal rule requires that UST owners and operators have cleanup coverage of $500,000 or $1 million per occurrence. In 1986, Congress mandated FR in the Superfund Amendments and Reauthorization Act (SARA) to eliminate unfunded cleanups. It was a no brainer—UST O/Os must have financial responsibility, because cleaning up the contamination from petroleum releases and paying third-party claims are expensive. Contamination from USTs threatens not only the public health but also the UST owner's livelihood.

LUSTLine

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Financial Responsibility enforcement benefits everyone. It can help prevent unfunded cleanups, keep a business in business, lower government spending on cleanups, and ensure there is money available to pay restitution to third parties.

Financial Responsibility enforcement benefits everyone. It can help prevent unfunded cleanups, keep a business in business, lower government spending on cleanups, and ensure there is money available to pay restitution to third parties.

If the FR requirement in and of itself isn't a sufficient argument for enforcing FR, then consider the following thoughts put forth by OUST's acting director Sammy Ng in *LUSTLine* #32, June 1999 ("Where Do We Go from Here? UST Program Direction for 1999 and Beyond"):

> "The job of ensuring that all owners comply with the technical requirements, including leak detection requirements, is far from over. We are concerned that although owners may have installed leak detection equipment on their tanks, a significant percentage of these systems may not be operated or maintained properly. EPA and stakeholder research confirmed that we have a lot of work to do to prevent leaks and address the estimated 170,000 unfinished cleanups. We need to ensure that we prevent the next generation of leaking tank systems."

So, I was just thinking that this "work" will continue to cost millions, so why not enforce FR?

What Does It Mean to Be Financially Responsible?

The *American Heritage Dictionary, Second College Edition,* defines "financial" as follows: "of, pertaining to, or involving finance, finances, or financiers." The adverb is "financially." "Responsibility" is defined as follows: "the state, quality, or act of being responsible. Something for which one is responsible: duty, obligation, or burden."

If I put these two words together I come up with "financially responsible": having the duty, obligation, or burden to pay for the consequences of our actions. I do not mean intentional acts that cause harm to the environment or another person or their property—I simply mean operating an UST, which has the potential to be a source of contamination. Because of the inherent nature of their business, UST owners and operators are required by law to be financially responsible businessmen and women.

And why should an UST facility be allowed to operate if an O/O cannot or does not have the ability to, in essence, "clean up" after himself or herself? Congress didn't pull the FR rabbit out of the hat when it mandated FR. Public and private sector groups came together almost 20 years ago to lobby for the FR requirement.

The Dust on the FR Tool

So, I was just thinking—Why is it that FR seems to be a tool that just collects dust in the regulatory toolbox? I conducted my own modest survey last year with the help of the Association of Territorial and State Waste Management Officials (ASTSWMO). I asked a few simple questions: Does your state enforce FR? If so, have you been challenged? If challenged, have your decisions been upheld? Is there support for FR enforcement in your state? I am grateful to the 25 individuals who responded. But I have to say, the responses were not encouraging.

The survey results told me several things. First, if a state has a fund, FR enforcement is nonexistent or a low priority. Demonstrating FR may merely mean supplying a document to the regulator or keeping a copy of the FR document at the facility.

Second, the survey confirms what I have heard from other states and what I have experienced: After contamination is discovered, the responsible state agency scurries around looking to see if the O/O's FR mechanism (if the O/O even has one) will pay for the cleanup.

The survey results suggest that fund participation in some states is requirement-free and that all O/Os are in the fund—and FR collects dust in the regulators' toolbox.

Despite what the survey results suggest, state funds generally have participation requirements. However, do the O/Os in states with a fund understand that they may have to meet certain participation requirements? Do they understand that failure to comply with these requirements may result in a reduction (or even disqualification) in coverage for the release?

Speaking of Coverage

We've also got some coverage issues that need to be considered. For example, many state funds provide full coverage (from a regulatory standpoint), even if they require the O/O to pay a deductible. This "first-dollar coverage" is similar to the way in which insurance policies work. If there is a release, the state (or insurance company) will pay up to the limit of the policy but will expect the O/O to pay the deductible. If the O/O can't pay the deductible, the state is stuck with the entire bill.

From a financial standpoint, nonpayment of the deductible is not good for the fund. From an environmental standpoint, the ultimate purpose of the financial responsibility requirement—cleaning up the release—has been accomplished. From a compliance standpoint, the O/O who is covered by a fund that provides first-dollar coverage is in full compliance with the FR regulations, even if he or she can't afford to pay the deductible. This does not rule out the need to ensure that the O/Os maintain their eligibility for the fund (e.g., paying fees, keeping compliant with technical requirements). Without fund eligibility, there is no coverage—at all.

Some states do not provide first-dollar coverage. In these cases, the state will not start paying until the O/O pays his or her deductible. In these situations, it is particularly crucial that the O/O can afford to pay the deductible. If the O/O can't pay, the site doesn't get addressed. In states where this scenario is the case, FR enforcement is enormously important.

State and federal regulators must remember that the existence of a state fund does not guarantee FR. When we are not mindful of this fact, then we are setting ourselves up for potentially unpleasant surprises.

What Happens in the State of Confusion?

Let's look at the fund in the State of Confusion, where Itza lives. In this state, first-dollar coverage applies, and many O/Os think they're in the fund, because they pay a tank fee. Their facility, however, must be in compliance with tank rules and regulations. If contamination is discovered, the O/O must apply for eligibility. If eligibility is granted, then and only then is he or she eligible for reimbursement of eligible costs. Therefore, in the State of Confusion, FR does not truly kick in until the O/O is notified that the release is eligible.

Let's say the facility is compliant and found eligible. Next, the O/O files for reimbursement. Now, does the cleanup fund pay for everything or are there ineligible costs? Oh, before I forget, the Confusion Cleanup Fund has a number of filing requirements for various milestones throughout the process. If the owner operator misses the filing deadlines, the facility may not have FR or the FR coverage may be reduced.

No Guarantees

State and federal regulators must remember that the existence of a state fund does not guarantee FR. When we are not mindful of this fact, then we are setting ourselves up for potentially unpleasant surprises.

What can contribute to this surprise factor?

- If you have a state cleanup fund, or if you merely assess fees, and O/Os just assume they are in the fund.
- When there is much too much reliance on the state fund by regulators.
- When demonstrating FR means merely submitting a piece of paper to the state agency.
- When FR is demonstrated by having the O/O check off the appropriate box on a state form requesting, among other things, "Financial Responsibility, please check the appropriate box: ❑ self insurance; ❑ state fund; ❑ private insurance; ❑ letter of credit...

FR, Let's Make It a Priority

Okay, maybe it's me, but I was just thinking—If you made a list of priorities, on a scale of one to ten, with ten being the highest, FR, might be near or at the bottom. At or near the top, I think we can agree that we'd find tank construction and design and, of course, leak prevention and detection.

I maintain that we must move FR higher up toward the top of the priority ladder. Now try to stay with me on this. Like I say, I'm just thinking. So let me explore a few themes:

What can we agree on?

- For the time being, gasoline and diesel are necessary commodities.
- Gasoline is a flammable liquid.
- Gasoline contains an alphabet soup of nasty and allegedly nasty constituents (e.g., benzene, ethylbenzene, toluene, xylene, MTBE, and, the latest talk of the town, TBA) that find their way from USTs to our ground and surface waters.
- Tanks and piping often leak.
- Fuel can be spilled unintentionally (about 750,000 gallons per year at

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FR Stands for What? *from page 3*

gasoline stations alone ["The Holes in Our UST Systems," *LUSTLine* #30]).

- The quality and workmanship of the tank installer can play a part in the productive life of a tank.
- Leak detection and leak prevention methods do not always live up to our expectations.
- Tanks leak in all 50 states.
- Unfunded cleanup sites occur in all 50 states—and the government ends up paying.
- USTfields exist in every state.
- Owners and operators are supposed to have up to $1 million coverage for each release, because of the above-mentioned points and because cleaning up the environment and/or paying third-party damages can be kiss of death for an O/O's business.

If we agree on all of the points I've just listed, then it stands to reason we agree that FR should be a priority. FR means peace of mind. It may be the only thing that allows an O/O to stay in business after the discovery and remediation of a release. If an O/O has FR, then it should follow that he or she can expedite a cleanup. If the O/O has FR, then your state LUST program is less likely to have to foot the entire bill for the cleanup. If the O/O has FR, then it is less likely that his or her property will become an USTfield—why abandon a site when there is money available to clean it up?

FR and the Deductible

"I know," you are saying to yourself, "we have owners in our state that meet the FR requirements, they have the coverage, but they just can't afford the deductible." (I am including state fund deductibles, which range from a a few thousand dollars to $25,000 or more.) That comment always gets me thinking—If they can't afford the deductible, do they really have FR? How can O/Os avoid costly cleanups and pay third-party claims if they cannot meet the coverage the law requires?

I was **not** thinking the answer is state funds, which were never intended to be nor ever will be a panacea. As mentioned in an article titled "State Cleanup Fund Evolutions" in *LUSTLine* #21:

> "State funds began as formless answers to anxious prayers. They were the last great hope for tank owners who couldn't get or couldn't afford insurance, couldn't pay for cleanups, and essentially had no means for complying with federal responsibility requirements. They were the last great hope for getting contaminated sites cleaned up."

If an owner truly cannot afford the deductible, state fund or otherwise, he or she does not have FR.

No doubt, we are going to have to be creative if we wish to balance protecting human health and the environment with operating UST facilities. If you are uncomfortable shutting down a facility until or unless it has FR, then you cannot have the proverbial cake and eat it too. Something has to give—somewhere, somehow.

Can We Afford Not to Enforce FR?

When we look at what we store underground, near groundwater, over aquifers, it is not unreasonable to require UST O/Os to have the ability to pay for damages caused by the operation of their facility.

If FR is enforced, some stations may close, permanently. I know that's a tough call. On the other hand, if FR is enforced, private FR options may grow in your state. If FR is enforced, creative individuals, both public and private, may come together to develop ideas, which in turn may become solutions.

No doubt, we are going to have to be creative if we wish to balance protecting human health and the environment with operating UST facilities. If you are uncomfortable shutting down a facility until or unless it has FR, then you cannot have the proverbial cake and eat it too. Something has to give—somewhere, somehow.

We do have choices. We can give FR enforcement a chance to work and stand up to the challenges that come with it. Or we can leave it in the toolbox and deal with the consequences as they are discovered. Remember, if facilities operate without FR, then the O/O's problem **really** becomes everyone's problem.

And, for the time being, tanks still leak, and we are bound to find contamination. So why don't we make FR a higher priority? It's on the books, at our disposal, and mandatory—according to state and federal law. If enforced it may require closing facilities, it may stimulate creative ideas, and it may help the Mr. Gonnacarrodas of the UST world who have no lifelines left. I was just thinking. ■

Arthur M. Zontini is General Counsel and Compliance Manager for the Massachusetts Department of Revenue Underground Storage Tank Program.

[Author's note: This article contains the opinions and conclusions of the author and not necessarily those of the Department of Revenue.]

Check Out OUST's New FR Reference Manual

EPA OUST recently published a manual titled *Financial Responsibility for Underground Storage Tanks: A Reference Manual*, developed to assist state and regional UST program staff in understanding and reviewing FR mechanisms. Copies of the manual were sent to all states and EPA regions. It can be accessed at:
http://www.epa.gov/swerust1/pubs/frustman.pdf.

Leak Prevention

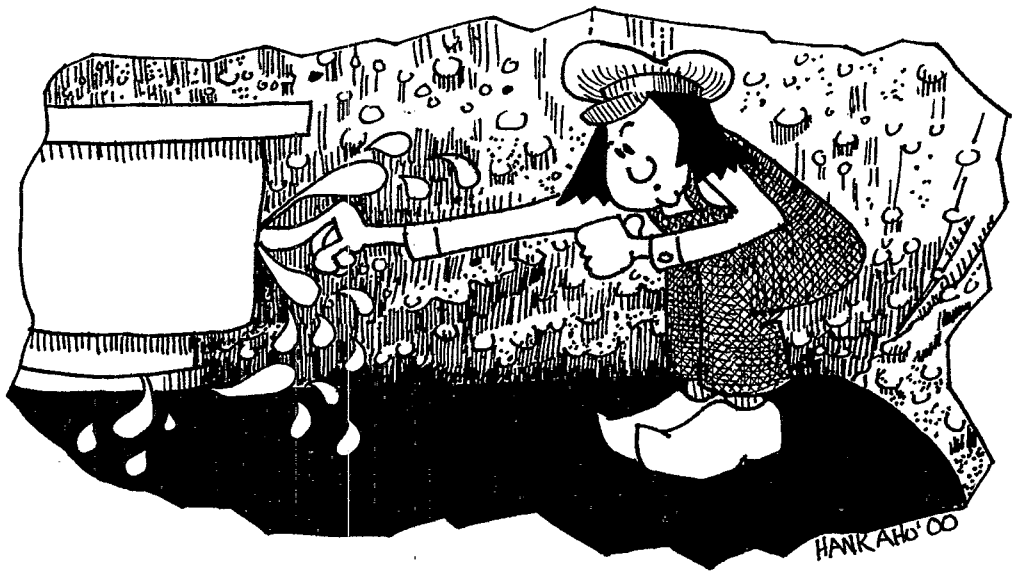
Tank-nically Speaking

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.

The Problem with Sumps

The following stories are true. Only the names and a few details have been changed to keep me out of trouble. Both incidents happened at state-of-the-art, double-walled storage systems with continuous interstitial monitoring.



Story #1

A Sigh of Relief Becomes a Groan of Despair

A line-leak detector is tripping frequently, so the owner calls his installer to come and have a look. The installer discovers a leaking union at the submersible pump and tightens it up. There is a small amount of product in the bottom of the sump, which the installer cleans up. The owner and installer are very glad to have secondary containment, because they have caught the problem in time, there has been no leakage, and so there is no need for a site assessment to determine the level of contamination. A few days later, however, product appears in a nearby drainage ditch. A review of recent inventory records for the tank with the newly repaired leak indicates that a substantial amount of product is unaccounted for. After some investigation and head scratching, the tank sump is filled with water. The water quickly disappears from the sump. As it turns out, the fitting that connects the bottom of the sump to the tank is leaking. Because the leak rate out of the sump is larger than the rate of product leaking into the sump, the product depth in the sump is never sufficient to trigger the sump sensor.

Story #2

A Chain Is Only as Strong as Its Weakest Link

The well water at a convenience store starts to taste funny, so a sample is sent to a lab for analysis. That funny taste turns out to be gasoline. The site had never had storage tanks until the current system was installed less than a year before. All primary system components reportedly tested tight. No alarms have been reported. The contamination assessment traces the product back to the middle of three dispensers, where a small amount of product is found in the sump. The only leak detection sensor in the system is located back at the tank top sump. For the leak to be detected, the product would have to accumulate in the middle dispenser sump, flow through the secondary piping to the first dispenser sump, fill this dispenser sump to the level of the piping entry, and then flow down the piping run to reach the tank top sump. For this scheme to work, all dispenser sump penetrations, all dispenser sumps, and all secondary piping must be liquid tight. Any weak link in the chain means the escape of product into the environment undetected. A water test of the middle dispenser sump reveals that there is a leak at a penetration fitting for the piping.

■ continued on page 6

Problem with Sumps *from page 5*

Based on comments from regulators from various parts of the country, it seems that these incidents are not unique and that similar stories are relatively commonplace. How did we get here?

Why Sumps Were Born

Initially, sumps presented a simple and elegant solution to an early problem in the implementation of secondary containment for piping. Putting pipe within a pipe was a simple enough problem to solve, but there was always the question of what to do when you got to the tank end of the pipe.

There were two issues: 1) What to do about terminating the secondary containment to enable leak detection, and 2) What to do about the single-walled section of pipe that remained between the submersible pump manifold and the beginning of the secondarily contained pipe. This single-walled section of piping almost invariably contained a union, and most everyone recognized that leaking unions were a problem. Leaks from the submersible pump itself were also a recognized problem.

The seemingly simple solution was to put a liquid-tight container around the entire submersible pump and terminate the secondary piping at the sump wall. This sump would serve as a containment vessel for leaks from the submersible manifold as well as from the immediately adjacent piping; it would also serve as a receptacle for any leaked product that might flow down the secondary containment piping. The sump could be equipped with sensors for leak detection, and any product that accumulated could be removed easily. It was a solution that was too good to be true.

However, the first sumps brought to market appeared to have been designed without a realistic appraisal of the challenges involved in building a subterranean, liquid-tight chamber with numerous penetrations that is surrounded by loose gravel and likely to be installed in a humid climate. The first such attempts were neither liquid-tight nor structurally sound, but they did demonstrate that the concept had merit.

Over the last decade, many generations of sump designs, penetration fittings, and methods of attaching the sump to the tank top have been developed, but it still seems that many of the designs, though they have benefited from some engineering expertise, are flawed.

Over the last decade, many generations of sump designs, penetration fittings, and methods of attaching the sump to the tank top have been developed, but it still seems that many of the designs, though they have benefited from some engineering expertise, are flawed.

Here Lies the Problem

The main problem with sumps has to do with keeping the sump liquid-tight. Areas of inherent "untightness" include the following:

- **Water entry via the lid.** Water entry via loose or inadequately sealed lids is most commonly the result of the infiltration of precipitation, but it can also be due to a very high water table. The challenge is to create a liquid-tight joint that can be made up and taken apart on at least an annual basis to test the line-leak detector. The joint typically relies on gaskets or flexible seals of some type, which is a problem because of the proximity of grit and dirt that can interfere with a proper seal. Pressure is also typically required to seal the joint, and finding ways to quickly and evenly apply pressure can be a challenge. Joints that are difficult to reassemble are not likely to be reassembled properly.
- **Water entry/product exit via fittings designed to seal around the pipe where it enters the sump.** The engineering of these fittings has improved greatly over the years, but the problem is often traceable to improper installation of the fitting. Problems range from drilling the wrong-size hole in the sump, to over- or under-tightening of clamps around the piping, to tearing the fitting a result of abuse or mishandling.
- **Water entry/product exit via electrical conduit penetrations.** This often occurs when the electrician is a separate contractor who does not understand the need to keep sumps liquid-tight and fails to use appropriate fittings to run the conduit through the sump wall.
- **Water entry/product exit via the connection between the tank top and the sump bottom.** Fiberglass tanks with factory-installed sump mounting rings to which the sump is glued seem to work pretty well (as long as the adhesive is properly applied), but steel and jacketed tanks that require the sump to be attached to the four-inch tank opening are often a source of problems. Because this joint is so critical to effective leak detection, a more fail-safe engineering solution needs to be developed.

Other problems stem from failure to properly support sump bottoms with backfill, choosing a sump or sump lid that is not suited to the field conditions (e.g., extremely high water table), and failure to properly repair holes that are mistakenly drilled into the sump.

Because water entry often leads to frequent false alarms and ignoring of alarm conditions, it is a significant obstacle to the effectiveness of secondary containment as a leak detection method. Product leaks from the sump, of course, completely defeat the purpose of secondary containment.

Solutions to the leaking sump problem include installing smaller retrofit sumps inside the existing sump, applying sealant compounds around the sump penetrations, and tearing out the old sump and starting over. Storage system owners frustrated by frequent water entry all too often resort to ignoring the problem entirely and thereby compromising their leak detection ability, or abandoning their secondary containment and utilizing potentially less effective leak detection methods, such as line-leak detectors and annual tightness testing. Problems associated with

product (and ofttimes water) leaking out of sumps typically go unnoticed until it is too late.

To Leak Is Human, to Detect Leaks Divine

In hindsight, is it any wonder that it is so difficult to keep sumps tight when we have had such difficulty keeping primary piping tight? Though there is certainly room for improvement in the engineering and installation of sumps, the possibility of leakage will always be present. Testing sumps at installation and periodically for the life of the storage system would seem to be a sensible approach to dealing with this issue, but such testing is not a widespread practice.

In reviewing the installation instructions from some of the leading sump manufacturers, I was surprised to learn that some instructions do not call for any testing of the sumps at installation, let alone during the life of the system. Florida currently requires sump testing at the time of installation, and California, in response to the problems described here, is heading down the road of requiring periodic sump tightness testing. The 2000 edition of PEI RP100 will specify that sumps should be tested according to the manufacturer's instructions before a facility is started up.

When Will It End?

I can hear the groans of storage system owners already: "Oh no, not another thing that I have to test! When will it end?" Let's face it, life is difficult. So do we accept that and deal with it? Or do we just complain? Operating a storage system responsibly is a task that requires dedication, perseverance, and money. Given the road we have chosen to travel with storage systems, there is no acceptable alternative.

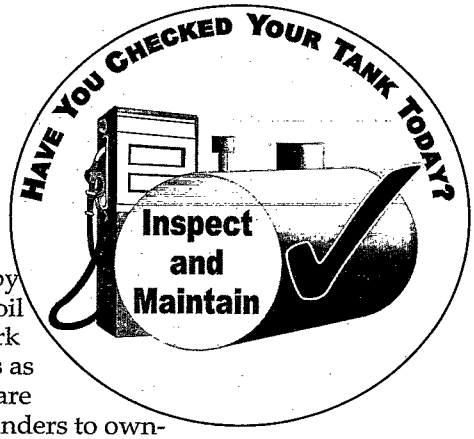
The Soap Box

The replacement (not upgrading) of bare steel tanks with corrosion-protected tanks has, at least for now, fairly effectively dealt with the issue of leaking tanks. I would venture to guess that better than 95 percent of today's leaks stem from pressurized piping. Though I doubt that anyone will take me seriously, I am convinced that if suction pumps were the dominant technology today, the leaking piping problem (which is what creates the need for tank top sumps in the first place) would not exist.

Suction systems still dominate in much of Europe, and I would wager that European gas stations are every bit as big and pump just as much product as American stations. Though many would consider it a step backward, it would clearly benefit the environment and, I believe, in the long term the tank owner, if we were to take a cue from our European brethren and adopt intrinsically safe suction systems as the product pumping system of choice.

A conversion to suction pumps is not likely to happen through regulation, nor is the petroleum marketing industry likely to adopt such a change voluntarily. But perhaps insurance companies (or maybe even state cleanup funds) could at least reward those who choose suction pumping systems by charging them substantially lower insurance premiums. ■

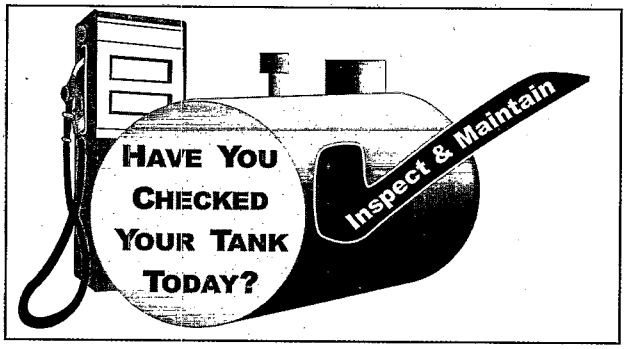
EPA Develops Two New Logos to Promote UST Operation and Maintenance

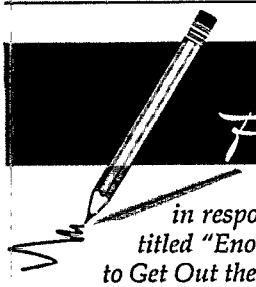


The EPA Office of Underground Storage Tanks (OUST), with help from the states and regions, has developed two new logos to promote routine UST system operation and maintenance (O&M). The logos can be used by regulators, equipment dealers, oil companies, and others who work with UST owners and operators as tools to encourage O&M. They are intended to serve as visual reminders to owners and operators that UST system O&M is crucial to day-to-day operations.

The logos can be used on anything that an UST owner or operator might see, including brochures, newsletters, manuals, letters, reports, application or notification forms, inspection forms, notices, certificates, stickers, permits, tank tags, delivery invoices, conference or training folders and materials, Internet sites, posters, banners, calendars, T-shirts, hats, key chains, cups...did we miss anything?

Logos can be downloaded from OUST's home page at www.epa.gov/OUST/ under the "What's New" button. If you have questions, contact Paul Miller at miller.paul@epa.gov.





From Our Readers

We received the following comments in response to a Tank-nically Speaking article titled "Enough with the Walking Softly, It's Time to Get Out the Stick!" in ***LUSTLine*** *#33.*

Paper Inspections Work Great!

from Carol Eighmey, Director of the Missouri Petroleum Storage Tank Insurance Fund

Marcel Moreau's article really "hit the nail on the head." It clearly makes two important points that have been axioms of the Missouri tank fund for years. First, one of the most effective leak prevention activities (or, as we call it in the insurance business, "loss prevention" activities) is careful and regular scrutiny of records. Second, tank owners will be motivated to keep proper records when there is a negative consequence for not doing so.

Missouri's Petroleum Storage Tank Insurance Fund is proof that both statements are true. Since 1992, tank owners who wanted to use the Fund as their "financial responsibility mechanism" have had to **apply** for coverage from the Fund. The application process requires that they send us a whole pile of documents—leak detection records, tank lining certificates, maintenance checks of line leak detectors, tank tightness test results, cathodic protection readings, and so on. We issue an insurance policy only after careful review of all of these documents. The policy must be renewed annually. So 12 months later, they have to go through the same routine!

This means that many UST sites in Missouri have experienced an annual inspection of their records for the last eight years. Our files contain an enormous amount of information about the operation of the site, which we can readily access in the event of emergency situations, such as when no one knows the source of the problem.

The big incentive that motivates the tank owner to keep up his or her paperwork and send it to us every year is the threat of getting the insurance canceled. That CANCELLATION NOTICE arriving in the mailbox gets the owner's attention. Frankly, giving the tank owner something he wants (insurance protection) motivates him to get into compliance—and stay in compliance—more readily than the threat of fines. Carrots work better than sticks.

We also physically inspect 10 percent of our insured sites each year to verify that what we're being told on paper is really how it is and to look for evidence of sloppy operating practices. (If we were an insurance company, our premiums would be based, in part, on our judgment of the diligence with which the owner/operator monitors his tank system and the degree to which his employees are trained. But, because we are a state fund, we charge everyone who demonstrates compliance the same amount.)

The Cost of Paper Inspections

By the way, since you asked about cost, the annual paper inspection costs us $61 per site (plus some overhead costs). We currently insure 2,615 UST sites, where there are 7,740 tanks, and 332 AST sites, where there are 1,392 tanks. All totaled, it costs us about $175,260 to do the "paper inspections" you describe. We pay $332 per site for the field inspections, so our annual site visits cost less than $100,000.

The paper inspections are done by a private company that is under contract to the Board of Trustees that manages Missouri's tank fund. Let me hasten to add that we also pay the company a fixed administrative fee each month. It's anybody's guess how much of that fixed fee supports the "paper inspections" (the company also provides other services), but my best estimate is that there's another $35 to $40 of overhead that should be added into the annual cost. This would make our real cost closer to $100 per site—still far less than a physical site visit. I'll wager there's no regulatory program in the country that achieves an equivalent level of compliance on more than 9,000 tanks for under $400,000!

So.... Thanks for reemphasizing the value and cost-effectiveness of "paper inspections." They work great!

Inspections Are Needed for Verification

from Brad Newton, Hydrogeologist, North Carolina Department of Environment and Natural Resources Division of Waste Management—USTs

You make some interesting points in your article, but I see one problem with paper-only inspections. Without an on-site inspection, how do you know that the UST system actually has any of the equipment required, such as spill/overfill or automatic line-leak detectors?

I went to a site in November that had tests from eight days prior showing that the mechanical line-leak detectors and sump sensors worked. When I opened the manhole to check the submersible pump, neither a line-leak detector nor a sump sensor was present—and this was a company with a good reputation to which I had never before issued a notice of violation.

I do agree that the majority of UST-system problems are paperwork foul-ups, but I don't see a way to find equipment violations without physically checking.

Moreau's Response: *Paper inspections will not eliminate the need for a field presence to verify the accuracy of paperwork. However, putting all your eggs in the field presence basket will not be effective either, unless you have the resources to visit every facility at least once a year.*

Leak Prevention

New California Law Focuses on the Human Side of UST Systems

by Shahla Dargahi Farahnak

"What's going to happen to the tank program once all the USTs are upgraded?" This question became a mantra among the unenlightened as the big upgrade compliance date of December 22, 1998, approached. Now that we are a year and a half past this date, it seems (as many of the enlightened could have foretold) that we are far from being done with the program. We are just getting ready to start "Underground Storage Tanks, Episode 2."

And we've learned a lot over the years. We've learned about those UST systems that were found to be leaking when uncovered as part of the upgrade activities. We've learned about those double-walled systems that were the victims of poor installation jobs, faulty secondary containment, or other problems. We've also learned that with the presence of fuel additives such as MTBE, it may no longer be a good idea to allow single-walled vapor recovery lines. (This area will await the results of our field-based research, probably in Episode 3.)

We've also learned that we've still got a lot to learn. So in California we have a new law (Senate Bill 989, signed into law effective January 1, 2000) that mandates us to do further research, implement new requirements, evaluate our enforcement authorities, and implement other program enhancements. What is different now from the UST movement of the late 1980s, as far as California is concerned, is that at this time we are not just focusing on corrosion protection, leak detection, overfill, or UST equipment, but are also emphasizing the human element.

We are looking at those who install, repair, maintain, and operate underground storage tank systems, as well as those who inspect them. We are looking for some means of ensuring that the people who do UST work have the training and knowledge to do the job right and that the knowledge does not get corroded over time!

Advice Heeded

In late 1997, we formed an advisory panel of local agencies, industry, tank owners, water agencies, and technical experts to evaluate the effectiveness of upgrade standards, study UST component compatibility and permeability with fuel additives such as MTBE, and identify the sources and causes of failures of new double-walled UST systems. Findings and recommendations of the work were published in three detailed reports and one summary report (January 1999—copies available at www.swrcb.ca.gov.

We are looking for some means of ensuring that the people who do UST have the training and knowledge to do the job right and that the knowledge does not get corroded over time!

The UST advisory panel report summarized its recommendations into 11 items, 9 of which ended up in Senate Bill 989. The two that were not included relate to compatibility and permeability standards and criteria; we plan to address those as one of the projects planned for 2000/2001.

Although the study revealed some areas of concern with respect to compatibility and permeability, those issues were not as problematic as some people had speculated. Instead, the nine recommendations addressed in the new law were thought to have the greatest influence on the effectiveness of UST systems, upgrade standards, and the tank program.

The comment period for the regulatory package for implementing Senate Bill 989 ends on July 18, 2000. We are also working on our 2001 regulatory package, which is intended to improve the existing requirements for leak detection and cathodic protection testing.

Highlights of the New Law

The mandates in the new law and the proposed regulations can be grouped into five major categories:

■ Training and Licensing

- **Installation contractors** We currently require installation contractors to have a contractor's license and health and safety training. However, with all the installation problems we have noted at new sites, this requirement does not appear to be adequate. We are looking into mandating that these contractors, as part of their licensing exam, take a test that evaluates their knowledge regarding UST systems and regulatory requirements. They will also have to have a certificate of training from equipment manufacturers and recertification every three years.
- **Contractors performing annual leak detection equipment certifications (required in California)** Contractors will be required to have a license, manufacturer's certification, and recertification every three years; use a prescribed form to report their work; and tag equipment they inspect and certify. Repair and maintenance contractors will be subject to similar requirements.
- **Tank owners and operators** Training and a certificate of training will be required. We will be working with the industry and local agencies to establish training standards and certification requirements for those who own tanks and those who are involved in the day-to-day operation of tank systems.

■ *continued on page 10*

■ New California Law *from page 9*

- **Local inspectors and other third-party inspectors** Training and certification will be required. The State Water Resources Control Board (SWRCB), in cooperation with local agencies and the industry, will establish training standards and certification programs for those who perform routine compliance inspections and inspect UST installations and removals.

■ Secondary Containment Testing

Now that I look back, I am amazed that it took us this long to require periodic testing of secondary containment, sumps, and spill containment boxes. Without such verification, tank owners are operating their UST systems with a false sense of security. Currently, we require testing of sumps, spill buckets, and secondary piping at the time of installation (our field evaluation shows that even this activity may not be happening at all sites) and before the system is put in service. After that, we just hope and pray that it will stay tight!

We will now require that secondary containment, sumps, and spill buckets be tested six months after installation and every three years after that—using installation standards and test methods. Most of the sumps and spill boxes will be tested using a 24-hour water-line test—fill them with water, mark the water line, and come back and check the water line again. Some systems, (e.g., double-walled systems that continuously monitor both the primary and secondary walls of the tank—brine-filled or vacuum-operated tanks) will be exempt from this testing. Licensed tank testers and installation contractors will be those considered qualified to do this work.

Secondary containment that cannot be tested because of inherent design (e.g., "open-trench" systems) will have a grace period if one-time, enhanced leak detection is implemented instead of secondary containment testing (discussed later). After that grace period, the system will need to be replaced with secondary containment that is testable, unless a testing method is developed during the interim period.

■ Dispenser Containment Boxes and Enhanced Leak Detection

- **Dispenser containment box** Currently required at all new installations, dispenser containment will now be phased in at all facilities, beginning with post-1987 facilities that are within 1,000 feet of public drinking water wells. In addition, under-dispenser containment must be continuously monitored and connected to an audible visual alarm.
- **Enhanced leak detection** All facilities with UST systems that have single-walled components (currently does not include vent lines and vapor recovery lines) within 1,000 feet of a public drinking water well will be required to implement "enhanced leak detection" every three years in addition to currently required monitoring. At this time, the only available technology to meet this proposed regulatory standard is the Tracer Tight test method (product of Tracer Research Corporation).

■ Enforcement

The new law requires us to review existing enforcement authorities and implement measures to enhance our enforcement—in California, the tank program is implemented by over 100 local agencies. We are also forming an enforcement unit that will investigate fraud related to upgrade compliance and assist local agencies with statewide enforcement issues.

■ *continued on page 11*

California Issues Advisory on Ethanol/UST Compatibility

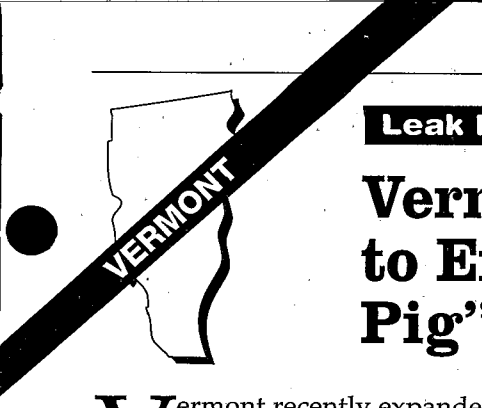
As California phases out MTBE in gasoline, the State Water Resources Control Board (SWRCB) suggests that ethanol is a likely replacement fuel oxygenate. In fact, gasoline supplies in some parts of the state already have ethanol concentrations as high as 10 percent by volume. Anticipating that more UST systems will store a gasoline/ethanol-blend fuel, in March the SWRCB issued an advisory to UST owners and operators regarding ethanol compatibility.

Based on the review of available compatibility testing information, industry literature, and other published research papers, the agency recommends that owners and operators verify the compatibility of ethanol-blend fuels with the following UST system components:

- Single-walled fiberglass tanks installed prior to 1/1/84;
- Single-walled fiberglass and flexible piping installed prior to 1/1/84;
- Lining material used to line old single-walled tanks for repairs or upgrades;
- Adhesives, glues, sealants, and gaskets used around the piping and other parts of the UST system (more of a concern for older systems, but may be an issue for new installations as well if the contractor failed to use the proper materials);
- Pump heads and other auxiliary equipment, including certain metals (e.g., aluminum, copper, some brass/bronzes), that come in contact with the product; and
- Older models of some leak detection equipment that may not operate properly or have parts that may wear out with exposure to ethanol-blend fuels.

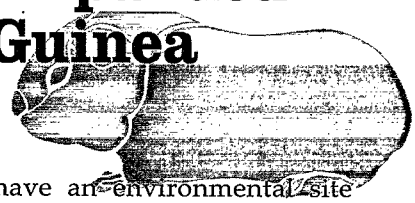
The advisory suggests that if owner/operators are unsure whether their current or future fuel supply contains or will contain ethanol, they should check with their fuel supplier.

If they do not have compatibility records in their files, they should ask their respective equipment manufacturer(s) for a written compatibility statement for ethanol-blend fuels before they begin storing that type of fuel. They should ask for information regarding the maximum concentrations of ethanol to which their system can be exposed, the industry testing standard, and the testing process by which the manufacturer supports the above statement. They should keep a copy of this information for their records. Owner/operators who have difficulty obtaining this information in writing from the manufacturer may seek assistance from their local UST-enforcement agency. ■



Leak Prevention

Vermont Loan Program Is Expanded to Encourage Upgrade of "Guinea Pig" Technologies



Vermont recently expanded its UST loan program to allow gas station owners to apply for loans to upgrade and improve their leak detection and piping systems. State UST program officials have discovered that some of the secondary containment and leak detection devices that were available in the late 1980s and early 1990s (the "guinea pig" technologies) have not performed as reliably as had been expected. Discussions with officials from other states confirm that it is a nationwide problem. (See "The Problem with Sumps" on page 5.)

A big part of the equation in Vermont is that manufacturers of secondary containment equipment did not sufficiently account for the effects of the annual freeze/thaw cycles to which underground equipment is subjected in Vermont. Furthermore, many installing contractors did not fully understand the new devices that became available in the 1980s and early 1990s.

Consequently, Vermont has a large number of documented cases where water has leaked into the piping system through piping containment sumps. Vermont has also found cases where, in far fewer instances, petroleum products have leaked through both the inner and outer walls of double-walled systems, creating a release of gasoline or another petroleum product into the environment.

Vermont's new law will allow the Agency of Natural Resources (ANR) to loan up to $40,000 interest free to any owner of a Category 1 one tank system who wants to replace first-generation leak detection and/ or secondary containment equipment with newer and more reliable equipment.

In 1989, the state legislature created its loan program (funded out of the Petroleum Cleanup Fund) to allow the ANR to provide interest-free loans of up to $40,000 to small-town and "mom and pop" gas stations and country stores with gasoline sales. The loans were to be used to assist the tank owners in replacing their old, high-risk gasoline tanks with newer double-walled systems that met the 1998 upgrade requirements.

This loan program has been tremendously successful—over the past decade, more than 150 small businesses and towns have taken advantage of it. The program was a major contributor to Vermont's achievement of 100 percent compliance with the federal upgrade requirement on the deadline date of December 22, 1998.

Home Heating Oil UST Loan Program Expanded

The new law also expands the existing residential grant/loan program for replacing underground tanks. Under a law passed in 1998, the agency could make grants or loans from the Petroleum Cleanup Fund of up to $500 to households with a gross annual income of $50,000 or less as an incentive to remove their underground heating oil tanks and replace them with less risky aboveground tanks or, in unusual circumstances, better-designed and safer underground tanks. The residential grant program was capped at a total of $50,000 in any one year.

In 1999, the ANR provided financial assistance to every eligible applicant. It had only 43 applicants, less than half of the maximum number allowed.

To encourage greater participation among households, the new law eliminates the $50,000 income cap, but still instructs the ANR to give priority to lower-income applicants. The law also raises the amount of assistance from $500 to $1,000 and raises the cap for the entire program from $50,000 to $100,000 per year.

The law also requires that anyone who benefits from a grant or loan must have an environmental site assessment performed to determine if the old underground tank leaked any petroleum products to the environment.

To learn more about either assistance program, call the UST Program at (802) 241-3888. ■

■ New California Law *from page 10*

■ Field-based Research

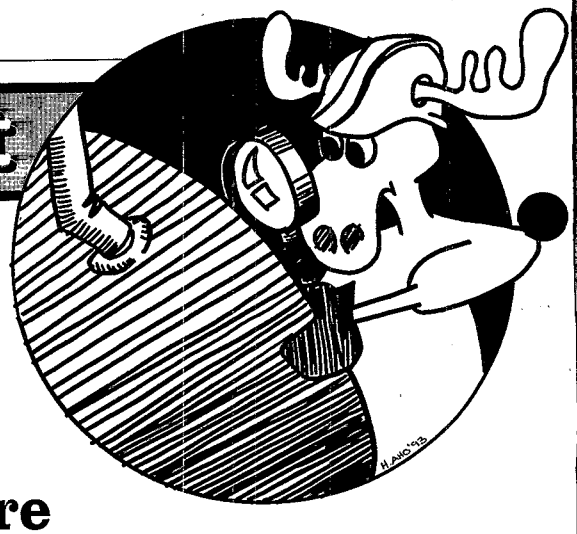
We still need to better evaluate our UST population with respect to effectiveness in preventing releases. We need to substantiate the relative risks associated with single-walled systems versus double-walled systems. Using field-based research we will randomly test 180 sites in six select regions in California and identify sources of vapor or product releases, pinpoint the location of these releases, and confirm the results. This evaluation will include three groups of UST systems: double-walled, single-walled, and hybrid (including fiber-trenched lines). This two-year study, under a contract with the University of California Davis and Tracer Research Corporation, will begin on July 1, 2000.

Walking Away with Better UST Systems

To my way of thinking, our UST program has taken its baby steps—we've tackled the basic problems with USTs. Now we are ready to walk through the new refinements to our rule. In the future, most likely at the conclusion of our field-based research, we may be able to start running. By then, I hope we'll be running in the right direction—full secondary containment! ■

Shahla Dargahi Farahnak, P.E., is Senior Engineer with the California State Water Resources Control Board's UST program.

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.*

The Tank That Never Leaked

Isn't It High Time We Made Sure USTs Don't End Up Where They Don't Belong?

Most people from "away" think of the entire coast of Maine as "Downeast"—down wind of Boston—but talk to a native Mainer and he or she'll more than likely point you in the direction east of Ellsworth, past all the crowds and souvenir shops that border the Acadia National Park region. The town of Lamoine is just the other side of Ellsworth, lying on a finger of land the glaciers laid down around 14,000 years ago.

Along with setting up some views of the "finest kind" of Mount Desert Island, the glaciers blessed Lamoine with the greatest natural gift of all—water. During the Ice Age, glacial meltwater flowed in streams under and through the ice, depositing sand and gravel on its way to the Atlantic Ocean. When the glaciers fully receded, those ice streams settled down as long, sinuous ridges of porous sand and gravel formations called "eskers" that are capable of storing large amounts of groundwater.

Along with their water supply value, eskers are excellent sources of sand and gravel for construction purposes (e.g., concrete, roadways). And Lamoine, like so many other sand and gravel towns across the nation, is pocked with gravel pits that, when all mined out, end up as big sandy bowls.

In the case of one particular gravel pit, conveniently close to an intersection of well-traveled roads, one entrepreneur built herself a small general store. After several years she sold the store to a new owner, who, based on some suggestions by his customers, decided to apply for a town permit to install gasoline USTs.

The Maine Department of Environmental Protection (DEP), which has the authority to register but not permit USTs, accepted the owner's UST registration form. No big deal, huh? Gas stations are built all the time, right?

> *I believe we need to begin talking seriously about siting and permitting USTs rather than sitting back and waiting for installation problems, operational errors, and plain poor housekeeping to keep sending some of these nightmare cleanups our way.*

Enter the Concerned Citizen

When word got out in Lamoine about this proposed gas station, a local organic farmer—who had moved to Maine and to this particular coastal community partly because of the clean water and the lack of gas stations—saw a potential problem. As with many grassroots efforts, this citizen educated herself about the esker/aquifer and the town's zoning ordinance, which allows for commercial development in this area, but only if there is no undue threat to the aquifer.

That one citizen was soon joined by many citizens, who then formed a group. They asked the town planning board to invite someone from the Maine DEP (guess who?) to visit Lamoine and help educate the community on potential groundwater threats from USTs.

And education is the operative word here. Because once the planning board became educated about aquifers and the potential threats that USTs present to the health and well-being of aquifers, they voted down the application. (See *LUSTLine* #32, "Convenience Is Nice, But UST Systems Aren't Potato Chips.")

Several weeks later at the appeals board meeting, the board members and over 90 townspeople were graced until the midnight hour with the combined wisdom of a bevy of geologists (including a university professor and yours truly) and lawyers representing both sides. They heard discussion on the pros and cons of siting a gasoline UST system over the aquifer. They also heard about an aquifer study the town had commissioned some years ago that addressed the importance of this potential water supply for future development of the community. The appeals board upheld the planning board's decision.

No Tanky, No Leaky

The current status of this story is that these tanks will not leak, because they will not go into the ground. The store has been sold to the owner of a large local supermarket/gas station. When asked what he planned to do at the site, he said he'd been following what the citizens group had been doing and definitely had no intention of installing any tanks.

He wants to draw people into the store by offering up homemade breakfast and lunch goodies—and lobster. Anyway, why would he want to put in a gas tank over an aquifer when there are many gas stations five or ten miles away in areas served by public water or not over an aquifer?

The 20/20 Hindsight Syndrome

Meanwhile, way down in southern Maine, where sand and gravel aquifers are more abundant, there was another situation in the town of Hiram—same story, different approach. The tale of woe began when a large oil company decided to move its regional fuel oil plant to a location with better highway access.

Because roadways tend to follow eskers and aquifers—well-drained soils and abundant road-building materials—the new location fell smack on an aquifer. And let's face it, there are plenty of towns and cities in this great country that are located on aquifers. When the population was smaller and water supplies seemed unlimited, groundwater protection wasn't such a big deal.

In Lamoine, the aquifer in question has been relatively free of environmentally threatening development, so why not keep it that way? But in Hiram, it's been harder to stay off the aquifer.

In Hiram, the town planning board did not solicit any technical assistance from the state. Although they had some loose groundwater protection language, they interpreted the risk to groundwater from the regional fuel oil plant to be minimal. The citizen's group was not able to organize until after the planning board had decided to give the go ahead for the permit.

So, the two 30,000-gallon USTs have gone into the ground, and the oil company is now trying to address the citizen group's concerns about release prevention from the tanks and piping and spill containment at the loading rack, where fuel is loaded and unloaded.

Who's in Charge of Keeping Environmentally Sensitive Areas Out of Harm's Way?

In both of the cases I've cited, the citizen groups howled at the DEP for its lack of rules to prevent the siting of USTs in sensitive groundwater areas.

At the start of our UST program in 1986, because we were not allowed to require outright prohibition of tanks in sensitive areas, we did set monitoring requirements for sensitive geological areas 300 feet from a private water supply, 1,000 feet from a public water supply, or sites over a mapped sand and gravel aquifer or recharge area. Now the state requires secondary containment and monitoring for all UST facilities but still has no siting prohibitions.

The sad fact is that at state and federal levels nationwide, the tools needed to truly protect groundwater are limited. On the other hand, local governments have the ability to exercise such controls if they see fit, but they often fail to do so for various reasons (e.g., lack of technical knowledge, lack of political will, need for an ever-increasing tax base).

I think many communities would welcome a state mandate that they could invoke (or blame) to prevent an unwanted situation. Meaningful source water protection siting requirements for storage of hazardous substances such as USTs could well be a welcome tool for community planning.

With urban sprawl, you can be sure that potential groundwater threats will also sprawl. In the last five years in Maine, of 125 new (not replacement) UST facilities installed, 56 have been sited in sensitive geological areas.

I believe we need to begin talking seriously about siting and permitting USTs rather than sitting back and waiting for installation problems, operational errors, and plain poor housekeeping to keep sending some of these nightmare cleanups our way.

During the last UST/LUST conference, I heard state UST regulators vent a lot of frustration about how UST owners and operators don't seem to care about operating and maintaining their facilities properly. Maybe next year we should start talking about adding siting to our quiver of arrows.

Such action, however, will require legislative buy-in and a massive educational effort. Or, it may require some great environmental disaster.

In Maine, as in other states, many legislators are concerned about MTBE and groundwater quality, but constituent concerns about potential "takings" tend to cloud the issue. Maybe it's time for regulatory agencies and legislators to listen to citizens who are concerned about groundwater protection. To my way of thinking, it is high time we made sure USTs don't end up where they don't belong. ■

See related article "Aquifer Protection Land Use Regulations Proposed in Connecticut" on page 23.

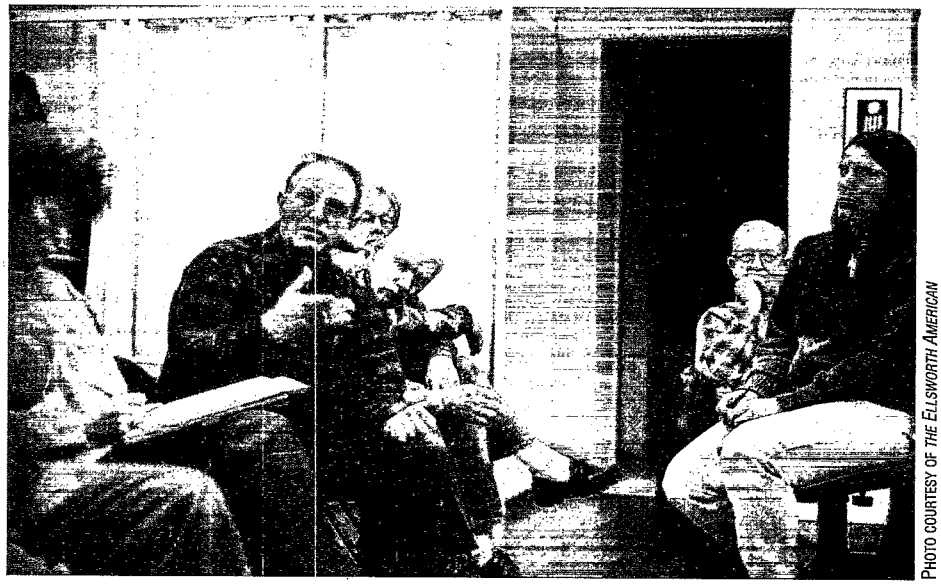


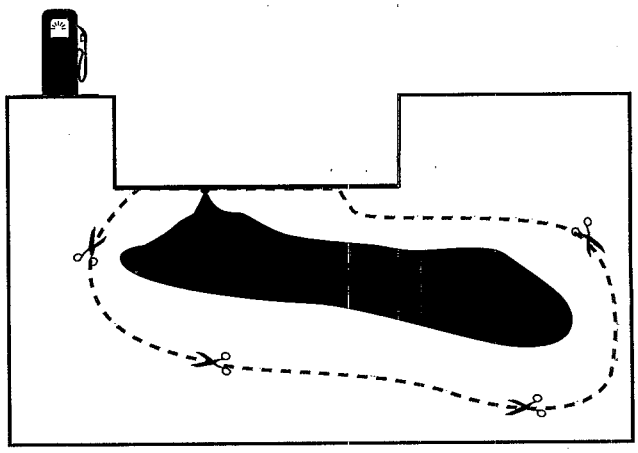
PHOTO COURTESY OF *THE ELLSWORTH AMERICAN*

Lamoine Planning Board meeting. Citizens discuss the future of their groundwater with respect to siting a new gas station in the town.

Investigation and Remediation

Source Control at LUST Sites

A Familiar Paradigm Returns to Center Stage



by Mike Martinson and Jeff Kuhn

A well-known paradigm has returned to center stage. The recent and unprecedented concern over methyl-tert-butyl ether (MTBE) and the nationwide recognition of its unique chemical characteristics have brought the well-accepted, yet often debated concept of source control back into focus. After veering away from this cleanup strategy, regulators are again recognizing that source control is the key to minimizing the impacts of petroleum constituents, particularly MTBE. We are again questioning how we can effectively recover petroleum free product (also referred to as LNAPL) to the "maximum extent practicable," thus meeting the federal requirement. A session at the 12th Annual UST/LUST Conference in Portland, Oregon, entitled "Source Control: Get It or It Will Get You," signaled the advent of renewed interest in source control.

Assess the Risk and Minimize the Impact

Source control of leaking underground storage tank (LUST) sites has been an issue in the LUST decision-making process for over a decade. According to U.S. EPA guidance (*How to Effectively Recover Free Product at Leaking Underground Storage Tanks Site*, September 1996):

> "each [petroleum hydrocarbon] release represents a potential threat to human health and the environment; appropriate remedial steps must be taken to assess the risk and minimize the impact."

"Assess the risk and minimize the impact"—that's easy to say. Over the past 10 or more years, however, actions designed to "minimize the impact" have varied widely, depending on the interpretation of state LUST regulatory programs and, sometimes, the corresponding solvency of state petroleum reimbursement fund programs. The "assess the risk" portion of this decision-making process has been even more disjointed from state to state, particularly in the early pre-risk-based corrective action (RBCA) days of LUST programs, as states varied widely in their risk-assessment approaches and risk-based decision-making policies.

Many of us who have followed the evolution of the LUST program since the late 1980s have observed several significant evolutionary trends that have led to the modern-day LUST program. These trends consist of the following:

- The pump-and-treat years,
- The RBCA and monitored natural attenuation (MNA) years—the application of risk assessment frameworks and the scientific principles and policy use of natural attenuation, and
- Most recently, the MTBE years.

The Pump-and-Treat Years

The increasing complexity of regulatory programs may be similar to the evolution of the earth, inasmuch as there is a tendency toward increased complexity in most federal programs. This complexity may be natural for many environmental programs that are driven by changes in scientific understanding and advances in technology.

The LUST program is no stranger to rapid evolution and increasing complexity. The program began with the simple, overriding concepts of "investigation" and "corrective action." These two terms are used extensively in the federal regulations. Along with these requirements is the simple mandate to recover free product to the "maximum extent practicable."

In the early years of the LUST program, states tried to achieve this standard for free-product recovery by using the accepted engineering tools of the time—pump-and-treat technologies and other total fluid extraction techniques, usually combined with excavation to remove highly contaminated source material.

Early types of engineered pump-and-treat remedial systems were very slow to meet the intended source reduction goals, and only slightly better at attaining source control or free-product recovery. System performance usually realized the recovery of a small fraction of the estimated free-product release. Operation and maintenance problems continually plagued well screens, well pumps, piping, and discharge treatment technologies, such as carbon filtration and air stripping.

Economics later played a large role in allowing many ineffective pump-and-treat systems to be taken off line when regulators realized that the high cost of recovering petroleum hydrocarbon mass, coupled with low hydrocarbon recovery, did not justify continued operation.

As new technologies emerged, the complexity of the LUST program continued to evolve, and a great deal of advancement in the science of petroleum remediation occurred. In situ treatment alternatives such as nutrient-enhanced and oxygen-enhanced biodegradation, soil vapor extraction, and air sparging were developed.

Better investigative methods were developed to meet the mandates of environmental regulations that require defining the extent and magnitude of the contamination. These mandates triggered the growth of the environmental industry as we

know it today. They also triggered a desire on the part of the petroleum industry and state petroleum funds to be more cost-conscious. Thus, the complexity of the program took another evolutionary step forward. Enter the world of RBCA and MNA.

The RBCA and MNA Years

In a sense, the LUST program grew wings when the principles of risk assessment were applied to LUST cleanups. RBCA was welcomed by EPA and state programs as a prioritization tool. While some saw it as a way to "do nothing," others saw it as a way to focus limited resources and help overtaxed state staff justify cleanup decisions through the use of risk-based decision making. It was obvious by the mid-1990s that state LUST programs could never adequately keep pace with the large number of cleanups arriving on their desks without a consistent and defensible prioritization tool.

The immediate answer to this overwhelming problem was risk assessment. However, RBCA actions designed to "minimize the impact" tended to be aimed at controlling BTEX/TPH plume migration and understanding plume behavior. Increasingly fewer source control remedial actions, including free-product recovery, occurred with any notable intensity, beyond initial tank and soil removal. In fact, engineered remediation systems became the exception as the RBCA era became the post-RBCA era, and MNA took on an increasingly larger life-cycle role in taking the typical LUST site to regulatory closure, or no further action.

The development of MNA filled the critical need for identifying sites where natural processes would successfully remove contaminants in a reasonable time period without significant expenditures for cleanup. Although MNA was a great step forward, free-product recovery was not strictly enforced in many cases, particularly when a demonstration of plume stability was provided via MNA methods.

MNA appeared to be acceptable, in many site-specific cases, even if the LUST life-cycle extended out several decades for closure. It also seemed logical to assume that the life-cycle of a petroleum release could be significantly shortened if more effort was placed on addressing the source area. EPA's MNA policy addressed this by emphasizing the importance of contaminant source removal to achieve regulatory standards and decrease the length of time required to attain site closure. However, at the present time, many states are still struggling with the question of what an acceptable time frame in which to apply MNA might be.

Some have likened the onset of MTBE to when the asteroid struck the Yucatan Peninsula, bringing the Cretaceous period to an end and ushering in a period of rapid evolution.

The development of MNA was the scientific response to RBCA that created a much-needed scientific standard for how sites, in the absence of active remediation, could be evaluated for groundwater monitoring only. The principles of MNA have been widely embraced by both EPA and the states and are now well accepted by state LUST programs. Research on aerobic and anaerobic biodegradation, which led to the development of natural attenuation guidance, helped establish a rational, scientifically defensible alternative to active cleanup at LUST sites.

Then MTBE hit.

The MTBE Years

Some have likened the onset of MTBE to when the asteroid struck the Yucatan Peninsula, bringing the Cretaceous period to an end and ushering in a period of rapid evolution. Perhaps the impact to the LUST program was not this severe. However, MTBE has eroded our complacency and lack of urgency in remediating BTEX/TPH petroleum hydrocarbon constituents. The cloud of dust has not yet settled, and LUST programs have already radically evolved to address the new challenge of fuel oxygenates.

MTBE did not fit the mold. It seemed to defy RBCA, MNA, and all of the tools on which the LUST programs came to depend. MTBE challenged the inadequacies of our site assessment tools and our hydrogeologic interpretations when we discovered that its plumes were thousands of feet long and "diving" beneath our monitoring well arrays.

Suddenly our view of groundwater science changed—and it changed rapidly. MTBE's chemical and physical properties brought with them the notoriety of not "behaving" like the more traditional BTEX/TPH petroleum hydrocarbon fractions typically found at LUST sites. On average, most BTEX/TPH groundwater plumes tend to extend no further than 300 to 400 feet from the source, even with free product present. This is not the case with MTBE.

Because MTBE does not readily undergo biological degradation, it does not fit into the standard BTEX model for MNA. Most experts agree that MNA is not going to limit the dimensions of an MTBE plume. Source control technologies are now thought to be the most effective means for limiting the spread of dissolved-phase MTBE—assuming remediation can be employed soon after the release occurs. This paradigm shift in source control emphasis is directly linked to the possibility that MTBE-contaminated groundwater will migrate, unchecked, off site—far off site.

Fortunately, and contrary to many fears, we are beginning to observe some levels of success in MTBE remediation. MTBE cleanup remains a formidable challenge both technically and fiscally, but its specter is slowly diminishing as discussions on phase-out and replacement alternatives continue.

Source Control—Get It or It Will Get You

This past March, and over 10 years following the inception of the federal LUST program, this paradigm shift to a greater emphasis on source control was recognized by EPA and state regulators attending the annual UST/LUST National Conference. In the "Source Control—Get It or It will Get You" session, each speaker provided a definition of "maximum extent practicable" from his own perspective and discussed various aspects of the difficulty of source control and free-product recovery.

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LUST Source Control *from page 15*

Recurring themes throughout the presentations included:

- Limitations of existing free-product recovery technologies,
- Risk-based decision making (RBDM),
- Control of plume growth and movement, and
- Cost-effectiveness and technical impracticability at low-permeability sites.

Some attendees expressed frustration with addressing cleanups at low-permeability sites and areas where nonpotable aquifers were present. The same frustrations have been shared by EPA, state LUST program managers, and consultants since the inception of the LUST program. Tools such as RBCA, MNA, and recent moves toward institutional controls have provided some relief.

Many of us at the conference felt a sense of déjà vu during the source control session. After all, didn't we have these discussions in the late 1980s and early 1990s as we all struggled with implementing strategies for state LUST programs and removing free product from some especially difficult LUST sites?

MTBE illuminated the fact that source control is still an important, and perhaps the most important, key to successful corrective action. Without it we can potentially waste valuable resources and time.

While there are many facets to the source control debate, free-product recovery has again emerged as the primary topic of discussion. LNAPL recovery is mandated by federal regulations but is subject to the interpretation of "maximum extent practicable" as determined by the implementing agency (40 CFR 280.64).

It is the definition of "practicable," generally regarded as "feasible," that has garnered differing opinions when it comes to implementing free-product recovery. Many would interchange "practicable" with "practical" or "sensible," but such interpretations are not the intent of 40 CFR 280.64, as evidenced by clarifying language in the preamble. The preamble clearly states that "the choice of 'practicable' in the federal regulation conveys that any limitation of free-product recovery should be technology based."

Although we anticipate that the debate over the interpretation of "maximum extent practicable" will continue into the foreseeable future, we are hopeful that state and EPA efforts will focus on the limits of existing technology, recognizing that new and better free-product recovery technologies will be forthcoming.

What Goes Around Comes Around

The national debate over MTBE and fuel reformulation has stirred up discussion and driven the LUST program on yet another evolutionary path. Interestingly, it's a path we all recognize from the infancy of the program—source control. Even in evolutionary theory, we recognize the "evolutionary survivors" and realize that they are far more complex than we thought.

But the complexity of source control stems from a simple, fundamental concept—clean up the heart of the problem first. After we break down all of the arguments, all of the inspiring advances in science and technology, the evolution of regulatory policy, and the important cost-control measures we have put into place, the simple goal of conducting "corrective action" at contaminated sites still remains.

MTBE illuminated the fact that source control is still an important, and perhaps the most important, key to successful corrective action. Without it we can potentially waste valuable resources and time. Source control has once again come to the forefront of our discussions in the LUST program. And that is exactly where it should be. ■

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Texas Pipeline Rupture Threatens Dallas Area Water Source

The U.S. EPA continues its cleanup efforts of a 500,000-gallon gasoline spill that occurred on March 9 from a pipeline that burst 35 miles northeast of Dallas. The gasoline represented about 2 percent of the daily flow through the 1,400-mile-long pipeline, which extends from the Gulf Coast to Chicago. The owner of the pipeline, Explorer Pipeline Company, is responsible for the cost of the cleanup.

Gasoline from the rupture washed over a rural area of cattle farms and fields before washing into East Caddo Creek. EPA is one of several federal, state, and local agencies involved in the cleanup of the creek, which feeds into Lake Tawakoni. Explorer has agreed to remove 30,000 cubic yards of contaminated soil along the creek.

The City of Dallas had shut down its water intake at the lake, which provided between 25 and 30 percent of its water supply. MTBE levels in the lake near the Dallas water intake have ranged from 0.67 ppb to 5 ppb. The City of West Tawakoni reopened its intakes at the end of March. The City of Greenville resumed pumping in late April.

The Dallas Water Utilities Department wants Explorer to compensate the city for all the emergency measures it has taken, including paying some of the cost of new pipelines. The Dallas City Council has approved a $12.5 million pipeline to bring additional water from Lake Ray Hubbard and $700,000 in consultant fees to study pollution of Lake Tawakoni from the March spill.

In late May, some Lake Tawakoni residents were still saying that they are suffering health problems because of the smell left by the spill; others fear that their property is contaminated. Explorer officials say that 20 to 30 residents in the area have contacted the company with complaints about the smell. One family was sent to a hotel for at least a week. MTBE levels in the soils range from undetectable levels up to 100,000 ppb. ■

Investigation and Remediation

New API Report on Characterizing Releases with MTBE Provides Useful Technical Information But Overlooks Important Regulatory Considerations

As oxygenate usage has grown, so have concerns about the potential impacts of these compounds on groundwater quality. A new American Petroleum Institute (API) report, *Strategies for Characterizing Subsurface Releases of Gasoline Containing MTBE*, publication 4699, uses the principles of risk-informed decision making to guide the assessment of sites affected by MTBE and other oxygenates. In bringing this publication to your attention, however, it is also prudent that we provide a regulatory caveat.

Although non-EPA guidances, such as API's publication 4699 may provide regional and state site managers, as well as the regulated community, with useful technical information, they may not be officially endorsed by EPA in that the agency does not necessarily agree with all their conclusions. In particular, all parties involved should clearly understand that such guidances do not in any way replace current EPA or OSWER guidance or policies addressing the remedy selection and implementation processes.

OUST's concern is that the document advocates more cursory levels of assessment and characterization than are warranted by a contaminant that behaves as MTBE does.

During development of this API document, OUST had the opportunity to provide comments. After a comprehensive analysis, OUST staff identified many areas with which they were not entirely comfortable. Of the approximately 20 major concerns expressed to the API authors, about half were satisfactorily addressed.

The unaddressed concerns that appear in the final version remain concerns to OUST. However, OUST is actively involved with the API workgroup developing training based on publication 4699 and is hopeful that the remaining issues will be resolved satisfactorily.

EPA Calls for More Detailed Assessment and Characterization

OUST's primary concern is that the document advocates more cursory levels of assessment and characterization than are warranted by a contaminant that behaves as MTBE does. Instead of going into a point-by-point critique, perhaps it would be more constructive to present excerpts of a January 18, 2000, letter from OUST Acting Director Sammy Ng, recommending that state programs begin to monitor and report MTBE contamination:

> "MTBE and other oxygenates behave differently in the environment than do the aromatic hydrocarbons, such as benzene, toluene, ethylbenzene, and xylene (BTEX). Therefore, conventional or traditional site characterization strategies and techniques designed to assess BTEX plumes may fail to detect MTBE plumes. MTBE is significantly less biodegradable than is BTEX, and MTBE does not sorb to aquifer material. As a result, MTBE moves farther and faster than does BTEX. Plumes tend to move deeper into aquifers as they move away from the source. Because MTBE plumes move farther from the source, MTBE may occur deeper in aquifers than does BTEX. Wells with short screens installed across the water table may fail to sample MTBE plumes. Conversely, wells with long screens may yield greatly diluted samples that mask the presence of MTBE and other contaminants.
>
> "To adequately characterize an MTBE plume, the focus must be on identifying its three-dimensional characteristics. Monitoring wells should be "nested" (that is, several wells installed close together with narrow screened intervals). The vertical distribution of hydraulic conductivity should be determined before a nest of permanent monitoring wells are installed at a new location. This can be done by examining core samples, by pressure dissipation tests with a cone penetrometer, or by miniature specific capacity tests in temporary push wells. The screens of permanent monitoring wells should be installed across the depth intervals with the highest hydraulic conductivity. If plumes appear to dive into the aquifer as they move down gradient of the source, the deepest well in the cluster should either be free of MTBE contamination, or be screened in material with low hydraulic conductivity that acts as an effective confining layer for the plume.
>
> "Because the potential area of the MTBE plume is much larger than for BTEX, there's an increased probability of encountering preferential migration pathways, such as sand stringers, fractures, and utility conduits. These pathways should be identified as they may provide avenues for plume migration that are either in unanticipated directions or at greatly increased rates over what is commonly expected based on ambient conditions. Monitoring well networks should be organized in transects that are perpendicular to groundwater flow. Well spacing in the transects should be relatively closely spaced to minimize the possibility of the MTBE plume migrating across the transect undetected.
>
> "As with most work to identify and solve a problem, the earlier you identify the problem, the easier the solution may be. That sce-

■ *continued on page 18*

New API Report *from page 17*

nario exists with monitoring and identifying MTBE contamination. If you identify the presence of MTBE in the early stages, remediating the site may be less costly and less complex than if you learn of (and remediate) the contamination at later stages."

The Framework of the API Report

Risk-informed decision making considers risk factors related to sources, exposure pathways, and receptors. The centerpiece of this approach is the development of a conceptual site model (CSM). A new decision framework developed by API helps the environmental site assessor to determine an appropriate starting point or an initial level of assessment from which the CSM can be confirmed.

The initial level of assessment is determined by the presence or absence of various risk factors. Sites with greater risk factors require the most intensive assessment of receptors, pathways, and sources. Sites with fewer risk factors warrant a more limited amount of assessment to confirm whether receptors, pathways and sources require further investigation. The level of assessment may be upgraded or downgraded as the CSM is refined. Important risk factors are discussed in the API report, along with descriptions of characterization tasks suggested for various levels of assessment.

The report also covers modern field assessment tools and techniques for rapid, cost-effective characterization and monitoring of MTBE in the subsurface. It describes how current expedited site assessment techniques can be applied to the collection and field analysis of soil, soil gas, and groundwater samples. A comprehensive guide to direct push assessment and monitoring tools, with emphasis on their proper use at MTBE-affected sites, is also provided.

In addition to presenting state-of-the-art strategies for MTBE site assessment, the report is a reference on the chemical and physical properties of oxygenates, their use in gasoline, and behavior in the subsurface environment. Analytical methods appropriate for MTBE detection are also discussed.

The publication, prepared for API by Eric M. Nichols and Steven C. Beadle of LFR Levine-Fricke and Murray D. Einarson of Connor Pacific/EFW, is available for download at www.api.org/mtbe. ■

Communication Among Agencies...How Good Is It?

by Greg Hattan

We recently found out how important communication among agencies can be. After the *60 Minutes* show about MTBE, the various bureaus within the Kansas Department of Health and Environment (KDHE) involved with MTBE got together to develop a press release to respond to the inquiries that we knew would be forthcoming. As a state, we felt we had done a very good job of dealing with the MTBE issue long before it was in the national spotlight. KDHE had been checking for MTBE at tank sites since 1991, MTBE has been a part of our routine Public Water Analytical for many years, and our first public well was shut down because of MTBE contamination in 1994. Our program had been active in remediation efforts and had three successful MTBE treatment systems in operation to treat water to be delivered for public consumption.

During a Division meeting, the director asked each bureau how many MTBE-impacted public wells had been identified. Each bureau had the same number, 18, that had MTBE contamination. We were very confident that we could answer any question. Bring on the media. Nothing could go wrong.

Oops!

KDHE is divided into several bureaus, including the Bureau of Environmental Remediation (BER) and a Bureau of Water (BOW). The BER includes the Storage Tank Section, which handles the remedial efforts at contaminated sites. The BOW regulates the public water supply facilities.

The Storage Tank Section has had very good relations with all bureaus, and we were confident that our communication with the bureaus was exceptional. Procedures for interagency communication included BOW-to-BER notification of any contamination from routine analyticals from annual public well sampling, and BER-to-BOW notification about any water supply impacts identified during site assessments. Evidently, because there is no MCL for MTBE, staff did not always recognize it as part of the list of chemicals for notification.

Surprisingly, the 18 public wells that BER had identified as contaminated with MTBE were not all the same 18 wells that BOW had identified. Fortunately, we discovered our inconsistency prior to the media release and before anyone was exposed to high levels of contaminants (levels were below the standard of 20 µg/L). Thus, in a matter of a few minutes, this discovery had increased our work load, and our staff members were off to identify more potential sites.

Information Bonuses

This communication glitch was the catalyst for even better communication among the bureaus. All gasoline constituents are now chemicals of concern in our internal bureau notifications. These notification procedures have increased the necessary paperwork but have also dramatically increased our confidence level.

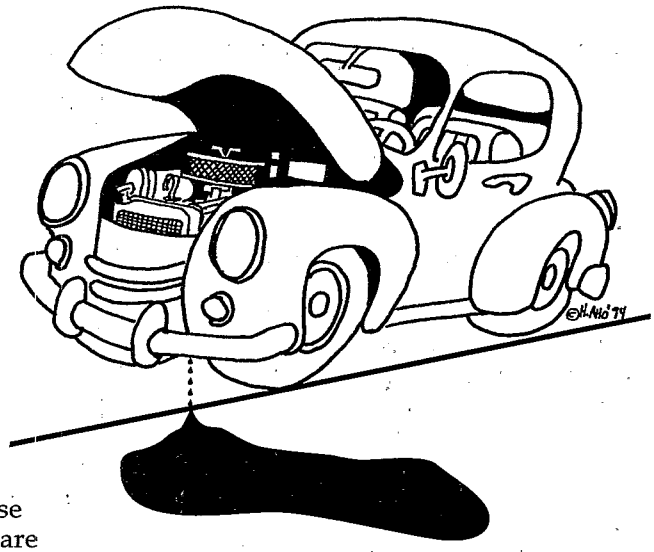
In addition, for those trying to identify suppliers and/or percent by volume of MTBE in gasoline, the Storage Tank Section opened a line of communication (as a result of a proposed ban on MTBE in the state) with our Board of Agriculture, Weights and Measures Department. We discovered that it performs about 2,000 random samples of gasoline each year as part of its fuel quality program. The analytical from these samples includes the supplier, location, and MTBE percent by volume. With one phone call, we now have a significant database of historical information on MTBE in Kansas. ■

Greg Hattan is Unit Chief with the Kansas Department of Health and Environment, Storage Tank Section.

MTBE

The Unintended Consequences of Small Spills of Gasoline with MTBE

by Peter Garrett



MTBE is now recognized as a widespread contaminant in groundwater in the United States. Throughout most of the late 1980s and the 1990s, it was often suggested that the problems associated with MTBE contamination of groundwater could be resolved with more stringent regulation of the nation's USTs and better enforcement of existing requirements. This argument centers on the premise that if tanks can be prevented from leaking, the MTBE problem will go away.

While well founded, this premise oversimplifies the situation. It is, of course, essential that we reduce the likelihood of releases from UST systems; however, the use of MTBE in gasoline has had unintended consequences that go beyond the technical issues of UST regulation.

Take small spills, for example. Data gathered by the state of Maine show that MTBE-contaminated groundwater can be attributed to small spills that are widespread and often unrelated to USTs. This is particularly disconcerting, given that about half of Maine's population obtains its water supply from domestic wells—the potential small spill receptors.

I'd like to zero in on such small spills. I'll restrict my discussion to Maine, partly because most of my work takes place in this state, and partly because Maine has investigated the presence of MTBE and other gasoline compounds in the state's drinking water in a study of almost all public supply wells and 951 randomly selected domestic wells. The message, however, is universal in its application, especially in rural states like Maine.

Common Features of Small Spills

Small spills of gasoline with MTBE have several features that separate them from small spills of gasoline without MTBE. Many of these features relate to the physio-chemical properties of MTBE, such as its high solubility (42 times as soluble in water as nonoxygenated gasoline) and its recalcitrant behavior in groundwater (because biodegradation rates are considerably slower than for other components of gasoline).

Common features include the following:

- **Sources of small spills are not perceived as a threat.** Sources of small spills are often regarded as "common" or "garden variety" and are either not noticed or not seen as important enough to report or remediate. For instance:
  - Many older cars have leaking gas tanks that drip slowly onto a driveway. Because gasoline is volatile, such increments of spillage usually go unnoticed for weeks or months, by which time several gallons may have been spilled.
  - When auto accidents happen, the rescuers are, understandably, less concerned about leakage of a few gallons from the gas tank than they are about the occupants, or about righting the vehicle, if need be, and removing it from the scene. Gas tanks generally hold between 12 and 25 gallons, some or all of which can be lost to a snow bank or to the ground.
  - Gasoline is often spilled when people are working on cars and trucks and small engines, such as those found in outboard motors, snowmobiles, snow blowers, ATVs, and lawn mowers.
  - Around the garden, people sometimes drain the gasoline from their lawnmowers at the end of a season, thinking, "What harm can a little gas do?" Gasoline is sometimes sprayed on the ground as a weed killer or poured down woodchuck holes to discourage the occupants.
  - When spills do occur, homeowners often ignore them. More than half of the small spills in Maine are probably in this category.
- **Gasoline stations are the locus of small spills on a daily basis.** For instance:
  - Fueling operations will commonly spill a little gasoline if the order is to "fill 'er up." Much of this spillage evaporates from the concrete or tarmac, but some may run off with rainfall onto a grass verge, down an improperly constructed monitoring well or tank cap, or into cracks in the paving.
  - Tank overfills still occur despite the best design of UST systems. Several tens of gallons can be lost during such events.
  - Small drips under-dispenser pumps are very common and create problems over time.

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Small Spills of Gasoline with MTBE *from page 19*

It is often difficult to pinpoint responsibility. The homeowner is clearly responsible for spills on the driveway or around the garden. However, not every homeowner is prepared to own up to such spillage. If remediation is required, the Maine Department of Environmental Protection (DEP) commonly completes the necessary work (e.g., installation of a granular activated carbon (GAC) filter or replacement of a well) at the expense of the state's cleanup fund.

Liability for spillage at an auto accident falls on the driver's insurance company, but only if the spill is reported. Many are not.

Liability for spillage at a gasoline station presumably goes to the station owner (even for self-service accidents), or to the fuel delivery company in the case of overfills. But specific overfills are difficult to prove, because their effects may take months or years to become manifest. Again, the mindset of "What harm can a little gas do?" prevents the reporting and cleanup of the spill.

Domestic wells are often the receptors. Small spills are the principal cause of contamination of domestic wells by MTBE. Because small spills typically occur in the driveway or garden, many are also close to the domestic well that serves the household. Many domestic wells are located close to the driveway, because it is a convenient location for the drilling rig. In neighborhoods with small lots, such small spills have been known to contaminate more than one well.

MTBE is commonly the only gasoline component detected. Perhaps the most distinctive aspect of small spills of gasoline with MTBE is that MTBE is the only gasoline component detected in water samples drawn from wells. This fact is remarkable for the following reasons:

- MTBE constitutes up to 15 percent of gasoline (highest concentrations are in winter fuels);
- Other components of gasoline can be detected by standard laboratory methods to the same concentrations (1-5 μg/L) as MTBE; and
- Concentrations of MTBE alone in groundwater are sometimes 1,000 μg/L or higher, without evidence of any other component of gasoline.

This last point is probably due to several factors that may operate independently or as a group to produce a plume of MTBE in groundwater. These factors include the following:

- Other components of gasoline, because their octanol/water coefficients are higher (i.e., more oily), are more likely to be retained on soil particles than is MTBE;
- MTBE, because of its considerably greater solubility, is more likely to dissolve in rainwater, which then recharges groundwater; and
- Other components of gasoline are rapidly biodegraded in the aerobic conditions of most soils.

The greater volatility of MTBE is not necessarily a factor in removing it from the ground surface before it is washed through the soil. Presumably, if a spill is small enough, it will not overwhelm the capabilities of the soil to aerobically biodegrade the non-MTBE components of gasoline in the vadose zone. MTBE, being very soluble in water and not very biodegradable in groundwater, tends to be carried through the soil zone to the water table, where it may well move on as a single component in groundwater, forming an MTBE-only plume.

Small Spill Tales

The following examples are taken from several well-studied sites in Maine, where gasoline spills are either known to be small, or are presumed to be small. They are arranged in an order of decreasing spill size and, coincidentally, from gasoline station to what one might consider domestic spills.

A newly constructed, state-of-the-art gasoline station. During site preparation for this new facility, bedrock, at a depth of a few feet below grade, was blasted to make space for the tanks. The tanks were double-walled fiberglass. The piping was also double-walled. A few years after it was put into service, another gasoline retailer was considering the site for purchase. An environmental consultant tested the monitoring wells and found contamination.

Contamination near the tanks included some other components of gasoline, along with 1,000-7,000 μg/L of MTBE. Wells monitored at some distance from the spill site contained only MTBE. Because the site was located close to a groundwater drainage divide, where bedrock is close to the surface, the contaminant plume probably moved downward and then laterally through fractured rock, and finally out into a large sand and gravel aquifer toward the public supply wells (700 and 1,100 feet away) that continued to pump throughout this period.

Concentrations of MTBE samples taken more than 500 feet from the spill site were less than 10 μg/L. This decrease in concentration with distance may have been the result of some dispersion of the plume, or of placement of the monitoring well screen elsewhere than in the center of the plume.

The UST installation was subjected to a series of tests that found it to be tight. Some evidence pointed to the source of the contamination as a tank overfill spill. The amount of product lost was probably 10 to 20 gallons.

A car overturned into a ditch. This incident happened in December 1997 on a slippery road. When the car was righted, it had lost some of the contents of its gas tank (7-12 gallons total) through the accumulated

For Information About Safe Gas Handling...

Regulatory agencies and oil companies and distributors need to get the word out about the importance of handling petroleum products in safe and environmentally responsible ways. ***LUSTLine*** #31 includes "Tips for Keeping Your Gasoline and Household Chemicals Out of Your Water Supply" as part of the article "A Little Drop'll Do Ya" by David McCaskill. Some safe gas handling Web sites include the following:

- The Alliance for Proper Gasoline Handling: www.gas-care.org
- American Petroleum Institute: www.api.org/consumer

snow pack. Local residents alerted the town's police and fire departments about the potential for well contamination from the spilled fuel, but their concerns were not taken seriously. The spill was neither cleaned up nor reported to the state.

In May 1998, after a few weeks of spring thaw, a nearby homeowner complained that the water pumped from his domestic bedrock well had a foul odor and bad taste. When tested, the well water had 6,500 μg/L MTBE, with no other gasoline components detected.

In each of these cases, the amount spilled must have been small and was not noticed until the contamination appeared in somebody's well.

A site investigation revealed gasoline-saturated soil from the ground surface to the top of the bedrock, a depth of nine feet. Soil contamination levels ranged from 2,500 ppm (by photoionization detector) at the surface down to 230 ppm at the bedrock surface.

The soil was characterized as a sandy, bouldery glacial till. Bedrock was described as highly fractured. The land sloped from the spill site toward a lake 2,100 away and, topographically, 110 feet below the spill site. The groundwater gradient averaged 0.05. Eleven other nearby domestic wells were found to be contaminated above Maine's 35 μg/L primary drinking water standard for MTBE. GAC filters were installed on most of these wells.

Remediation entailed the removal of 80 cubic yards of gasoline-contaminated soil, leaving only a small amount of such soil under the roadway. The domestic wells were pumped at domestic rates only. No other efforts were made to pump and treat contaminated groundwater. The result of this remedial action was that MTBE concentrations declined rapidly, so that within 17 months, all wells were below the 35 μg/L standard, but above the state action level of 25 ppb.

The state calculated that it would be more cost-effective to extend nearby public well water than to maintain point-of-entry treatment systems for an estimated three years, by when MTBE levels would be expected to drop below 25 ppb. The cost to the state for providing the water main extensions to 15 homes with contaminated wells was $250,000.

■ **A coastal village, where most of the homes are built on shallow granite bedrock.** All of the homes have private wells, most of which are drilled into the rock. Lots vary in size from one to several acres. The village has one gasoline station, which has not experienced any gasoline spills or been associated with any contamination detected in nearby domestic wells.

The village became the subject of investigation as a result of two fuel oil spills in 1992. As sampling efforts expanded, a number of wells were noted to have other types of petroleum contamination besides BTEX. Some wells had MTBE. Now, after several years of semi-annual sampling, approximately 250 wells have been sampled at least once. Most have been sampled many times, some as part of a 16-week intensive study of the effectiveness of water treatment systems.

After nine years of sampling—with 1,485 samples taken, many from the same wells—the results are as follows:

- Groundwater contamination with non-MTBE components of gasoline is rare, and concentrations are always close to detection.
- MTBE has been detected in only about 22 percent of all samples taken. Eight percent have between 2 and 5 μg/L MTBE. Ten percent have between 5 and 35 μg/L. Four percent are above the Maine standard of 35 μg/L. The highest concentration recorded was 680 μg/L.
- Where the sampling has been weekly (in one case), the contamination peaked in four weeks, then dropped to below the 35μg/L standard after about six months.
- There have been at least four small spills of gasoline with MTBE in the village between 1992 and 1999. Other spills may have occurred before sampling became widespread or have not been discovered or separately identified. In each of the four identified spills, more than one domestic well had MTBE above the 35 μg/L standard for at least one sampling event.

The circumstances associated with each of the four small spills were as follows:

Spill 1 - A saddle tank, which had been removed from a pickup truck with some gasoline still in it, was placed on a ledge in the backyard. It was later found to be leaking slightly. The amount of gasoline lost was unknown.

Spill 2 - A car was parked in the yard 20 or more feet from a domestic drilled well. After the contamination was discovered, the car's gas tank was found to have a pinhole leak. The amount of gasoline lost was unknown.

Spill 3 - The homeowner recalled that a car hit her business sign one night a few weeks before the contamination was discovered. She was not aware of any gasoline spill.

Spill 4 - The homeowner with the highest concentration of MTBE contamination could not recall any incident when gasoline was spilled, nor could the neighbors.

In each of these cases, the amount spilled must have been small and was not noticed until the contamination appeared in somebody's well. Indeed, "We have met the enemy and it is us."

Effects of Small Spills of Gasoline with MTBE

The effects of such small spills of gasoline with MTBE, as experienced by the Maine Department of Environmental Protection, other state officials, gasoline retailers, their consultants, and homeowners, include the following:

■ **MTBE cleanups that mean extra costs for taxpayers and the state.** Maine's Groundwater Oil Cleanup Fund, which is replenished by a tax on all petroleum products imported and sold in the state, supports the positions of many state enforcement and technical personnel

■ *continued on page 22*

Small Spills of Gasoline with MTBE *from page 21*

who are involved in petroleum cleanup and reimburses for cleanups by other parties. Because spills of gasoline with MTBE cause more widespread contamination than similar spills without MTBE, the fund is liable for higher cleanup costs.

■ **Absence of a known responsible party which means no reimbursement to the state fund.** Reimbursement to the fund is sought in cases that are not covered by the state. Because many small surface spills that are not covered by the fund lack a clearly documented responsible party or parties, it is usually impossible to seek such reimbursement. In any case, homeowners typically carry no pollution insurance and are usually unable to pay remedial costs. Thus, the fund must be replenished by higher taxes paid by the petroleum consumers of the state.

■ **Public uncertainty regarding toxicity and cleanup standards** One difficulty in dealing with MTBE as a groundwater contaminant is absence of a federal maximum contaminant level (MCL). Many states, including Maine, have resorted to establishing their own standards, but they vary greatly from state to state. Some standards are as high as 200 μg/L. California and New Hampshire recently adopted primary standards of 13 μg/L. New York's enforceable guidance criterion is 10 μg/L.

The confusion that this uncertainty engenders has resulted in distrust by the public of any number given to them by public officials. And because the standards are subject to frequent change, and are supplemented by policy numbers, such as Maine's "action level" for remediation of 25 μg/L, the confusion continues.

There is considerably less confusion regarding MCLs and action levels for gasoline components such as BTEX. The federal MCL for benzene, for example, has been 5 μg/L since at least the mid-1980s. Maine's health-based Maximum Exposure Guideline for gasoline range organics has been at 50 μg/L for just as long.

■ **Worry as an associated health effect.** Confusion causes worry, which, in turn, can affect health. For example, a retired couple, both smokers, decided to make a big lifestyle change. They chose a simpler, more rural lifestyle, built a new home in the country, started raising organic beef cattle, and gave up smoking. Then their well was hit by MTBE contamination at concentrations that they could taste and smell (>40 μg/L).

Public officials were unable to assure the couple as to whether their water was safe for drinking or bathing. Although a GAC water treatment system was installed, there was still no assurance that contamination would not break through. The whole situation drove the couple back to their cigarettes. It is quite possible that the worry and the smoking were worse for their health than the MTBE might have been, but...

■ **Diminished property values.** It goes without saying that property values fall for homes that have contaminated wells. Some properties become devalued simply because of the stigma associated with being located in a neighborhood where MTBE contamination has occurred. Because spills of gasoline with MTBE—even small spills—spread much farther than spills without MTBE, the combined loss of property values must also be greater.

Beware Spilling Any Gasoline...

In the days before MTBE, we could afford to be a little careless with small spills of gasoline, because gasoline components rarely showed up in groundwater. With MTBE in the mix, however, even small spills—sometimes too small for homeowners to notice—can cause contamination of groundwater and nearby wells with MTBE above any state's drinking water standard. ■

Peter Garrett, Ph.D., is Vice-President with the firm of Emery and Garrett Groundwater, Inc. in Waterville, Maine. Peter can be reached at PeterGarrett@eggi.com.

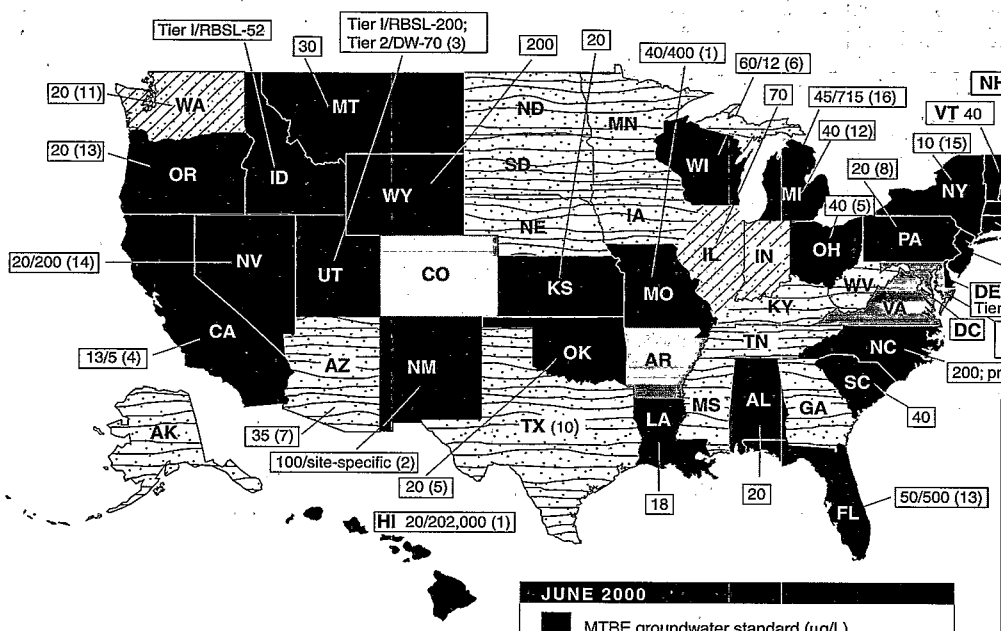
New API Research Bulletin on Small Spills

The American Petroleum Institute (API) contracted with the U.S. Geological Survey to create mathematical model simulations to predict the extent of groundwater contamination at gasoline-release sites where chronic and single small-volume releases of gasoline remain trapped in the unsaturated (vadose) soil zone. A vadose-zone transport model was used to predict loading rates and breakthrough times of MTBE and benzene at the water table as a result of small-volume gasoline releases. The report, *Simulation of Transport of Methyl Tert-Butyl Ether (MTBE) to Ground Water from Small-Volume Releases in the Vadose Zone* will be available at API's technical bulletin Web site at www.api.org/ehs/sgres-bul.htm in June.

Simulation results indicated that groundwater recharge had the greatest effect on mass-loading rates to groundwater, because diffusive transport is limited in the capillary zone. Diffusion to the atmosphere and biodegradation also significantly affected the amount of contaminant mass available to enter the groundwater. Recharge can limit mass losses to the atmosphere, especially in fine-grained soils.

For benzene, biodegradation in the vadose zone was a substantial limitation on mass loading to groundwater. Water that recharges an aquifer beneath a release site can, therefore, be enriched in MTBE, relative to benzene, compared to water that is in equilibrium with gasoline. Model-simulated breakthrough times for MTBE at the water table ranged from days to hundreds of years, depending primarily on depth to groundwater and soil type. ■

State MTBE Groundwater Cleanup Levels for UST Sites: Current and Proposed (June 2000)



FOOTNOTE LEGEND

(1) - Cleanup level dependent on GW use as potable/non-potable
(2) - Cleanup level/enforceable site-specific standard possible for drinking water
(3) - Tier 1-RBSL cleanup/action level/Tier 2 drinking water cleanup level
(4) - Public Health Goal (PHG)/enforceable secondary standard
(5) - Action level
(6) - WDNR NR 140 Enforcement Standard/Preventative Action Limit goals
(7) - Health-risk guidance level; not enforced for LUST cleanup
(8) - Groundwater resource used as drinking water
(9) - Cleanup level/action level (i.e., ME 35/25)
(10) - No PST cleanup level/non-PST aesthetic guideline level at 15 µg/L
(11) - Method A MTBE groundwater cleanup level at 20 µg/L
(12) - Tier 1 RBSL level based on aesthetics, effective March 2000
(13) - (OR): drinking water guidance standard; (FL): rule—potable/non-potable
(14) - Interim action MTBE levels (i.e., NV 20/200)
(15) - Enforceable guidance criteria
(16) - Proposed closure level: residential/nonresidential

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Contact: Mike Martinson (mmartinson@deltaenv.com).
This map can be accessed at U.S. EPA OUST's MTBE Web site: http://www.epa.gov/swerust1/mtbe/mtbemap.htm.

Aquifer Protection Land Use Regulations Proposed in Connecticut

As part of its continuing effort to protect the state's drinking water resources, the Connecticut Department of Environmental Protection (DEP) has released proposed aquifer protection land use regulations. The proposed regulations would increase protection for critical areas associated with the state's highest-yielding public water supply well fields (in sand and gravel aquifers).

DEP estimates that roughly 2 to 3 percent of the land area in Connecticut would be subject to these regulations. The proposed regulations are intended to protect drinking water supplies through the regulation of activities that could contaminate public water supply aquifers. The proposal would require municipalities to designate scientifically identified aquifer protection areas on municipal zoning maps and adopt compatible regulations for local implementation.

The proposal identifies certain existing activities that must register with a municipality and implement pollution prevention-related activities. Such activities include specific types of entities, both business or government, that use or generate hazardous substances, hazardous wastes, bulk pesticides, or petroleum products (e.g., chemical manufacturing industries, gasoline stations, vehicle repair shops, and dry cleaners).

Included in the proposed regulations are prohibitions of siting higher-risk activities as new uses and administrative procedures to allow existing regulated activities to expand and modify. The only prohibition associated with expansion of an existing business is the increase in the number or capacities of underground storage tanks for hazardous materials, including petroleum products.

The proposal prohibits the installation of heating fuel tanks for commercial purposes within these critical areas and the installation of #2 residential heating oil USTs within 500 feet of the nearest water body. A procedure for exemption from prohibition is also proposed.

In drafting the proposal, DEP received and considered input from many interests, including an advisory committee that convened specifically for this proposal. ■

MTBE

Connecticut Survey Finds MTBE-Contaminated Heating Oil and Diesel Fuel Statewide

by Gary A. Robbins and Peter Zack

In the June 1999 issue of *LUSTLine* ("Evidence for Contamination of Heating Oil and Diesel Fuel with MTBE"), we introduced preliminary evidence on the occurrence of MTBE in heating oil and diesel fuel, based on a review of case files at the Connecticut Department of Environmental Protection (DEP). Although MTBE is not intentionally added to heating oil or diesel fuel, investigators have been finding it at sites where heating oil and diesel fuel releases have occurred (reported MTBE contamination in groundwater was as high as 4,100 ppb). To find out how widespread the occurrence of MTBE in these fuels is, the University of Connecticut Hydrogeology program joined forces with the DEP to sample heating oil and diesel fuels at various locations throughout the state.

Since last summer, we have sampled heating oil and/or diesel fuel from 26 locations for heating oil and 5 locations for diesel fuel. These locations included residences, service stations, and repair garages around the state. We conducted temporal monitoring at three of these homes, a repair garage, and a service station. We also sampled four terminals. We found the following:

MTBE was found in all heating oil samples. Concentrations ranged from 10 to 906 mg/L. The statewide distribution appeared to exhibit a spatial trend. Concentrations tended to increase the farther away they were from terminal locations. This suggests that fuel contamination could occur when heating oil commingles with gasoline in bottom-loading tanker trucks.

All the diesel samples (obtained from five service stations representing different oil companies) were found to be contaminated with MTBE. Concentrations ranged from 73 to 119 mg/L.

Based on our calculations, commingling of heating oil or diesel fuel with gasoline in ratios of several thousand to one result in observed contamination levels. Mixing just two gallons of gasoline (with 11% MTBE) with about 5,000 gallons of heating oil, results in the average heating oil concentration we observed in our statewide survey (32 mg/L).

Fuel concentrations in samples obtained at terminals were at concentrations as high as 53 mg/L. Our highest levels were obtained from heating oil samples taken from a barge (that shipped only heating oil) that had just arrived from an out-of-state refinery.

Contamination by commingling of fuels may occur at refineries, on ships and barges, on bottom-loading tanker trucks, and during fuel shipment by pipeline between terminals. Our data and observations suggest that there is a low likelihood for on-site terminal pipeline contributions (at terminals the fuel lines are segregated).

MTBE concentrations in heating oil and diesel fuel at monitoring locations exhibited over an order of magnitude variation during a nine-month monitoring period.

Significant losses (likely by volatilization) of MTBE occurred while fuel was stored, unused, in tanks over a three-month period.

The Implications

As part of this study, we developed a GC method for analyzing low levels of MTBE in fuels. The method entails fuel/water equilibration. An aliquot of the water is equilibrated with air, and the MTBE concentration in the water is determined using static headspace analysis. Using a fuel/water partition coefficient, the concentration of MTBE in the fuel is then determined. A special GC column is used to prevent coelution of the MTBE with other compounds.

The MTBE concentrations we observed in heating oil and diesel fuel were clearly many orders of magnitude lower than those blended into gasoline (typically over 100,000 mg/L). Yet, given the concentration levels we detected, if the fuels were equilibrated with water, they could result in MTBE concentrations in water that are on the order of thousands of ppb.

We predicted this relationship by using fuel/water partition coefficients from the literature (K_{ow} = 10 to 20) and coefficient values we determined during this study. Note that we actually observed these levels in performing fuel/water equilibrations. Although these concentrations are far in excess of regulatory standards, the extent to which a significant groundwater problem might arise depends on many factors, not just the fuel concentration.

A Word to the Wise

Our findings suggest that MTBE contamination of heating oil and diesel fuel is widespread in the United States. Other fuels may also be contaminated. Our findings certainly support the need for routine analysis of fuel and groundwater for MTBE at sites where fuel releases have occurred.

Our temporal data indicate that if fuel releases occur over extended periods, MTBE concentrations in groundwater at the source might exhibit significant variations. This fact should be kept in mind when attempting to identify contaminant sources.

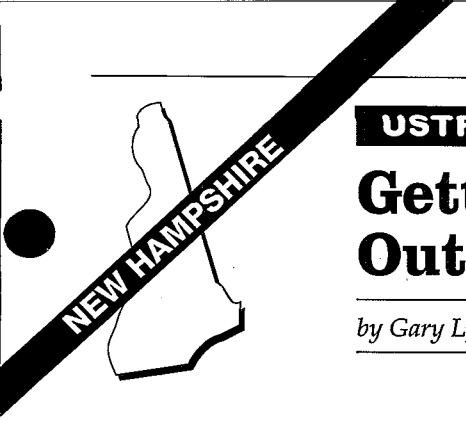
When a well is found to be contaminated with MTBE, focus is generally placed on investigating gasoline sources. Our work indicates that significant levels of MTBE contamination can stem from heating oil and diesel fuel releases. Thus, these potential sources should also be thoroughly investigated.

In Connecticut, we are documenting MTBE-contaminated wells resulting from heating oil and diesel fuel releases. We suggest that other states pay attention to these sources so that we can begin to establish a baseline for evaluating the severity of such problems.

For More Information

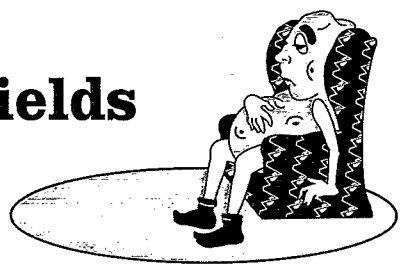
For more information on our study,

■ *continued on page 25*



USTFields

Getting Small-Town USTfields Out of the Doldrums



by Gary Lynn

Every four years, the first-in-the-nation presidential primary is held in New Hampshire, and, like clockwork, the national pundits question whether New Hampshire is sufficiently similar to national norms to merit its large role in selecting the next president. After all, New Hampshire is notoriously anti-tax (the only state in the continental United States without a sales or income tax), anti-government spending, and not particularly diverse.

I'm placing this national bone of contention on the table in case you might be concerned that New Hampshire's experience with petroleum-related brownfield (i.e., USTfield) sites is insufficiently similar to national norms and, hence, irrelevant to your program. On this matter, however, I can assure you that, for the most part, it is.

New Hampshire's constraints in establishing an USTfield-type of program are at least as severe as those of any state looking into this type of initiative (e.g., no new funding, no new legislation, and, get this, a planned 4 percent budget cut and hiring freeze!). I submit, therefore, that if New Hampshire can start an USTfields initiative with its limited resources and small government psyche, then anyone can.

Why Bother?

Why bother diverting scarce resources to the development and execution of this type of program? For one thing, we've found that we, as a program, can build stronger relationships with communities through our efforts to fix long-standing eyesores, safety hazards, or economic development nightmares. Also, our UST program staff derives a good deal of job satisfaction from connecting with a community and helping resolve difficult issues.

Most importantly, however, when we help initiate the cleanup of a site that has languished because the property was abandoned or tax-delinquent, human health and the environment are better off and the property is made viable once again.

The central question, however, is this: How can we achieve significant results with limited resources? Let me share some of the approaches that are working well for us.

Piggyback with Existing Programs

The easiest way to become involved in moving abandoned or underutilized sites with tanks out of the doldrums and into favorable winds is to identify existing programs that share similar goals (e.g., EPA/state/local government brownfields redevelopment efforts, EPA's Emergency Removal Program) and become a role player in working with these programs to move a site forward.

The biggest reason such programs don't do anything about abandoned UST sites on their own is that they have significant gaps where USTs are concerned. For example, Superfund brownfields initiatives cannot address petroleum contamination (there is a petroleum exclusion in CERCLA) and cannot currently fund remediation at USTfield sites. But these gaps provide an opportunity for petroleum programs to develop synergistic relationships that can go far to address difficult sites. Your petroleum program's strengths (e.g., focusing on the thousands of petroleum storage systems throughout the country and remediating releases) are frequently the weakest components of current brownfields initiatives.

Dip into Your UST Toolbox

UST programs have a variety of tools that can be used to address USTfield sites. These tools include UST reimbursement programs, tank removal programs, oil cleanup funds, and liability protection statutes (e.g., liability protection for downgradient properties and municipalities that tax deed property).

We have discovered that, in many cases, educating local governments about existing programs and liability protection provisions is sufficient to get these entities involved in resolving difficult abandoned sites in their communities. Petroleum programs can also provide significant, tangible assistance simply by explaining and resolving program eligibility issues. Remember, your UST program is your state's "information central" on site eligibility for petroleum-related programs and requirements for participating in the programs.

Adopt a Municipality

New Hampshire is a predominately rural state, made up of many small towns. A significant number of municipalities have petroleum-contaminated site problems that overwhelm the mostly volunteer, part-time town governments. Municipalities are often painfully aware of their abandoned sites because of complaints, overdue back taxes, or concerns raised by the fire chief about fire hazards caused by the derelict properties. In most cases, municipalities also have the essential tools for addressing the problems (e.g., back tax relief, the ability to

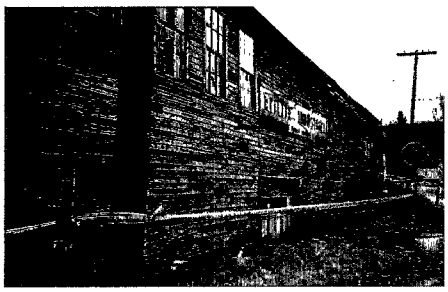
■ *continued on page 26*

■ CT Survey *from page 24*

visit the following Web sites:
www.sp.uconn.edu/~hydrogeo/deprept.htm or
www.api.org/ehs/sgresbul.htm

Gary Robbins is a Professor of Hydrogeology in the Department of Geology and Geophysics at the University of Connecticut. Gary can be reached at gary.robbins@uconn.edu.

Peter Zack is Director of the LUST Program at the Connecticut Department of Environmental Protection.



The Avilite property was an eyesore, drug graffiti on walls, and evidence of vagrancy.

One lot after redevelopment.

■ **Small-Town USTfields** *from page 25*

demolish structures, contacts with interested developers).

In our experience, the best way to help the local governments is to meet with them face to face so that we can work together to outline an approach for making progress at a site using the existing federal, state, and local tools available. We also try to get word out about abandoned-site issues through municipal association annual meetings and mailings. We've found that arousing municipal interest and working with local officials to find viable solutions is an effective way to identify USTfields and remove the barriers to cleaning them up.

Become a Program Integrator/Clearinghouse

In most cases, petroleum-contaminated USTfield sites require more than one program or tool to resolve environmental issues and promote redevelopment. Some of the issues may include liability concerns, the need to complete an emergency removal of drums or hazardous waste, UST closure, petroleum contamination, hazardous substance contamination, unsafe structures, and poor infrastructure. If staff from your UST program can integrate their knowledge of other programs into USTfield solutions, provide communities with timely education/suggestions for solutions, and try to make sure that communities are able to keep things moving, real progress can take place.

Making Things Happen in Marlborough

The former Avilite manufacturing facility is a good example of how an USTfield program can function. Avilite was a small manufacturer located in the small town of Marlborough (population 2,051) in the western part of the state. When the owner of the facility died, his heirs legally abandoned the facility by a process called "escheat." The heirs were concerned about the facility's UST and the general condition of the property.

In 1997, the town of Marlborough attempted to get the state to take title to the property. Based on structural concerns about the building, the state declined. In March 1998, after the roof collapsed on the two-story portion of the building, the town requested state assistance. When representatives from the state visited the building, they found a dozen drums containing wastes (several partially buried by the roof collapse), drug graffiti on many walls, and evidence of vagrancy.

Together, officials from the state and the town mapped out a plan. Elements of the plan included the town taking the property for back taxes to resolve the title, the state completing an emergency removal of the drums, liability protection for the town (qualifying holder protection in N.H. statutes), town demolition of the unstable structures, and town conveyance of the property to a local business that would complete the demolition, remove the tank, and participate in the UST reimbursement program.

The town took possession of the property for taxes in April 1998. The state mobilized immediately after the town took possession of the property, overpacked the leaking drums, and staged them in a stable portion of the building.

Once the town started with this project, it was hard to keep up with it—the town completed the demolition of the unstable portion of the building before state personnel returned just two weeks later to pick up the drums. By the summer, the tanks were removed. By October 1999, contaminated soil had been removed, the site investigation was complete, and the site was closed.

The state invested $19,000 (80% of which was from the UST reimbursement fund) and the town paid $8,000 for the demolition and disposal of the debris at the regional landfill. The lot has been subdivided. A new building is already in place on one lot, and the other lot is up for sale. The owner of the redeveloped lot is a specialty staircase manufacturer, which has set up a business and added jobs in the town.

According to Larry Biron, the town's Administrative Assistant, fixing the Avilite property was "the greatest blessing that has occurred to the residents of the community for many years past. The site is in prime commercial territory at the gateway to the town along Route 101, and the absence of the ugly, dilapidated building was praised by residents town-wide."

The new construction yields property taxes of approximately $5,000 per year. When development of the other lot is complete, annual property tax income to the town will be equivalent to the town's initial $8,000 investment. In a city, this type of gain would not have a significant impact. For Marlborough, however, with its annual budget of $1.3 million, it does. This example clearly shows the value of town involvement and the need, in many cases, to integrate programs to address the cross-cutting issues posed by abandoned, former industrial properties. ■

Gary Lynn is Supervisor of the New Hampshire Department of Environmental Services, Petroleum Remediation Section.

USTFields

...And They Were USTfields No More

Michigan Confronts the Challenge and Prevails

by Amy S. Carter

Brownfields exist most often at old industrial sites where contamination has occurred because of past use. The term "USTfields" was coined recently to describe abandoned gas stations or other UST sites that need to be cleaned up and rehabilitated. States can create the impetus to get these sites back on track and into productive use by providing development incentives and removing roadblocks that discourage potential reuse.

As it turns out, USTfields can offer certain types of redevelopers (e.g., convenience stores, pharmacies, fast-food chains) the perfect solution to their business development and expansion plans. USTfields can provide the ideal-size parcel, complete with an existing infrastructure and a local labor work force—as long as the barriers can be overcome without a lot of aggravation.

What barriers do developers face when considering these environmentally challenged properties for redevelopment, and how has Michigan aggressively developed the means to eliminate these barriers?

The Barriers

The most important barrier that developers and business owners face when considering USTfields for redevelopment is incurring potential liability for contamination that may exist at the property. When the very first USTfields redevelopment project was initiated in 1986, the liability scheme for environmental contamination was strict, joint, and several—liability for cleaning up contamination at a gas station was attached to any person who was an owner or operator. It didn't matter if the person had actually caused a release, contributed to one, or exacerbated an existing release. Thus, someone who purchased an old gas station to redevelop for another business use basically bought the liability for cleaning up the site—not a favorable incentive to foster redevelopment in the business community.

In an attempt to stimulate redevelopment and allay these liability concerns, the Michigan Department of Attorney General and the Michigan Department of Natural Resources began providing protection from liability through a Covenant Not to Sue (CNTS) agreement with developers.

It soon became clear, however, that the process for obtaining a CNTS was very labor- and time-intensive. In addition, in many cases, there was insufficient information available to distinguish the nature and extent of existing contamination from potential releases that could occur in the future.

USTfields can provide the ideal-size parcel, complete with an existing infrastructure and a local labor work force—as long as the barriers can be overcome without a lot of aggravation.

The Michigan legislature established a financial assistance program, the Site Revitalization Grant and Loan (SRGL) program, in an attempt to stimulate redevelopment at these contaminated locations. In conjunction with the CNTS process, the SRGL program energized stagnated redevelopment projects and provided a viable mechanism to allow the contamination be cleaned up.

One of many success stories in Michigan involves the bankruptcy of 23 Action Auto stations, all contaminated by releases from USTs. Through the use of SRGL monies and the CNTS process, all 23 properties were successfully redeveloped and are in productive use today.

The CNTS process, however, still proved to be costly and time-consuming to finalize. Furthermore, the environmental cleanup costs were excessive. Ultimately, redevelopment through the SRGL and CNTS process became feasible only for large corporations and developers with substantial financial assets.

Overcoming the Barriers

To avoid these barriers, in 1995, Michigan amended its laws governing environmental cleanup to create various tools to allow redevelopment of contaminated property to move forward. Important aspects of these amendments included creating a process for conducting an assessment of the type and extent of contamination existing at each location, called a baseline environmental assessment (BEA).

A person who completes a BEA, in accordance with the BEA rules, can use this information as a defense to liability for preexisting contamination. Liability for conducting cleanup was changed from strict or status-based liability to a causation-based scheme, meaning a person must have caused a release through an act or failure to act.

There was a change in the human health-based criteria for determining the maximum allowable contaminant concentrations that may be left in the environment. Michigan adopted a pure risk-based cleanup process that creates flexibility in the types of cleanups that are allowed and provides for a more cost-effective solution. Several financial assistance and incentive programs were added to the mix, including the Clean Michigan Initiative and the Cleanup and Redevelopment Fund.

In 1996, Michigan passed more

■ *continued on page 28*

■ **USTfields** *from page 27*

legislation, creating the Brownfields Redevelopment Program to provide additional funding and tax incentives to businesses that clean up and redevelop contaminated land.

Historically, the "brownfields" redevelopment programs promoted by states have not identified contamination specifically resulting from USTs. Today, USTfields redevelopment in Michigan, with its ancestral roots in brownfields redevelopment, has become a very successful program. The Michigan Department of Environmental Quality (MDEQ), Storage Tank Division (STD), has approved over 350 BEAs, which are conducted at each USTfield location to establish the type and often the degree of existing contamination.

Tell Your USTfield Stories

A survey conducted by the state of Utah for the recent National Brownfields Conference showed that 37 states have active brownfields programs; yet only six states recognize USTfields. If states have had successful redevelopment of USTfields, it is important that they make it a point to tell their stories. Why?

- USTfields are a common sight nationwide, and their numbers are increasing because of costly federal and state UST system upgrade requirements. Tank upgrade and replacement often result in the discovery of contamination, which prompts many owners of marginal gas station businesses to abandon the property.
- USTfields reuse often serves as the incubator for stimulating the redevelopment and rejuvenation of a neighborhood or community, because these properties can often be put back into productive reuse more quickly and less expensively than larger, more extensive redevelopment projects.
- USTfields have characteristics, such as readily identifiable contaminant sources and types, that are released underground. These characteristics do not typically limit surface property use, which can be a selling point to many types of developers.
- Redevelopment of a smaller parcel, such as an USTfield, can allow a local government entity to become familiar with available redevelopment tools and thus pave the way for that entity to approach larger and more substantial projects.
- USTfields often do not qualify for many of the federal Brownfield Redevelopment Tools because of the petroleum exemption in CERCLA, the underlying framework of several nationally available environmental cleanup tools.
- The positive recognition, exposure, and understanding of the benefits of USTfields will encourage the development of additional tools that are specifically tailored to USTfields projects.
- USTfields often require the involvement of stakeholders from government, business, and industry to achieve success in marketing and reuse.
- USTfield projects promote the establishment of innovative and often unique public/private partnerships, where promotion of an USTfield program can serve as an additional incentive for large oil companies to take an aggressive role in working with these partnerships.

Editor's Note: These articles on the New Hampshire and Michigan approaches to USTfields are our way of telling your stories. Has your UST program considered the economic benefits (e.g., increased revenue through taxes collected and new jobs) derived from rehabilitating abandoned UST facilities? If you have a story to tell, please let us know.

Public/Private Partnerships

The public/private partnership is a critical aspect to USTfields redevelopment and a new innovative approach that Michigan is launching an effort to encourage more USTfield redevelopment. Michigan's aim is to get "major customers" to look at their problems statewide and to address their environmental issues proactively and in concert with state and local goals. The state is working with various stakeholders to promote "Tell Your Story" as an incentive for others to follow.

What Do USTfields Mean to Environmental Protection?

With a risk-based, land use decision-making framework governing corrective actions at USTfield sites, limited resources can be focused on direct exposures and source removal aspects of cleanup. Corrective action can be designed to abate the continued exacerbation of contamination in the environment and eliminate the risk to public health.

The use of institutional controls and restrictive covenants can allow redevelopment to occur more quickly and in conjunction with corrective actions. Ultimately, the costs of cleanups are significantly reduced and no longer serve as a barrier to redevelopment.

The MDEQ Storage Tank Division continues to evaluate new ways to achieve faster and quicker cleanups (e.g., Pay-for-Performance, Tank Racer). As a result of Michigan's innovative approaches, environmental issues are no longer the limiting factor for redevelopment of environmentally challenged properties. The costs of cleanups are significantly reduced and no longer hinder redevelopment.

There is an answer for every site: it might not be the first reuse of choice, but, if the development team works together the factors influencing the decisions can be addressed and the barriers eliminated.

Marketing, Marketing, Marketing

To maximize its own investments, Michigan is developing a marketing plan for other LUST sites that have been cleaned up with state resources. The state is also significantly expanding its Web page presentation to include a specific section on USTfields.

The MDEQ-STD Web page is at http://www.state.mi.us/std and will cross-link reviewers to the more extensive database on the tools that have been developed in Michigan. ■

Amy Sue Carter is Chief of the Operations Section at the Michigan Department of Environmental Quality, Storage Tank Division.

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

You may also go to the ASTSWMO Web page to find out what's new at: http://www.astswmo.org/whatsnew.htm. *Take a look at the new "ASTSWMO Letter," an on-line, weekly newsletter highlighting ASTSWMO subcommittee and task force activities, projects, and upcoming events, also on the ASTSWMO home page.*

Tanks Subcommittee

The Tanks Subcommittee completed a very successful mid-year meeting, held in Milwaukee, Wisconsin, during April 17-19. The full Subcommittee met to discuss current issues, including ASTSWMO's participation in the 2000 OUST National Conference, planning for the 2000 State Fund Conference and the 2001 OUST National Conference, MTBE phase-out and other oxygenates, USTfields, and budget numbers.

Subcommittee members were active participants in the Twelfth Annual UST/LUST National Conference held in March in Portland, Oregon. They helped draft the agenda and planned, organized, and spoke at a variety of the sessions (state personnel moderated 20 of the 25 sessions organized for this year's conference).

The Subcommittee is in the process of completing work on an USTfields survey and document, which will be a compendium of mechanisms and initiatives that states use to address UST closure. The planned completion date for this document is fall 2000. Interested parties should contact Kevin Kratina (NJ) at (609) 633-1415.

The Subcommittee also conducted a peer match in which Susan McAnally, Remediation Division, Montana DEQ, traveled to Anchorage, Alaska, to meet with Ben Thomas, UST Program, Alaska DEC, to observe and participate in Alaska's inspector training class.

The Subcommittee Task Force Chairs will be meeting with OUST Regional Program Managers to discuss reporting requirements and compliance enforcement.

If you are interested in getting involved with the Association, or if you have comments on Tanks Subcommittee activities, contact Steve Crimaudo or Scott Winters.

UST Task Force

UST Task Force members were involved with planning the National Conference. They also participated in a two-day meeting in February at OUST to discuss performance measures. One day of the meeting was spent developing a method to more accurately measure compliance, and one day was devoted to developing outcome-based measures for the UST/LUST program. This effort is being coordinated by Mark Barolo at OUST.

The UST Task Force is currently working on the USTfields survey and document, drafting a survey on performance measures, evaluating current statistical inventory reconciliation (SIR) methods, and working on developing an UST Operator Training Certification Program. Ben Thomas (AK) is heading the training and certification effort. He may be contacted at: bthomas@envircon.state.ak.us.

The UST Task Force is looking for new members. For more information on UST Task Force activities, contact Dale Marx (UT) at (801) 536-4100.

LUST Task Force

The LUST Task Force's MTBE Workgroup recently drafted and published its eighth quarterly MTBE Newsletter (March 2000), which includes updates on how state LUST managers are coping with MTBE contamination at LUST remediation sites. The newsletter can be found on the ASTSWMO Web page at: astswmo.org/publications/summaries.htm#MTBE.

The MTBE Workgroup met for a half-day immediately following the UST/LUST National Conference. Workgroup Chair Jeff Kuhn (MT) moderated the meeting. Discussion included the status of the group, newsletter issues, and ASTSWMO support. Presentations were given on the status of EPA MTBE Blue Ribbon Panel recommendations, EPA OUST's MTBE Task Force and other efforts, an industry perspective from API, state perspectives, and MTBE research and concerns. For more information on MTBE Workgroup activities, contact Jeff Kuhn at (406) 444-5976.

Other LUST Task Force activities include continuing review of ASTM's work on two new standards—"Evaluating Remedial Decisions" and "Integrated Site Management"—and preparing a spreadsheet on fuel additives and other oxygenates that will include an evaluation of alternative oxygenates. The LUST Task Force plans on being involved in the

■ *continued on page 30*

Field Notes

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

PEI PUBLISHES REFUELING FIRE REPORT AND AST RECOMMENDED PRACTICES

The Petroleum Equipment Institute (PEI) has published two documents recently that might be of interest to *LUSTLine* readers. Following is a brief description of each publication.

Refueling Site Fires

In January, PEI began investigating fires that have occurred when vehicles were being refueled. We asked our members and newsletter readers to send us reports of refueling accidents presumably caused by static electricity. (A full discussion of these efforts appeared in *LUSTLine* #34.)

PEI collected 81 reports of fires that appeared to be static-related over the next three months and issued a report on April 26, 2000. The primary cause of the fires was electrostatic discharge (ESD) generated by people getting in and out of the vehicle and touching the area around the filler pipe.

A three-page summary report on the subject and a 15-page summary of the fire reports are located on PEI's Web site: www.pei.org/frd. The report references over a dozen documents, listed on page 3. We will mail a full set of all referenced documents to *LUSTLine* readers on request. The documents involve over 50 pages of material, so they cannot be faxed. Fax PEI at (918) 491-9895 to request a copy of "Refueling Site Fires—Referenced Documents."

Updated Recommended Practices for ASTs

The fourth edition of PEI's *Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling* (PEI/RP200) has been published and is now available to individuals and agencies interested in the subject.

RP200-99 contains chapters and drawings on all phases of proper AST installation: site planning, foundations, support and anchorage, dikes, vaults and special enclosures, tanks, pumps and valves, fills, gauges and vents, pipe and fittings, corrosion protection, environmental protection, electrical installation, and testing.

Recommended Practices also includes appendices describing size calculations for dikes and venting, fire code regulations, and documents used for reference. RP200-99 covers only stationary, shop-fabricated tanks used at commercial and retail service stations and marinas. Both horizontal and vertical aboveground storage tanks are addressed in the publication.

Regulators who are familiar with the earlier recommended practices will note many changes from the 1996 edition throughout the document. Extensive editorial revisions were made to this edition that make the document easier to read and understand. A new chapter was added that outlines recommended procedures for proper facility layout and operation. The chapter also describes training requirements for personnel operating the fueling facility.

Ten drawings were revised to improve clarity, and captions were added to all illustrations. Appendix B on venting now includes tables that provide precalculated data to determine emergency vent capacity for most standard aboveground tanks. Appendix C, which contains a table that summarizes AST code requirements, has been updated to reflect changes in the national codes.

The single-copy price for RP200-99 is $30. For an order form, fax PEI at (918) 491-9895. ■

■ **Coast to Coast** *continued from page 29*

national discussion on free-product recovery.

For more information on LUST Task Force activities, contact co-chairs Kevin Kratina (NJ) at (609) 633-1415 and Richard Spiese (VT) at (802) 241-3880.

State Cleanup Funds Task Force

The Task Force spent much of the last six months planning for the Ninth Annual State Fund Administrators Conference, which was held in Scottsdale, Arizona, during June 4-7, 2000. The Task Force met in Scottsdale in January to prepare the agenda for this year's conference. Task Force members are the conference track leaders and session organizers.

For more information on State Cleanup Funds Task Force activities, contact Patricia Nowack (AZ) at (602) 207-4327 or George Matthis (NC) at (919) 733-1332.

TIE Task Force

The Training and Information Exchange (TIE) Task Force worked hard to ensure the successful planning and implementation of this year's ASTSWMO Mid-Year. The Task Force continues to work on and update ASTSWMO's Internet home page. For more information on TIE Task Force activities, call Kathy Stiller (DE) at (302) 323-4588.

OUST Working on MTBE Rulemaking

On March 24, 2000, EPA published an Advanced Notice of Proposed Rulemaking (ANPRM) indicating that the agency is considering limiting or banning the use of MTBE as a fuel additive under Section 6 of the Toxic Substance Control Act. The ANPRM discusses numerous issues surrounding MTBE and other fuel additives and requests information and comments about those issues.

In support of this rulemaking, OUST is currently working to assess the impacts of MTBE and other additives from leaking USTs, including looking into the extent of groundwater contamination from USTs, the incremental costs of cleanup, and compatibility issues. OUST may contact states to discuss their experiences with MTBE or other fuel additives, and to request any available data that states have compiled. EPA hopes to complete the proposed rulemaking in the next 6 to 12 months. For more information, contact Mark Barolo at (703) 603-7141, barolo.mark@epa.gov.

EPA HQ UPDATE

EPA Oil Program Encourages States to Share AST Release Information

As part its MTBE Advanced Notice of Proposed Rulemaking, EPA has requested information on the amounts, locations, sources, and types of MTBE releases, and the levels and sources of water resource contamination from MTBE. EPA has also asked for information regarding the relative contribution of different sources, such as USTs, aboveground storage tanks (ASTs), and pipelines, to present and future MTBE contamination of groundwater, surface water, and drinking water.

ASTs are a known source of gasoline containing MTBE. Under the Clean Water Act, section 311, Spill Prevention Control and Countermeasures (SPCC) program, EPA regulates approximately 440,000 facilities with ASTs that are located so as to be reasonably expected to discharge oil to surface waters or adjoining shorelines. A facility is regulated if it has an AST with a capacity of more than 660 gallons, or multiple ASTs with a combined capacity of more than 1,320 gallons. ASTs are also subject to EPA's more general requirements for the reporting of oil spills to navigable waters, 40 CFR part 110, and EPA's prohibition on the discharge to navigable waters of oil that will:

- Violate applicable water quality standards,
- Cause a sheen on the waters, or
- Cause a sludge or emulsion to be deposited beneath the surface of the water or adjoining shoreline.

Despite EPA's regulatory programs, almost 20,000 oil spills to navigable waters (from all sources, including tank trucks, barges, and so on) are reported each year. About half of these spills occur in the inland zone over which EPA has jurisdiction.

Several states also have programs within their environmental agencies to address spills and leaks from ASTs, with various tank size thresholds. State fire marshals may inspect tanks that

■ *continued on back page*

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

■ **EPA HQ Update** *continued from page 31*

come under federal or state thresholds. Often when gasoline discharges occur, responders may not know if the gasoline contains MTBE. State programs that track such releases may require MTBE testing to ascertain if ground or surface waters have been affected. EPA encourages states to share information by:

- Beginning or continuing to monitor and document AST releases for MTBE contamination;
- Coordinating information sharing by way of their respective Web sites; and
- Compiling information on fire marshal tank inspections to address tanks that contain and could potentially release MTBE.

EPA may serve as a link between states to share these data and, thereby, improve public understanding of ways in which EPA and states are addressing MTBE contamination.

EPA HQ UPDATE

For more information about data sharing or our AST/SPCC program, contact William Nichols at (703) 603-9918 or Dana Stalcup at (703) 603-8735 from the EPA Oil Program Center.

Latest Edition of List Of Leak Detection Evaluations for USTs Now Available

The *List of Leak Detection Evaluations* (7th edition; EPA 510-B-00-007) is a 309-page reference manual that contains a summary of specifications, based on third-party evaluations, for over 275 systems that detect leaks from USTs and their piping. Each summary provides information on such items as certified detectable leak rate/threshold, test period duration, product applicability, calibration requirements, restrictions on the use of the device, and so on. The *List* is a reference tool for state and EPA regulators, especially inspectors of USTs; knowledgeable UST owners and operators wanting to compare specifications for various leak detection devices; and vendors of UST leak detection systems. (**Note:** Although maintained by a work group consisting of state and EPA members, the *List* is not a list of "approved" leak detection systems. Approval or acceptance of leak detection systems is the responsibility of the implementing agency—in most cases the state environmental agency.)

The most recent edition of the *List* is always available in electronic form for free viewing, downloading, and printing at www.epa.gov/swerust1/pubs/ldlist.htm. OUST has sent one printed copy of this latest *List* to EPA Regional UST programs, state UST programs, each vendor that appears on the *List*, and several trade groups. Please note that this is the last time EPA will print the *List*; future editions will be advertised and posted at the Web site noted above but will not be printed.

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