New England Interstate
Water Pollution Control
Commission

Boott Mills South
100 Foot of John Street
Lowell, Massachusetts
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Bulletin 41
June
2002

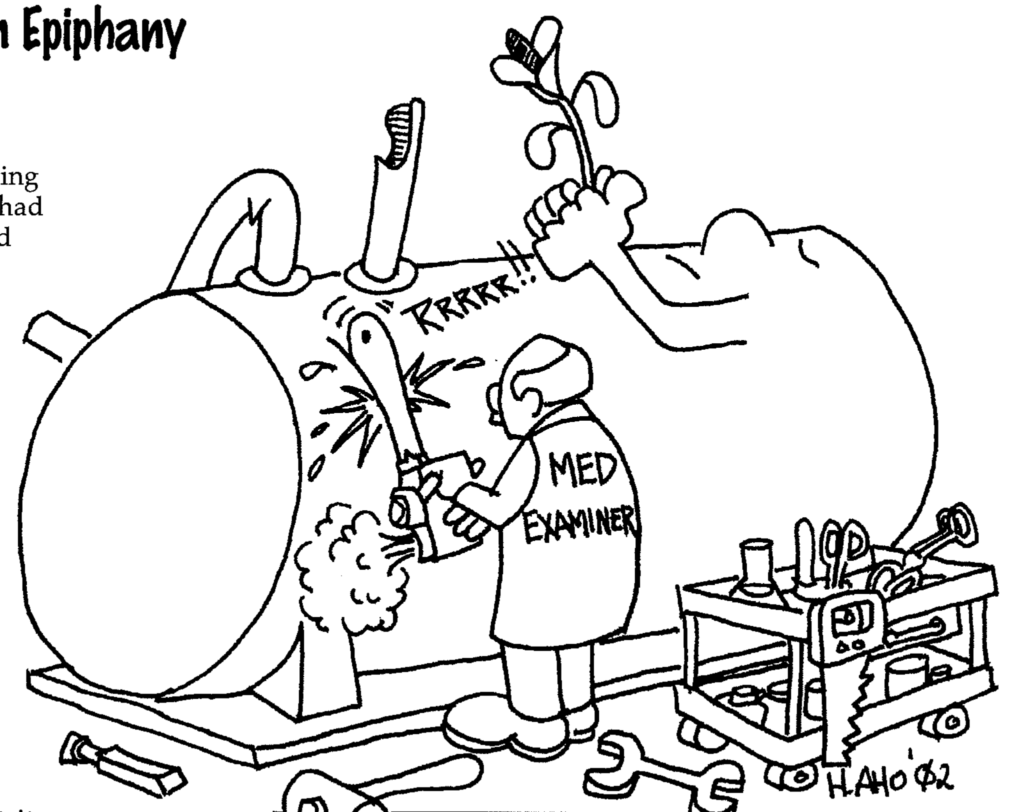
L.U.S.T.LINE

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

Looking for Leaks in All the Wrong Places

A Short Story with an Epiphany

by Marcel Moreau



The Chief looked over his reading glasses from the report he had been reading as his senior field inspector shuffled into his office. The Chief had sent him out that morning to investigate a recently discovered release at an UST facility. The Inspector slumped into the chair across from the Chief's desk.

"Well, what'd ya find?" muttered the Chief.

"Not much," was the noncommittal reply. "The usual stained soil and smelly excavation; no groundwater yet, but contamination likely. Water supplies a couple hundred feet away, MTBE in the gasoline." Though unspoken, both the Chief and the Inspector recognized that it was only a matter of time before this release hit the headlines—and there had been too many of these headlines of late.

"So what happened? What leaked?" grumbled the Chief. He didn't like sitting in the hot seat when some well owner's legislator called demanding an explanation.

"Dunno," said the Inspector. "Most of the site was dug up by the time I got there. Piping all gone. Saw the last tank come out. It looked okay."

"Great!" exclaimed the Chief, throwing the report down on his desk. "Reporters, legislators, lawyers, and well owners all breathing down my neck wanting to know why this is happening, and all you can tell me is 'Dunno!' How are we ever going to get to the bottom

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Inside

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of this with answers like that? How are we ever going to know if this program has accomplished anything? How are we going to continually improve the performance of storage systems if we don't know what's going wrong? How are we going to fix problems that we can't even be sure exist? How are we going to get to a place where our grandchildren aren't trying to solve the same problems we are? Look, I want some answers, and I want you to find them. Don't bother coming back until you figure out a way to get the information we need."

"Yes, sir. I'll get right on it."

The Inspector shuffled down the hall, grabbed a mug of black coffee, snaked his way past stacks of unread reports, journals, and guidance documents, and settled into his cramped quarters. He knew the Chief was serious about getting to the bottom of storage system leaks. But he also knew some disturbing facts.

LUSTLine

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LUSTLine is a product of the New England Interstate Water Pollution Control Commission (NEIWPCC). It is produced through a cooperative agreement (#CT825782-01-0) between NEIWPCC and the U.S. Environmental Protection Agency.

LUSTLine is issued as a communication service for the Subtitle I RCRA Hazardous & Solid Waste Amendments rule promulgation process.

LUSTLine is produced to promote information exchange on UST/LUST issues. The opinions and information stated herein are those of the authors and do not necessarily reflect the opinions of NEIWPCC.

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NEIWPCC was established by an Act of Congress in 1947 and remains the oldest agency in the Northeast United States concerned with coordination of the multimedia environmental activities of the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

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Anecdotally Speaking

Fourteen years and over 400,000 releases after the federal tank rules went into effect, no one could tell him with any certainty where the leaks were coming from in today's systems. He knew there had been some attempts to answer the question, but the results of tank autopsy studies completed so far had been dismal. He had some hope that more recent studies might produce better results, but he doubted that they would produce the kind of information the Chief was after. The anecdotal evidence pointed heavily towards pressurized piping systems as today's dominant source of releases,

> ***If you want to really know which UST component has failed, you can't go at it with a backhoe any more than a coroner can do an autopsy with a chain saw.***

but specifics on what was failing and why were nonexistent as far as he could tell.

He suspected the problem was in the data. It was not easy to come by. Because the state cleanup fund essentially provided "no fault" insurance to the tank owner, there was no financial incentive to find the cause of the release and seek cleanup cost recovery through the legal process from anyone who might potentially be responsible for the release.

There was also typically no one on site during repair or removal procedures who was there specifically to determine the origin of the release. He doubted that among his own staff he had people experienced in finding release sources, and he had never heard about any course on how to identify a leak.

Tank installers, though knowledgeable, had their own agendas. If they had installed or maintained the UST system, they were not likely to point out their own mistakes. Nor were they too keen on snitching on their competitors, for they knew that that competitor might some day be uncovering some of the mistakes that they had buried over the years. Tank workers were generally paid by the tank owner and were not anxious to point out that the release should have been discovered long ago through leak detection. Truth is, a great many more people had an interest in hiding the source of the release than in finding it.

Getting the answers the Chief wanted was going to take some good data, but he could see that this was not going to be an easy nut to crack. As his spirits began to flag in the face of the task, his eyes rested briefly on the top document in a pile that he had generally designated as his "reference" pile. The title, "EPA Requirements for Quality Assurance Project Plans," suddenly clicked into his consciousness.

The new department quality assurance guru had recently dropped it on his desk, saying, "It's dreadfully dull reading, but if you've got questions, here's a description of a process for getting answers." Hmmm, he thought, maybe there's something in it that would help…

The Cold, Hard Facts

A week later, the Inspector handed the Chief a slim document. "This isn't the answer, Chief, but if you want to get the answers, here's a description of what we need to do."

"Listen," growled the Chief, "I told you not to come back until you had answers. I don't need another report telling me what I already know we don't know."

"I know," replied the Inspector. Though their interactions were often gruff, the two had worked together since the beginning of the UST program and had great respect for each other's abilities.

"I have the answer, but it's not what you think. I've finally figured out the problem. The reason we're not getting any answers is that we're looking in all the wrong places with all the wrong tools. If you want to really know which UST component has failed, you can't go at it with a backhoe any more than a coroner can do an autopsy with a chain saw. We need to think in terms of crime scenes rather than demolition derbies. We need to be looking for fingerprints and stray hairs, not the getaway car."

"You've been reading too many whodunits," interjected the Chief, interested but still not convinced that he was going to hear an answer.

"Yes, sir," replied the Inspector, "Look, if you're serious about getting quantitative answers, it's not going to happen overnight. Here's what we need to do. We need to identify our questions and carefully define the kind of data that we need to answer our questions. We have to figure out how to get quality data, go out and get it, review it to see if it's any good, and then look at it to see what it's telling us. We need a Quality Assurance Project Plan, a QAPP. I know it sounds bureaucratic, and I had to wade through a pile of jargon to figure it out, but this is a concept with some meat to it. If you want answers, this is how to get them. I've got to run to meet a contractor, but here are my thoughts. See what you think." With that, he headed out the door.

The Chief reluctantly picked up the few pages, and this is what he read.

A PLAN TO FIND THE SOURCE(S) OF AN UST RELEASE

■ Step One: Define the questions that we are trying to answer.

We can gather data 'til the cows come home, but how will we know we have the answers unless we are very clear about the questions. The questions, as I see them, are as follows:

- Which components of today's UST systems are responsible for releases into the environment and how frequently do they fail?
- Why did these components fail?
- Did release detection find the release? Why or why not?

■ Step Two: Define the types of data required to answer the questions.

The types of data (listed in the order that they might be gathered) that are useful in answering these questions include but are not limited to:

- **Review all available records.** Look carefully at leak detection records, inventory records, maintenance records, repair records. It may be that the leak has already been detected and repaired before the regulator ever appears on site to try to track down the source of a release. Have leak-detection equipment (e.g., ATGs, line leak detectors) checked out to be sure that they are operating properly and can detect the required leak rate.
- **Make a visual observation of the operating system.** Many leaks can be observed with a simple visual investigation of the dispenser and submersible pump sump (while it is operating) before anything has been disturbed. If a leak is observed but its exact origin cannot be pinpointed, drain the piping, pressurize the system with nitrogen, and conduct a soap test to pinpoint the defect. Document the defect with pictures and a detailed description.
- **Tightness test the piping system.** If no leaks can be observed in the piping, conduct a standard piping tightness test. Use a piping test that uses a threshold of .01 gph. Conduct a tightness test even if leaks are found in the observable portions of the liquid-carrying system—there could be multiple leaks. If piping is double walled, air test the secondary piping and water test the dispenser and piping sumps.
- **Locate the approximate release point.** If tightness testing indicates a release that is not visible without excavation, conduct a helium test to locate the approximate point of the release.
- **Excavate with care.** Saw cut and remove paving. Do not use a jackhammer! Excavate with a hand shovel, then carefully with a hand trowel as you get close to the piping. If piping is backfilled in gravel, use a heavy-duty shop-type vacuum to clear away the backfill immediately adjacent to the piping.
- **Conduct a nitrogen/soap test.** When the area of the release is uncovered, conduct a nitrogen/soap test of the uncovered pipe to pinpoint the release.
- **Document the defect with pictures and a detailed description.** Take pictures to document the release site. Makes notes of all surrounding conditions (e.g., backfill, proximity of other components such as electrical conduit, other piping runs, grade stakes).
- **If piping is tight, proceed to investigate the tank.** Conduct a tightness test—one you have confidence in. Test the spill bucket by filling it with water to determine if delivery spills might be contributing to the source. If the tank is suspect, inspect it internally, or excavate it carefully. When the tank is removed, clean off all adhering soils and arrange to have it nitrogen tested and soaped to locate any perforations. Look especially carefully at the bottom of the tank where hard-to-detect internal corrosion holes may occur in steel tanks. Document perforations with pictures and a written description.

  Early in the excavation process, examine soils around the fill pipe and submersible pump and all other tank-riser pipes for evidence of contamination. Document staining or other visible evidence with pictures and written descriptions. Back up with PID and laboratory samples to document contamination.

■ Step Three: Gather reliable data.

Develop detailed protocols on steps to follow in the investigation, including how to document it and how to ensure the quality of the data. Select a few of the most experienced and knowledgeable personnel, and designate them as an elite leak-detective corps. Whenever a release is suspected, they are to be called in immediately, before evidence is disturbed or destroyed. Provide ample classroom and field workshops on how to carry out the protocols.

Provide a budget so that inspectors can pay for investigative procedures such as tightness testing, manual excavation, and nitrogen testing—things for which the tank owner may be unwilling to pay. Preapprove contractors so inspectors can immediately call in someone to do the work. Resources should be expended only where a preliminary

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assessment indicates there is a good chance of obtaining quality data.

■ **Step Four: Have an independent review committee look at reports submitted to determine if data quality is adequate to answer the questions posed.**

Only reports deemed to be of acceptable quality (the review committee determines that a leak has been positively identified) are entered into the database. Discard reports found to be inadequate, but study them to determine if a change in procedures should be made to improve data reliability. The review committee should include people versed in statistics, knowledgeable staff, and perhaps some stakeholders, such as tank installers and large tank owners.

■ **Step Five: Analyze the data.**

Study the data carefully to extract information that answers the questions originally asked. Note that we are only gathering data about known failures. If we really want to get a handle on leaks, we would have to do a study involving a random sample of operating UST systems.

SUMMARY

This is not a project for the faint of heart. It will take a significant investment in time and expertise to develop a project plan, let alone carry the project through to a meaningful conclusion. Though everyone wants answers now, the fact is we don't have the data now, and it's going to take considerable time to gather it. But, if we keep doing what we've been doing, we're going to keep getting what we've been getting. If a nationwide project plan could be developed and implemented by interested state agencies, more data could be gathered sooner.

Epiphany

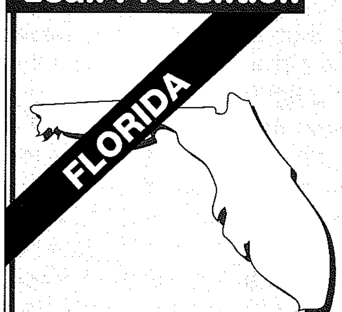
The Chief laid down the report. His brow furrowed as he sipped his cold coffee and recognized how radical the ideas he had just read really were. And suddenly, it dawned on him how dramatically times had changed.

He remembered that when he had started in the tank business, the leak problems were mostly pencil-sized corrosion holes in the tanks. You could easily spot them just by scraping the dirt off the tank after it was out of the hole. He realized that while everyone was pointing to the holes in the tanks and saying, "There's the problem," there were no doubt less-obvious leaks that were also present but going unnoticed. Now that corrosion holes were mostly a thing of the past, the other leak culprits were getting some long overdue notice.

But while the problem had now shifted from obvious corrosion perforations to the more subtle failings of joints and fittings, leak investigation techniques, if applied at all, had failed to develop. Inspectors still tended to look in the tank excavation for information that wasn't there. They were looking in the dirt, when the answers were in the equipment. They needed to trade their backhoes for facility paperwork, trowels, whisk brooms, and soap solutions.

The Inspector's report made sense to him, but he would have to sell it to the powers that be. And he would have to change the way his people did business. He'd have to change a lot of things. But what were his choices? Bumble on into the future, fighting all the little fires and wishing that things would change? Or start a process that would lead to data that would support changes that would make a difference to human health and the environment? It seemed a no-brainer to him, but he recognized that there would be a lot of inertia to overcome. But at least now he had a direction to head in and a compass to guide him on his journey.

Leak Prevention



Florida Launches a Storage Tank System Cause of Leak Study

The Florida Department of Environmental Protection (FLDEP) Storage Tank Regulation Section has initiated a Florida Cause of Leak Study, a joint U.S. EPA/FLDEP effort to investigate the causes of releases from underground and aboveground storage tank systems. The study will not consider leaks from older steel tank systems that were not protected from corrosion. Instead, it will focus on data from discharges that occurred after January 1, 1995, ensuring that only facilities that are protected from corrosion, constructed of corrosion-resistant materials, or that have secondary containment are included—the state database has 6,549 post-1995 Discharge Report Forms (DRFs).

FLDEP will hire temporary employees who are experienced County Local Program Inspectors to perform a file review of the DRF sites, fill out the survey forms, attach supporting information, and mail the data on a monthly basis to FLDEP. They will also investigate Incident Report Forms, which indicate potential leaks. The inspectors will perform these file reviews after their regular work hours.

The information will be scanned into the state's tanks database and will also be transmitted on a CD to EPA on a monthly basis. EPA's contractor will compile the information and summarize the results. This study will contribute to EPA's UST System Evaluation initiative, and the results of the study will help the agency make future decisions on how best to prevent and detect releases from UST systems. FLDEP plans to use the information to assist with rule development and program management.

The inspectors will review discharge files from nine counties, representing about 62 percent of all of the post-'95 discharges. The inspections will take place from April 15, 2002, through August 30, 2002. For more information, contact Marshall Mott-Smith at (850) 488-3935 ■

Marcel's Postscript

What I have outlined here is the basic process of defining data quality objectives and developing a quality assurance project plan (see **http://www.epa.gov/quality/qs-docs/xg4-final.pdf** and **http://www.epa.gov/quality/qs-docs/g5-final.pdf**). A fully developed plan would involve much greater detail. But the point is, data quality for UST leak-related studies that I have reviewed to date has been very poor. If the questions are worth answering, then data are worth gathering, and we must expend the effort required to obtain quality data. The techniques for doing this are well defined; they only need to be applied to the questions at hand. The goal of this article is not to present a final solution but to plant the seeds of quality assurance project planning in the UST world. Your thoughts are invited.

Many additional procedures for finding leaks in tank systems are described in Appendix D of California's "Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates." (See *LUSTline* #37.) ■

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.**

Field Notes

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

PEI Members Weigh in on UST System Performance

The Underground Storage Tank Branch of the Delaware Department of Natural Resources and Environmental Control offered these comments about the current status of the state's UST program in the most recent issue of its quarterly newsletter, *Think Tank:*

> *Just because the tanks have the equipment that is needed to meet the regulations doesn't mean that the equipment is being maintained, or that the equipment is operated properly. Upgraded tanks can leak, too, so . . . no, we cannot rest on our laurels. Now we must make sure that operating UST systems have the equipment they need and that they are maintained and operated in a manner that complies with the regulations.*

So what are the regulators in Delaware and other states likely to find when they check to see how the new tank systems are performing? The Petroleum Equipment Institute (PEI) was wondering the same thing when the organization surveyed a representative sample of its members in May. An average of the responses received from 28 members operating in 45 states is shown below. For purposes of this survey, a leak was defined as a visible wetness due to petroleum outside of the primary containment system (e.g., tank, pipe, dispenser, pump).

If you opened 100 dispenser cabinets at operating facilities, how many times would you find leaks in the following equipment?

Impact valves	8
Unions	16
Filters	7
Meters	9
Solenoid valves	5
Other	2

If you opened 100 submersible pump sumps, how many times would you find leaks in the following equipment?

Functional element	5
Base of line leak detector	6
Line leak detector vent tube	6
Packer O-ring	7
Union	8
Swing joint	5
Flex connector	4
Ball valve	2
Other	1

If you conducted 100 piping tightness tests of FIBERGLASS piping, how many leaks in each of the following would you expect to find between the impact valve and the submersible pump? (Do not include any leak areas already described above.)

The piping itself	1
The piping joints	6
Flex connectors	3

If you conducted 100 piping tightness tests of FLEXIBLE piping, how many leaks in each of the following would you expect to find between the impact valve and the submersible pump? (Do not include any leak areas already described above.)

The piping itself	1
The piping joints	7
Flex connectors	3

With regard to secondary containment systems, if you tested 100 of each of the following components (water test for piping and dispenser sumps, 5 psi air test for piping) how many of each type would FAIL the test?

Piping sumps	39
Dispenser sumps	33
Secondary piping	19

When the number of reported leaks in the dispensers and submersible pumps are considered together with the failure rate of the dispenser and piping sumps, it seems likely that a good number of petroleum delivery and storage systems are not tight and could be leaking product into the ground. The industry is close to getting the job done, but it's not there yet. ■

Leak Prevention/Enforcement

"We've Shown 'Em Our Backs Long Enough!"

It's Time to Rededicate Ourselves to Tough Enforcement

by G. Scott Deshefy

A pundit on the radio recently described the early 21st century—and I paraphrase a bit—as a time of smart bombs and stupid politics. While unworthy of comparison with Dicken's "best of times and worst of times," the remark, nonetheless, made me reflect on the social changes that I have witnessed in the last 50 years, some of which may be attributable to the dilemma that Marcel Moreau described in his March 2002 *LUSTLine* article, "Of Square Pegs and Round Tanks." That dilemma, the horns of which critically gore our UST programs, can best be described as operator ineptitude (if not indifference).

Seventeen years into the UST regulatory process, you would think that the way to the summit of UST compliance would be less daunting. But I can't help thinking that a lack of enforcement conviction over these many years has made the slope treacherous and sheer. A decided overemphasis on "compliance assistance" has kept us tumbling back to base camp, and, sociologically, operator ineptitude may be symptomatic of a pandemic disease—a growing lack of critical thinking and a shirking of individual responsibility. I shall try to piece together what I consider the root causes of this problem and offer some possible solutions.

The Guy with His Name on the Sign

When I was a youngster in the 1950s, heroes were a mainstay of our culture. We had our bigger-than-life TV, movie, and sports heroes, and we had our everyday local heroes, whom we all knew and looked up to. Even the local mechanic was something of a hero in those days of tight communities. Everyone knew him by his first name. He sold penny candy and nickel baseball cards to the kids. His soda cooler stocked a few big names, and for the connoisseur, one or two exotic pops, such as Fox Spring's birch beer.

When the mechanic in my town pulled a transmission, locals gathered around him like the disciples of Socrates. He rarely stood behind the counter. Bells, triggered by cars at the pumps, summoned this genie of interminably greased hands from his magic lamp of automobile hoods and hydraulic lifts. Despite the interruptions, he politely greeted each customer, pumped gas, checked the oil, cleaned the windshield and rear window, and made correct change without the aid of a computer.

The gas station owner of the '50s was (usually) not a Rhodes scholar, but his mechanical expertise was often genuine and highly respected. He alone was responsible for a business that spanned his lifetime. The metal sign swinging squeakily in the wind bore his name.

These stations of bygone days were not the namesakes of their distributors; they were called Ziggy's, or Gene's Garage, or Ski's. Their bold painted lettering proclaimed a certain sense of owner responsibility—an unwritten guarantee for work performed and fairness of price.

Granted, things weren't all peaches and cream—waste disposal practices often meant tossing or pouring materials out the back door, particularly those chemicals that seemed to dematerialize into the reeky, petroleum-stained soils. Loss of product from a tank was strictly an inventory issue, even when neighbors began noticing a sheen on the pond. But in the '50s and well into the '60s, one man was all things in the gasoline business—owner, operator, mechanic, gasoline attendant, bookkeeper. And that guy was the fellow with his name on the sign.

Transition to Estrangement

I'm not sure when the cataclysm hit, exactly. The cultural climate started to change, I suppose, during the late '50s and '60s, when the number of cars on our highways increased dramatically. At the gas station we started to see the young assistant, who was given the tasks of pumping gas, wiping windshields, and changing oil, but little beyond that. The Ziggys, Skis, and Genes were still on the premises working on the cars, keeping the books—ultimately accountable.

The asteroid sealing the fates of these grimy pillars of our Cenozoic communities hit sometime in the late 1970s, just before the "me" generation was upon us. Baseball cards shot up to 50 cents a pack and sold among the milk, bread, beer, cigarettes, and a growing a list of groceries.

Out of necessity, people began pumping their own gas. "Attendants" stayed behind counters changing money. Windshields were, more often than not, left to their own metaphoric obscurity. The focus had shifted to merchandise on shelves, not gasoline dispensing or auto repairs. Owners and operators suddenly took divergent evolutionary paths. They ceased to be the same animal. Ziggy's road sign was replaced with a corporate logo.

As facility owners became increasingly distanced from the day-to-day operations of their gasoline storage, accountability went by the wayside. Legal firms represented owners now. Faces became unfamiliar. The person behind the counter selling junk food had no investment in the gas station, no apprenticeship at stake, no reputation to protect, no desire to know the first names of his customers. It was as if the heart had gone out of responsibility and community, and we as UST regulators were left to reap the consequences of that estrangement.

This time of social transition was really the start of operator ineptitude. It's not that the Ziggys and Genes and Skis were sophisticated in their gasoline inventory controls and paleolithic leak detection, but at least they looked critically at the books from time to time and performed the necessary math to see if product was being lost—less to protect the environment perhaps than to protect themselves from the dishonest distributor or the clandestine filling of some teenager's jalopy. But they had to rely on themselves—their own stick measurements and simple math—to make that determination.

With the advent of minimarts came the parallel evolution of the pocket calculator and digital watches. Gas station operators and all of the rest of us were relieved of the responsibility of simple calculations and the privilege of thinking for ourselves. We learned to respond to the spin of the sound bite and electronically enumerated dials. We now trust the "decisions" of machines, eschewing intellectual exercise—critical analysis atrophies, indifference bloats.

As facility owners became increasingly distanced from the day-to-day operations of their gasoline storage, accountability went by the wayside. Faces became unfamiliar. The person behind the counter had no investment in the gas station, no apprenticeship at stake, no reputation to protect, no desire to know the first names of his customers. It was as if the heart had gone out of responsibility and community, and we as UST regulators were left to reap the consequences of that estrangement.

Back to the Future?

So operator ineptitude is par for the course. And, as we can't go back to the future, tinker a bit, and make that transition to the new reality work better, we've got to recognize that some serious behavioral repair is in order.

But with technologies that have increased the precision of measurements of product levels and alarms designed to identify an abnormal loss or gain, I fear that today's UST operators have been lulled into a false sense of security. What's the point of taking time to critically examine the printouts of an ATG when the priority is selling pretzels? Can there really be a problem if the alarm doesn't go off? (Or what's the point of smelling smoke if the smoke detector's silent?) Furthermore, as I've suggested, analysis of ATG readouts requires an intellectual acumen that for many of us is near vestigial. Furthermore, does anybody care?

If we are going to do behavioral repair work, we'll need to revert back to ye olde sense of responsibility. Operators must first be willing to take the responsibility for consistently conducting UST system analyses. Second, they must be trained to perform the analyses with precision. Third, and most important, they must trust their own analytical skills over the presumed infallibility of the machines.

Failure on any one of these counts will result in the shortcomings we find in our inspections—either the ATG data are not analyzed properly at the site or responsibility is taken away from the operator altogether, and ATG records are automatically forwarded to a central office for a cursory *in vitro* review. Such reviews provide ownership the legal buffers with which to insulate themselves from enforcement and buy time to get records "straightened out" when releases occur. But whenever ATG measurements are not analyzed *in situ,* mitigative timeframes suffer—deliveries are made to leaking systems.

Timely leak detection can only be achieved if operators are thoroughly trained and held culpable for identifying suspected releases on-site. Furthermore, operators must be empowered by their employers to stop deliveries and initiate corrective actions when a suspected release has been identified. This may be too much to ask of individuals who, unlike the Ziggys and Genes and Skis of yore, have no investment in the success or failure of the business, much less overriding concerns for protecting the health of human and nonhuman elements of the ecological community.

With frequencies of operator turnover somewhere between 30 and

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■ **Tough Enforcement** *from page 7*

60 days, can we expect UST owners to provide necessary training for the transients at the cash register? If the answer to this question is a conciliatory NO, then we are in trouble. We must be cognizant that if we lower the compliance bar, a portion of the regulated community will feel no urgency to jump.

The *de minimus* Syndrome

The adaptiveness of lawyers to exploit regulatory loopholes aside, we as regulators have created an atmosphere in which owners of USTs have developed *de minimis* strategies for meeting the bare-bones legal requirements necessary to pump gas and maximize profits from the least amount of capital expenditure. While I am thrilled to find the occasional station whose owner has looked beyond the cheapest ways to achieve baseline compliance—stations with multiple leak detection apparatus, redundancy in alarms, and fail-safe mechanisms to rapidly identify a loss—I also concede that such stations and station owners are few and far between.

All animals—our own species included—by instinct or reason, make decisions about cost versus benefit for every type of activity. If the energetic investments (costs) for defense of territory or for a particular foraging pattern exceed the energetic benefits derived from that behavior, then the individual's survival is compromised. If biological cost exceeds biological benefit, then the behavior has to be modified for the organism to survive and, in the biological currency of genetic fitness, stay in the black.

While *de minimis* approaches to UST compliance are likewise understandable in terms of natural selection, in terms of regulatory selection we are responsible for creating a cultural habitat in which benefits derived from failing to comply with UST regulations typically exceed the comparative costs. In evolutionary terms, we have created a selective pressure that rewards noncompliance.

Costs for UST upgrades and sophisticated leak detection instruments are high, penalties imposed for failing to make upgrades are low, if imposed at all. The odds of being caught, particularly for operational noncompliance, are slim to none.

Take, for example, the inability of most states to routinely inspect all UST facilities within a reasonable period of time, a function of UST numbers versus numbers of inspectors. Having run an enforcement program in southern New England without state funding other than the minimum match to keep federal baseline grants coming in, no one knows this frustration better than I.

In evolutionary terms, we have created a selective pressure that rewards noncompliance.

While staffs for state cleanup funds have increased severalfold in Connecticut, commitment to pollution prevention (i.e., UST enforcement) has remained stagnant. Four people comprised our UST enforcement program in 1985; four people comprise the program in 2002. We started with over 43,000 registered tanks in Connecticut in 1985 and have closed out nearly 25,000, a Herculean effort by a handful of people. But the task that now lies before us is even more intimidating.

We know of nearly 18,000 commercial tanks still in service in Connecticut (over 7,200 operational sites), and we average (in addition to our other duties) only 320 inspections per year. If I were an UST owner or operator in Connecticut, would I lose sleep over being out of compliance with leak detection requirements? For the average violator of UST requirements in Connecticut, insomnia is probably not pervasive.

Furthermore, while the antiquated tank problem has always been a stationary target, operational compliance is not. Once antiquated tanks are closed, they are gone for good. Leak detection systems, on the other hand, may be legally operated one minute, then grossly out of compliance the next—a swarm of fireflies in the night, on again, off again. Operators, too, are in a constant state of flux, and neither of these problems is limited to Connecticut.

The Economics of Noncompliance

To further complicate matters, we have created an environment in which UST owners not only discount the probability of an inspection, but, once inspected, the amount of any civil penalty is miniscule when compared to the economic benefits derived from an illegally operated tank.

Even after leakage is discovered and remediation begun, cash flow is seldom a problem. Once again, we as regulators have had much to do with that. Granted, cleanup funds have led to better reporting and accelerated identification and cleanup of UST releases. But by taking the financial burdens of those cleanups off the shoulders of UST owners, we have eliminated (or at least severely reduced given a contaminated station's downtime) a major deterrent to UST noncompliance. This is particularly true of cleanup accounts that make no correlation between size of award and degree of noncompliance as a proximate cause of release.

Before cleanup funds, UST owners with poor management practices and histories of major or frequent releases were limited by competitive exclusion. They could not afford to both clean up their messes and stay in business pumping gasoline and selling cigarettes. One edge of the cleanup fund sword has been that UST owners are now less likely to walk away from contaminated sites. The other edge has been the owner's disincentive to spend money on compliance when golden geese around the country lay their cleanup reimbursement eggs regardless.

The Zero Tolerance Approach

So, do we raise the white flag and say to the owners/ops, "Just tell us yourselves if you're in compliance. We'll believe anything you say so long as we can report an improvement in numbers—after all, perception is what it's all about. The heck with reality, pollution prevention, cleaner drinking water, and the investment of 17 years"?

Well, my Hungarian-Czech heritage suggests strongly that we do otherwise. But do what? How do we rededicate ourselves to wage war against operator ineptitude and owner indifference? And we must wage war. We must recognize that we are not in the business of compliance assistance and pandering to the blind hope of voluntary compliance. As a nation, we have declared war on poverty and drugs but never so pervasive an environmental threat as USTs.

It is high time we took a zero tolerance approach to violations of these environmental laws. And that first step in a long road to victory is to guarantee the regulated community that civil penalties will result from *every* UST infraction documented.

In Connecticut, we have had great success with an "expedited consent order," complete with civil penalties, sent to *every* respondent for whom '98 deadline violations have been verified. To date, there have been no exceptions. This approach, at least in principle, simulated federal field citations, a necessary adaptation on our part to cope with the high volume of '98 deadline violations anticipated from our database.

The "trench warfare" that is all too often the case with conventional consent orders (COs) would have tolled a death knell for correcting any appreciable number of the '98 deadline violations. With a staff of four, such drawn-out battles were not an option. We had to adapt and did so by developing a "cookie-cutter" consent order, the boilerplate of which was limited to '98 deadline violations and closure requirements.

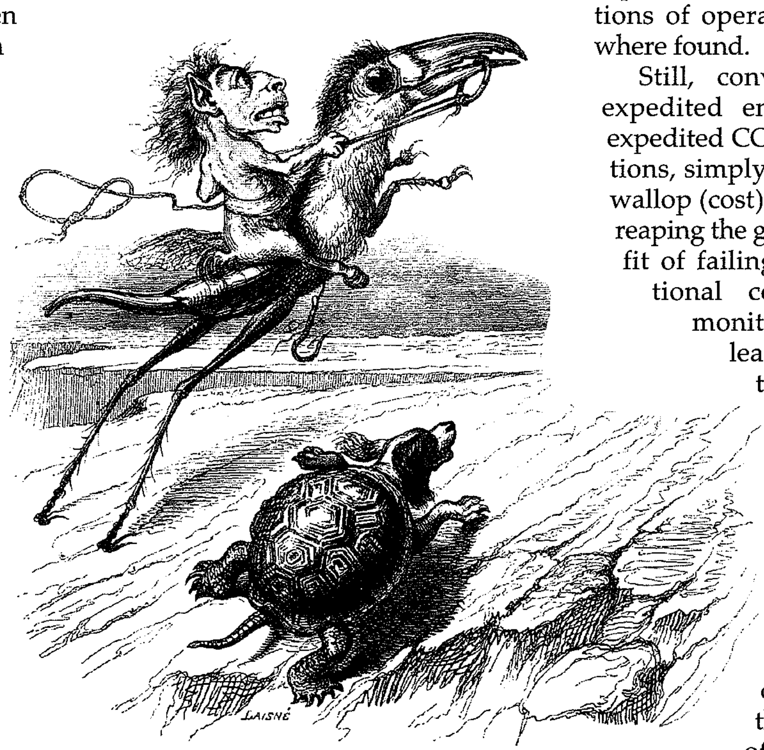
With penalties of $3,500 (roughly comparable to legal retainers), the financial cost to sign the CO, pay the smaller civil penalty, and undertake corrective action was smaller than the costs of legal combat, particularly to the steps of the attorneys general and the imposition of much higher civil penalties and punitive consequences.

Largely because of the deterrent of our expedited COs and promises kept of penalties without exception, we have gotten very close to 100 percent compliance with the '98 deadline in Connecticut. But we also have had the luxury of a database with which to target that small and static subset of the tank universe (i.e., antiquated USTs for which we had no legal confirmation of closure). As discussed previously, we don't have that luxury with operational compliance.

And Onward to Operational Compliance

Given that sites may be found in compliance with leak detection requirements one minute and out of compliance the next, the entire universe of operational tanks is always at large. Databases have no relevance here. Furthermore, investing precious inspectional resources to maintain a database on operational compliance may be ludicrous—like painting a whirlwind.

Also troubling is that leak detection violations are so numerous and so dynamic that even specially designed, expedited COs may be too time-consuming to keep pace with inspectional caseloads. Furthermore, some states may be unwilling to invest the time and resources necessary to develop and seek legal approvals for expedited COs when the priority at this juncture is cranking out inspections.



Given that the Connecticut expedited CO was designed to simulate the efficiency and speed of federal field citations, wouldn't it be helpful if states were "duly deputized" with the authority to use federal field citations for minor infractions of UST operational compliance? The TSCA/PCB program of which I was a part in the 1980s issued federal credentials to all state PCB inspectors, in essence lengthening the federal arm of the law.

I propose that the same policy be broadened for state UST inspectors with the added authority to directly issue federal field citations. Failures on the part of UST owners/ops to fully comply with federal field citations, issued by state personnel, would be handled by states' attorneys. This would be accomplished by memorandums of agreement between states and EPA and as an integral part of grant commitments. States could also reserve the right to use their own enforcement tools (e.g., expedited COs) for substantial violations of operational requirements, where found.

Still, conventional means of expedited enforcement, whether expedited COs or federal field citations, simply do not carry enough wallop (cost) to deter owners from reaping the greater economic benefit of failing to invest in operational compliance—properly monitoring ATGs and line leak detectors; investing time, energy, and money into training ephemeral personnel; and paying operators enough wages to keep them on board for more than 30 days.

To enforce operational compliance, day in and day out, there must be a means of penalizing violators that is both expeditious (in order not to compromise the number of inspections due to red tape) and that carries a lot of clout, particularly for major operational violations. Then and only then will we get the owners' attention and conquer operator ineptitude.

One approach is to inspect for operational compliance every applicant to a UST cleanup fund. Anything less than full operational compliance both before and after a release would be grounds for rejection of a claim, either partially or in totality. Is full operational compliance too much to ask of an owner

■ continued on page 10

■ **Tough Enforcement** *from page 9*

who asks the public to help pay for his mistakes? Tank funds also could be off-limits to any owner/operator with a history of major releases. A "three (or possibly two) strikes you're out" policy to limit reimbursable cleanups would certainly bolster financial incentives not to pollute. [The Catch-22 here is that the mom-and-pop owners (a rare bird, but still extant) may not clean up a major release in a timely manner if ineligible to access the fund.]

I suspect that the most effective mechanism for enforcing UST operational compliance would be the authority to lock up fill pipes whenever significant or major leak detection violations are discovered. Unfortunately, many states have had difficulty in obtaining this kind of authority except in cases of clear and present danger—emergencies usually limited to threats to public health and safety outside the scope of "mere" environmental degradation.

Again, I urge U.S. EPA to consider the option of seeking these authorities and stopping deliveries to any tanks identified as grossly out of compliance with leak detection requirements. Once again, the agency should explore the feasibility of delegating that authority to state inspectors with the provision that tanks would be shut down until total operational compliance had been demonstrated.

Because the number of UST inspections performed in a given year by a given state will always be a function of the number of inspectors, we need state and federal funding that will guarantee that every UST in the nation is inspected at a frequency that "encourages" better rates of compliance. If states can spend tens of millions of dollars annually to clean up UST petroleum releases, then it is logical for every state to at least commit a few hundred thousand dollars to prevent those pollution events from occurring. The "Chafee Bill" (Senate #1850) is a step in the right direction and that dialogue is encouraging, but...we'll just have to see, won't we?

And let's not kid ourselves. Substantially increased enforcement staffs, capable of inspecting every UST once every two years, in and of themselves are not enough. Two years of potential noncompliance between inspections and enforcement actions is far from acceptable for leak detection, especially when UST operator turnover is every two months and many stations pump over 30,000 gallons of product a week.

The Fast-Food Paradigm

Oddly enough, we may yet have a solution to operator ineptitude to complement higher frequencies of inspections and rapid-fire enforcement actions if we look to the fast-food industry. For the record, I wish to state that I am uncomfortable drawing this parallel. The fast-food business represents to me the antithesis of cruelty-free living, good health, sound environmentalism, and ecologically efficient, ethical sources of protein. But the fast-food industry, which suffers from the same minimum-wage turnover problems that compound our operator ineptitude dilemma, is nonetheless a stellar example of consistency of product from store to store to store. Why?

Just as the fast-food industry has its highly paid troubleshooters going from store to store to check operations and calibrate equipment, we, too, for the same reasons, need certified, professional tank operators who visit every UST facility at least once per week to guarantee compliance.

Well, let's go back again 40 or 50 years, to a time when the fast-food industry was a newly emerging creature—a low-priced, corporate critter competing with the well-established Jurassic giants of car-hops, family restaurants, and mom-and-pop diners. The mobilized environment was ripe for evolution, but competition among newly emerging forms was stiff. Those franchises that did not provide consistency of product during the nickel-burger, cutthroat competitions of the '50s and early '60s quickly fell off the map.

Among the survivors you will find techniques for preparing foods precisely the same way and with remarkable consistency no matter which franchise you visit. This was accomplished in two very important ways. First, the frying process became mechanized around 1970. Where originally a young man or woman was responsible for making visual judgements as to whether a product was cooked to corporate specifications, that humanly intuitive process was replaced by the cold, hard stainless steel precision of temperature probes, timing devices, and alarms.

Second, all the major fast-food chains employ professional "troubleshooters," men and women paid handsome salaries to visit each store at least once a week to verify consistency of products, look at the inventories of sales, count discarded food items (e.g., stale buns), and carefully evaluate the machinery that eliminates guesswork by the here-today, gone-tomorrow crews.

The troubleshooters, on *at least* a weekly basis, see to it that probes and timers, heat sensors, and refrigerated components function at the standards set by teams of quality control people hundreds of miles away. The parallels I'm about to draw with ATGs, UST operators, and proper UST inventory control are self-evident.

I agree with Marcel Moreau's premise that, just as the fast-food industry has its highly paid troubleshooters going from store to store to check operations and calibrate equipment, we, too, for the same reasons, need certified, professional tank operators who visit every UST facility at least once per week to guarantee compliance. This could easily be accomplished by the majors and jobbers in the petroleum industry and by larger businesses and municipalities, as well.

Trained professionals could be put on the payroll for clusters of five or six tank facilities within the owner's jurisdiction. Each day, one of the five or six facilities would be thoroughly investigated for *total* operational compliance until the entire loop has been completed during the course of a work week. That weekly routine is repeated *ad infinitum*, just as in the case of the fast-food industry.

For single mom-and-pop facilities and for very small businesses, the cost of certified, professional tank operators giving the place an operational compliance once-over every week can be ameliorated by forming cooperatives. Then and only then, in a synergy with enforcement measures previously discussed, will we finally turn the tide in this 17-year struggle. The most expeditious means to this end (and time *is* of the essence) is by federal regulation.

Once federal or state requirements were to kick in, certified, professional tank operators and associated training programs for accreditation should become green industries. Additionally, as Marcel suggests, state boards consisting of regulators and industry professionals could police the certification standards. During the interim, checklists and guidance documents could serve as an intermediate, albeit limited, stopgap phase until the transition to certified, professional tank operators was complete.

We Won't Succeed with Good Intentions

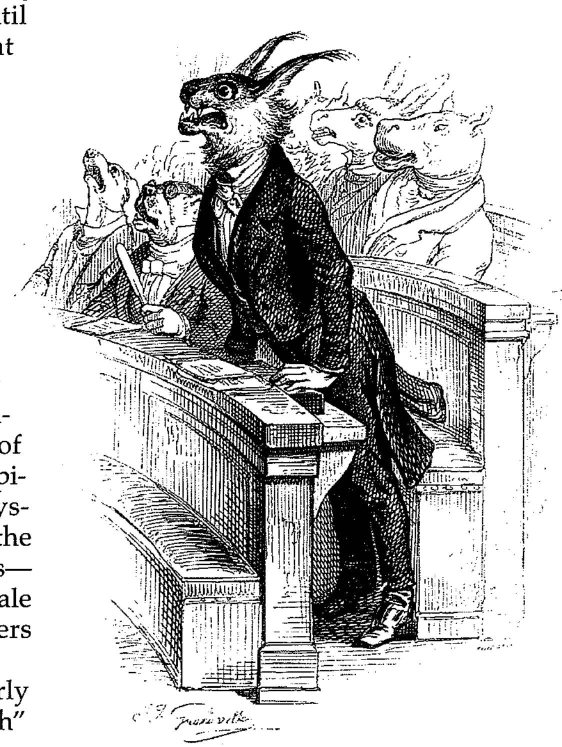
As an animal behaviorist and middle-aged cynic, I do know one thing with certainty: Some people don't like to make sacrifices or to be inconvenienced for the sake of a better world—even if the benefits are theirs to reap. Thus, Americans are rarely asked to be inconvenienced until catastrophe comes knocking at the door.

As Paul and Anne Ehrlich discuss in their 1996 book, *Betrayal of Science and Reason,* biology may explain this very well. Our animal species has evolved to respond to dramatic and immediate threats to life and wellness. Our nervous systems are designed to make us jump at the sound of rattlesnakes' warnings or cringe at the thought of bites from Sydney funnel-web spiders. But that same nervous system is ill-adapted to discern the subtler environmental problems—the slowly developing, large-scale venoms of contaminated waters and tainted air.

The Ehrlichs quite properly have coined the term "brownlash" to describe the backlash of political or corporate contrarians against "green" policies. They also conclude that we are at the Dunkirk of global environmental degradation. We had better dig in or else.

Whether that is true, or whether we are more accurately stalled on the beaches of Normandy, I don't know. But it seems to me that we'd better proceed with a sense of environmental urgency. We'd better not relax environmental regulations or concede leak detection requirements to operator ineptitude or trust the integrity of tank owners to let us know the score. We'd better not rest our laurels on good intentions. We must demand more, rather than less, from people storing thousands of gallons of toxic chemicals underground. As Errol Flynn shouted to his desperately outnumbered troops in the movie *Rocky Mountain,* just before their last, gallant charge: "We've shown 'em our backs long enough !" ■

Scott Deshefy regulates USTs as a Supervising Environmental Analyst and Emergency Scientific Support Coordinator for the State of Connecticut. He is also a biologist and behavioral ecologist. This article was written by the author in his private capacity, and the conclusions and opinions drawn are solely those of the author.



PEI's RP for Testing Electrical Continuity of Fuel-Dispensing Hanging Hardware Available

PEI's 20-page *Recommended Procedure for Testing Electrical Continuity of Fuel-Dispensing Hanging Hardware* (PEI/RP400-02) describes a standard procedure for testing electrical continuity of hanging hardware associated with petroleum dispensing systems. The test establishes that an electrical bond sufficient to dissipate electrical charges between the nozzle and the dispenser exists. The document was developed because very few written continuity testing procedures existed, and the procedures that were available were not universally followed and accepted.

The procedure described in the publication should be followed whenever testing for continuity is appropriate. The document explains how to test safely and accurately, if and when a need to have the equipment tested develops. Such circumstances include installing or replacing any hanging hardware or component, after a drive-off, and/or as part of a scheduled maintenance program.

The document includes sections on definitions, when to test, testing equipment, safety, initial test procedure, pass/fail criterion, locating the problem if the initial test fails, correcting the problem, and documentation. It also contains two illustrations and 13 photographs. Material in the appendix includes a sample form to record continuity test data, a pictorial summary of the continuity test field procedures, and a publication reference. Each copy is accompanied by a laminated card with full-color pictures that summarizes the test procedure in eight steps.

The single-copy price for RP400-02 is $75 (including shipping and handling) for nonmembers of PEI. You can order copies online at www.pei.org/catalog. ■

Leak Prevention

ICBO to Develop an UST Operator Certification Exam

by Lynn A. Woodard

Now that the 1998 deadline for UST systems to meet upgrade, closure, or new UST system standards is behind us, and most systems have all the new bells and whistles required to alert facility owners/operators when a problem occurs, it is time to upgrade or replace existing operators where necessary.

If you attended the UST/LUST National Conference last March or have been paying attention to the last couple of editions of *LUSTLine*, it is abundantly clear that the weak link in the UST regulatory landscape is the UST owners/operator knowledge gap regarding technical standards and reporting requirements.

In an effort to provide industry and regulators alike with some measure of confidence that the person hired to oversee the operation and reporting requirements for an UST facility has a minimum level of competence, the existing IFCI (International Fire Code Institute) UST Advisory Committee petitioned the ICBO (International Conference of Building Officials, the parent company of IFCI) to design and administer a certification examination specifically for UST operators. The proposal to design and administer an UST operators examination was presented to the ICBO Board of Directors and received approval and funding.

Exam Committee Formed

The next step was to put an exam design committee together to represent both the regulators and owners/operators. While we were unable to obtain the diversity of owners and operators we were seeking, we were nevertheless able to establish a very competent committee. The committee consists of regulators from Oregon, California, and New Hampshire; facility owners from Rhode Island and New Hampshire; an installation contractor from New Hampshire; and professional exam writers from Alabama and California.

On March 25-27, 2002, the committee met for the first time in Manchester, New Hampshire, to define its goals and objectives, receive instruction on the exam development process, review existing exam questions already in the data bank, and assign tasks to committee members. At that meeting, the committee determined that the exam should be written for the facility operator, who may or may not be the owner of the facility. The "operator" was defined as follows:

> *The individual designated to be in control of, or having responsibility for, the operation of a UST system and has responsibility for the operation and maintenance of the system in a manner to ensure that it is in compliance with applicable state and federal regulations and industry standards to protect the health, safety, and welfare of the public and environment.*

An Industry of Trained Operators?

It would be nice to think that when the exam becomes available enough states will adopt it into their certification programs to provide a demand for highly trained and knowledgeable operators. And it is important to note that a certification exam is only one component (the final component) in meeting this goal. The upfront training and education of owners/operators is another very important component.

Operator certification could in turn be a first step in establishing an industry of trained operators to oversee the operation and maintenance of the nation's UST facilities (much the same as with drinking water and wastewater treatment plant operators). If this would occur, we may be able to turn the corner on the disappointing compliance status that currently exists nationwide.

Our second committee meeting is slated to be held in Salt Lake City on June 20-22, 2002. If a third meeting is required, and it probably will be, it will be scheduled for later this summer. ICBO experts on exam writing will then do whatever is necessary to make the exam available by the early part of 2003. ■

Lynn A. Woodard, P.E., is Supervisor of the Oil Compliance and Initial Response Section in the Waste Management Division of the New Hampshire Department of Environmental Services and is serving on the ICBO Operator Certification Exam Committee. He can be reached at **lwoodard@des.state.nh.us.**

Leak Prevention

Tanks Down East

by W. David McCaskill

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

When It's Hard to Take "No" for an Answer

Maine's UST Siting Law Revisited

I'm sitting at my desk thinking about the recent passage of our new UST siting law, when I get a phone call from the owner of a chain of C-stores in the mid-coast area. He wants to know if the new siting law applies to his proposed UST bulk plant project. The site is on land that is adjacent to one of his existing C-stores, and the area is served by public water. But there is a hitch; not everyone in that neighborhood is connected to the public water supply. In fact, there's a home within 300 feet of the proposed UST facility (we include all tanks, piping, and dispensers in the setback determination) that gets its drinking water from an on-site well.

My painful answer to the man's question was that if a residential well is within 300 feet of the project, it means a no go. He told me he thought that Maine's siting rule was passed to reduce the massive and expensive cleanups needed when a well has been impacted. His rationale was that if there is public water nearby, then the house with the residential well can be hooked up to that water supply in the event of a spill.

I proposed two alternatives that might satisfy his needs: (a) prove that there is no hydrogeological connection between his site and the private well or (b) connect the homeowner to the public water supply. The first option is a real gamble because the whole area is shallow bedrock, a condition in which everything is usually connected to everything. As for the second option, well, it seems the homeowner likes his well water just fine, thank you. (And besides, who wants a bulk plant in his backyard!)

The law and its intent seem pretty clear on this—to protect against facility creep. I suspect that we will continue to see different siting scenarios that we never dreamed of and that owners, entrepreneurs that they are, will also continue to explore ways to get around our UST siting laws. No one likes to hear the word "no."

But as time would tell, the C-store owner had a third option.....

In this edition of "Tanks Down East" I'll give you the latest on the trials and tribulations of administering our comprehensive UST siting law. When I broke the news in *LUSTLine* last year ("There Ought to Be a Law," Bulletin #38) I also predicted that we might encounter some potential problems. Well we've had some, and wouldn't you know it, they were not the ones we'd expected! Funny how that works.

Maine's UST Siting Law: A Refresher

Maine's UST siting law prohibits or modifies the installation of UST facilities in proximity of existing water supplies (public and private wells) and future water supplies (significant sand and gravel aquifers). This law went into effect in October 1, 2001, with respect to private and public wells. The regulations that address the siting of USTs over aquifers go into effect on August 1, 2002. The siting requirements apply only to motor fuel and bulk plant USTs and not to the replacement or expansion of USTs that existed at a site prior to the implementation date. The following is a thumbnail overview of the siting requirements as a whole:

■ Where you can't install tanks:

- Within a 300 feet of a private well, other than the one used to supply water to the business*
- Within 1,000 feet (or within the "source water protection area," which ever is larger) of a community water supply (municipal well, mobile home park well, condominium, etc.) or a school well*
- Over a high-yield (more than 50 gpm) sand and gravel aquifer

**The only exception is if the applicant can prove that there is no hydrogeological connection between the site and the well—something that's very hard to do.*

■ *continued on page 14*

■ **UST Siting Law** *from page 13*

■ **Where you must go through a permitting process and provide additional protection:**

- Within 1,000 feet (or within the "source water protection area," which ever is greater) of a transient or nontransient public water supply
- Over a mapped moderate-yield (between 10 and 50 gpm) sand and gravel aquifer

The kicker with the mapped aquifers is that in most instances the data for the high-yield areas comes from the fact that someone has drilled a real gusher in the area, and this information is added to the maps. What this means is that anyone wanting to install tanks on a moderate-yield aquifer would first have to plunk down around $10,000 for a bore hole to prove that the mapped moderate-yield area is not also a high-yield area. High yield area = no tanks.

The Political Test

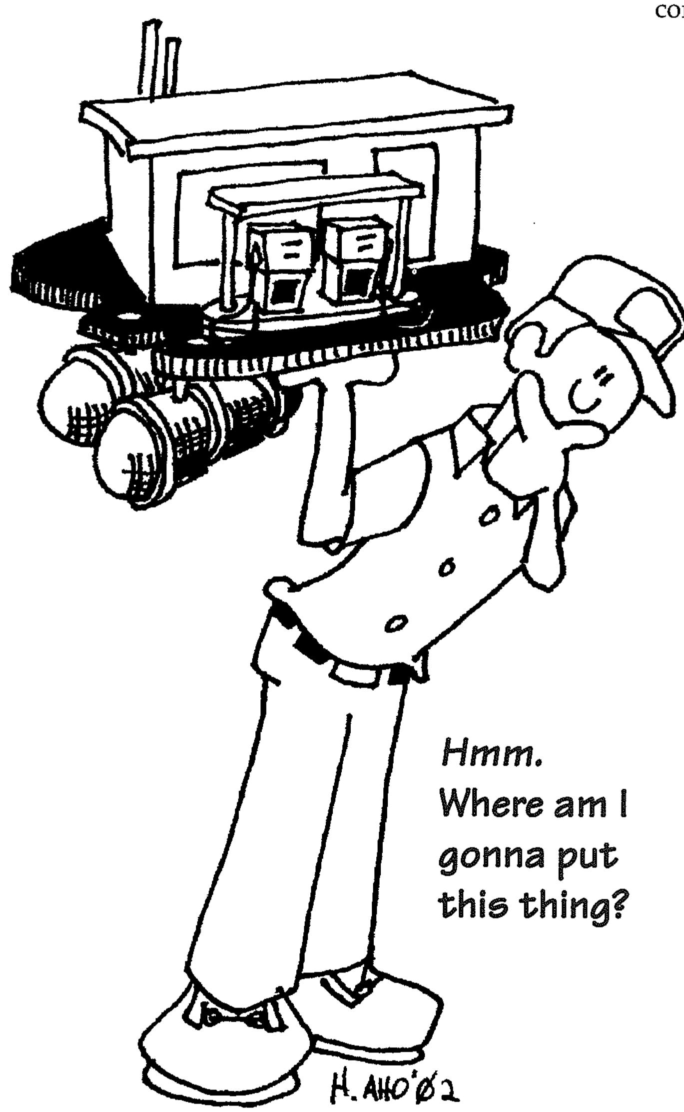
During the last legislative session, there was an attempt to reduce the setback to private wells from 300 to 75 feet, if the area was served by public water. If the area was not served by public water, in the event of a release the facility owner could agree (ahead of time) to replace the homeowner's water supply. The rationale was that these are "low-risk areas" and there are available remedies that would not adversely burden our state cleanup fund.

The Maine Department of Environmental Protection disagreed. For one thing, we wondered about the financial mechanism for replacing the water supply. Our position was that it would not be a solution if we had to tap the state cleanup fund. Fortunately, the legislature agreed.

Interestingly enough, in preparation for the debate over the adequacy of the 75-foot setback amendment, we initiated a study titled "Historical Oil Contamination Travel Distances in Groundwater at Sensitive Geological Sites in Maine" **http://www.state.me.us/dep/rwm/usts-OilTravel.doc.**

The study was based on a survey of the documented travel distances of Gasoline Range Organics (GRO), Diesel Range Organics (DRO), and MTBE and other gasoline oxygenates at 20 percent of our 394 long-term oil-remediation sites. The results showed that 70 percent of the sites had petroleum contamination traveling more than 75 feet from the source—even the less-mobile DRO traveled more than 75 feet from the source in 50 percent of the sites.

This survey essentially validated the 300-foot setback, in that 76 percent of the time the 300 feet provided adequate protection over a broad range of hydrogeological conditions and product types. Our rules have always defined a "sensitive geological area" to be within 300 feet of a private well or 1,000 feet of a public water supply or over a mapped significant sand and gravel aquifer or recharge area. I don't know the origin of these numbers, but based on our experience they seem to work rather well.



The Technical Fix

Another larger company found itself in this same UST-siting boat. A homeowner's well was within 300 feet of the proposed UST site. The company's solution to the setback requirement was to install underground vaulted tanks. Unfortunately, our definition of an UST prevents us from calling a vaulted tank an UST—as the vault has access for inspecting the tank, it is considered an AST, so welcome to the neighborhood!

From the get-go, we knew that some people might go with the obvious loophole of the AST, as opposed to a vaulted tank, to get around the setback requirement. But we also knew that this option wouldn't be so easy because of fire-code setback requirements and space limitations. Furthermore, most owners aren't keen about the way ASTs "ugly up" their nice C-stores, not to mention the potential for vandalism, fire, and all the other various drawbacks. However, if a tank were installed in a subsurface vault (according to National Fire Code Association [NFPA] 30A), then the major obstacle becomes the cost of the large-cast, in-place concrete vaults required for each tank.

The company in this example was considering a new prefabricated vault/ tank system that allows only two inches of space between the tank walls and the vault on all but one end. The tank sits in the vault like a hand in a glove, allowing the system to be prefabricated, reducing the amount of concrete needed, and simplifying the installation—thus reducing the price (according to the manufacturer). All the piping and dispensers sit over the vault in a spill containment area. On this site, though, to keep the delivery trucks out of the customer's way, they would have to install three 150-foot, double-walled offset fill lines! Except for the need for offset fill lines, it could be a good system.

But in my opinion a gas station is a gas station. Whether a tank is above or below ground, spills happen! Our best option is to make sure the owners are fully aware of what we see as potential problems with the system.

Now That You Said No, What Are My Options?

A couple of years ago a fellow bought an existing oil company that had many gas station locations with "problems," including one space-challenged gas station in a less than desirable location. His plan for this station was simple—buy the thriving convenience store across the street from the station and relocate his gasoline retail operation there. This way, his station is moved out of a dangerous intersection and is upgraded across the street.

There's one problem, however—this whole area is located over a high-yield sand and gravel aquifer. The owner would have to buy the convenience store, get a variance from the town (as this area is not zoned for gas stations), and fully install the UST system before August 1, 2002.

To meet that deadline he would still have to locate the UST system more than 300 feet from several private wells in the area (plus obtain a variance to site an UST within 1,000 feet of a transient public water supply). His geologist consultant did find a location on the site—around 60 feet by 40 feet—which met the setback requirement. This information was presented to us at a preapplication meeting at which no one present felt really confident that the whole tank, piping, and dispenser system could be squeezed into such a small area. The underground vaulted tanks were mentioned but they too would limit the layout of the facility.

Now here was a guy, thinking he's doing the right thing, proposing to upgrade a cramped little facility by locating it right across the street where, without the siting law, he would have had more room to install a state-of-the-art facility and also add suds, sodas, and sandwiches to his business. But the safest solution to this situation would be to remove the facility and not replace it at all over this valuable resource. This area is growing rapidly from rural to suburban and, in my opinion, will need an ample public water supply because of the potential for contamination (e.g., oil spills, septic systems) that comes with the clustering of homes. This is something that is beyond our environmental rules, however, much less the UST siting requirements. But the deal is off for now—the guy with the convenience store wants more than the oil dealer is willing to pay.

Continuing Shell Games

At the time of printing we are drafting an advisory opinion, at the request of a large convenience store operator, on whether a new UST can be installed at an existing facility but on a separate parcel of land that was bought before the law went into effect. The law and its intent seem pretty clear on this—to protect against facility creep. I suspect that we will continue to see different siting scenarios that we never dreamed of and that owners, entrepreneurs that they are, will also continue to explore ways to get around our UST siting laws. No one likes to hear the word "no." ■

SNAPSHOTS FROM THE FIELD

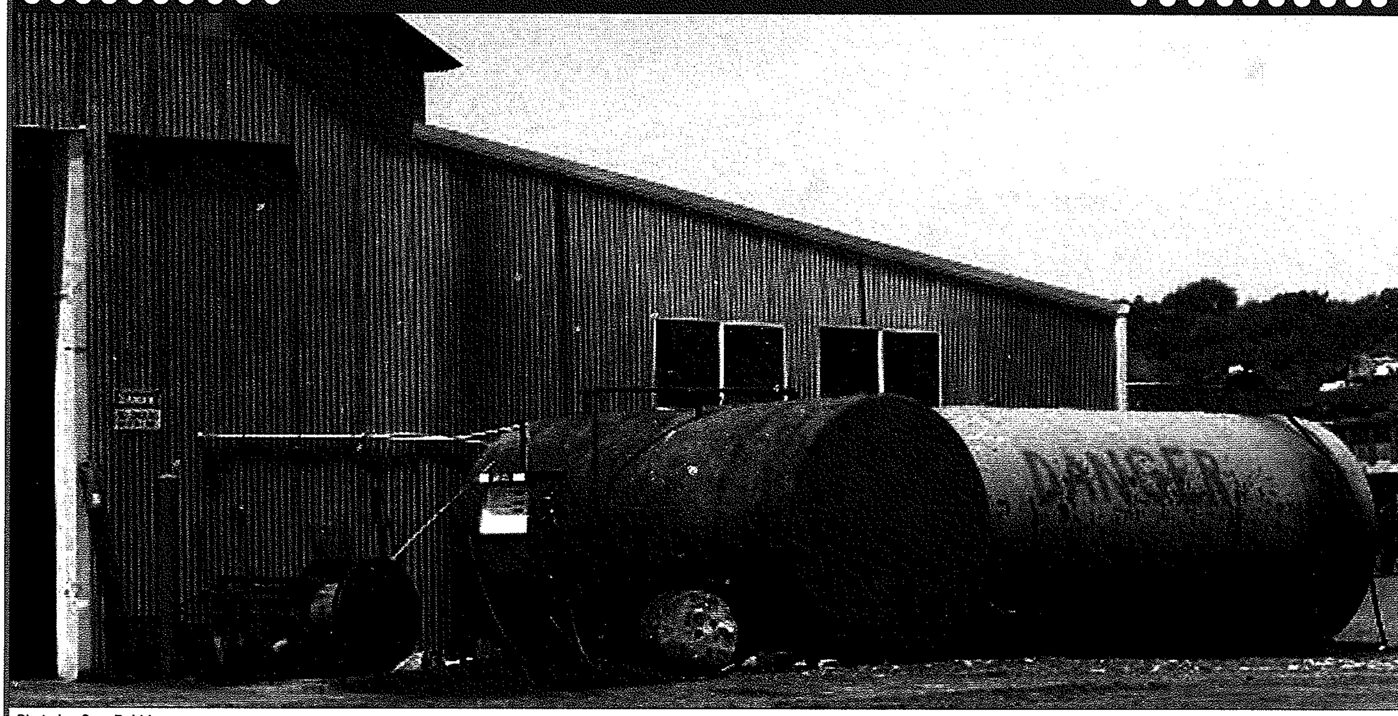


Photo by: Gary Robbins

Okay, what do we have here? Looks like two 10,000-gallon tanks full of petroleum product. Aargh!

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

Leak Prevention

STI Publications Update

The Steel Tank Institute is a trade association of aboveground and underground steel storage tank manufacturers. The Institute develops standards, recommended practices, informative articles, and other publications related to the fabrication, use, and installation of shop-fabricated steel storage tanks. The following is a list of several of STI's more recently issued or revised UST publications.

RP012-02 *Recommended Practice for Interstitial Tightness Testing of Existing Underground Double Wall Steel Tanks.* The purpose of this testing procedure is to meet the secondary containment testing requirements of the CA SWRCB (California State Water Resources Control Board). The practice is applicable to steel tanks built to both the UL 58 *Steel Underground Tanks for Flammable and Combustible Liquids* and UL 1746 *External Corrosion Protection Systems for Steel Underground Storage Tanks* constructions, which include:

- Type I double-wall storage tanks
- Type II double-wall storage tanks
- Jacketed secondarily contained storage tanks

The RP identifies the applicable code references of CA Code 2637 (a), the International Fire Code (IFC), Uniform Fire Code (UFC), and NFPA 30 regarding secondary containment testing. It contains an explanation of external hydrostatic pressure and its effect on the pressure within the interstice or annular space. The RP details separate procedures for testing tight-wrap double-wall and jacketed tanks, double-wall USTs exposed to water table, and double-wall USTs not exposed to water table. The RP also includes a table of recommended vacuum test pressures based on tank size and water table height.

RP011-01 *Recommended Practice for Anchoring of Steel Underground Storage Tanks.* This recommended practice covers procedures for anchoring steel underground storage tanks. It includes a table on minimum tank burial depth, as well as general guidelines for sizing, constructing, and installing deadman anchors, concrete slab anchors, and tank anchor straps. The RP contains recommendations for using deadman and slab anchors, which can be used in conjunction with the mandatory installation instructions issued with each tank.

R972-01 *Recommended Practice for the Addition of Supplemental Anodes to sti-P3® USTs.* On occasion, tank owners of sti-P3 tanks find that the cathodic protection readings are more positive than the NACE-recommended –850 millivolt criterion. In this case, the cathodic protection system must be supplemented so that the tank continues to be protected from corrosion. The addition of supplemental anodes can cause the tank potential to be more negative than the recommended –850 millivolt criteria. This RP only applies to sti-P3 tanks that require no more than 30 milliamps of current to bring the tank to protected levels.

This RP contains information regarding the number, size, and type of anodes that may be used to supplement the cathodic protection of an sti-P3 tank, the installation of the anodes, the installation of test stations, and methods for verifying the proper operation of the anodes after installation. Procedures for cathodic protection testing, verification of electrical isolation, and measurement of supplemental protective current required are also included in this RP.

F021-02 *Specification for the AquaSweep™ Gravity Oil Water Separator.* This specification covers the AquaSweep Gravity Oil Water Separators for either underground or aboveground applications. AquaSweep is offered in several models, all of which have been tested and are listed to UL Subject 2215, *Outline of Investigation for Oil/Water Separators.* The user may select the model best suited for his particular application. The AquaSweep gravity oil water separator technology may be used with any STI underground technology (sti-P3, ACT-100®, ACT-100-U®, or Permatank®), aboveground technology (Fireguard®, F921®, Flameshield®), or other UST/AST tank technology.

U.S. EPA set forth regulations in the Clean Water Act and the Storm Water Pollution Act that require the discharge of a storm water drainage system to meet certain effluent cleanliness limits. The AquaSweep gravity separator is designed to comply with certain requirements of these Acts.

This specification incorporates all the designs offered and shows how to construct a properly designed and tested gravity oil water separator. The primary purpose of this specification is to establish proper production procedures that are fully supported by quality assurance measures and proper installation, start-up, maintenance, troubleshooting, and repair requirements.

For more information about these and other STI standards and recommended practices, or to order a copy of the complete document, visit the STI Web site at* www.steeltank.com, *or contact the Steel Tank Institute at 570 Oakwood Road, Lake Zurich, Illinois, 60047. Phone: (847)438-8265; fax: (847)438-8766; e-mail: information@steeltank.com.

Oxygenates

Wander LUST

by Hal White

A column by Hal White that explores "a dimension as vast as space and as timeless as infinity—representing the middle ground between light and shadow, science and superstition ... between the pit of man's fears, and the summit of his knowledge."

Do Monitoring Wells Monitor Well? Part II

The Regulatory Basis for Monitoring Well Design, Siting, and Monitoring

In Part I of this article (LUSTLine #40) I discussed the function of monitoring wells and presented several of their many shortcomings. To recap from the last article, the primary function of a groundwater monitoring well is to provide subsurface access for (a) the measurement of liquid levels and (b) the collection of liquid samples for analysis. Monitoring wells may also be used to collect gas/vapor samples and measure vertical transport properties, and they are convenient (although rarely optimally located) places to install various components of a remediation system. I also asked the questions, "Why is it that so little consideration is actually given to the question of whether the data we derive from them is of adequate quality? Are we somehow bound by inflexible rules that defy common sense?"

In Part II of this series, I'll take you through an in-depth look at the federal regulations (and preamble) to identify potential constraints and then develop a defensible strategy to overcome whatever obstacles we may encounter. Beware! The sections titled "Regulatory Language" and "Preamble—Clarification and Guidance" contain material that may induce narcolepsy in all but the most detail- and academically oriented readers. To prevent serious bodily injury in the event of loss of consciousness, skip these two sections and dive right into "A Probing Analysis." You can always refer back to these sections in case of insomnia.

Regulatory Language

By now *LUSTLine* readers should be intimately familiar with 40 CFR 280, the federal regulations for the technical requirements for underground storage tank systems. Considering the extremely broad scope of these regulations, and the amount of detail in some of the sections (e.g., release detection), it is somewhat remarkable that the regulations are only 13 pages in length—a mere footnote by normal regulatory standards! It is somewhat disconcerting, however, that in the corrective action portion of the regulations (Subparts E and F) the word "well(s)" is only mentioned three times (and then only once within the context of a "monitoring well"), whereas in the prevention section (actually only in Subpart D) "monitoring well(s)" is used 10 times.

Granted, this frequency or infrequency of occurrence isn't the issue, it's what's actually said that's important. And it's important to note that the corrective action sections of the regulations provide no guidance with respect to monitoring well design, siting, and sampling. None. The free-product-removal regulations merely spell out the information requirements for the free-product-removal report that must be submitted to the implementing agency within 45 days after confirming a release.

The sections on release detection provide substantially more detail, though these sections don't apply to wells used for environmental monitoring. Because vapor monitoring and groundwater monitoring are allowable release-detection methods, it isn't at all surprising that Subpart D makes frequent mention of "monitoring well(s)." Monitoring wells are also mentioned in the requirements for the interstitial monitoring release-detection method. Let's look at what these release detection regulations say about monitoring wells.

■ **Vapor Monitoring** Regulatory language for vapor monitoring in the first five subsections of §280.43(e) describes requirements for "monitoring device(s)" and only in the final two sections does it refer to "monitoring wells" per se. Section §280.43(e)(6) requires that the UST excavation zone be assessed to "...establish the number and positioning of monitoring wells that will detect releases *within* the excavation zone..." Note that this clause refers exclusively to releases within the excavation zone and not those (if any) in the soil surrounding the excavation (e.g., from piping or vent lines). The final section (§280.43(e)(7)) merely requires that vapor-monitoring wells be clearly marked and secured.

■ **Groundwater Monitoring** Section §280.43(f) mentions a few limited design specifications regarding

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groundwater-monitoring wells. Section §280.43(f)(3) stipulates that "[t]he slotted portion of the monitoring-well casing must be designed to prevent migration of natural soils or filter pack into the well and to allow entry of regulated substance on the water table into the well under both high- and low-groundwater conditions." Section §280.43(f)(1) defines a "regulated substance" as being both immiscible in water and having a specific gravity of less than one.

The intent of these two passages is quite clear: groundwater-monitoring wells installed for the purposes of *release detection* must allow entry of regulated substances that float (having a density less than one) on the water table (i.e., a light nonaqueous-phase liquid [LNAPL]) and that they do so when the water table is at both its highest and lowest elevations (presumably on an annual cycle). If this weren't sufficiently clear, Section §280.43(f)(6) settles the issue as follows: "The continuous monitoring devices or manual methods used can detect the presence of at least one-eighth of an inch of free product on top of the groundwater in the monitoring wells."

Section §280.43(f)(4) requires that the annular space be sealed from the top of the filter pack to ground surface. This is a standard design feature of any well to eliminate a pathway for contaminants on the ground surface to reach groundwater. Section §280.43(f)(6) stipulates that these "monitoring wells or devices intercept the excavation zone or are as close to it as is technically feasible." As with the vapor monitoring section, there is a requirement (§280.43(f)(7)) for the UST excavation zone to be assessed to "...establish the number and positioning of monitoring wells or devices that will detect releases..." However, here they are not restricted to being within the excavation zone. Finally, there is a requirement that the monitoring wells be clearly marked and secured (§280.43(f)(8)).

■ **Interstitial Monitoring** The final occurrence of "monitoring well" in the UST regulations occurs in §280.43(g)(2)(vi) and merely requires that the monitoring wells be clearly marked and secured. These wells will not be considered further in this article.

Now that we've scoured the regulations for language relating to monitoring well(s), what have we learned? Not much. The next avenue is for us to look at language in the preamble and conduct a similar examination.

It is somewhat disconcerting, however, that in the corrective action portion of the regulations (Subparts E and F) the word "well(s)" is only mentioned three times (and then only once within the context of a "monitoring well"), whereas in the prevention section (actually only in Subpart D) "monitoring well(s)" is used 10 times.

Preamble—Clarification and Guidance

In contrast to the rule itself, the preamble is over 100 pages in length. The words "monitoring well(s)" occur with much greater frequency and, not unexpectedly, most of these occurrences relate to the same sections we've already examined in the regulation. For convenience I'll organize the discussion in the same manner as above, but I'll focus the discussion on what's different and (hopefully) more explanatory than the regulations.

■ **Vapor Monitoring** Vapor-monitoring wells serve functions that are very different than groundwater-monitoring wells. In the discussion of the effectiveness of vapor-monitoring wells, the preamble recognizes this by stating: "...a vapor-monitoring well does not necessarily mean a typical groundwater well. Instead, a vapor-monitoring well means any sampling point from which vapors are collected and brought to the monitor by any means." No additional clarification or description is provided for either the vapor-monitoring wells or "sampling points." These wells will not be considered further in this article.

■ **Groundwater Monitoring** The preamble acknowledges that "[t]he final rule still allows monitoring on top of the water table for free product but with several changes: well placement is no longer limited to the excavation zone; the well screen must be designed to prevent clogging and intercept the water table at both high- and low-groundwater conditions; and the well must be sealed from the ground to the top of the filter pack." This allows monitoring wells for release detection to be located even farther from the potential source of a release.

In the discussion of "Limitations" of this method, the preamble restates that groundwater monitoring is "limited to use with products that are immiscible in water and lighter than water so the product can be detected by the monitors." Further discussion of this issue reveals that U.S. EPA recognizes that this release-detection method is "...intended for use with gasoline and other substances that are, in fact, slightly soluble in water. Thus, the immiscibility requirement does not exclude substances that are, in fact, slightly soluble. The slight solubility will not interfere with rapid detection because most of the product is still floating on top of the water table where the monitor can sense it."

The final section on groundwater monitoring discusses the sensitivity of the monitoring device. For this the agency adopted a performance standard "requiring that the monitoring equipment be capable of detecting the presence of at least one-eighth of an inch of free product on top of the groundwater."

According to the preamble, "This value was selected because it is the maximum performance that manufacturers continue to claim can be achieved by existing automated monitoring equipment," although it is "intended to apply both to automated and manual monitoring techniques."

A bit later, the preamble recognizes that "manual methods of collecting and analyzing groundwater samples...may be more sensitive than automated monitors..." but dismisses this argument supporting the use of manual methods because they are "...very subjective and can only be conducted intermittently, whereas automated methods can be continuous and are less subjective."

Debating the "subjectiveness" of methods for measuring free product on the water table as release detection completely misses the more important point of whether or not a particular method is at all effective in detecting a leak *before* it causes a serious environmental problem. This is akin to rearranging the deck chairs on the Titanic.

A Probing Analysis

Now that we've completed a thorough examination of both the regulations and the preamble, what do we know about monitoring well design, siting, and monitoring? With respect to design, monitoring wells are only really discussed in the context of groundwater monitoring for release detection, and specifically for measurement of free product. Although language in the preamble does recognize that gasoline (and its components) aren't totally immiscible, applicability is explicitly restricted to substances that are immiscible or only "slightly soluble" in water.

At first blush this restriction may seem to be a material weakness (and it is) because the regulations only superficially address monitoring requirements for dissolved contaminants. But there is an unintended positive consequence. This consequence is that groundwater monitoring as release detection is implicitly disallowed for use with substances that are more than "slightly soluble" (e.g., MTBE, other ethers, alcohols). It's bad enough that the measurement criteria is explicitly set at one-eighth of an inch even for slightly soluble substances. So what are the monitoring requirements for dissolved substances?

The only explicit mention of "dissolved" substances appears in section §280.65(a): "In order to determine the full extent and location of soils contaminated by the release and the presence and concentrations of dissolved product contamination in the groundwater, owners and operators must conduct investigations of the release, the release site, and the surrounding area possibly affected by the release..." This section also lists several criteria, of which at least one must apply before §280.65(a) applies, and it is likely that at least one would apply at most release sites if an adequate investigation were conducted.

Alas, no substantive guidance is provided on how one would go about determining "the presence and concentrations of dissolved product contamination in the groundwater." Fortunately, however, other sections of the regulations that do not deal with release detection provide some insight into "measuring for contamination," although this too is rather vague.

Section §280.52(b) ("Site Check") requires that owners and operators "...measure for the presence of a release where contamination is most likely to be present at the UST site. In selecting sample types, sample locations, and measurement methods, owners and operators must consider the nature of the stored substance, ...the depth of groundwater, and other factors appropriate for identifying the presence and source of the release."

Similar language appears in sections §280.62 ("Release Response") and §280.72 ("Out-of-Service UST Systems and Closure"). Language in the preamble explains that the agency intentionally did not prescribe a given sampling method or measurement technique because it "may not provide representative results for all types of regulated substances and site conditions."

With respect to the siting of monitoring wells for release detection purposes, section §280.43(f)(5) directs that such wells are required to be sited as close to the tank excavation as is technically feasible so that a release may be detected as quickly as possible. Section §280.65(a) makes it clear that the area of investigation includes not only the release site but the surrounding area that might be affected by the release, so presumably environmental monitoring wells may be sited virtually anywhere.

Piecing Together a Strategy

From the above dissection of the regulations (and preamble) we see that 40 CFR 280 presents a rather disjointed collection of guidance and requirements for monitoring wells that, although good-intentioned, is incomplete and sometimes incongruous. Bear in mind that the regulations were written in the mid-to-late 1980s, and a lot of what we now know about how fuel releases behave in the subsurface has been learned in the years since promulgation of the regulations. For instance, the writers were blissfully ignorant of the characteristics of MTBE and the other oxygenates. They hadn't had the benefit of having spent several years dealing with the MTBE issue on a day-to-day basis. Even the transport and fate characteristics of free product, in general, and its more soluble components (i.e., BTEX), were at best incompletely understood.

Today we cannot credibly hide behind those same excuses. Although there's still a lot that is unknown, we can't afford the luxury of ignoring some of the most basic principles governing the transport of dissolved contaminants in groundwater. And although the regulations are far from perfect, we *can* piece together an improved strategy for dealing with fuel releases that is defensible from a regulatory perspective.

The starting point is language directing responsible parties to "measure for the presence of a release where contamination is most likely to be present at the UST site" considering "the nature of the stored substance,...the depth of groundwater, and other factors appropriate for identifying the presence and source of the release." So, let's see what we've got:

■ **We all need to recognize that conventional monitoring wells that are screened over long vertical distances are inadequate and unsatisfactory.** Such wells absolutely cannot provide the three-dimensional data that is essential for delineating the extent of dissolved contamination. All monitoring wells should have relatively short screens (no more than two to five feet), and a sufficient number of wells should be installed in close proximity (as in a "nest") such that there is continuous coverage from the seasonal high water elevation down to a depth below the water table, beneath which it is unlikely that a dissolved plume will dive. This generally will be an increasing depth with distance from the source.

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■ **New monitoring wells should be installed in transects spaced at appropriate intervals along the length of the plume.** The network of wells should be dense enough to provide a high degree of confidence that the plume is not migrating undetected, either between wells or beneath them. The plume should be surrounded by wells that lie outside the plume (i.e., samples collected from these wells should contain no trace of contamination at any depth).

■ **Discrete samples collected from each of these new monitoring wells should be analyzed for the major fuel components (i.e., BTEX) plus all potential oxygenate additives (e.g., MTBE, ETBE, TAME, TAEE, DIPE, TBA, TAA, ethanol, and methanol) each and every time a sample is collected.** EPA has recently completed a study that demonstrates that Methods 8015 and 8260 are appropriate for determination of MTBE and the other fuel oxygenates using appropriate sample preparative methods (e.g., Methods 5021, 5030 [at elevated temperature] or 5032). The protocol for using these methods is only slightly different than current practice, so any cost increase should be insignificant in relation to the improvement of the quality of the data thus produced. Whatever the incremental increase may be, it is certainly worth paying a little more to obtain data that are accurate, comprehensive, and credible. Information on these methods will soon be available from a variety of sources. An article will be published in *LUSTLine*, an EPA fact sheet is in production and should be circulated soon, and SW-846 (EPA's methods compendium) will be updated in the near future (visit **http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm**).

■ **New monitoring wells should be "monitored" on a frequent basis.** Quarterly events are not unreasonably frequent, especially where oxygenates are concerned. Water table elevations fluctuate in response to local influences (e.g., thunderstorms, tides) as well as annual weather patterns. Dissolved contaminant concentrations in wells may also vary significantly over the course of a year. Sometimes this is in conjunction with water level fluctuations; sometimes it isn't.

Without sufficient data to identify such trends, it is impossible to make credible predictions about plume behavior. Further, the increasing reliance on degradation rates calculated from plume centerline behavior is predicated upon data from wells that are in fact located on the centerline. In many cases the primary direction of groundwater flow, and hence migration of contaminants along the "centerline," may exhibit seasonal variation by as much as 90 degrees.

Although the regulations are far from perfect, we can piece together an improved strategy for dealing with fuel releases that is defensible from a regulatory perspective.

Such variation is problematic enough for determining whether receptors may ultimately be impacted—data from wells that aren't actually on the centerline (or which are sometimes and are not at other times) can yield an erroneous and overly optimistic calculated degradation rate. This in turn leads to an erroneous calculated time frame for achieving cleanup objectives and points out the importance of regular monitoring to track remedial progress.

Decisions about site closure should only be made based on actual field data. Under no circumstances should a site ever receive a "no further action" determination until it's been confirmed that remediation objectives have, in fact, been achieved and demonstrated to remain at or below the desired level for a specified period of time thereafter.

■ **Groundwater monitoring for release detection should be abandoned.** The presumption that free product floating on the water table will serve as a timely first indication of a release is just plain wrong! Especially with fuel oxygenates present in just about any UST at any time, a significant dissolved plume could have formed and begun migrating long before one-eighth of an inch of free product is noticed in a monitoring well that might be checked every 30 days.

If groundwater monitoring is used for release detection, then *daily* collection and analysis of groundwater samples for dissolved contaminants should be required. Once every 30 days is insufficient, especially when another month is allowed to confirm the first month's results. By this flawed strategy, a release could have been ongoing for 60 days before the "suspected" release was even reported. Months could pass before any remedial efforts would occur, and in that amount of time the plume would continue to grow.

If dissolved contaminants are detected in a monitoring well, then there's no doubt that a release has occurred; it isn't "suspected," it's a fact! Only the magnitude and cause of the release are unknown. (Unfortunately, implementation of this recommendation at the federal level would require a change in the regulations, which could take decades. Perhaps implementation at the state level could be achieved more quickly?)

The third article in this series will consider existing "conventional" monitoring wells. We'll look at examples both from real sites and from hypothetical situations to reinforce the points I've tried to make in the two preceding articles. Perhaps then there will no longer be any lingering doubts about the answer I've provided to the eternal question, "Do monitor wells monitor well?" ■

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This article was written by the author in his private capacity, and the conclusions and opinions drawn are solely those of the author. The article has not been subjected to U.S. EPA review and therefore does not necessarily reflect the views of the agency, and no official endorsement should be inferred.

Remediation

Reevaluating the Upward Vapor Migration Risk Pathway

by Blayne Hartman

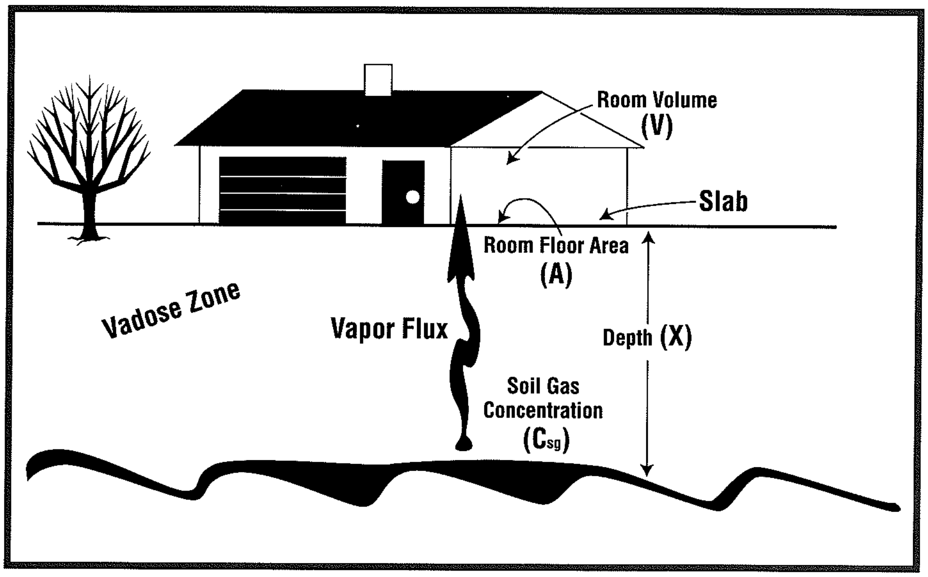
*When we last addressed this topic in November 1997 (LUSTLine #27, "The Upward Migration of Vapors"), the article began with a prologue indicating that the human health risk due to the upward migration of subsurface contaminants in the vapor phase is a growing concern to regulatory agencies. Four years later, it is safe to say that concern among regulatory agencies surrounding this risk pathway has grown quite considerably. It now seems that federal, state, and local agencies across the country know about calculating risk using the Johnson-Ettinger model. In fact, U.S. EPA has a 63-page User's Guide for the Johnson & Ettinger (J-E) model and another Supplemental Guidance document currently posted on its web site (**www.epa.gov/correctiveaction/eis/vapor.htm**). Custom versions of the J-E model are commonplace from state to state and in some states, from county to county.*

But the proper approach for assessing this risk pathway is still under debate. In May 2001, by direct request from the governor, the Michigan Environmental Science Board evaluated the use of the J-E model and issued a report that concluded that the model was appropriate, although the committee expressed confusion over the model's failure to adequately predict trichloroethylene (TCE) concentrations from a Colorado study. Earlier this year, the Denver Post *brought even more attention to the debate over this risk pathway and the Johnson-Ettinger model in a series of articles calling the model "flawed," attacking U.S. EPA's use of the model, and even accusing EPA of a cover-up about a "botched toxic-gas probe" (**www.denverpost.com/Stories/**).*

Confused? You're clearly not alone. So, what better reason to take another look at the upward vapor risk issue and see if we can clear up some of the confusion that currently exists.

A Review of the Concepts

Simplified, the Johnson-Ettinger model allows us to compute the indoor room concentration from the upward flux of a contaminant in the vapor phase. The vapor flux into a building is computed from Fick's first law, requiring measurements of the soil vapor concentration at some depth underlying the structure. Soil vapor concentrations may be measured directly. Alternatively, in the absence of actual soil vapor data, soil vapor concentrations are commonly calculated from soil and groundwater data, assuming equilibrium conditions, using equations based on Henry's Law constants and soil-to-water partitioning constants (ASTM, 1995). *And here lies the source of most of the problems that are currently being experienced with the use of this model.*



Remember the Salad Dressing

Immediately following the deluge of equations in my 1997 article, I gave a warning about using these equations to calculate soil vapor data. Let's repeat some of the text here to refresh our memories:

You must recognize that the equations used to calculate the soil vapor concentration from soil-phase data, water-phase data, or free product assume equilibrium partitioning between the phases. Equilibrium partitioning is obtained only if a system is well mixed. This condition is very rarely accomplished in the subsurface, because there are no blenders or stirrers present to homogenize the vapor, soil, and groundwater.

A common analogy used to illustrate this mixing concept is the preparation of a salad dressing using oil and vinegar. When the ingredients are initially added to the container, they fall into separate layers; the container must be shaken to mix the ingredients. If the container is not shaken, the oil and vinegar mix very slowly, "equilibrium is not reached," and the resulting salad dressing does not taste very good.

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Indeed, the results of published studies comparing measured soil vapor concentrations to soil vapor values calculated from groundwater using Henry's constants indicate that calculated values are often overestimated by factors of 10 to 100. Contaminant partitioning from soil to soil vapor is also likely to be far from equilibrium.

> ***My personal experience, based on measurement of contaminated soil and soil vapor at the same location, is that in the case of hydrocarbons, calculated soil vapor values from soil-phase data often overestimate actual soil vapor concentrations by factors of 10 to 1,000.***

My personal experience, based on measurement of contaminated soil and soil vapor at the same location, is that in the case of hydrocarbons, calculated soil vapor values from soil-phase data often *overestimate* actual soil vapor concentrations by factors of 10 to 1,000. In the case of chlorinated hydrocarbons, calculated soil vapor values from soil-phase data often *underestimate* actual soil vapor concentrations, perhaps due to the presence of contaminant vapor clouds infiltrating into the vadose zone from the surface and creating higher soil vapor concentrations. (See *LUSTLine* #28, "The Downward Migration of Vapors.")

The Key Conclusion

If calculated soil vapor values can differ from actual values by factors of 10 to 1,000, than the calculated vapor fluxes, and in turn, the calculated room concentrations using any version of the J-E model will be off by a similar factor. In other words, the error introduced by the calculated soil vapor data is likely to be far greater than errors introduced by any of the other parameters used in the model (e.g., porosity, advection, multi-layers).

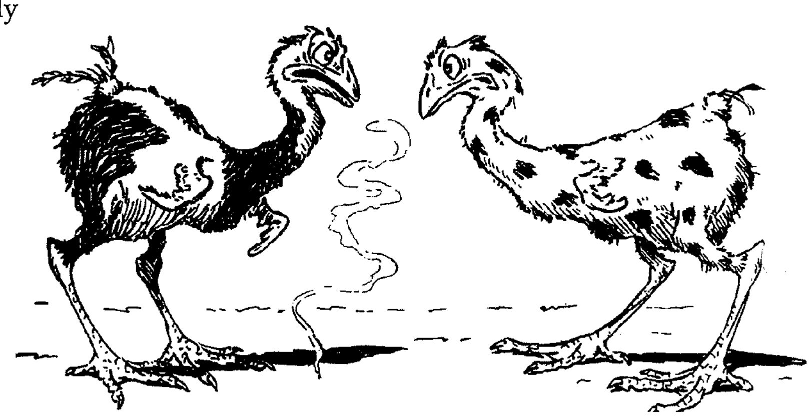
What Happened in Denver?

The EPA was under fire because indoor air measurements showed the presence of a contaminant (1,1 DCE) in homes at concentrations exceeding 1 in 1 million risk levels, yet indoor air values calculated from the J-E model indicated values below this risk level. The conclusion reached by the press was that EPA was using a faulty model.

But upon inspection, one learns that soil vapor values were not measured but calculated from groundwater values. Further adding to the potential error, the groundwater values themselves were not measured under the majority of the homes, but were estimated from contours of surrounding monitoring well data.

These are two very big potential errors that, combined, could introduce errors of two to three orders of magnitude in the soil vapor value used in the model calculation. While the situation here is a little more complex, the unfortunate fact is that EPA is getting torched in the press over the use of a bad model when, in fact, the real reason might be the inaccuracy of the data input into the model (i.e., the soil vapor concentration).

The "moral" of this story is that one must be careful about calculating soil vapor concentrations from groundwater- or soil-phase data. Many people feel that soil vapor values calculated from groundwater or soil data are more dependable than measured values because they show less variability than measured soil vapor data. While it is true that actual soil vapor data will show more variability than groundwater values, the gain in precision does not come close to offsetting the loss in accuracy. If soil vapor data are collected properly, the variability in the measurements (i.e., precision) from day to day is generally less than a factor of two. This is much smaller than errors of a factor of 10 to 1,000.



The Optimum Approach for Evaluating the Upward Vapor Migration Risk Pathway

Okay, so what's the optimum technique for determining the upward vapor migration risk? In my experience, the J-E model, limitations aside, tends to *overestimate* risk in nearly all cases if the proper soil vapor values are used, and hence is a conservative approach to the problem. However, the likely fallout of the negative press on the Denver site is that there will be a tendency to move away from the use of the J-E model and toward evaluating this risk pathway using surface flux-chamber measurements and indoor air measurements.

Beware, because these techniques have their limitations also, principally the following:

- A lack of data points (1 or 2 measurements over limited time intervals)
- Potential for contamination from sources besides flux from the bottom (with an indoor air measurement, how do you know where the contaminant came from?)
- No knowledge of what lurks below
- High potential for blanks that are then misinterpreted as fluxes
- An unsophisticated end-user (i.e., consultants who can't interpret the results)

The point is not that these techniques are not valid to use, but that they too have limitations that need to be considered before selecting the best method to use. You wouldn't consider proposing or accepting a site-assessment report with only one analysis from one or two borings, would you? So why would you accept only one or two flux-chamber or indoor-air measurements to close this risk pathway?

The likely fallout of the negative press on the Denver site is that there will be a tendency to move away from the use of the J-E model and toward evaluating this risk pathway using surface flux-chamber measurements and indoor air measurements.

Until we get a better database from which to make a reasonable conclusion as to the optimum approach, I strongly recommend the following:

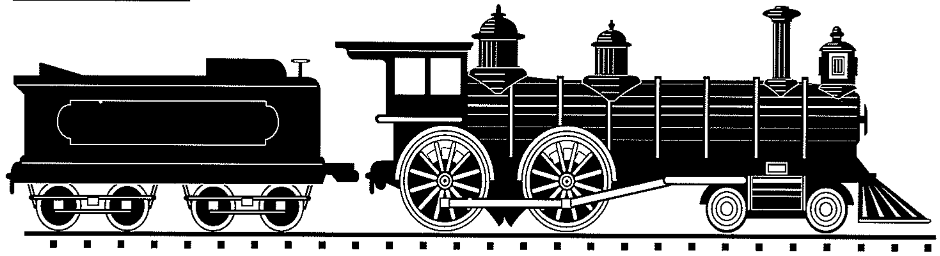
- Use J-E type models with actual soil gas data. Analyze the soil vapor at a reasonable number of points (minimum of four) covering the footprint of the existing or future building. Analyze soil vapor at shallower depths if samples collected at 5-feet below ground surface (bgs) indicate a potential problem. If samples are to be collected at very shallow depths (<3 feet bgs), consider installing vapor implants and measuring the soil vapor multiple times to evaluate the precision of the measurements. Refer to the article in *LUSTLine* #27 for a sampling protocol.
- For flux-chamber or indoor-air programs, take more than one measurement, collect for at least 8 hours (24 hours preferred), and collect at least one soil vapor sample under the footprint to see if anything lies below, especially at chlorinated solvent sites. ■

Blayne Hartman, PhD., is a principal of HP Labs and the founder of TEG. He has lectured on soil vapor methods and data interpretation to over 20 state agencies and to all of the U.S. EPA regions. Blayne has contributed numerous articles to LUSTLine *and authored chapters in three textbooks on soil vapor methods and analysis. For more information, either e-mail Blayne directly at bhartman@hplabsonsite.com or check out his Web page at* **www.hplabsonsite.com.**

Remediation

All Aboard the UST Train

by Debbie Mann



Do you remember the "Little Engine that Could"? With encouragement and willpower, he did what he set out to accomplish. Region 4 states have the same resolve when it comes to training and are headed down the track with a project we call the "UST Train," a vision for training LUST program personnel.

In an ideal world, states looking for employees to perform environmental technical duties would hire personnel experienced in environmental engineering, geology, and so on. Unfortunately, states are not always able to hire those experienced people. Instead, they often hire individuals who they believe have potential to learn but who may or may not have the necessary experience. The new hire is then thrust into our programs with little or no knowledge and asked to perform as well as an experienced veteran. Likewise, the veteran also needs continuing education and resources in this ever-changing field.

One of the greatest challenges of any LUST program is getting new hires trained as quickly as possible and training not-so-new hires in advanced topics at a reasonable price so they can effectively contribute to the assessment and corrective action of LUST sites. This becomes a challenge not only for the LUST program but also for the environmental and business communities, who find themselves patiently—or not so patiently—waiting for responses to their proposals. Better-trained regulators should lead to more effective cleanups, including a shortened time to closure and a reduced financial investment.

Recognizing this common challenge, U.S. EPA Region 4 states partnered with British Petroleum (BP) and Smoothstone Systems to create interactive, Internet-based training on basic hydrogeology and to explore the possibilities for developing a future on-line training program and on-line tools for LUST professionals. In less than a year, through our partnering efforts, we developed an on-line training pilot using material directed at new hires to serve as a beginning point for concept development.

At the 2002 UST/LUST National Conference, the pilot project was voted first place at the State Fair. During the fair, EPA and state LUST personnel from across the country expressed to us the same training frustrations. They also expressed the desire for this concept to move from prototype to production. If you visit **www.ust.smoothstone.com**, you will see why they were interested in seeing the project moving forward.

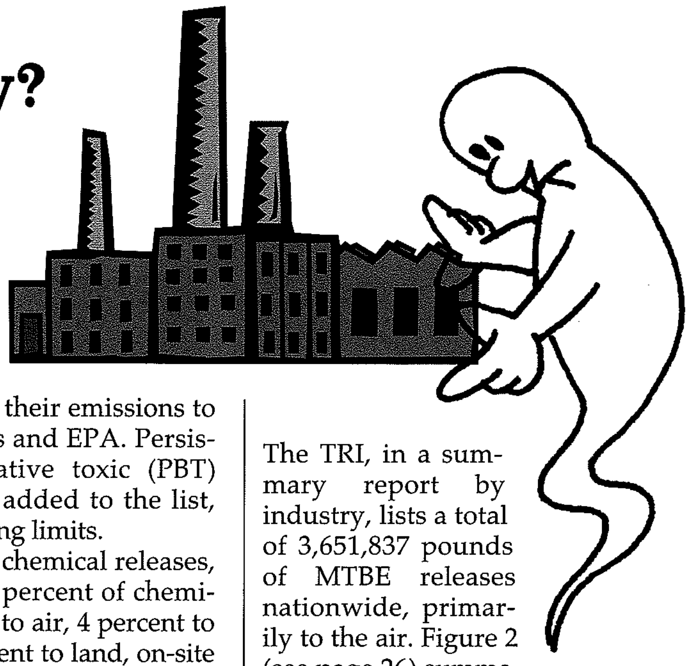
Wouldn't it be great if a training protocol and material were developed to help train your LUST and UST employees at all levels? Region 4 states are working with ASTSWMO and OUST to make this a reality. We welcome your input and ideas and would like for you to voice your thoughts for a cost-effective training solution to ASTSWMO and OUST. It's time for us all to get aboard the UST Train. ■

Comments and ideas can be sent to the Region 4 states by contacting Debbie Mann at **Debbie.Mann@state.tn.us** *or Walter Huff at* **Walter_Huff@deq.state.ms.us.**

Oxygenates

Lose Some MTBE Lately?

Unsettling Poundage in EPA's Toxic Release Inventory



by Patricia Ellis

In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act. The law, prompted in part by Union Carbide's Bhopal chemical disaster, required companies to make public the amounts of chemicals they release into the air, land, and water. Every year since then, EPA has published the Toxics Release Inventory (TRI) to disclose chemical release information to the public.

EPA released the annual report in May 2002 for data collected during the year 2000. The report documents the amounts of about 670 chemicals released into the environment by large manufacturing facilities and industries. Nationally, some 23,000 facilities released about 7.1 billion pounds of toxic substances in 2000. Mining, coal-burning power plants, and chemical and petrochemical plants produce much of the pollution.

Based on trends since the inception of the TRI in 1988, chemical releases have decreased about 48 percent. The TRI is a tool to help citizens assess local environmental conditions and to help them make decisions about protecting their environment. The data can be used in conjunction with environmental information to analyze trends in environmental indicators at both the national and local levels. The data often spur companies to focus on their chemical management practices.

Metal and coal-mining companies, coal-fired and oil-burning utilities, chemical wholesale distributors, petroleum distributors and storage facilities, and hazardous waste treatment and disposal facilities with more than 10 employees that manufacture or process in excess of 25,000 pounds or use more than 10,000 pounds of toxic chemicals a year are required to report their emissions to state governments and EPA. Persistent, bioaccumulative toxic (PBT) chemicals, newly added to the list, have lower reporting limits.

Looking at all chemical releases, approximately 27 percent of chemicals were released to air, 4 percent to water, and 69 percent to land, on-site and off-site. Releases from the mining industry made up 47 percent, or approximately 3.4 billion pounds. Releases from manufacturing industries accounted for 32 percent of all releases, or 2.3 billion pounds. About 1.5 billion pounds, or 16 percent of the releases, were from electric utilities. The TRI is available to the public at **http://www.epa.gov/tri.**

MTBE Lost to the Environment

You may wonder why I am writing an article about the TRI. As I read my morning newspaper on May 24, 2002, I noticed that in little Delaware, 76 facilities reported releases of 108 different TRI chemicals. Reported on-site releases totaled 9.8 million pounds. (Of this amount, approximately 7.8 million pounds were reported as released to the air, while 866,312 pounds were released to water and approximately 1.1 million pounds were released to land.) The total reported waste amount for Delaware, including on-site releases, off-site transfers, and waste managed on-site, totaled approximately 154.6 million pounds.

Then I got to my favorite bit of news. At the Motiva Enterprises Delaware City Refinery, emissions of MTBE increased dramatically from 47,500 pounds in 1999 to 272,000 pounds in 2000, the highest release of MTBE at any industrial site in the nation. (See Figure 1 – The Dirtiest Dozen on page 25.)

The TRI, in a summary report by industry, lists a total of 3,651,837 pounds of MTBE releases nationwide, primarily to the air. Figure 2 (see page 26) summarizes the 2000 MTBE releases on a state-by-state basis. Only California, Texas, and New Jersey had higher MTBE releases than Delaware, and Delaware only has one refinery!

The total TRI MTBE inventory for the entire country represents a mere 6 or 7 million gallons of MTBE lost to the environment. Is it any wonder that MTBE is showing up at low levels in air and groundwater in areas that are nowhere near documented UST releases?

In recent testimony before the U.S. House of Representatives Subcommittee on Environment and Hazardous Materials, Benjamin Grumbles, EPA Deputy Assistant Administrator for Water, stated that data from the USGS National Ambient Water Quality Assessment showed that MTBE frequently occurs in water supplies in regions with high MTBE use but that the vast majority of detections are at very low levels, with a median concentration of 0.5 ppb.

In a recent study by the American Water Works Association Research Foundation (AWWARF), completed in conjunction with the Metropolitan Water District of Southern California, the Oregon Graduate Institute, and the USGS, which involved testing of 954 randomly selected Community Water Systems (including 579 wells, 171 rivers, and 204 reservoirs), MTBE was detected in about 9 percent of all sources sampled and was the second most com-

Figure 1

THE DIRTIEST DOZEN

	Total Air Emissions	Surface Water Discharges	Underground Injection	Releases to Land	Total On-site Releases	Total Off-sites Release	Total On-site and Off-site Releases
Motiva Enterprises LLC, Delaware City, DE	272,000	840		0	272,840		272,840
ExxonMobil Refining and Supply, Baytown, TX	140,671				140,671		140,671
Bayway Refining Co., Linden, NJ	117,000	210			117,210		117,210
BP Amoco Texas City Business Unit, Texas City, TX	61,000	38,000			99,000		99,000
ExxonMobil Refining and Supply, Baton Rouge, LA	98,242	48			98,290		98,290
Valero Refining Co. Texas, Corpus Christi, TX	95,098	11			95,109		95,109
Chevron Products Co., Richmond, CA	76,000	15,000			91,000	9	91,009
McLaren Engines, Inc., Livonia, MI	89,715				89,715		89,715
Motiva Sewaren Terminal, Sewaren, NJ	64,046	18			64,064	0	64,064
Chevron USA Products Co., El Segundo, CA	28,699	28,981		25	57,705		57,705
Equilon Martinez Refining Co., Martinez, CA	55,000	1,100			56,100		56,100
Deer Park Refining LP., Deer Park, TX	51,000	1,900			52,900		52,900

monly detected VOC (at a reporting level of 0.2 micrograms per liter).

Findings in Delaware

As part of the National Air and Water Quality Assessment (NAWQA) Program, the USGS collected samples in Delaware from 30 randomly selected drinking water supply wells screened in the unconfined aquifer to access the occurrence and distribution of selected pesticides, volatile organic compounds, major inorganic ions, and nutrients. The samples were collected between August and November 2000.

Volatile organic compounds were present in all 30 wells, generally at less than 1 microgram/liter. Chloroform, tetrachloroethene, and MTBE were the most frequently detected VOCs, and were found in at least half of the samples. Seventeen of 30 samples had MTBE detected. Six of the samples were between 1 and 10 ppb, and one sample was above Delaware's 10 ppb drinking water standard.

In another study, last summer and fall, the Delaware Department of Natural Resources and Environmental Control and Delaware Division of Public Health sampled public wells in unconfined aquifers and surface water intakes that were within a one-mile radius of known hazardous waste sites. Thirty-nine wells and four surface-water intakes were sampled, both raw and treated water, for a total of 58 samples.

The samples were analyzed for 69 regulated chemicals, 10 chemicals with secondary standards, and 108 other chemicals. Of the 58 samples, MTBE and chloroform were detected in 21 samples. MTBE was the only chemical that exceeded a Delaware or U.S. EPA MCL. These included two wells with MTBE at 12 and 16 ppb, and the MTBE in one of those wells has more recently increased to 30 ppb.

Neither of these studies targeted wells near gasoline stations. Delaware has over 400 public drinking water supply wells that are screened in unconfined parts of the shallow aquifer alone and thousands of shallow domestic wells. When the Delaware Division of Public Health initially began routine sampling for MTBE in public wells in June 2000, of the first 210 samples collected, MTBE was detected in 38 samples, or 18 percent detects. This set of data was not limited to wells in the unconfined aquifer.

Is Something Wrong with This Picture?

Should we be concerned that such a high percentage of wells had MTBE

■ continued on page 27

Figure 2 2002 TOXIC RELEASE INVENTORY – REPORTED RELEASES (IN POUNDS) FOR MTBE

	Total Air Emissions	Surface Water Discharges	Underground Injection	Releases to Land	Total On-site Releases	Total Off-Site Releases	Total On-Site and Off-Site Releases	Notes
Alabama	6,320				6,320	1	6,321	
Alaska								No data
Arizona	16,930				16,930	5	16,935	
Arkansas	81				81		81	
California	559,299	52,545	0	5	612,350	89	612,439	
Colorado	2,350	24		5	2,379		2,379	
Connecticut	43,411	308			43,719	5,356	49,075	
Delaware	275,048	840			275,888		275,888	
DC								No data
Florida	28,173	1			28,174		28,174	
Georgia	7,792				7,792	15	7,807	
Hawaii								No data
Idaho	629				629		629	
Illinois	43,280	19			43,549	783	44,532	
Indiana	35,799	5			35,809		35,809	
Iowa	34,860	0			34,860		34,860	
Kansas	755	250			1,005		1,005	
Kentucky	36,817	1,469		4	38,290	20	38,310	
Louisiana	256,965	338		357	257,660	301	257,961	
Maine	9,635	41			9,676	630	10,306	
Maryland	52,017	475			52,492	45	52,537	
Massachusetts	87,561	3,150		54	90,765	11,426	102,191	
Michigan	150,396	1	23,001	0	173,398	15	173,413	
Minnesota	0	0	0				0	
Mississippi	13,605	60			13,665		13,665	
Missouri	6,393	0		5	6,398		6,398	
Montana								No data
Nebraska	255			0	255		255	
Nevada	3,531				3,531		3,531	
New Hampshire	9,340	89			9,429		9,429	
New Jersey	411,213	16,140	1	7,812	435,166	360	435,526	
New Mexico	3,707				3,707		3,707	
New York	134,649	236		5	134,890	1,047	135,937	
North Carolina	1,077	196			1,273		1,273	
North Dakota								No data
Ohio	6,044	0	0	0	6,044		6,044	
Oklahoma	33,232	21		82	33,335		33,335	
Oregon	319			8	327	8	335	
Pennsylvania	122,935	1,833			124,768	4,984	129,752	
Puerto Rico	26,991	0			26,991	0	26,991	
Rhode Island	28,292	78			28,370	3,819	32,189	
South Carolina	1,255	0			1,255		1,255	
South Dakota								No data
Tennessee	11,294	5			11,299	5	11,304	
Texas	813,307	41,918	4,334	1213	860,772	3,230	864,002	
Utah	7,330				7,330		7,330	
Vermont								No data
Virgin Islands	37,177	0			37,177		37,177	
Virginia	99,375	3,736		0	103,111	195	103,306	
Washington	1,239	0			1,239		1,239	
West Virginia	2,350	250		250	2,850		2,850	
Wisconsin	11,255				11,255	0	11,255	
Wyoming	19,400		3,900		23,300		23,300	
TOTALS	**3,453,683**	**124,028**	**31,236**	**9,800**	**3,619,503**	**32,334**	**3,652,037**	

■ **Lose Some MTBE Lately?**
from page 25

detected (17/30 and 21/58), even if the detects were at low levels, or should we be pleased that the recent NAWQA and DNREC/Public Health studies identified only three wells that are above the new Delaware MTBE MCL of 10 ppb?

Besides the releases that are tracked by the TRI, some of the other sources that contribute to MTBE detections in groundwater include leaking underground storage tanks (the usual scapegoat), other gasoline storage and distribution facilities such as bulk storage terminals, small household/farm gasoline tanks, aboveground storage tanks, petroleum pipelines, small releases (e.g., gasoline tank ruptures during car accidents, or consumer disposal of gasoline in backyards), engine exhaust and related releases into lakes and reservoirs from two-stroke watercraft and older four-stroke watercraft, and stormwater runoff.

Squillace et al. (1996) suggest that when small concentrations (0.2 to 3 μg/L) are detected in groundwater, the source of contamination may be a point source but is more likely is a nonpoint source, such as atmospheric washout. With the huge volumes of MTBE that have been released to the environment in some manner, it doesn't seem surprising that MTBE detects are so common.

In 1970, MTBE was the 39th-highest produced organic chemical in the United States. By 1998, it had become the fourth-highest, with an aggregate production of about 60 million metric tons over that period (Johnson et al., 2000). Is there anyone else out there who, like me, is uncomfortable with the sheer extent of contamination, rather than relieved that the impacts have not been more common? Maybe my generally optimistic nature will return when or if we see a national phase-out of the use of MTBE and similar gasoline additives. ■

Pat Ellis is a hydrologist with the Delaware DNREC UST Branch and served as member of EPA's Blue Ribbon Panel on MTBE. She is a technical advisor and regular contributor to LUSTLine *and can be reached at* **pellis@dnrec.state.de.us**.

INDIANA

Oxygenates

MTBE Hot Spot at an Indiana Elementary School Leads to Concerns and Questions

by Ellen Frye

On February 14, 2002, the strong smell of fuel at the Boezeman Marathon gas station in Roselawn, Indiana, led the Newton County Health Department to file a complaint with the Indiana Department of Environmental Management (IDEM) regarding possible groundwater contamination. Upon investigation, the Marathon drinking water well was found to have 2,300-ppb benzene, 1,400-ppb toluene, and 15-ppb MTBE. It was soon discovered that the well for the nearby Roselawn Elementary School had had MTBE levels of 32 ppb to 350 ppb—but no benzene or toluene—for a period of at least two years. Of the 41 nearby private residential wells tested, only two had MTBE—one located east of the school (2.5 ppb) and the other located north of Marathon (9.2 ppb). As it turns out, there had been some failures to communicate. As Craig Schroer, LUST Section Chief at IDEM, acknowledges, "Some hard lessons have been learned."

Discovery

"The most difficult piece of all of this for us is our concern for the health of the children and the staff at the school," says Schroer. That the MTBE-contaminated water had been used at the school for at least two years before it was acknowledged is partly a result of the fact that MTBE is not regulated by the federal Safe Drinking Water Act. In 2000, U.S. EPA asked public water suppliers to begin to report for MTBE on a voluntary basis. That year, the school sent IDEM's Drinking Water Branch a report showing 32 ppb MTBE in its water supply. IDEM put this information into its drinking water quality database and sent the report on to U.S. EPA. Inasmuch as there is no standard for MTBE, IDEM's drinking water program did not respond in any manner regarding the detection of MTBE in the school's water.

In 2001, the school had its water tested again and submitted to IDEM a fax of the test results. The MTBE level at this time had risen to 150 ppb. In response, IDEM's Drinking Water Branch faxed a copy of the U.S. EPA Drinking Water Advisory, recommending that the school system notify the affected parties. Apparently, nothing was done in response by the school. In addition, the MTBE level was at the end of the faxed page and difficult to read. The number was entered into the database incorrectly. This data entry error resulted in a lack of notification of IDEM's Remediation Se0rvices Branch.

In March, 2002, IDEM UST and LUST staff and U.S. EPA staff visited Boezeman Marathon for the first time to conduct a facility inspection and scope out the area. The facility, which serves both a retail and distribution function (for two other Boezeman stations), contains about 64,000 gallons of fuel within its tank system. The facility inspection failed to indicate a suspected release. The storage system subsequently passed two sets of tank and line pressure tests.

During the initial investigation, a few private residences as well as the school were visited to assess whether petroleum odors had been detected. No complaints were noted. Since then, however, water at the school well has tested as high as 350 parts per billion (ppb) of MTBE—10 times U.S. EPA's Drinking Water Advisory levels of 20-40 ppb for MTBE. IDEM's LUST site Risk Integrated System of Closure residential default closure level is 45 ppb.

In late March, school officials voluntarily discontinued use of school water for drinking, food preparation, and hand washing. The school is providing bottled water for drinking and hand washing. Food is prepared at an off-site location and brought to the school. And if MTBE contamination

■ *continued on page 28*

■ MTBE at School *from page 27*

weren't enough, school officials have already incurred the wrath of parents because of an alleged black mold problem in the school building. While this problem has, hopefully, been mitigated, parents' questions and concerns surrounding both issues have not.

Subsurface Investigation

The Marathon gas station station sits directly upgradient from the school well. "Due to site lithology, hydrology, and pumping effects, it looks like we have a very narrow plume that dives very quickly toward the school's well," says Craig Schroer. "Fortunately, the plume does miss the hundreds of private wells located directly across the street from the school. We could have seen a lot more wells affected."

As of mid June 2002, Boezeman's consultants had conducted five subsurface investigations both on the gas station property and off-site—a total of 41 soil borings and 8 monitoring wells. Very little soil contamination has been found, which is not surprising, as the area is mainly fine sands to a depth of 50 feet or more.

Initial groundwater samples showed no contamination when collected at the surface of the groundwater at 15 feet at the property boundary. However, a subsequent round of borings and monitoring wells that were installed at varied depths revealed BTEX and MTBE at 25 feet and greater. Benzene levels were as high as 24,700 ppb. MTBE levels were as high as 1,190 ppb.

That the MTBE-contaminated water had been used at the school for at least two years before it was acknowledged is partly a result of the fact that MTBE is not regulated by the federal Safe Drinking Water Act.

The fourth subsurface investigation, conducted in May, took place off-site to the north in the direction of the school's well and groundwater flow and focused on collecting grab samples at 10- to 25-foot intervals and revealed more BTEX and MTBE at 25 feet and below. BTEX, however, was much less prevalent than on site, reaching 464 ppb. MTBE was higher than on site, reaching 2,190 ppb.

The fifth subsurface investigation was conducted in June, this time around the school's well to determine how the MTBE plume is tracking and to assess whether there is another source. This investigation identified MTBE near the well as high as 1,070 ppb.

Craig Schroer notes that current data indicate that the BTEX and MTBE plumes seem to be behaving differently in that one seems to be going north and the other northwest. "I was kind of surprised by that," says Schroer, " but we'll be doing further investigating."

Boezeman Marathon, which responded quickly in terms of taking appropriate investigative and mitigative actions, has taken the position that their station may not be responsible for the MTBE contamination found at the school and in private wells. To see if the dots of responsibility do, in fact, connect, Boezeman's consultant plans to conduct further investigations on and off site.

Next Steps

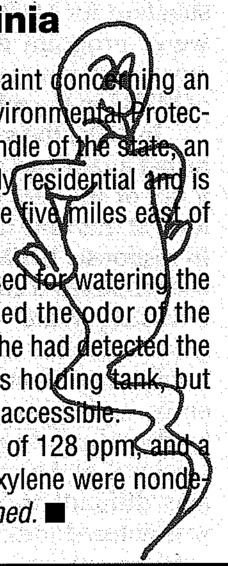
IDEM staff continue to respond to groundwater contamination issues in the Roselawn area to identify and eliminate exposure to groundwater contamination and address community questions and concerns. IDEM staff formally requested the Indiana State Department of Health to conduct a Health Consultation in order to evaluate whether any health effects have resulted from exposure to MTBE in the school's water.

Boezeman has agreed to fund the installation of a treatment system on the school's well. Other options such as a deeper well in another aquifer are being considered. As an interim measure, Boezeman has agreed to install a carbon filter on the school well to maintain hydraulic control of the MTBE plume and to protect downgradient wells. The water will be discharged to surface water using an NPDES permit. Boezeman plans to conduct further delineation around the wellhead and at the Marathon station in hopes of finding a source.

IDEM staff are concerned that two additional wells located downgradient from the school's well—a Generations Center, which provides services for children and seniors, and a church—are at risk. IDEM also plans to request that U.S. EPA conduct a Spill Prevention Control and Countermeasure (SPCC) inspection as the facility, which because of the size of its tanks is also subject to these requirements under the Clean Water Act.

Since this occurrence, IDEM has implemented a program to effectively communicate detection of contaminants between both programs. Seven other public water supplies were found to show MTBE detection in the two years since MTBE testing began. Of those, only two have significant levels. Indiana recently passed a resolution virtually banning the use of MTBE by July 23, 2004, allowing only trace amounts of the chemical. ■

Mystery MTBE Hot Spot in West Virginia



The Berkeley County Health Department referred a complaint concerning an odor in well water to the West Virginia Department of Environmental Protection (WVDEP). The well is in a town in the Eastern Panhandle of the state, an area that's primarily a karst geology. The town is predominately residential and is surrounded by agricultural areas. The nearest known USTs are five miles east of the town—there are a few closer farm tanks and ASTs.

The area is supplied by public water. The affected well is used for watering the garden and washing the car. The WVDEP inspector described the odor of the water as smelling like paint thinner. The well owner stated that he had detected the odor approximately one month earlier and had flushed out his holding tank, but the odor returned. Other wells in the immediate vicinity were inaccessible.

Lab analyses confirmed a benzene level of 1,890 ppb, GRO of 128 ppm, and a MTBE level of 231,000 ppb. DRO, toluene, ethylbenzene, and xylene were nondetect. An investigation of possible sources is underway. *Stay tuned.* ■

EPA Announces $3.8 Million in USTfields Grants to 26 States and 3 Tribes

On July 1, 2002, U.S. EPA announced 40 pilots totaling $3.8 million in grants to 26 states and three tribes to clean up properties contaminated from leaking underground storage tanks. These USTfield pilot projects involve abandoned or underused industrial and commercial properties with perceived or actual contamination from petroleum that has leaked from USTs. Petroleum contamination has generally been excluded from funding under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and has not, therefore, been covered under EPA's Brownfields Program.

Each of the pilots will receive up to $100,000 for assessing and cleaning up petroleum contamination from USTs. The grants are being awarded to states and tribes to demonstrate what can be accomplished in the assessment and cleanup—and ultimate reuse—of petroleum-impacted sites when federal, state, tribal, local and private entities work together. The pilots are intended to provide states, tribes, municipalities, and communities with useful information and strategies to promote a unified approach to site assessment, environmental cleanup, and redevelopment of contaminated properties.

In awarding these grants EPA intends to spur partnerships among state and local governments, community groups, investors, and developers to get sites cleaned up and ready for community use instead of remaining a liability to the community and a continuing threat to public health and the environment.

These 40 pilots, combined with EPA's original 10 USTfields pilots, brings to 50 the total of USTfields pilot locations nationwide. For more information, visit EPA's Web site at http://www.epa.gov/oust/ustfield .

The 40 USTfields pilots and the amount of their grants are:

Alabama
Selma – $100,000

California
Los Angeles – $100,000

Colorado
Denver – $100,000

Florida
Clearwater – $100,000
Escambia County – $100,000
St. Petersburg – $100,000

Idaho
Smelterville – $100,000

Illinois
Freeport – $100,000
Waukegan – $84,870

Indiana
Indianapolis – $100,000
South Bend – $100,000

Iowa
Clinton – $100,000
Des Moines – $100,000

Louisiana
Baton Rouge – $90,000
Westwego – $88,000

Maine
Hiram, Portland, Westbrook, Lewiston – $50,000

Michigan
Detroit – $100,000
Kalamazoo – $100,000

Minnesota
Minneapolis – $100,000

Mississippi
Jackson – $100,000

Missouri
St. Louis – $100,000

Montana
Billings – $100,000

Nevada
Mineral County – $100,000

New Hampshire
Northumberland – $85,000
Statewide – $50,000

New Jersey
Hudson County – $100,000

New York
Yonkers – $99,801

North Carolina
Concord – $100,000

Ohio
Youngstown and Boardman – $100,000

Pennsylvania
Lancaster County – $100,000
Philadelphia County – $100,000

South Carolina
Greenville – $100,000

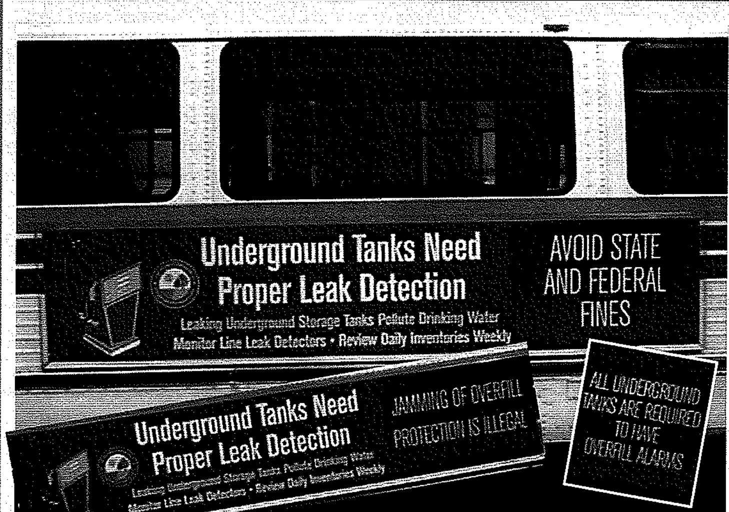
Tennessee
City of Kingsport – $100,000

Texas
Houston – $100,000

Washington State
Rosalia – $33,000
Seattle – $100,000
Tacoma – $100,000

Tribes
Crow Tribe - Pryor Trading Post – $100,000 in Montana
Gila River Indian Community - St. John's Mission –$100,000 in Arizona
Metlakatla Indian Community – $100,000 in Alaska

Connecticut Brings a Strong Leak Detection Message to the Streets



Photos by: Scott Deshefy

With Connecticut fast approaching total compliance with UST '98 Deadline requirements for equipment, the enforcement focus is switching to UST operational compliance. The state is reinforcing the critical importance that leak detection and prevention play in safeguarding human health and the environment from the hazards of gasoline pollution. Owners and operators must have proper leak detection mechanisms in place, properly monitor their ATGs and line leak detectors, and review daily inventories weekly. The Connecticut Department of Environmental Protection's enforcement program chose to convey its message through a bus placard outreach campaign similar to that used prior to the '98 Deadline.

Funding for the informational campaign was made possible by a supplemental environmental project, included as part of a large civil penalty in an enforcement action against a major petroleum distributor that had egregiously violated UST release detection regulations. The company failed to report the leak in a timely manner and also failed to immediately investigate and correct the leak as required.

For up to 12 months, the bus placards will carry three versions of the operational compliance message and will appear in every major city and transit corridor in the state. Press releases and half-page newspaper ads will supplement the project in certain areas of the state. ■

EPA HQ UPDATE

LUST Remediation System Evaluations to be Undertaken by TIO

OUST has teamed with OSWER's Technology Innovation Office (TIO) to conduct Remediation System Evaluations (RSEs) at LUST sites. RSEs are conducted to determine if a current remediation system at a site is operating efficiently and cleaning the site up in the fastest way possible. TIO has promoted the use of RSEs at 25 Superfund sites to date and has shown that a potential savings of $5 million at these sites could be expected if recommendations from the RSE team were implemented. Region 2 will be conducting a pilot project at one or two locations in New York State, where a review team will look at pump-and-treat sites that have been languishing. This project is expected to begin in late summer.

Pay For Performance Toolbox Unveiled

The initial version of the *Pay For Performance (PFP) Toolbox* on the OUST Web site was unveiled and demonstrated at the 2002 UST/ LUST National Conference. PFP is a type of performance-based contracting that states and owners/operators can use to contract for LUST cleanups. The PFP Toolbox is designed to assist state regulators in developing a PFP program and provides information on how to use PFP contracting, develop a PFP contract, implement a PFP program, and expand an existing PFP program. In addition, the Toolbox provides examples of actual PFP contracts used in existing state LUST PFP programs, PFP presentations prepared by state staff, and articles written by state staff about PFP performance from *LUSTLine*. OUST will update the Web site as states provide more information on their LUST PFP programs. The PFP Toolbox can be seen at **www.epa.gov/oust/pfp/toolbox.htm.**

OUST Joins Industrial Triage Project with Energy Department

OUST has joined in an interagency agreement with the U.S. Department of Energy to refine a "triage system" that communities plagued with Superfund, brownfields, and USTfields sites can use to help prioritize these sites for reuse/revitalization. The project will examine and refine Industrial Triage software developed by the Argonne National Laboratory. The software was designed to allow local parties to combine readily available data about property characteristics, economic and demographic infrastructure, environmental concerns, and financing considerations in a way that generates a meaningful understanding of potential brownfields or USTfields sites. Once refinements are completed and data collected, the database can be used by interested parties to evaluate and select sites for reuse, based on real estate market assessment, environmental analysis, economic incentives, or unique contributions of the community. The Industrial Triage system can subsequently help these parties streamline the application of limited assessment and corrective action dollars to sites with the greatest reuse potential.

Five Case Studies of USTfields Pilots Available on OUST Web site

A new case study on the Utah USTfields pilot is now available on the OUST Web site, along with case studies of the pilot activities in NH, NJ, IL, and OR. Each case study gives a background on the project as well as a description of the accomplishments to date and challenges the pilot has faced. The newest case study explains how the State of Utah is partnering with Salt Lake City to assess, clean up, and reuse a site in the western part of the city. Salt Lake Neighborhood Housing Services plans to build affordable housing on the site once cleanup activities are complete.

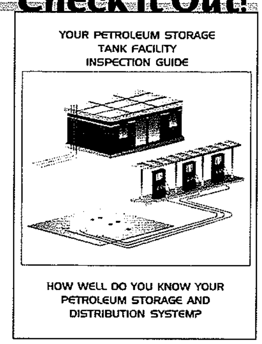
REGION 2: UST Enforcement Actions

EPA Region 2 reports that it reached a $175,000 settlement in action against Super Value, Inc., for UST violations at four facilities in New Jersey. Super Value had failed to permanently close 20 of its UST systems and to report the release of petroleum at one of its facilities. The settlement also requires Super Value to complete permanent closures and site assessments at the four facilities that were the subject of the complaint and at all UST systems owned and/or operated by it in the State of New Jersey that have been out of service for greater than 12 months.

In another case, a District Court granted a Motion for Default Judgment against an individual and three companies that had owned and operated a gas station in Brooklyn, NY. The defendants had failed to upgrade or close their six substandard UST systems and repeatedly failed to comply with relevant regulations concerning release detection and release detection recordkeeping. In this case, the Order and Judgment of Default issued by the judge requires the defendants to pay a $300,000 penalty.

Florida's Petroleum Storage Tank Facility Inspection Guide

Check it Out!



Florida's Broward County Department of Planning and Environmental Protection and the state Department of Environmental Protection (DEP) have teamed up to produce *Your Petroleum Storage Tank Facility Inspection Guide: How Well Do You Know Your Petroleum Storage Distribution System?* This 24-page guide was developed by Broward County UST inspector Astley A. Johnson in an attempt to simplify the UST regulations for the regulated community in Broward County.

The guide highlights the key elements of a facility inspection and emphasizes the importance of maintenance and recordkeeping. It contains full-color illustrations of all aspects of UST and AST systems. The Florida DEP adapted the publication for statewide application and provided a copy to every regulated UST facility owner/operator in the state. Copies can be downloaded from the Florida DEP Web site at:

www.dep.state.fl.us/waste/categories/tanks/default.htm.

Oxygenates

San Francisco Jury Says Oil Companies Knew of MTBE's Hazards Early On

In April 2002, a San Francisco jury found that gasoline with the additive MTBE is a defective product and that Shell Oil Co., Atlantic Richfield Chemical Co. (now owned by Lyondell Chemical), and Tosco Corp. (now part of Phillips Petroleum) were aware of the chemical's dangers but withheld the information when they put it on the market. The Superior Court jury made its finding in a product liability case brought by the South Tahoe Public Utility District over contamination of the district's groundwater. The district sued in 1998 after MTBE pollution forced it to close a third of its drinking-water wells.

In its verdict, the jury said the companies had placed a defective product on the market when they began selling gasoline with MTBE. The jury also found that Shell and Lyondell acted with malice when they withheld information about the chemical. Lawyers for the South Lake Tahoe district had presented evidence that the companies promoted MTBE even though they knew it could contaminate water supplies.

> **Lawyers for the South Lake Tahoe district had presented evidence that the companies promoted MTBE even though they knew it could contaminate water supplies.**

This landmark verdict came after seven weeks of deliberation following a five-month trial. Dozens of such cases are pending against the nation's largest oil companies, and could expose the industry to billions of dollars in cleanup costs and punitive damages. The trial is now in phase two, where damages and the question of whether MTBE was the cause of groundwater pollution in South Lake Tahoe will be decided.

South Lake Tahoe is a resort community with a population of 28,000 that swells to 50,000 in the summer. It is one of the communities hardest hit by MTBE pollution. The city closed 12 of its 34 drinking-water wells because of the MTBE contamination. The South Lake Tahoe utility estimates that it has spent more than $9 million, which doesn't include the cost of treating the tainted water. The cost to remove MTBE from the water supply is estimated at $45 million.

In 1998, South Lake Tahoe sued 31 companies, alleging that their defective product spoiled drinking water. Twenty-six companies already settled for $33 million in 2001.

Shell and Tosco were named because they owned the gas stations along Highway 50 where USTs leaked MTBE. Arco Chemical manufacturers MTBE. ■

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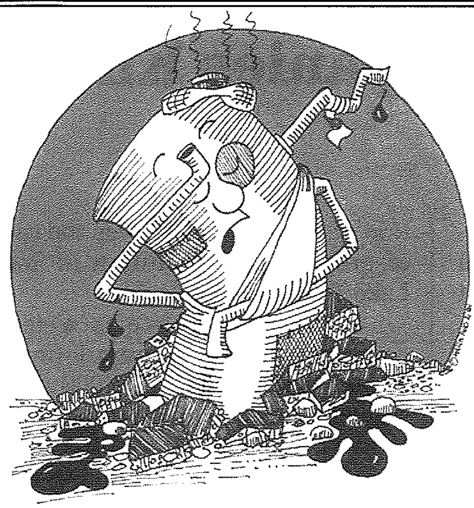

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