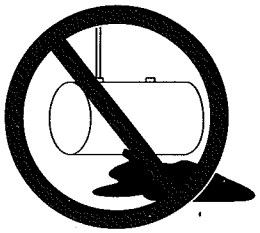
New England Interstate Water Pollution Control Commission

255 Ballardvale Street
Wilmington
Massachusetts
01887

Bulletin 22
June
1995

L.U.S.T.LINE

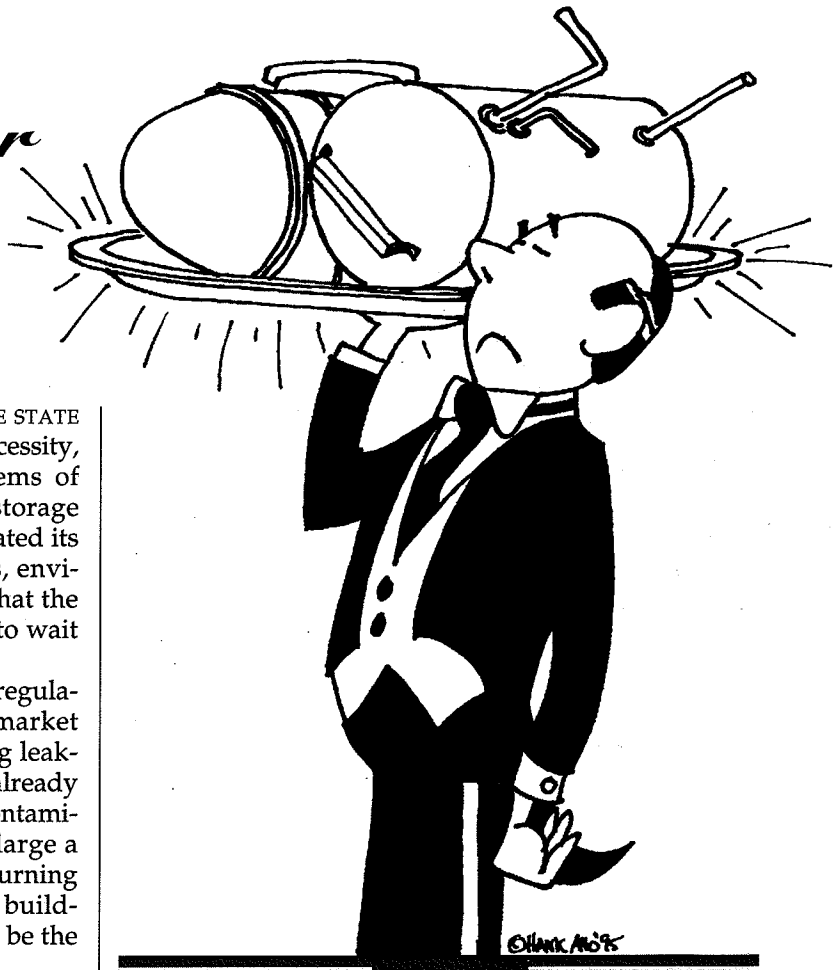


A Report on Federal & State Programs To Control Leaking Underground Storage Tanks

Serving Up USTs On A Silver Platter

Is The Stage Set For The Insurance Industry's Return?

by William J. Morrissey



OVER THE YEARS, THOSE OF US WHO MANAGE STATE environmental cleanup funds have, of necessity, learned a great deal about the problems of insuring sites with petroleum product storage tanks. Back in 1988, when EPA promulgated its petroleum storage and financial responsibility rules, environmental regulators didn't have a clear picture of what the real insurance issues would be. But they didn't have to wait long to find out.

As the UST regulatory program got underway, regulatory agencies found out that the private insurance market wouldn't be available to provide coverage for existing leaking underground storage tank (LUST) sites that were already contaminated. These sites, many of which had been contaminated through years of operation, were simply too large a risk to insure. When asked what it costs to insure a burning building, insurers typically answer, "The cost of the building." Likewise, the cost of insuring a LUST site would be the cost of the remediation.

At the same time as the insurance companies were withdrawing from the UST market, the states were cranking up their enforcement programs by creating site assessment protocols, establishing remediation standards, ordering the closure of out-of-service tanks, and verifying that leak detection requirements were being met. Pandora's box was thrown wide open bringing about an immediate growth in the number of sites in need of environmental remediation. Unfortunately, many owners and operators lacked the insurance or other financial resources necessary to pay for the required cleanups.

This widespread lack of financial resources brought the states into the insurance market as the primary providers of

■ *continued on page 2*

Inside

■ **Serving Up UST's** *from page 1*

financial responsibility. Wisconsin has paid claimants $200,000,000 since 1989; its current payment rate is $3,000,000 per week. From a positive point of view, the experience we've gained in managing the cash flow associated with our cleanups has provided us with an impressive body of knowledge on insurance and the cost of conducting environmental remediations.

A Whole New Ball Game

Part of our new-found knowledge is the realization that a fundamental change needs to take place in the thinking of owners and operators of petroleum storage systems. Traditionally, these folks have thought of themselves as service stations operators, trucking companies, farms...or any one of a hundred different businesses. But many of these businesses deal with petroleum storage along with a variety of other hazardous and otherwise questionable wastes such as waste oil, solvents, and antifreeze. These business men and women may not yet have come to terms with the fact that they run a high environmental risk operation.

Paper makers, platers, and chemical companies have figured this out, but the vast majority of our owners and operators still think that they sell gasoline or fix cars or manage a fleet. The environmental factor doesn't become a reality until the life blood of their trade KOs the neighbor's well. At this point, the tank owner/operator begins to realize that petroleum products are not benign entities and that they store and dispense a hazardous substance made up of carcinogens and heaven knows what else.

As long as Americans are of the notion that protecting human health and the environment is important to their overall sense of well being, it's safe to say that, for tank owners and operators, the good old days are gone. It's a new ball game, and the environmental risk of dispensing petroleum products needs to be a real part of the business and financial game plan. Until this happens, leak detection, equipment upgrades, and financial responsibility will be just pesky government regulations and not a core issue for the owner.

Part of our new-found knowledge is the realization that a fundamental change needs to take place in the thinking of owners and operators of petroleum storage systems. ...many of these businesses deal with petroleum storage along with a variety of other hazardous and otherwise questionable wastes such as waste oil, solvents, and antifreeze. These business men and women may not yet have come to terms with the fact that they run a high environmental risk operation.

Coverage, Coverage, Coverage

When owners or operators investigate private insurance, they're usually concerned about cost and whether it "meets EPA requirements." This point of view misses the point. To paraphrase the last presidential election: It isn't cost and EPA requirements, it's coverage. The issue isn't whether the insurance policy meets EPA's needs; insurance isn't bought to protect EPA. The issue is: Does the policy meet the needs of the owner? If a policy meets EPA requirements but fails to meet the owner's environmental risks, it's the owner who will have swallow the financial burden, not EPA.

The fact that an owner has an EPA-qualifying policy doesn't mean a thing if an uncovered event piles up environmental or legal bills. In the end, if a business goes bankrupt, the reason for the bankruptcy is irrelevant; bankruptcies look pretty much the same in court.

Then there is the issue of the cost of a policy—the continuing question of affordability. Again, an essential point is being missed. The question isn't, "How cheap can I get a pollution liability policy?" The real question is, "What will it cost to buy insurance so that I can reduce my risk to an acceptable level?"

Before the cost and value of a policy can be discussed, the owner ought to be assessing the risks that the business needs to recognize and insure. After the core coverage needs are identified, then the owner can look at the question of where he or she can get a quality policy that meets those needs. Pollution liability insurance is a cost of doing business, and it is a cost that is central to the survival of the business.

Reeling In The Insurance Market

The most common complaint, since 1988, has been that pollution liability insurance is not available or affordable. For existing contaminated sites, this is largely true—ergo, state funds. It's not true, however, where sites have been remediated and have upgraded tanks and lines. These are now insurable, low-risk sites that might well be served up to the insurance industry on a silver platter.

In Wisconsin, the legislature has taken the position that sites with upgraded equipment or completed remediations must have private pollution liability insurance by January 1, 1996. Upgraded sites with on-going remediation as of January 1, 1996 will have that remediation covered by the state fund. New releases, however, will not be insured by the state and will need to obtain private insurance.

LUSTLine

Editor, *Ellen Frye*
Kate Becker, *EPA Project Officer*
Jennie Bridge, *NEIWPCC Project Officer*
Marcel Moreau, *Technical Advisor/Contributor*
Ricki Pappo, *Layout*

Prepared by the NEIWPCC with a grant (#T902790) from 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.

The New England Interstate Water Pollution Control Commission 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.

NEIWPCC
255 Ballardvale Street,
Wilmington, MA 01887
Telephone: (508)658-0500
FAX: (508)658-5509

The requirements established in Wisconsin reflect a public policy that assigns remediation of historic contamination to the state fund and new releases to the owner (to be covered through insurance). It is not the intent of the state to run a pollution liability insurance company on a permanent basis or to take over a role that private companies can best provide.

The existence of such public policy, however, is no guarantee that a healthy insurance market will follow. Ultimately, the viability and competitiveness of the insurance market (which will lower cost and provide more value) will be driven by the number of facilities that buy insurance and the quality of the new tanks, lines, and leak detection systems that they have installed.

Currently, a small number of companies are providing insurance coverage in Wisconsin. Prices average around $300 per tank system with a $900 site minimum. The average policy has a premium of approximately $1,700 per year. Although these are much better prices than would have been obtainable a few years ago, it's still not a competitive market.

The reinstitution of a viable insurance market will only happen when individual states establish and enforce insurance transition requirements. By moving the premium sites off of state coverage and into the private market, the universe of applicants will grow. This growth will allow the market to become large enough to encourage companies to open offices, hire adjusters, and generate the volume of premiums that will make the effort profitable. As in any market, when size and profitability exist, new and better insurance products at truly competitive prices will emerge.

Take An Insurance Company By The Hand

Over the past 7 or 8 years, there have been significant advances in the investigation and remediation of LUST sites. Now when a contaminated site is investigated, there are extensive protocols for investigation methods, sampling, sample preservation, laboratory testing, site documentation, and remedial alternative selection. Comparing a 1988 investigation to one conducted in 1995 is like traveling in a time machine—we've entered an entirely new era.

Unfortunately, the dramatic improvements in the technology of investigation and remediation have not necessarily been followed by the insurance companies. The insurance industry needs to get up to speed on the level of documentation that exists on sites undergoing remediation. Sites with completed investigations should be highly insurable and sought after. Not only has the existing contamination been identified and documented, it will, in most states, be covered by a state fund. If a new release should occur at a facility that has undergone remediation and is now in compliance, it will be identified quickly and differentiated easily from previous contamination.

For reasons that are not readily apparent, the level of documentation that exists on many sites appears not to have been recognized by the insurance companies or integrated into their estimates of risk. Insurers have also not looked at the degree and extent that leak detection, new tank systems, owner education, and state enforcement activities, combined, will help prevent and minimize any releases that might occur.

The risk to insurers has been substantially reduced and we need to reconnect them with the market so that they can start to understand the changes that have taken place. Since 1988, a general resignation—that the only solution to contamination is a state fund—seems to have infiltrated insurance companies, states, and owners alike.

This attitude fails to recognize the progress achieved in recent years. State funds may be a successful response to historic contamination, but they are definitely not the only solution to covering future environmental risks. In terms of insurance, owners are able to buy policies that:

- Cover all risks and products stored and handled on site—not just products covered by state statute.
- Cover catastrophic situations and the possible need for a higher site maximum—rather than limiting the owner to a statutory amount.
- Cover legal fees, loss of business, and similar expenses—costs which are frequently excluded or provided limited coverage under state funds.
- Assist in managing a remediation—rather than allowing the cleanup to be a do-it-yourself effort.
- Integrate workers compensation, health, and other insurances into one risk program—rather than require the owner to deal with multiple sources and "claim adjusters."

The ability to customize private pollution liability insurance, to buy additional coverage, and integrate it with other insurances makes the insurance route a viable and desirable solution for UST owners who are looking to the future. ■

William Morrissey is the Director of Wisconsin's Petroleum Cleanup Fund (PECFA) and its UST/AST and Petroleum Inspection programs.

Tank Bits

NACE Updates Cathodic Protection Standard

The National Association of Corrosion Engineers (NACE) Standard, RP0285-95, *Corrosion Control of Underground Storage Tank Systems by Cathodic Protection*, has been updated and revised by NACE International. The document provides guidelines for designing, installing, operating , and maintaining an effective cathodic protection system. The standard addresses cathodic protection of existing bare and coated mild steel tanks, new coated mild steel tanks, metallic piping and flexible connectors, as well as other metallic components. RP0285-95 is a revision of NACE's 1985 recommended practice. The price is $18.00 for NACE members; $24 for non members. To order, contact the NACE Membership Services Department, P.O. Box 218340, Houston, Texas 77218-8340. Phone: (713) 492-0535, X 81. Fax: (713) 579-6694. Reference: #21030. ■

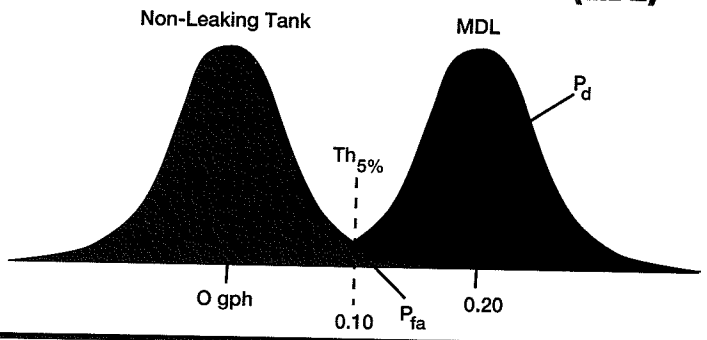
■ The Law on SIR *from page 5*

(Figure 2). The MDL is always equal to twice the threshold. If the threshold for a data set is 0.1 gph, then the MDL is 0.2 gph.

So let's say we have a reasonably careful storage system owner doing inventory control at a site with relatively small throughput. This person might have inventory records such that the threshold leak rate for a certain month is 0.1 gph. This means that the MDL for this data set would be 0.2 gph, which meets the regulatory standard. If the calculated leak rate for this data set is 0.08 gph, then the test result is "pass" as there is greater than 95 percent probability that a leak of 0.2 gph does not exist.

Now let's say this careful owner hires an extremely conscientious helper and gives her the job of sticking the tanks. If she reads the gauge stick even more accurately than before, then the quality of the inventory data will improve. As a result, the threshold leak rate will decrease (say to 0.05 gph), and on a subsequent month the identical calculated leak rate (0.08 gph) might result in a "fail" test result because it exceeds the threshold. Remember, the rules specify that all evidence of a leak must be reported, regardless of the size (40CFR280.50(c)). (As Lamar Bradley points out in the following article, there is no "allowable leak.") This scenario is summarized in the table below.

Figure 2 **Minimum Detectable leak (MDL)**



Once the ($Th_{5\%}$) is determined, the minimum detectable leak is determined by rotating the original bell curve around the $Th_{5\%}$ axis (another way of saying this is that the MDL curve is the mirror image of the non-leaking tank curve). The value of the smallest leak rate that can be identified with 95 percent probability of being correct (P_d) is located under the peak of the MDL curve and is numerically equal to twice the $Th_{5\%}$.

Minimum Detectable Leak Rate(gph)	Threshold Leak Rate(gph)	Calculated Leak Rate(gph)	Test Result
0.2	0.1	0.08	pass
0.1	0.05	0.08	fail

While basing pass/fail decisions on the threshold leak rate is valid statistically and environmentally, it is easy to see how this procedure could create consternation among tank owners.

Personally, I vote for playing the game with a variable threshold (as California has done), as long as all three numbers (minimum detectable leak rate, threshold, and calculated leak rate) are reported with every analysis along with the vendor's conclusion of "pass," "fail," or "inconclusive."

The only difficulty I have with this variable threshold approach is that for other volumetric leak detection methods such as automatic tank gauges and tightness tests, a threshold is established during the method's evaluation and is used in all subsequent testing. This is true, even though leaks smaller than the regulatory standard can be identified reliably in many cases. It is not fair, it seems to me, to hold SIR to a tighter leak detection standard than other methods. My vote would be to create a level playing field and tighten up the standard for all volumetric methods, rather than relax the SIR standard.

How The Game Should Be Played

There are a few areas in this stir about SIR where both regulators and vendors could easily reconcile SIR practices and regulatory requirements. Here are a few examples:

Don't Confuse SIR With Inventory Control

SIR is not inventory control and is not subject to the federal requirements for inventory control. How SIR data are gathered is solely at the discretion of the SIR provider (Item 3, above). There is no requirement to take measurements to an eighth of an inch, no requirement for drop tubes, and no requirement to reconcile delivery receipts with before and after delivery stick reading unless the SIR vendor specifies that these are the procedures to be followed.

I repeat: SIR is not inventory control. For inventory control, the rules specify that a release is not to be suspected (and reported) until two consecutive months of inventory control records are beyond the 1% + 130-gallon standard (40CFR280.50(c)(2)). Inventory control is the ONLY leak detection method for which this two-month standard applies. For all other leak detection methods, including "other methods," such as SIR, a single report of a failed test means that a suspected release must be reported.

As with other methods, a report of a failed test doesn't mean that the storage system must be dug up immediately. It does mean that an investigation should be undertaken to determine possible reasons for apparent loss, such as a mistake in data recording or transcription. If a mistake is found and a prompt re-analysis of the data corrects the problem, then everything is fine.

If a problem cannot be located, then a confirmation of the release (40CFR280.52, typically through a tightness test) must be conducted. The rule does not allow another month to pass and a second analysis to be conducted to confirm the first analysis,

any more than it allows a month to pass after a failed automatic tank gauge (ATG) test result before another ATG test is conducted.

Identify Leaks Within a 30-Day Period

Items 6 and 7 specify that releases must be detected on a monthly basis. Several SIR methods use data gathered over significantly longer periods (42- to 64-days) in order to complete their analyses. In this case, the rule has been stretched to mean that a leak analysis must be conducted every 30 days...but it's OK to look back in time as long as necessary to achieve valid results. I don't believe that this data period stretching is the intent or the meaning of the rules.

Consider the following extreme example. Let's say a SIR vendor needed 6 months of data to complete an analysis. Let's say a leak develops at the beginning of the sixth month of data. The analysis is conducted with 5 months of data in which the storage system is tight and one month of data in which there is a leak. What is the likely result of the analysis? The storage system will pass.

Thirty days later, another analysis is conducted. Now we have 4 tight months and 2 leaking months in the analysis. The storage system will likely pass again. After another 30 days, we conduct another analysis. Now we have 3 months of tight data and 3 months of leaking data. Will a leak be detected now? Who knows? The point is, the monthly detection standard has long been exceeded.

If an analysis requires data-gathering periods that are significantly over 30 days, the likelihood of failing to detect a leak within the specified 30-day interval increases significantly. I submit that for SIR to be acceptable within the rule, sufficient data must be gathered in something close to a 30-day interval to reach a conclusive result.

If a method requires more data points, then the frequency of data gathering should be increased, rather than the length of the data gathering period. For example, require the operator to take inventory data twice a day (generating 60 data points in a 30-day period), rather than once a day. If a method can't find a leak using data from a 30-day interval, it's not a valid monthly monitoring method.

Establish an Appropriate Response to "Inconclusive"

Yes, some SIR vendors boast of not having any inconclusive results. But this claim can't even pass a laugh test. (See the minimum detectable leak discussion above and the definition of inconclusive given below.) I am convinced that there are operators out there whose sticking habits are so poor that valid analyses cannot be obtained without significant improvements in their data gathering techniques. An inconclusive SIR result constitutes non-compliance with leak detection as specified in Items 6 and 7.

My hunch is that SIR use will become much more widespread in the future as inventory control (the dominant method of leak detection today) is phased out.

Here's my proposal for dealing with inconclusive results. Where inventory control and tightness testing is still a viable method of leak detection (according to the federal rule, this includes all systems up until December 1998), an inconclusive result would simply mean that the system was using inventory and tightness testing rather than SIR for leak detection until such time as 12 consecutive conclusive SIR results were obtained.

Any 12-month period containing an inconclusive result would require an additional independent tightness test (not a SIR analysis to 0.1 gph). The pass/fail criteria for the inventory data would become the standard 1 percent + 130-gallons rule for those months with inconclusive results. The operator would have the additional financial incentive (the added cost of a tightness test) to improve his recordkeeping, and the spirit and the letter of the rule would still be honored.

After 1998, when inventory control and tightness testing is no longer a viable method of leak detection for many tanks, every inconclusive report would need to be followed up with a tightness test (or an acceptable monthly monitoring method such as a valid ATG result) to remain in compliance.

SIR: Tank and Piping Tightness Testing

The federal rule is pretty clear in its definition of tightness testing (40CFR280.43(c)): a tightness test must be able to detect a leak of 0.1 gph from any portion of the tank that routinely contains product, while accounting for thermal effects, vapor pockets, tank deformation, evaporation and condensation, and the location of the water table.

While it could be assumed that an evaluation protocol would require that a tightness test method be evaluated with regard to thermal effects, vapor pocket, and so on, the fact is that the tightness test protocol EPA has published for volumetric tightness testing does not include any procedure to evaluate either vapor pockets or the water table. Therefore, a demonstrated ability to deal with these variables is not required to establish a method as a tightness test.

All that must be demonstrated, according to the protocol, is an ability to meet the 0.1-gph performance standard with the required probabilities (Item 1). Most SIR vendors have demonstrated that, for the data used in their evaluations, they can detect leaks of 0.1 gph with the required probabilities. Therefore, I see no basis in the federal rule for not accepting SIR as a tank tightness testing method, if the EPA protocol has been met.

This conclusion begs the question of whether SIR really can meet the accuracy required of a tightness test using real world data. But, this question cannot be answered until an effective SIR evaluation protocol is published and the real world performance of SIR methods is determined.

The federal rule is also clear in its definition of piping tightness testing (40CFR280.44(b)): a piping tightness test must be able to detect a leak of 0.1 gph at one and one-half times the operating pressure. There is a piping tightness testing evaluation protocol which, to my knowledge, has never been applied to any SIR method. As a result, there is no SIR method that qualifies as a piping tightness test.

■ *continued on page 8*

■ **The Law on SIR** *from page 7*

SIR: Piping Leak Detection

The federal rule explicitly allows "other methods" of leak detection (40CFR280.43(h)) to be used for monthly leak detection on piping (40CFR280.44(c), 40CFR280.41(b)) if they are designed to detect a release from any portion of the piping that routinely contains product. Unlike the piping tightness test definition, there is no specified pressure at which a monthly piping leak detection method must operate.

Because the SIR method looks for product losses from the storage system as a whole, a piping leak will be as apparent in a SIR analysis as a tank leak. The SIR protocol explicitly states that the method can be used to monitor tanks and piping for leaks. As a result, all SIR methods that have passed the protocol can be used for monthly leak detection monitoring of piping.

The Rules Of The SIR Game

There are other problems with SIR that, I believe, should most properly be addressed by amendments to the federal rule. My hunch is that SIR use will become much more widespread in the future as inventory control (the dominant method of leak detection today) is phased out.

The needed rule changes are simple enough. The requirements under which SIR is to be conducted must simply be spelled out. How? Well, here are my suggestions.

- With regard to measurement accuracy, water detection, drop tubes, delivery volume, frequency of measurements, type of measurements, and meter calibration, data gathered for SIR analysis must use the same procedures as those specified in the rule for inventory control.
- Results of analyses must be reported using one of three words: Pass, fail, or inconclusive. These words should be defined, as California has done (LG 139, January 20, 1995) and as has been suggested in the proposed EPA amendments to the SIR protocol:

  • If the calculated leak rate is less than the leak threshold, and the minimum detectable leak rate is less than or equal to the certified performance standard (0.2 gallons per hour), the test result is "pass."

  • If the calculated leak rate is greater than the leak threshold, the test result is "fail."

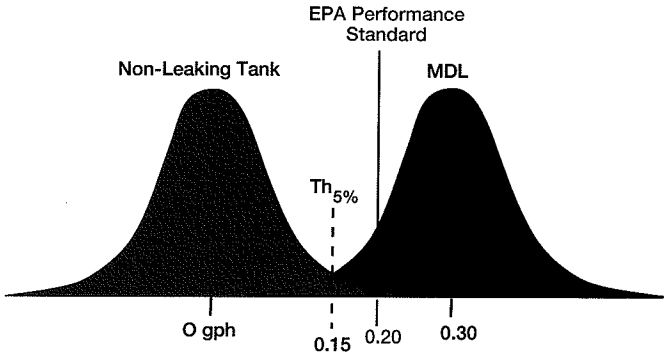
  • If the minimum detectable leak rate exceeds the certified performance standard (0.2 gallons per hour) and the calculated leak rate is less than the leak threshold, the test result is "inconclusive." (See Figure 3.) If, for any other reason, the test result is not conclusive (i.e., "pass" or "fail"), the result is "inconclusive."
- The SIR results form should include, at a minimum, the following data: facility name, address, SIR provider, SIR version, period covered, tank number, contents, capacity, throughput, leak threshold, minimum detectable leak rate, calculated leak rate, results of analysis (pass, fail, or inconclusive), and a listing of the raw inventory data.
- The rule should specify the minimum number of usable data points (say 28) for valid analysis and the maximum amount of time (say 30 days) in which the data can be gathered.

In addition to rule changes, an official, effective protocol must be published and used to more accurately evaluate the performance of the various SIR vendors. Although EPA does not have the authority to require SIR vendors to be evaluated by a second protocol (if one should be published), documents published by EPA have a certain clout in the regulated community. Any SIR vendor who passed a new EPA protocol would use this as advertising copy, thereby, virtually forcing other vendors to follow suit. If EPA does not produce a new protocol, a less palatable but effective technique would be to retract the original 1990 protocol, forcing the SIR industry to produce a new and, hopefully, improved SIR protocol.

An ASTM work group consisting primarily of SIR vendors has failed to create a new protocol in the 2 years that it has been meeting. It is high time for EPA to step in and create standards where industry has failed to do so. This is how and why the initial leak detection evaluation protocols were created. SIR issues affect all 50 states and would be much more efficiently dealt with once and for all by EPA than by all 50 states individually. Failure to act promptly and decisively will severely compromise the effectiveness of the UST program in protecting human health and the environment.

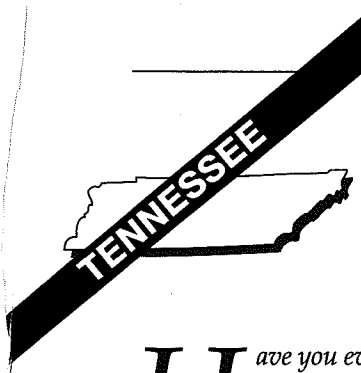
What do you think? ■

Figure 3 **Relation of Threshold, MDL, and the Performance Standard**



The other performance standard set in the federal rule is that the probability of detection (P_d) for a leak of 0.2 gph must be at least 95 percent. In terms of our curves, this means that the MDL must be less than or equal to 0.2 gph in order to meet the requirements of the rule. If the MDL point is greater than 0.2 gph, it is still possible to reliably identify a leak greater than the MDL (so a result that exceeds the $Th_{5\%}$ is a valid "fail"), but it is not possible to be 95 percent sure that a leak of 0.2 gph does not exist, so the result must be inconclusive because the regulatory performance standard has not been met.

Leak Prevention



A Regulator's Concerns with SIR

By Lamar Bradley

Have you ever asked directions of a stranger, who—after reciting a long string of routes, streets, throughways, and turns—ends with "You can't miss it"? Have you ever arrived home with a new purchase that requires assembly and—after opening the carton—found 6,000 parts and no instructions? If you've had either of these experiences, then you may be able to empathize with the state of mind of many state UST regulators who, a few years back, first learned that they would have to contend with this little-known leak detection method called Statistical Inventory Reconciliation or SIR. Regulators' emotional responses were all over the board—skepticism, fear, confusion, anger, curiosity...

HOW TO DEAL WITH THIS "NEW KID" method was an adventure in itself. Getting help from EPA was like trying to get gold from Fort Knox. It wasn't that EPA didn't want to give up information; folks at the Agency simply didn't have anything to give. So, regulators did what they sometimes do when they want answers; they started talking to each other. When we first met, we each pretty much fit into one of three loose categories: Those who didn't like SIR at all, mainly because they were skeptical about it; those who reserved judgement because they didn't know anything about it; and those who took the position, "If it's O.K. with EPA, it's O.K. with us."

EPA realized that it needed to respond to our frustration and formed the National Work Group on Leak Detection Evaluations (NWGLDE) (see article in *LUSTLine* #21) to examine SIR, as well as other methods. At the same time, EPA had also begun to believe what regulators and others had been saying for some time about the SIR leak detection protocol, which was completed in 1990. The protocol had significant flaws and shortcomings, yet it was the yardstick by which SIR methods were being judged.

Shortly before the first NWGLDE meeting, EPA approached ASTM about developing a national standard for SIR. But, after 2 years, ASTM seems to have gotten itself inextricably mired down in its own process. EPA finally rallied its troops and in late 1994, completed a draft proposed addendum to the existing SIR protocol.

The proposed addendum is an excellent beginning, in my opinion. Speaking on behalf of some of my fellow regulators, however, there are still some issues that need attention. Here is a list of some of the issues and practical matters in the proposal that many UST regulators feel need to be addressed.

SIR Vendors' Use of Performance Standard as "Fail Point"

Based on what I've seen, most if not all SIR vendors seem to only want to "fail" a tank if the leak rate exceeds the performance standard (i.e., 0.2 gallons per hour (gph) for a monthly test or 0.1 gph for an annual test). For example, a SIR vendor might call a leak rate of 0.14 gph on a monthly test a "pass" because it did not exceed the performance standard of 0.2 gph. This position ignores the threshold for the method and violates the 95-percent probability of detection and 5-percent probability of false alarm criterion.

Whether or not vendors understand the distinction between applying the threshold and failing a tank only if it exceeds the performance standard is speculation. Those I have spoken with seem to understand, but they say that they don't want to be at a disadvantage to their "competition" who might not fail a tank until the performance standard is exceeded.

SIR Vendors' Reluctance to Use the Term "Inconclusive"

EPA's proclamation a year and a half ago—saying that in its view, a SIR "inconclusive" was tantamount to an owner's not doing leak detection—sent shock waves through the SIR vendor community. SIR vendors' almost immediate response was to embrace other terminology for "inconclusive" and treat the word "inconclusive" as if it were a case of the pox. Some SIR vendors quickly put a positive spin on EPA's position by proclaiming, "Our method doesn't give inconclusives."

To regulators, it was and still is a matter of semantics. If a vendor can't say with at least 95-percent certainty (at the 0.2-gph performance standard) that his results indicate a pass or fail, then he should call the result "inconclusive." Inconclusives, after all, are not a reflection of the ability of the SIR method, but rather, a reflection of data quality.

No Standardized Language Among SIR Vendors for Reporting

Not only is there no standardized language for what would appear to be straightforward terms like "pass," "fail," or "inconclusive," but there is also no standardized reporting format. SIR reporting formats range from less than full page data summaries, which leave a lot of questions in regulators' minds, to multi-page printout reports, in which SIR is only a small component.

What is a regulator to make of all this? It certainly makes the inspectors' jobs more difficult, because they can't compare apples to apples. The State of California tried to meet this challenge by developing

■ *continued on page 10*

■ Regulators and SIR

from page 9

a standardized reporting format for all SIR vendors. Recently, I surveyed SIR vendors (sent out a letter with a series of questions); they agreed almost unanimously that a standardized reporting format would be a good and acceptable idea as long as it could be computer generated and it could be adopted without significant modifications by all the states.

Mythical Concept of "Allowable Leak"

EPA has always taken the position that there are no "allowable leaks" (i.e., that all subsurface releases must be reported and dealt with). If this were a perfect world, and if leaks were detectable at 100-percent accuracy with zero false alarms or missed leaks, EPA's lofty proclamation could be the standard to which all leak detection methods were compared and to which all regulators aspire.

Alas, ours is not a perfect world. Some leaks are not going to be detected because of the detection limit of the method, the application of the method (operator error), masking interference factors (noise), or a combination of these things. Acknowledging both the prevalence of imperfection and the technological barriers to achieving perfection, EPA did three things. First, it described performance standards for release detection methods, which any method must meet or exceed in order be considered viable. Next, it prescribed precision criteria for performance of a method by saying that the method must have a Probability of Detection (Pd) of at least 95 percent, while at the same time having a Probability of False Alarm (Pfa) of no more than 5 percent. Finally, it said that such precision must be determined by a third-party evaluation.

Now my understanding of statistics is just enough to make me dangerous, so I will not attempt a studious explanation here. I will just say that the concept of a preset Pd and Pfa acknowledges the world's imperfections; thus is born the concept of a threshold, or a number which, if exceeded on any given analysis, indicates that the tank has failed the test. Failing the test does not necessarily mean that the tank is leaking; it means that for whatever reason, the tank has not passed the test.

A SIR failure could be caused by many things, including thermal effects, incorrect tank charts, meter errors, stick errors, tank tilt, delivery discrepancies, a leak, or any combination of these things, or other things not listed. Any time the threshold for the method being employed is exceeded, the results must be declared a fail.

"Inconclusive?" Why sir, we don't use that word around here!

Number of Data Points Used in SIR Analysis

How many days of usable data must a SIR vendor have in order to make a reliable call—a call for which he has at least 95-percent confidence? If you want to know, just ask him. The answers you get will probably vary widely. I heard one vendor claim, years ago, that his method could make a determination with as few as 7 days of readings. Now, I suppose that for a tank with no activity, an opening stick reading on the first day of the month and closing stick reading on the last day of the month would be all that was needed for a highly accurate determination (similar to manual tank gauging).

But what about a very active tank with high throughput? Suppose you have such a tank and the person taking the readings simply did not bother to take readings on half a dozen days, although the station was open and there was activity in the tank? You simply would not have accurate days' data for those 6 days. (Each daily set of stick readings, sales figures, and delivery information is considered in calculating daily overage or shortage and is calculated to comprise a data point.)

Regulators' concerns focus on just how many of these data points a vendor absolutely must have in order to make a call with 95-percent certainty that this call is correct. This information is contained in the NWGLDE list and ranges from 30 to 90 days. If a tightness test goes through an evaluation using a 3-hour testing period, that is the minimum test time that can be used for that test. Likewise, if a SIR method is evaluated using 30 days worth of valid data, a valid analysis cannot be conducted using fewer days.

Third-party evaluation results reflect that vendors need at least 30 days of valid data because it is what is used in most evaluations, and it is the only thing on which evaluators can base their judgments. Can a vendor make a call with less than 30 days of data? Maybe so; it depends on the data and the method. But, unless the method is evaluated using fewer than 30 days of valid data, it may not use fewer days to conduct an analysis. If, for any reason, the methodology that was used to pass the evaluation cannot be carried out during the analysis of real world data, the results must be considered inconclusive.

"Moving Target" Threshold Concept Will be Impossible to Implement

EPA's proposed addendum to the SIR protocol contains what appears to be a statistically sound and reasonable argument for setting the threshold as a function of the quality of data for a given data set. However this concept appears to pose significant problems for regulators and regulated alike, when it comes to understanding what is happening and how the criterion for failing a tank in a certain month could be less than the criterion for failing it in a different month.

A SIR failure could be caused by many things, including thermal effects, incorrect tank charts, meter errors, stick errors, tank tilt, delivery discrepancies, a leak, or any combination of these things, or other things not listed. Any time the threshold for the method being employed is exceeded, the results must be declared a fail.

This concept is called "the moving threshold" and it means that a threshold value, calculated as a function of the minimum detectable leak rate for a given set of data is peculiar to that data set. The threshold, then, would not be fixed at, say 0.1 gph or 0.05 gph, but it would be calculated each month as a function of the quality of the data. This flexibility would open the possibility that a tank with a calculated SIR value of 0.07 gph for 2 given months might be a pass one month and a fail in another. Also, a tank with a SIR value of 0.09 gph could pass, and the same tank with a SIR value of 0.05 in a different month might fail. Thus, as you might imagine, we risk unleashing a chaos factor of unimaginable proportions into the regulated community and regulators alike. The reaction we experienced to EPA's pronouncement on "inconclusives" would seem like a walk in the park by comparison.

A group of regulators has suggested that even though it might create the "allowable leak" condition discussed earlier, "fixing" the threshold for declaring a "fail" for monthly monitoring at 0.1 gph would be preferable to chaos. (See Marcel's article for a different point of view.) For annual SIR, figures would be one half of those cited above. This position appears to be a compromise between what is described in EPA's SIR protocol addendum and what seems to be happening with many SIR vendors now.

Concerns Over SIR as an Annual Leak Detection Method

An aggravating notion has arisen recently in some states where SIR is allowed as a substitute for an annual precision test. It seems that some owners and operators have tried to argue to regulators that since SIR can be considered a "stand alone" method and an annual SIR requires only 30 or 60 days of data, they have only to keep inventory control records for the 30 or 60 days they plan to submit to the SIR vendor.

I have no idea how such an insidious notion got started or how widespread it may be, but let me proclaim here and now that this notion is wrong. I ask any state who would even consider such a position, if they allow tank owners to just conduct an annual tightness test without requiring them to do monthly inventory control. If the answer to that question is "Yes" I suggest to them that that position would not pass the "no less stringent" EPA criterion.

Many regulators, myself included, are not convinced that annual SIR is a very sound idea, anyway. Our chief concern is that the period of tank activity may not be representative of "typical" tank activity patterns of the entire year. For example, a tank at a marina might experience seasonal patterns of use. An annual SIR conducted during the off-season might well pass because of the minimal activity and low product levels, whereas a leak in an upper portion of the tank might only appear during peak season with higher product levels.

The big question is, When is the SIR Protocol Addendum going to hit the streets? ■

Lamar Bradley is Assistant UST Program Director for the State of Tennessee.

What's EPA Doing on the SIR Front?

Modifications to the SIR Protocol

In June 1990, EPA-OUST issued *Standard Test Procedures for Evaluating Leak Detection Methods—Statistical Inventory Reconciliation Methods*, a protocol to assist in evaluating statistical inventory reconciliation (SIR) methods of release detection for UST systems. In October 1994, OUST sent out a draft of a proposed Addendum to the protocol and asked for comments by December 1994. OUST (with assistance from the Leak Detection and ASTM work groups) is currently in the process of reconciling and incorporating the comments received. Topics being dealt with include: Definitions and interpretations; manner by which artificial leaks are introduced into data sets; re-use of data sets; stand-alone software certification; SIR as an annual tightness test; applicability to manifolded systems; use of computer-generated data; and grandfathering of currently evaluated SIR methods.

SIR Users Guide

OUST is developing a SIR users guide, which will be similar to *Doing Inventory Control Right* and *Manual Tank Gauging*. It will assist owners and operators in understanding what SIR is, who can use it, how data are collected, and what the results mean. Potential clients of SIR services will be provided with information to make them better informed consumers when selecting a SIR vendor or product. Planned topics include: "Questions to Ask Your Vendor," "What Information Your Vendor Should Supply," "An Inconclusive By Any Other Name," and "A Checklist For Choosing A Leak Detection Method." The SIR booklet is expected to be available toward the end of the year.

Leak Prevention

Tanks Down East

by W. David McCaskill

David McCaskill is a petroleum storage specialist with the Maine Department of Environmental Protection. ***Tanks Down East*** *is a regular feature of LUSTLine. As always, we welcome your comments.*

How To Pick 'Em

Questions to Ask When Selecting an Underground Storage System Installer

It's time to replace the tanks. You're lucky, you have an established location, and a major oil company has designed the tank system and selected the installation contractor. As you sit back and watch the out-of-state contractor install the double-walled tanks and double-walled pressurized piping systems with continuous leak detection—we're talking state-of-the-art—your sense of well-being runneth over.

But...months later, the school across the street is evacuated because of gasoline vapors in the basement. An investigation ensues and, lo and behold, the leak is traced back to your hi-tech, state-of-the-art facility. Further investigation points to leaking fittings.

But wait, even if they leaked, why didn't the leak detection system pick it up? Why didn't the double-walled piping contain it?

It turns out that the piping didn't slope back to the leak detection sumps (per the construction drawings), where probes and an alarm would have announced the problem, and, to top it off, the secondary piping also leaked.

How could this happen? Big time engineers designed the system and hand-picked the installer.

This sad but true tale happened here in New England. As you can well imagine, a major lawsuit is pending. I had to import this story because, as yet, Maine doesn't have a really clear "who done it" UST installer horror story (perhaps, because of our installer certification program). We are investigating the cause of a million dollar cleanup at a site where an UST system was installed 8 years ago, but the evidence is still murky as to whether it was the installer or the owner/operator who was at fault.

Don't get me wrong, there's no shortage of installation horror stories. In fact, nationwide, we could compile an impressive anthology of installation bloopers. In this issue of *LUSTline*, however, I'm going to talk about about how to pick an UST installer...and a lot of what I'm going say is practical information that has been put forth by the installers themselves. So take heed.

In Praise of the Knowledgeable and Prudent Installer

Here in Maine we decided early on that it didn't make a darn bit of difference if you put in a double-walled this or a cathodically protected that if the contractor turned around and installed it incorrectly. Furthermore, because we knew we didn't have the resources to inspect all installations, we were going to have to rely on a properly trained and certified installer work force to help ensure that these systems were installed properly.

Back in 1986, when our installer program was launched, we had a one-time test for an initial lot of installers who had at least 2-years prior experience. We gave an on-site exam for applicants who had less than 2-years experience.

Our program has evolved to where we now require all new applicants to take an initial basic knowledge/regulation test, then enter into an apprentice program, and then take a final in-depth test. Once certified, all installers are required to maintain 8 hours of continuing education training every 2 years. A voluntary, 7-member licensing board, which has enforcement powers, oversees the program.

Our certification program has worked well for us and has allowed us to weed out many of the bad (or "unenlightened) actors. I shudder at the thought of the quality of installer work in those states or municipalities who are bereft of a licensing and effective enforcement program. For heaven's sake, most states require plumbers, electricians, and engineers to have licenses before they can practice. Shouldn't a contractor who installs a storage system that will contain a liquid (gasoline) with carcinogenic compounds and a -45°F flash point be required to show some proof of competence?

With all the potential blessings of a certification program, however,

whether or not a contractor is certified is not, in and of itself, your only criterion in selecting a tank installer, especially if your state doesn't have a certification program. The tank owner or operator who's shopping for an installer needs to do some homework and ask informed questions.

Question #1 Who is Qualified to Install Your UST System?

If you want to select a qualified contractor (and I'm taking it for granted that you do) be sure you know what "qualified" means. Begin by calling your state or local UST regulatory agency to find out if any specially licensed personnel are required to install (or inspect) UST systems. If you're lucky enough to be located in one of the 25 or so states that have some form of installer certification, then you'll probably have access to a list of certified installers. Once you've narrowed your search to a few installation companies (i.e., developed your short list), then you can go back and research their regulatory record (provided your state keeps a file on individual installers or companies).

Everybody makes mistakes, but watch out for situations where a certain contractor has made mistakes that cost the tank owner money and grief. Again, you can find out some of this information from regulatory records. Sometimes state or local inspectors find problems during installation inspections before tank systems are backfilled and paved over. Sometimes they find them after the fact during routine facility inspections. Other times, installation-related problems aren't discovered until there's been a leak. (Sometimes you can attribute a leak to improper installation and sometimes you can't—problems can also be the result of faulty equipment or an "act of God.") Some contractors take responsibility for their mistakes, others run to the next town. Chances are, if you ask enough people, you'll get the who's who on the bad actors.

It helps if you can document how well established an installation company is and how well qualified the people who will actually be doing the work are likely to be. The term "qualified" is not limited to whether or not a contractor has a license; the contractor must have the experience and genuine ability to install your particular type of UST system. If, for example, you have a service station motor fuel system, then find a company that specializes in these systems. More specifically, be sure whomever you hire has experience installing the kind of system you have selected.

There was a small "mom and pop" way Down East that left it up to its distributor to set up the tank replacement. A general contractor was given the job; he, in turn, subcontracted out the tank and pipe work to a mechanical company that had experience installing heating oil systems, but not gas stations. A few years later, water was found in the tank. Another installer was called in to investigate. The water had entered the tank through a cracked vent line that had been installed improperly. (This was one of a number of things that went wrong.) While no contamination was found, the mom and pop had to pay the bill. The general contractor is out of business. The subcontractor's installer's license was downgraded.

Question #2 Who Will Still Be Around?

Here in Maine, before all this groundwater protection and tank upgrade business began, there was a handful of petroleum service companies that provided installation and maintenance services to the major oil companies and large independent jobbers who owned all the tanks, including those at mom and pop stations. After the new UST regulations were implemented, new UST installation companies were formed and existing excavation companies and environmental cleanup firms expanded into this field.

But, after the tank replacement rapture is over (when things get back to normal and work loads go down) who will be left? I suspect that those same petroleum service companies who were here before there were any tank regulations will be the ones left to pick up the pieces. In fact, in Maine, this devolution has already begun. On the national scale, smaller regional petroleum service companies are being bought out by mega-firms.

Make sure your contractor will be around to service your system or, more importantly, to pay for any mistakes. This ability to pay for screwups raises the question of insurance. Make sure that all bidders have general liability and pollution insurance. Good installers pay big money to protect both themselves and you against potential accidents and mistakes. The fact that a contractor has insurance can be a sign that he does good work—insurers don't generally insure the bad actors.

Insurance ensures that the installer can make good on faulty workmanship and not leave the owner holding the bag. And, who knows how long state cleanup funds will be around? Many have sunset clauses that terminate funds somewhere around the year 2000. Think ahead, if something goes wrong, and you have a leak that's linked to poor installation, your contractor's additional coverage may be needed to help pay the cleanup costs.

Ask for proof of insurance. One installer told me that the only people who ask him for proof are other installation subcontractors and major oil companies. These folks ask for insurance because they know there can be consequences where there is none.

Another kind of insurance for installers is safety training (especially for removal of tanks and contaminated soils). Ask for proof that the contractor has proper OSHA health and safety training. One contractor told me that once his workers received their health and safety training, his worker's compensation claims eventually diminished because there were fewer accidents.

Question #3 How Do I Evaluate Bids?

Installers tell me that many customers look at price and price only and fail to ensure that competing bids are of equal value (i.e., bidding apples to apples). Don't hesitate to ask questions about the equipment and technology that you are purchasing. Many contractors have their favorites; so do some homework ahead of time, otherwise you'll

■ *continued on page 14*

■ **Tanks Down East** *from page 13*

become overwhelmed by all the trade names and techno-babble associated with today's petroleum equipment.

Talk to your state or local regulatory agency to find out what technologies are allowed in your area and request technical information from local petroleum equipment supply companies. The more specific your equipment requirements are, the better; otherwise you run the risk that your contractor's bid will include the minimum that you need to meet compliance. If you're serious about sticking around in this business, then buy the best equipment you can afford. This is not the time to be cheap; the consequences can be too damaging.

If one bid you receive is significantly lower than the others, ask questions. I've heard stories about bids that left out the electrical work and even the tanks, for goodness sakes!

Question #4 Where Do I Find Qualified Installers?

I suspect that most independent mom and pops ask their fuel distributor for contractor recommendations. But, as I mentioned earlier, make sure your distributor has actually used the contractor he's recommending at one of his own flagship stations. Also, get recommendations from the friendly competition, and ask your prospective bidders for references from other customers. Some contractors tell me that they've been asked to install tanks—with no bid process—based solely on the recommendation of one satisfied customer. As Shakespeare said, "There is no greater virtue in all the world than a spotless reputation."

The little things are also important. When checking out references, be sure to ask questions about the contractor's attention to detail, site housekeeping and cleanup, and whether there were any major problems with scheduling and delays. When you're not pumping product, you're losing money and customers are inconvenienced. Poor project management can result in hidden costs that are not reflected in an attractive low bid.

Visit facilities where installation work was done by the contractors you are considering to look at the quality of their work. How was their finish work? Often the quality of the work you can see is indicative of the quality of the work you can't see.

If you are completely new to the exciting world of owning or operating a tank and haven't a clue as to who's who and what's what in tank installation, contact a trade organization such as the Petroleum Equipment Institute* (PEI - a national association based in Tulsa, Oklahoma) or a state organization. Again, your state or local UST regulatory agency should be able to give you the names of any local trade groups. Such organizations provide their members with training opportunities and regulatory updates. Membership usually suggests professional pride and an interest in staying on top of industry and regulatory changes. In my days as a consultant, such resources proved helpful for locating reputable UST services for out-of-state jobs.

Remember, the UST installation business is a highly competitive market and there are contractors out there who are willing and desperate enough to take chances. The thing about USTs is that they're pretty hard to fix after the fact. So before you sign a contract, or, as we say Down East, "make the dicker," do some homework, establish your bidding criteria, and ask informed questions...lots of them. ■

** For information about PEI, call (918) 494-9696.*

Mississippi's New Interactive, Computerized Certification Exam is a Learning Experience

Last December, the Mississippi Department of Environmental Quality (DEQ) introduced an interactive computer testing system into its UST installation, removal, and repair certification program. The interactive test uses text, graphics, video, audio, pictures, and animation to both test and educate applicants who take the test at DEQ's central office in Jackson.

DEQ chose the interactive testing approach to enable the applicant to learn while being tested. Sources indicate that people remember 20 percent of what they see; 40 percent of what they see and hear; and 70 percent of what they see, hear , and do. "Computerized testing helps us and the certified worker. A more knowledgeable applicant will conduct better UST installations, removals, and repairs, " says Walter Huff, Chief of the UST Branch. "By doing the job right to begin with we can expect fewer releases."

To take the Mississippi test, the applicant does not need prior computer knowledge. The test uses a touch monitor, and detailed instructions provide the applicant with practice at touching the screen before the test begins. Once an answer is selected, it is graded. The applicant is shown the correct answer after he or she has selected the answer. When the test is completed, the final grade appears on the screen.

The computerized test is the first part of a 2-part computer training and testing project that is being produced by Mechell Allen and Linda Vaught of the DEQ UST Branch. Part Two of the project will be an interactive series of computerized training modules for UST inspectors and the regulated community. These modules will cover such topics as tank and piping installation, UST closure, cathodic protection, and leak detection.

For more information about the Mississippi test, contact Linda Vaught at (601) 961-5278.

Field Notes

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

Market Projections: A Leaner Tank Population By 1998

NEW INFORMATION FROM EPA AND OTHER SOURCES has caused us to reconsider some of our estimates concerning the UST replacement market. Here's what the new figures show and some thoughts on what they mean to the petroleum marketing equipment industry.

EPA's Office of Underground Storage Tanks (OUST) reports that 1,177,198 underground storage tanks were in use at the close of fiscal 1994. That number is down from 1,307,563 tanks in 1993. The EPA report also showed that over 155,000 tanks were closed in fiscal year 1994, which means that approximately 25,000 new USTs were installed during that same time period.

We believe that over 400,000 USTs currently comply with the federal requirement that all USTs be protected from corrosion (i.e., cathodically protected, constructed of fiberglass, or internally lined) by 1998. Keep in mind that we are not saying these 400,000 tanks are in complete compliance with the 1998 tank upgrade standards, because many tank owners have yet to install overfill prevention and spill containment. Indeed, a relatively recent survey of UST program managers from eight states indicated that only 15 percent of the existing tanks in their states completely meet the 1998 technical standards.

If we subtract 400,000 from 1,177,198, we end up with nearly 800,000 tanks that are currently in the ground and still in need of either corrosion protection, replacement, or closure by 1998. At first blush, these figures would tend to support the idea that the industry will need to produce hundreds of thousands of replacement underground tanks over the next 4 years to meet anticipated demand.

But that number does not take into account the tremendous number of tanks that have been and will continue to be taken out of the ground or closed in place and not replaced. We know, for instance, that the number of USTs has decreased from 2.1 million in 1988 to a shade under 1.2 million in 1994. This means we have lost a total of 900,000 USTs since the beginning of the program, or an average of 150,000 tanks per year for the past 6 years.

Is it realistic to assume that the industry will continue to take 150,000 tanks out of service per year from now until 1998? The figures we have suggest that 150,000 per year is very doable. In fact, it may be conservative. For example, take a look at what has happened in Illinois. The Illinois Environmental Protection Agency keeps a record of tank closures by year. As you can see from the following table, tank closures have increased in Illinois each year since 1987.

Year	No. of Closures
1986	1
1987	0
1988	5
1989	22
1990	230
1991	509
1992	522
1993	840
1994	917
1995	77 (1st 4 months)

If the industry continues to take 150,000 tanks out of service each year, tank contractors will be called on to replace, line, or cathodically protect somewhere around 200,000 tanks over the next 4 years. That's still an appreciable amount of work to do, but it does not approach the staggering numbers some had expected to post. Here are some thoughts on what these figures may mean to the industry.

- If the number of USTs nationwide is indeed reduced to the 600,000+ level by 1998, that means over two-thirds of the tanks in service in 1988 will not be in service 10 years later. That, of course, will greatly affect the market for UST-related equipment and services in the future.
- The tank excavation and removal business will get better and better as we approach 1998.
- The number of aboveground storage tanks (ASTs) containing regulated substances will continue to grow as ASTs fill the void left by USTs.
- Any attempt by Congress to regulate small ASTs in the future will affect a significant number of tank owners.
- Many private and public fleets that once relied on their own central refueling site will continue to move in greater numbers to cardlocks at retail and unattended fueling sites because the cost of replacing or upgrading their own USTs is too prohibitive.
- Cleanup work will continue to be strong through the end of the century if the money is available to pay for it.
- The number of retail motor fuel sites is beginning to drop as industry experts predicted in the mid-1980s. The latest addition of *National Petroleum News* (NPN) reports that the number of retail outlets had dropped below 200,000 for the first time in 5 years. NPN reports that there were 226,459 fueling sites in 1972; 210,120 in 1991; and 195,455 in 1995. We think the number should level out near the 150,000 mark by the turn of the century. ■

LUST Investigation & Remediation

Assessing The RISK in RBCA

by Marjorie G. Norman

Risk-based corrective action (RBCA) is a process for identifying an appropriate corrective action for a petroleum release site based on the goal of protecting human health and the environment. RBCA is a multi-step procedure that involves site investigation, classification, and evaluation. This article does not attempt to address the entire RBCA process; rather, it addresses the risk assessment principles on which it is based.

Risk Assessment Principles

Risk is related to two factors: Toxicity and exposure.

Risk = Toxicity & Exposure

Concentration Intake

The toxicity of a chemical tends to be an inherent property of the chemical and can be thought of as a constant. Exposure, on the other hand, is not a constant. The extent to which a person is exposed to a chemical is dependent primarily on two factors: The concentration of the chemical that is present in the media (e.g., air, soil, water) to which a person may be exposed and the amount of that media that is taken into the body.

Let's look at this risk relationship in terms of sugar. Let's assume, for example, that the risk associated with exposure to sugar is gaining weight. The toxicity of the sugar, as determined by reading the side of the sugar box, is 16 calories per teaspoon. If we look at the equation above, we can see that the "risk" of gaining weight is related not only to the fact that sugar has 16 calories per teaspoon, it is also highly dependent on how much sugar a person eats (i.e., the exposure). How much sugar a person eats, in turn, is dependent on how much sugar that person puts into his or her food (i.e., concentration) and how much food that person actually consumes (i.e., intake). This same toxicity/exposure relationship holds true for environmental contaminants.

Risk Assessment Step by Step

Through the process of risk assessment, we can predict the likelihood that adverse health effects will occur as a result of exposure to environmental contaminants. Risk assessment consists of three basic steps: A toxicity assessment, an exposure assessment, and risk characterization.

The **toxicity assessment** establishes the relationship between the amount of the chemical of concern entering the body and the occurrence of an adverse health effect. This dose-response relationship, as it is called, is generally identified by reviewing data gathered through animal toxicity tests or human epidemiological studies. EPA reviews such studies for numerous chemicals and publishes the resulting toxicity values in its Integrated Risk Information System (IRIS) database. Because cancer and non-cancer health effects are believed to occur by different biological mechanisms, two types of toxicity values are published: Reference Doses (RfDs) for evaluating non-carcinogenic health effects and Slope Factors for evaluating carcinogenic effects.

The **exposure assessment** is an estimate of the degree to which a person may be exposed to the chemical in the environment and how much of the chemical may enter the body. Referring again to the equation above, the exposure assessment is a two-step process: First, we determine the concentration of the chemical that is present in the medium at the point of exposure, and second, we determine the degree to which that medium is taken in.

During a RBCA risk assessment, the concentration of the chemical at the point of exposure may be measured by sampling or predicted by using fate and transport modeling. When using measured data, it is important to keep in mind that samples are taken at discrete locations and at specific times; however, exposure may actually occur over a broader area and for longer duration. Also, sampling may not be possible when estimating potential exposure that will occur in the future. In these cases, future concentrations may have to be predicted using a fate and transport model.

The degree to which the exposed individual takes in the medium is estimated by considering the type of person and the associated activities typically undertaken at the point of exposure. EPA publishes recommended intake rates for different populations (e.g., adults, children), different land uses (e.g., residential, commercial), and different behaviors (e.g., drinking the water, inhaling the air or dust, ingesting the soil). For example, EPA generally assumes that the adult residential intake for drinking water consumption is 2 liters per day. For children in residences or adults in commercial situations, the assumed intake rate is 1 liter per day.

In the **risk characterization** step, the information collected in the previous two steps is combined. That is, the information about the toxicity of a chemical is combined with the estimate of the magnitude of exposure to the chemical in the environment. The calculated outcome is a measure of the potential that an adverse effect will occur as a result of the exposure.

For exposure to carcinogens, the calculated outcome is a unitless Risk Estimate, which is an upper-bound estimate of the probability that an individual will contract cancer as a result of the exposure. These numbers are generally expressed as a fraction such as 1/10,000 (10^{-4}), or one additional case per 10,000 persons.

For exposure to non-carcinogens, the calculated result is a Hazard Index. The Hazard Index is the ratio of the estimated magnitude of the exposure to the chemical in the environment to the level considered acceptable by EPA (i.e., the reference dose). If the estimated exposure is less than the acceptable level and the Hazard Index is less than one, the exposure is not considered likely to result in adverse health effects.

Using Risk Assessment to Determine Allowable Concentrations

We can also take the risk equation described above and rearrange it so

that allowable chemical concentrations in the environment can be determined:

$$\text{Concentration} = \frac{\text{Risk}}{\text{(Toxicity x Intake)}}$$

The term "risk" used in this equation is the desired target or acceptable risk level. To fill in this parameter, the user must make a policy decision about the level of risk he or she is willing to accept. If the risk assessment is being conducted under a regulatory program, the implementing agency makes all policy decisions. The toxicity factors can be found in EPA's IRIS. The intake parameters must be appropriate for the exposure scenario that is being evaluated.

The American Society of Testing Materials' (ASTM's) RBCA standard uses this reversed risk relationship to calculate risk-based screening levels and cleanup goals. To implement this approach, we must identify the different ways people are exposed at a site and then calculate the concentration associated with protection to the specified risk level. In this way, all sites are protected to the same risk level; however, the concentration of the material that is allowed to remain at an individual site may vary with respect to its land use and the extent of potential exposures that can be expected now or in the future.

Tiered Risk Assessment Approach

While the risk principles found in RBCA are the traditional ones, the unique feature of the process is that the evaluation can be conducted in a tiered fashion. ASTM's standard consists of three tiers, each one more involved than the first. This tier concept is something like federal incomes taxes. When it comes to taxes, we are aware that there are certain tax laws or principles that we must legally follow; however, when doing the actual filing, we have the option of choosing whether we want to use the short form or the long form. Similarly, in RBCA, while we can't change risk principles or target risk levels between tiers, we can choose to do either a simple or a more complex evaluation.

In ASTM's Tier 1, the risk equation uses relatively high, conservative intake rates with the underlying assumption that the potential for exposure is at the source area where there is the highest level of contamination—if we proceed conservatively from where contamination levels are highest, then any lesser exposure at another point will also be okay. The health-based allowable contaminant concentrations that are calculated using these conservative parameters are compiled in a lookup table format for each media and exposure pathway. If site concentrations are compliant with those in the Tier 1 tables, we assume that the site poses no significant health threat.

If a site doesn't pass the Tier 1 screening process, it doesn't necessarily mean that the site poses an unacceptable risk. For many sites, the conditions used in Tier 1 may not be realistic. For example, many gas stations are located in commercially-zoned, urban areas where municipal water is readily available. These areas often have no residences or private drinking water wells. In such situations, it may be more prudent to advance to a Tier 2 level of evaluation in which the conservative default assumptions of Tier 1 are replaced with more site-specific information.

Risk Assessment in a Nutshell

- **Identify the chemicals of concern, the populations that may be exposed to the chemicals now and in the future, and the pathways by which they may be exposed.** Toxicity factors for the chemicals (i.e., Reference Doses and Slope Factors) can be identified from EPA's IRIS database.
- **Estimate the extent of exposure.** Use EPA's default intake assumptions or other intake assumptions that are more appropriate for the situation being investigated.
- **Calculate Risk Estimates and Hazard Indices.** These values can be compared to guidelines adopted by EPA to determine if the predicted risks are acceptable. EPA has adopted a policy that the acceptable range for carcinogens is a Risk Estimate of 10^{-4} to 10^{-6}; for non-carcinogens, the Hazard Index is 1.0 or less.

At the Tier 2 level, allowable contaminant concentrations for the site are calculated using site-specific exposure assumptions and a simple transport analysis. The resulting concentrations are termed "site-specific target levels" (SSTLs). The actual site concentrations are compared to the SSTLs; if the site passes the comparison, we assume that it does not pose an unacceptable health risk.

A Tier 3 evaluation differs from Tier 2 only in the degree of complexity. Tier 3 is reserved for those evaluations that require the highest level of analysis such as Monte Carlo simulations and complex fate-and-transport modeling. Very few sites are likely to require this level of evaluation. As we move from tier to tier, the exposure risk does not change. As evaluations become more site-specific, however, the cleanup goals for individual sites may change to more or less stringent levels based on the risk characterization and subsequent risk management strategy.

RBCA Integrates Risk and Corrective Action Concepts

For each exposure that shows a potential health threat based on the results of the tiered evaluation, a corrective action is developed. Such actions may include active or passive measures to reduce contaminant concentrations to target levels. The potential for exposure may also be reduced or eliminated through the use of institutional controls (e.g., deed restrictions) or engineering controls (e.g., capping, hydraulic control).

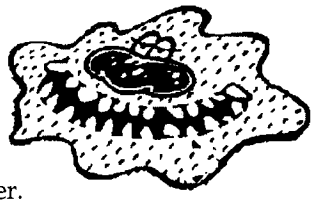
When properly applied, this risk-based approach to corrective action decision-making provides a means for ensuring that all sites are addressed and that appropriate measures are taken at each site to protect human health and the environment. Risk characterization gives us a basis for our corrective action decisions and gives us the opportunity to put our cleanup resources where they are needed most. ■

Marjorie Norman , Ph.D., is the director of risk assessment and management programs with Foster Wheeler Environmental Corporation in Seattle, Washington. She is a member of the ASTM RBCA task force and is one of the nine certified ASTM RBCA trainers.

LUST Investigation & Remediation

What About Natural Attenuation?

Mother Nature Has Her Own Cleanup Technology, But Will It Meet Our Cleanup Goals In a Timely Fashion?



by Gilberto Alvarez

OVER THE PAST 10 YEARS, MANY leaking underground storage tank (LUST) sites have inadvertently undergone "natural attenuation"—Mother Nature's own cleanup technology. Only recently, however, has natural attenuation found itself traveling in the alternative cleanup technology circles—basking, no doubt, in the risk-based corrective action (RBCA) spotlight. But in the not-too-distant past, natural attenuation was not so much a corrective action choice as a good-intentioned, "put it on the back burner and we'll get to it later" consequence of bureaucratic overload.

Like doctors and nurses at the battle front, LUST regulators have traditionally triaged LUST sites, targeting limited resources at sites in most urgent need of attention. RBCA is, in fact, a more formalized and standardized process for identifying the amount and urgency of corrective action needed for individual LUST sites in order to protect human health and the environment. It is a multi-tiered exposure/risk assessment procedure that provides a consistent basis for classifying individual sites and determining initial response, cleanup goals, and corrective action for soil and groundwater. Resulting corrective action determinations may include active measures (e.g., source removal, treatment programs) or passive measures (e.g., natural attenuation programs) to reduce contaminant concentrations to target cleanup levels.

But some critics of RBCA see the notion of using passive remediation, which often amounts to nothing more than a monitoring program, as unprotective "inaction." But, this ain't necessarily so. A growing body of evidence shows that, under the right conditions, natural attenuation is a viable corrective action or monitoring alternative. RBCA can provide a sound basis for allowing nature to do its thing. Even at those sites where corrective action was put on the back burner several years ago, Mother Nature's hydrocarbon-degrading militia has more than likely marched in and set up camp.

Under The Right Conditions

Natural attenuation (a.k.a. passive biodegradation, intrinsic bioremediation, natural bioremediation or some other hybrid) is a passive technology that depends on natural processes to degrade and dissipate petroleum contamination in soil and groundwater.

Natural attenuation of petroleum products involves such processes as aerobic and anaerobic biodegradation, dispersion, volatilization, and adsorption. For petroleum hydrocarbons, biodegradation is the most important natural attenuation mechanism; it is the only natural process in which, through the presence of healthy, functioning, naturally occurring microorganisms, the actual reduction of the petroleum constituent mass occurs.

Before a site is selected for natural attenuation, however, a site investigation is necessary to provide data on site conditions and hydro-

Potential For Natural Attenuation: Site Factors

Soil texture	Coarse-grained soils provide the greatest drainage and aeration, but may also promote contaminant migration.
Soil structure	Layered soils inhibit vertical migration and dispersion of constituents, but may promote lateral spreading.
Adsorption potential	Higher organic carbon content and smaller grain size in soil results in greater adsorption of chemicals and retards migration.
Groundwater flow rate	Greater groundwater flow rate will enhance constituent dispersion.
Soil and groundwater aeration	Greater when soil $O_2 \geq 2\%$, and groundwater D.O. ≥ 1 to 2 mg/L.
Soil moisture content	Greatest between 40 to 85 percent of field capacity.
Soil pH	Greatest between soil pH values of 6 to 8.
Microbial community	Greatest with soil/groundwater conditions that allow O_2 flow and in the absence of toxic levels of constituents.
Precipitation	Most favorable at 10- to 60-inches of rain per year.
Temperature	Most active microbial activity occurs at ambient temperatures of 5° to 45°C. Activity typically doubles for every 10°C rise in temperature.
Soil nutrient concentration	Greatest when the C:N:P: ratio is about 100:10:1.

carbon constituents. Then the data should be evaluated to determine if conditions are sufficient for effective natural attenuation. Furthermore, site conditions must be monitored over time to confirm whether or not contamination is being degraded at reasonable rates to ensure protection of human health and the environment.

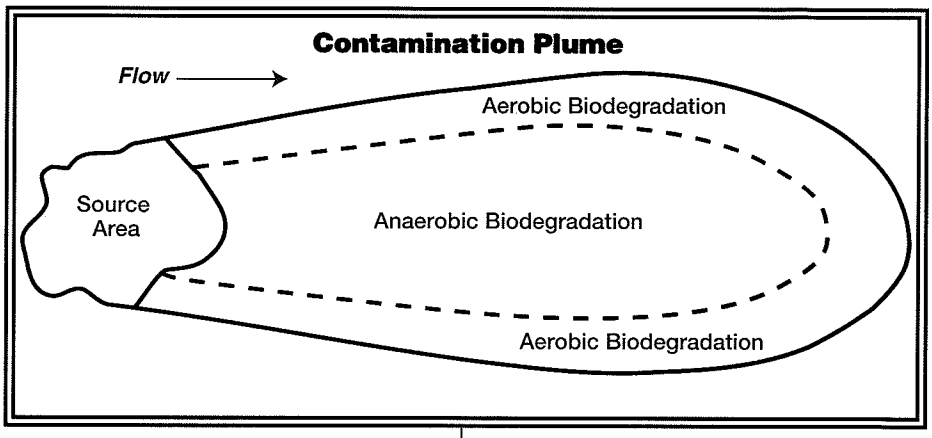
Biological microorganisms (i.e., bacteria) in soil and groundwater consume petroleum and oxygen and convert them to carbon dioxide (CO_2) and water by-products. The oxygen is usually measured as dissolved oxygen (DO) in groundwater, and carbon dioxide is usually measured as a percentage in a volume of extracted gas. Natural biodegradation bacteria work most effectively from the outside in of the contamination plume (the aerobic environment - see diagram), which explains why DO levels are higher on the edge of the plume and become lower as the source area is encountered.

Despite nature's remarkable healing techniques, however, we haven't sufficient reason to pack up our sparging and venting systems and go home. Although nature has responded to man's environmental abuse on a continuous basis, she can't always work as fast as necessary, and she is often overwhelmed by our excesses. At the center of the hydrocarbon plume, for example, where anaerobic degradation takes place, it does so at a very slow pace.

We've still got a lot to learn about cleaning up our messes. As far as natural attenuation goes, questions like: "How long does it take a contamination plume to degrade to the point of being 'clean'?" or "What conditions are optimal for natural attenuation?" are still a matter for debate, and so the research continues.

Pilot Studies Underway

Recognizing the need for more field data on natural biodegradation at LUST sites, EPA Region 5's Office of Underground Storage Tanks assembled a team to set up a pilot program. The team is made up of representatives from EPA Region 5, the Wisconsin and Illinois LUST programs, and Amoco Oil Company. One goal of the study is to help each



of the participating states' LUST programs improve their existing guidance documents on natural attenuation by gathering information on the effectiveness of the technology in representative hydrogeologic and soil conditions.

The study is also meant to improve Amoco's in-house procedures for testing and monitoring of natural biodegradation parameters and to enable Region 5 to establish procedures and baseline information that it can share with other states and regions. The team selected sites with groundwater contamination because there is less information on the effectiveness of natural bioremediation in the groundwater environment than in the soil environment.

The pilot study involves seven sites where specific monitoring parameters and sampling schedules will be put in place. Most of the sites were reported 2 or 3 years ago and were already on periodic monitoring programs. This study, however, will measure a broader range of parameters on a more intensive sampling schedule. The sites were screened from a larger pool of sites using the following criteria: Presence of liquid-phase hydrocarbons, dissolved oxygen levels, groundwater pH, depth to groundwater, presence of suitable bacteria (TPC tests), inorganic nutrients, and BTEX levels. Dissolved oxygen, pH, depth-to-groundwater levels, and BTEX levels will be monitored on a quarterly basis. Bacterial counts will be monitored on an annual basis.

To measure cleanup progress, the team will compare the groundwater contamination levels recorded at each site during the original site investigation with state agency groundwater cleanup goals. Cleanup criteria parameters, including BTEX, MTBE, and gasoline range organics (GROs) levels, will be monitored on a quarterly basis. Soil gas parameters (e.g., percent O_2, percent CO_2) will also be monitored on a quarterly basis.

The team will meet periodically to discuss the data, review issues, and evaluate the progress of the remediations. While it may take a year or two before any real determination can be made, the resulting information should help provide much needed insight as to the role natural attenuation may be playing not only at those sites left sitting on the back burner, but also at RBCA sites.

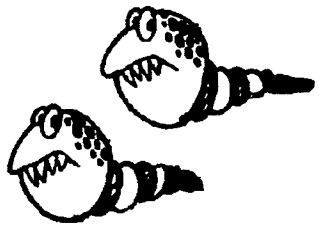
Finally, the team approach is a good example of a public/private partnership whereby the various viewpoints (i.e., regulator, industry, and consultants) reach consensus and attempt to solve mutual problems. Because of the length of time usually associated with monitoring-only corrective action, the region anticipates that this project will require at least one year of data before any trend can be documented. The project team will prepare periodic updates on the status of the project.

On another front, the American Society of Testing Materials (ASTM) has just organized a task group to begin work on a standard for remediation by natural attenuation. ■

Gilberto Alvarez is an Environmental Engineer with the EPA Office of Underground Storage Tanks Region 5 based in Chicago, Illinois.

LUST Investigation & Remediation

The TPCs of Natural Attenuation



A COMMON PARAMETER THAT'S measured when using natural attenuation is the total plate count (TPC) of naturally occurring bacteria that are available for degradation. While it is generally recognized that the necessary bacteria are present in almost all subsurface environments and that enumeration is probably not necessary at all sites, the procedure is often used for scientific study of natural attenuation.

In taking TPC samples, its important to keep in mind that microorganisms (indigenous or lab cultivated) require an acclimation period to adjust to new food sources (i.e., hydrocarbons) that are not normally in their environment. This acclimation period is exhibited as a lag period—slow growth, negative growth, or both—during the early phase of biodegradation. As the microbes become acclimated, the rate of growth, and hence biodegradation of the hydrocarbons, increases.

As biodegradation and other chemical and physical attenuation mechanisms act on the contaminant mass, its composition changes. Microorganisms that were active in earlier stages may become inactive as the nature of the food source changes over time. As a result, there can be cyclic periods of growth and decline of the microbial population, as well as changes in the types of microbes present. Thus, if your TPC sample is taken during a period of microbial adjustment or cyclic fluctuation, you may not have an optimal picture of attenuation potential.

Methods of Enumerating

There are two types of microbial plate counts associated with natural attenuation at LUST sites: Measurements of heterotrophic populations (that use organic compounds as their source of carbon) and hydrocarbon-degrading populations. The heterotrophic measurement reflects the aerobic bacteria population in the sample. It is a qualitative measurement that indicates the quantities and varieties of microbes in the sample.

The method for measuring the heterotrophic bacteria that are present in the sample is described in *Standard Methods* - 18th Edition; Standard # 9215 for Heterotrophic Plate Count. However, different labs give different numbers, depending on which technique within the standard procedure they choose to use. As a rule of thumb, for a given lab, higher counts represent high populations and vice versa.

Hydrocarbon-degrading bacteria are a sub-population of the heterotrophic population that uses hydrocarbons, specifically, as an energy source. Investigators need to be sure that there are enough of these populations in the soil. Unfortunately, there is no standard method for determining the number of hydrocarbon-degrading-specific bacteria in groundwater or soil samples—individual laboratories maintain their own procedures for this test.

Both types of TPC measurements are undertaken by collecting a soil or groundwater sample, placing it on a petri dish and leaving it in a warm environment (incubator) for a specified length of time. A laboratory analyst then examines the culture under a microscope and counts the number of bacteria clusters within a unit area. This value is presented as colony forming units (CFUs) per milliliter of groundwater, or colony forming units per gram dry weight of soil. The values are compared against a range of values to determine if a site is suitable for natural attenuation. The LUST site manager completes the analysis of these data to determine what constitutes a "sufficient" TPC level.

Look For The Trends

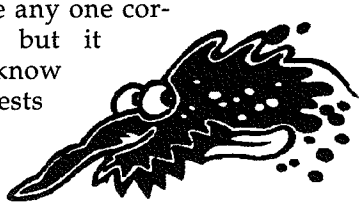
When reviewing proposals that involve natural attenuation, regulators should find out which test was used for TPC measurements and on what basis the suitable range was selected. Most investigators will determine that a site is suitable if both heterotrophic and hydrocarbon-degrader bacteria are present in the sample. It is difficult, however, to make direct correlations between the two sets of values.

For natural biodegradation to work effectively, there should be sufficient numbers, as well as the right type of naturally occurring bacteria to consume the hydrocarbon contamination. Typical acceptable heterotrophic values range between 100 and 10^6 CFUs/ml for groundwater and between 10^3 and 10^8 CFUs/g dry wt. for soil. There are no target numbers for hydrocarbon-degrading bacteria, so the investigator needs to look for reasonable values, given the lab method used.

Some lab reports may list a TPC level in units of thousands of colonies per milliliter of groundwater and others in millions of colonies per milliliter of groundwater. Even with a standard, different laboratories may require different incubation times that end up producing larger or smaller comparative values. There may also be temperature variations in operating equipment.

For reasons such as these, regulators should be aware that when comparing results that are orders of magnitude different, it is the relative difference between them that should be evaluated; much like comparing soil contamination levels from field instrument readings with results from laboratory analyses. The trend is the key, not the specific value.

One way regulators might put various lab procedures in perspective is to collect all of the TPC test procedures available, compile the parameters within those tests, then list them in table form to see which labs follow similar procedures. There may not be any one correct way, but it helps to know how the tests were conducted. ■



LUST Investigation & Remediation

LUSTs...RBCA...and Financial Institutions

Lenders Recognize the Whys of RBCA, But...

by Nona Hancock

Editor's Note: *ASTM's "Emergency Standard for Risk-Based Corrective Action Applied at Petroleum Release Sites" (ASTM ES 38-94), widely referred to as RBCA, has caused some concern among lending and trust institutions. This article reflects the banking industry's concerns on a number of issues that surround the RBCA standard. This article does not reflect the opinion of EPA.*

As the RBCA approach to LUST cleanup becomes more and more widely accepted, we at ***LUSTLine*** *recognize that there are many players in the process and that the concerns of these players will need to be addressed so that we can move forward in implementing cleanups as effectively as possible.*

Liability and Property Value

When it comes to USTs, banks have two primary concerns: Liability and the value of their real estate interests. Environmental liability comes in many forms. The owner of an UST site, for example, may be held liable for any cleanup costs that may result from a leak or spill. Lenders are reluctant to extend loans to businesses where the real estate is the primary collateral and tanks are involved for fear of incurring cleanup liability should the business become bankrupt and the lender take possession of the property through foreclosure. At present there are no regulations exempting lenders from liability for USTs in these foreclosure circumstances (Congress has, under RCRA, provided a statutory exemption for lenders); EPA is expected to publish its UST lender liability rule this summer. The rule will likely contain guidelines on what activities a lender may undertake regarding USTs.

In the way of the world, however, no matter how well the lender liability regulations are written, lenders may not know what is acceptable until future court cases are decided. Thus, it could be several years before banks have a clear idea of what they can and can't do in terms of leaking underground storage tank (LUST) sites. Given the current liability scheme, it is often difficult for lenders to make loans on UST sites that may have contamination.

The potential for third-party lawsuits is another liability issue for banks. These suits can arise when owners of land adjacent to LUST sites allege personal or property damage or diminution in property value. Tort law, however, prohibits EPA from exempting lenders from third-party liability in its UST lender liability rule.

Potential CERCLA liability is also a concern. Waste oil tanks, which often contain solvents and other hazardous substances, are frequently present at gas station sites. Leaking waste oil tanks may lead to CERCLA liability. Again, the UST lender liability rule is not expected to address this issue. According to current proposals, Superfund reauthorization is expected to provide lenders with some exemptions from direct liability; but again, it cannot address third-party liability.

The Consultant Dilemma

The concept of risk-based closure of a contaminated site is not completely new to the larger banks and trusts who have gained some sophistication in environmental issues. However, the majority of banks and trusts nationwide are smaller financial institutions whose environmental workload does not support the services of a full-time, in-house environmental professional. Furthermore, even where larger banks are concerned, individual loan officers and branch personnel often don't understand environmental issues adequately. As a result, these banks and individuals have no choice other than to rely on the documentation provided by the environmental consultant.

One of the greatest problems that banks have encountered in their environmental cleanup dealings is the varying quality of environmental consultants. While there may well be many consultants who are qualified to perform RBCA closures, banks have encountered many who are not well-qualified to perform a traditional LUST site closure, let alone a RBCA closure. The most environmentally sophisticated banks understand this and protect themselves either by limiting the consultants whose reports they will accept to a very short pre-qualified list or by having in-house environmental staff review all reports, evaluate risks, and closely manage consultant work. In fact, consultants find it very difficult at many banks to achieve a pre-approved status. Even if they are approved, their work is monitored closely.

The problems with the consulting field are due in part to the fact that, in most states, there are no criteria for entering the consulting market. The consultant needs no certification to go into business. It would seem that by now a shakeout in the market might have occurred. But because there are potentially millions of tanks in the country and because the owner or operator who needs LUST remediation services is not educated in these matters, he or she is dependent on the consultant. There are still so many tank sites around and tanks that are being removed, that an unqualified consultant can simply move on to the next town if his incompetence is discovered. Smaller lending institutions in rural areas seem to see more than their share of poor consultants. Often, the consultants in these areas have never worked for large companies or large banks and the quality of their work has never been

■ *continued on page 22*

■ RBCA and Financial Institutions *from page 21*

challenged. As a result, they often don't upgrade their skills to meet the technical demands of the field. Frequently, they are not even aware that they are doing poor work.

This consultant dilemma leads to one of the problems with implementing the RBCA standard—many of these unqualified consultants suddenly become risk assessment specialists. They won't really learn the skills necessary to follow the standard, but they'll state that their work and reports meet it. Thus, throughout the cleanup process, both banks and borrowers find themselves dealing with information that may or may not be reliable.

Up until recently, numerical standards have been the norm in most states. Compliance with a numerical standard at least gave the consultant something specific to meet. For the owner or operator buying the service, compliance with a numerical standard is easy to evaluate. The numerical standard is easy to read and compare to the sampling results. With RBCA, more sophistication will be required on the part of both the consultant and the owner/operator. Consequently, lenders and trustees will have an increased workload. They will have to learn the standard and ensure that their consultants learn it and follow it. But, no doubt, the smaller, less environmentally sophisticated banks and trusts will have a tougher time evaluating what's what.

Closure Letters

Another problem that banks and trusts have with LUST sites is state agency-generated closure letters. Many a bank is accustomed to receiving a closure letter from a state agency stating that a particular site has been remediated adequately. These banks, in most cases, view such letters as adequate protection against risk. The more sophisticated banks, however, realize that a closure letter is not the absolute end of liability. Most states reserve the right to reopen a LUST closure and require additional remediation if problems are found later on down the line.

Some states don't have the wherewithal to send a staff person to inspect each closure site; they rely on the report submitted by the consultant. Many states have a large staff turnover, which can limit their ability to evaluate the reports adequately. Furthermore, the consultant may be inclined to manage the closure and closure report to the advantage of the owner/operator who hired him to do the job. The environmentally sophisticated banks understand the limitations of closure letters and generally request closure reports and backup documentation for LUST closures. They may even require third-party sampling as a check on the remediation. Again, the smaller banks generally depend on the consultant, good or bad, who completed the closure report.

The concept of risk-based closure of a contaminated site is not completely new to the larger banks and trusts who have gained some sophistication in environmental issues. However, the majority of banks and trusts nationwide are smaller financial institutions whose environmental workload does not support the services of a full-time, in-house environmental professional.

A key part of RBCA's success, as far as the banking industry is concerned, will depend on whether state agencies come up with closure letters that state that there is no further liability, or at a minimum, define the limit of liability. This would allow banks to assess risks on UST properties and make decisions regarding them more easily.

Off-Site Compliance Points

One of the most disturbing aspects of the RBCA standard, as far as lending institutions are concerned, is the issue of alternative compliance points. The standard allows for a point of compliance to be set somewhere other than the actual location of the LUST. This point could be at the property boundary or even off site. Where a compliance point is set at the boundary of a property, institutional controls, such as deed restrictions or drinking water well prohibitions, may be used to limit potential contamination pathways. In some cases, such controls may limit the use of the property and more than likely lower its value. In other cases, however, such restrictions and close-out letters may allow property that had previously been in limbo to be sold. For example, through the RBCA process, an industrial property may be restricted to its industrial use and maintain its value as such.

State regulations may allow for the property use to be upgraded later on if the site undergoes more extensive cleanup. In the meantime, however, the lender will have to be aware of the impact of the lesser cleanup level on the value of the property. This is especially true if the lender already has a loan on the property or if the property is already in trust.

Setting a compliance point off site leads to other potential problems. The RBCA standard allows for an off-site monitoring option as long as the chosen risk level for the contaminant is not exceeded. For example, suppose a monitoring well is located downgradient and off site from the source. The well is meant to act as an early warning device to indicate if contaminant levels are rising for some unpredictable reason. If the contaminant levels did rise, then further remediation or control would be required.

The concept behind alternate compliance points is that, over time, contamination levels decrease naturally under certain soil and groundwater conditions (natural attenuation). However, when the RBCA process relies on off-site properties for the space and time that are needed for natural attenuation to occur, the plain and simple fact is that someone else's property is being contaminated—which is a problem for adjacent landowners, banks, and trusts. Owners of adjacent properties may file third-party lawsuits, and banks that are involved with the LUST properties may not want to risk these suits. On the other hand, if banks or trusts are considering becoming involved with adjacent downgradient properties, they must

consider the potential devaluation of these properties because of the presence of contamination. Ideally, banker concerns should be weighed into the RBCA decision-making process.

The Environmental Justice Movement

Many contaminated sites are in economically disadvantaged areas. People living in these areas are becoming more aware of the presence of contamination in their environment and are concerned about making sure that cleanups are adequately and fairly carried out. In these areas, there may be resistance to leaving contamination in place...even if it is proven that the site has been cleaned up to a scientifically acceptable risk level. Banks are committed to lending in these areas and may have difficulty in accepting higher levels of contamination because they may be perceived to be supporting an activity that is viewed by the community as harmful.

Public Perception of Risk

For RBCA to be successful, it may be that society as a whole will need to move from thinking that contamination must be cleaned up to background, or even pristine levels, to accepting some residual level that is considered safe. Granted, there is a major backlog of contaminated property in this country that is not selling, and there is not enough money in all the state LUST funds to remediate these sites—which is the major reason why the RBCA standard was developed. We must, however, acknowledge that it may take several years before some of the concepts embodied in the RBCA standard will be accepted by property owners, banks, realtors, and neighbors. Indeed, there are still numerous problems that we need to address. Regulatory changes, time, cooperation, and education will play a part in the success of RBCA. ■

Nona Hancock is Corporate Environmental Manager at Boatman's Bancshares, Inc. in St. Louis Missouri. She is also Chair of the Technical Developments Committee of the Environmental Bankers Association.

A Heating Oil UST With A Bumper?

While excavating what was thought to be a conventional 5,000-gallon UST, a bewildered worker announced, "There's a bumper down here." Indeed, a 6,000-gallon tanker truck with its 30-foot chassis, axle, and wheel hubs had been buried beneath the driveway of a three-decker Leominster, Massachusetts house for more than three decades. The tank was apparently sound, but the cost of removing it was sobering. What was planned to be a 2-day job turned out to be a 2-week job at more than double the expense. The removal company's 12-ton excavator couldn't lift the beast from the ground; the job had to be finished with a crane. Contractor Dave Perry theorizes that the area where the tank was buried was once a slope, and the truck was just backed in and backfilled.

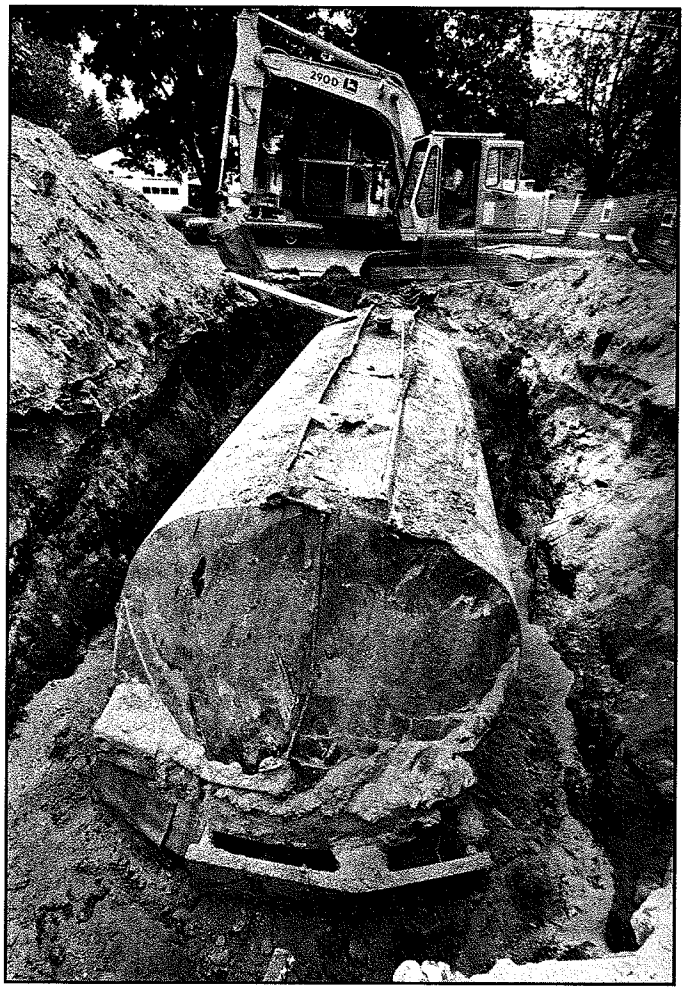


Photo credit: Reprinted with permission of the Worcester Telegram and Gazette.

Risk-Based Corrective Action (RBCA) Video

An introduction to *The Risk-Based Corrective Action Process (RBCA) Applied at Petroleum Release Sites* is now available in a video produced by Shell Oil Company. The video is a broad overview of ASTM's ES 38-94 Emergency Standard Guide. The video was produced to introduce the concepts of risk-based corrective action and encourage its use where petroleum has been released from underground storage tanks.

The video includes interviews with a number of the people who are most familiar with RBCA, including: Aaron Allen, Chevron U.S.A. Products Company; Chet Clarke, Texas Natural Resources Conservation Commission; Melissa Bauman, Nations Bank; Annette Guiseppi-Elie, Mobil Oil; Paul Johnson, Arizona State University; Kathy Kelly, Shell Oil Company; Lisa Lund, EPA-OUST; Gerald Phillips, EPA Region 5; Dennis Rounds, South Dakota Petroleum Release Compensation Fund; and Curt Stanley, Shell Development Company.

To order copies of the video, contact the Environmental Media Center, P.O. Box 30212, Bethesda, Maryland 20814. Phone: 1-800-522-0362. The cost is $60.00 per video plus a $3.00 shipping and handling fee (checks or Visa and Master Card accepted). When ordering, please specify form of payment and shipping address. ■

HEALTH & SAFETY NOTES

TRENCHING, SHORING, AND UST'S

OSHA's Excavations Standards Must Be Met During Underground Storage Tank Excavation Work

by Matthew E. Fitzgerald

After a four-man crew had removed an underground filter tank at a car-wash construction site, they entered the 9-foot deep, 6-foot by 14-foot excavation to hand grade the bottom. The sides of the excavation were neither shored nor sloped. A wall of the trench collapsed, killing one worker and seriously injuring another. The employer was in clear violation of the OSHA standards that cover excavations (29 CFR Subpart P, sections 650-652).

EXCAVATION CAVE-INS ARE REAL hazards that happen all too often, and underground storage tank (UST) installation and removal operations are no exception. Bureau of Labor Statistics (BLS) for 1993 state that 138 workers were killed by collapsing materials. That figure represents 2 percent of all work-related fatalities that were caused by injury in that year.

Yet, there is no shortage of stories about employers who go to great lengths to avoid having to comply with these important OSHA requirements, which clearly saves lives. (Did you hear the one about the tank installer who was found installing tanks at 3:00 am to avoid the OSHA inspectors?) The safety requirements for excavations are not unduly burdensome regulations that have no real life impact on workers; these requirements save lives...everyday.

Are these requirements that tough to meet? Just imagine if you'd been the foreman on the car-wash job described above, and the onus was on you to inform the worker's spouse and children that their loved one was crushed to death at work today. And more often than not, the loved one does have dependent children—BLS reports that 66 percent of workers killed on the job are less than 45 years of age. Considering these potentially tragic consequences, compliance with the OSHA requirements seems the smart thing to do.

OSHA Requirements For Excavations

The 29 CFR 1926.651 *General Requirements for excavations* are laid out in paragraph form and include the following subsections:

(a) Surface encumbrances.

According to the standard, "All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees." When trenches are dug alongside of buildings or fixed objects, the weight of the building on the side of the trench may cause the trench wall to collapse. This type of situation can be especially true in the tight areas associated with remediations.

For example: *During a pipe laying operation, a tree adjacent to the excavation was undercut at the roots, 3 feet below ground level. The tree fell and when it did, it pinned a worker against the pipe that was being laid at the bottom of the trench.*

(b) Underground installations.

According to the standard, "The estimated location of utility installations—such as sewer, telephone, fuel, electric, or water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work—shall be determined prior to opening an excavation."

Clearly, the potential of striking an underground electrical or fuel line needs to be addressed before an excavation is begun. Usually utilities companies can be contacted directly and are very responsive to requests for review of a planned excavation. Potential hazard also lurks in a situation where a trench intersects an area of previously disturbed soils. Many fatalities associated with trenching accidents have occurred at the intersection of a trench and a previously filled trench (e.g., a utility conduit).

For example: *A trench, 10.5 feet long, had been dug in preparation for laying a sewer pipe. A gas main was located 4 feet to the east of the trench. As the worker was grading the bottom of the trench, the east wall collapsed. The worker was crushed to death. The section that fell consisted of fill material from the previous installation of the gas main.*

(c) Access and egress.

This paragraph requires that adequate consideration be given to access and egress into and out of the trench and brings to mind the children's story of Mike Mulligan and his steam shovel, Mary Ann. Taking up a challenge to dig the basement of Popperville's city hall in one day, they worked so fast and furiously that they forgot to dig themselves a way out. Fortunately for Mike and Mary Ann, things worked out fine—Mike was hired on as maintenance man at the new town hall, and Mary Ann was transformed into the town hall boiler.

In the real world, however, getting out of an excavation can be quite hazardous. The very act of scaling a vertical wall can cause it to collapse. Consequently, OSHA requires that either ramps and runways, designed by a "competent person", or stairways or ladders be included in all excavations. A **competent person** is defined by OSHA as an individual

who is "capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate or control these hazards and conditions." (Note: OSHA published an "intent" of its definition of a competent person in the 10/31/89 *Federal Register*. It states that a competent person must have specific training in and be knowledgeable about soil analysis, the use of protective systems, and the requirements of the standards.) A means of egress is also required for all excavations greater than 4 feet deep and must be placed in such a manner so as to require no more than 25 feet of lateral travel distance for employees.

(d) Exposure to vehicular traffic.

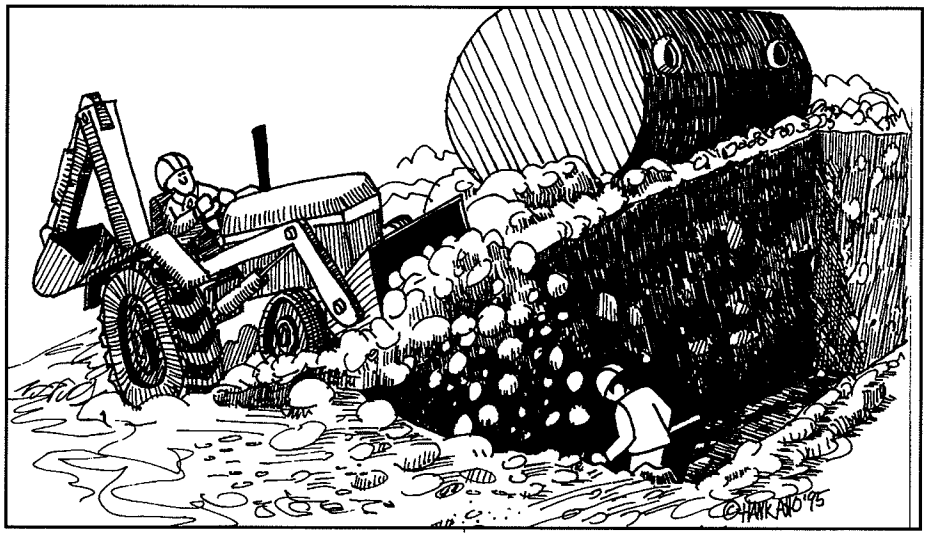
UST operations often take place at gas stations, where vehicular traffic can be a real hazard. In 1993, 361 workers died as a result of being struck by vehicles—6 percent of occupational fatalities for that year. Because trenching operations often take place adjacent to or in roadways, OSHA requires that workers exposed to vehicular traffic be provided with warning vests or other suitable garments marked with or made of reflective or high visibility material.

(e) Exposure to falling loads.

There are many examples of workers in trenches being crushed by falling loads. Workers must not be permitted underneath loads that are being handled by lifting or digging equipment. For example, when a tank is being lifted out of an excavation, workers must be restricted from entering the tank excavation or drop zone.

(f) Warning system for mobile equipment.

Because construction equipment operators are often unable to see everything that is going on to their rear during operations, a general practice of construction safety is to equip all heavy equipment that is used on site with backup alarms. When working from the surface into an excavation, these operators are also very limited in terms of what they can see in the excavation. Consequently, where mobile equipment



What's wrong with this picture?

is used adjacent to an excavation where the operator does not have a clear and direct view of the edge of the trench, OSHA requires a warning system, such as barricades, hand or mechanical signals, or stop logs, to be utilized.

For example: *A sewer pipe was being laid in an 8-foot deep trench. One end of the trench was being back filled by a front end loader. A worker, new to the job, entered the area of the trench that was being backfilled and was crushed to death when a load of fill was dropped on him. The other workers in the area did not realize the worker was missing until several minutes had passed. Only after searching did they determine that their co-worker must have been buried in the backfilled area. The operator of the front end loader, who's view of the excavation was obscured, had no idea that he had buried his co-worker.*

(g) Hazardous atmospheres.

Hazardous atmospheres can be a problem in trenches. Because of the nature of a trench (i.e., because a trench is a narrow depression in the earth) hazardous gases may accumulate as they are released from the soil or groundwater. This potential for concentrations of gases is particularly true at hazardous waste sites and may pose a problem at UST remediation sites where the tank has leaked. If there is the potential for a hazardous atmosphere to exist in a trench greater than 4 feet deep, OSHA requires atmospheric testing of the trench before employees are allowed to enter—oxygen levels must be greater than 19.5 percent, the atmosphere must not exceed 20 percent of any lower explosion limit (LEL), and toxics below the permissible exposure limit (PEL). Hazardous atmospheres and entry into confined spaces, such as trenches greater than 4 feet, can be extremely hazardous. For this reason, if an UST removal operation is being performed in contaminated soil where the potential exists for hazardous atmospheres, a competent safety professional should be consulted.

For example: *An UST was removed from an excavation approximately 6.5 feet wide and 6 feet deep. There was approximately one foot of water at the bottom of the excavation. In preparation for installation of the new tank, two workers entered the excavation to splice two pipes. Unbeknownst to the entrants, propane gas had leaked from an underwater joint on the pressurized side of the pipe being spliced. Both workers were killed by asphyxiation.*

(h) Protection from hazards associated with water accumulation.

OSHA requires employers to adequately protect workers from the hazards associated with water accumulation in an excavation. OSHA outlines three strategies for doing so, including shield systems, removal of accumulated water, or use of a safety harness and life line. Heavy rainfall or water accumulation from groundwater seepage is often associated with trench collapse. Particular care should be taken when inspecting trenches with water accumulation.

■ *continued on page 26*

■ **Health & Safety** *from page 25*

(i) Stability of adjacent structures.

This paragraph of the standard requires that proper precautions be taken when the stability of an adjacent structure is jeopardized by the excavation. Support systems must be designed by a competent person, or a professional engineer must certify that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity. The standard also states that if sidewalks and pavements will be undermined, there must be an appropriate support system to protect employees from the possible collapse of such structures.

(j) Protection of employees from loose rock or soil.

OSHA requires that employees be afforded adequate protection from the hazard of loose rock or soil falling or rolling from the face of an excavation. Specifically, OSHA requires that all materials and equipment be kept at least two feet from the edge of an excavation.

(k) Inspections.

OSHA requires that daily inspections be performed to identify evidence of situations that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, and other hazardous conditions. These inspections must be performed by a "competent person."

(l) Fall protection.

Where a falling hazard exists, an employer must mitigate the hazard. Because trenches and excavations may pose a fall hazard, employers are required to provide physical barriers to prevent inadvertent entry. The standard requires:

- Walkways or bridges with standard guardrails where employees or equipment have to cross over an excavation.
- "Adequate barrier physical protection" at all remotely located excavations. Wells, pits, shafts, etc. must be barricaded or covered. Temporary wells, pits, shafts, etc. must be backfilled upon completion of exploration operations.

OSHA Requirements For Sloping And Shoring

The following section, 29 CFR 1926.652, *Requirements for protective systems*, describes how employees who must enter excavations are to be protected. There are essentially two options to ensure the safety of workers who enter excavations: Sloping or shoring.

Proper sloping of trenches is described in paragraph (b) *design of sloping and benching systems*. Employers have four options for proper compliance:

- *Option 1* - requires a slope of 1 and 1/2 horizontal to 1 vertical for a slope of 34 degrees measured from the horizontal. This requires that the slope be cut back 1 and 1/2 foot from the trench for every foot of depth. A 6-foot trench, therefore, would require a slope 9 feet out from the base of the trench.
- *Option 2* - allows for steeper slopes, based on the type of soil in which the excavation will be dug. For an in-depth discussion of soil types and required slopes see 29 CFR 1926.652 Appendix A, *Soil Classification*, and Appendix B, *Sloping and Benching*. There are essentially four types of soils: Stable rock, type A, type B, and type C. The angle of sloping in Option 1 assumes a type C soil. By definition, UST remediation work cannot possibly be done in type A soil, because type A soil, as defined by the standard, must never have been previously disturbed. Soil around a tank removal operation has obviously been previously disturbed (i.e., when the tank was installed). Type B soil requires a slope of 1 horizontal unit to one vertical for a slope of 45 degrees. It is probably easiest to simply dispense with the process of classifying soil and to assume it is type C, which requires a slope of 1.5 to 1.
- *Option 3* - requires the use of tabulated data approved by a registered professional engineer.
- *Option 4* - requires sloping systems designed and approved by a registered professional engineer.

The requirements for shoring systems are found in paragraph (c) *Design of support systems, shield systems and other protective systems*. As with sloping, there are several options for using acceptable shoring devices, including systems which meet the requirements of Appendices A, C, and D of the standard; systems which are used in accordance with the specifications, limitations, and recommendations issued or made by the manufacturer; systems based on tabulated data approved by a registered professional engineer; or systems designed by a professional engineer. Protective systems which meet the intent of the standard are discussed in some detail in Appendix C, *Timber Shoring for Trenches*, and Appendix D, *Aluminum Hydraulic Shoring for Trenches*.

Staying Out of Harm's Way

In 1985 OSHA prepared a report entitled, *Selected Occupational Fatalities Related to Trenching and Excavation as Found in OSHA Fatality/Catastrophe Investigations*, which was a review of some 206 trenching and shoring fatalities. The conclusion listed several recurrent problem areas, including:

- Failure to provide adequate support systems (shoring);
- Failure to set excavated material back an adequate distance (required 2-foot minimum) from the edge of the excavation;
- Inadequate sloping of trench walls;
- Causing equipment and vehicles to come into contact with sources of electrical current;
- Operating equipment and vehicles too close to the edge of the excavation;
- Failure of workers to communicate in such a way as to prevent co-workers from being struck by equipment; and
- Failure to properly brace standing walls adjacent to trenches.

OSHA went on to list secondary causes of fatal accidents. These included:

- Inexperienced workers or workers new to a particular job;
- Employees taking unnecessary personal risks;
- Dangerous work practices (e.g., shortcuts that increase the likelihood of an accident);
- Failure to coordinate work in small areas; and
- Health problems relating to the

physical condition of workers (e.g., alcohol).

OSHA concludes the report by listing several sets of measures which can be taken to prevent the complex events that are a function of human, machine, and environmental interactions that too often result in fatal trenching accidents. These preventive measures include:

- Establishing and strictly enforcing trenching and excavation safety measures, such as shoring, sloping, and removal of spoil from the edge of the excavation;
- Increasing training and education for work safety procedures and activities; and
- Improving supervision over required safety measures.

Excavations associated with UST installation and remediation are by their nature dangerous, and no worker should be expected to enter a trench without the proper protection. Yet as hazardous as such work may be, there are some very effective strategies for protecting workers. A good place to start is by complying with the OSHA regulations. ■

References:

OSHA, 29 CFR Part 1926 Occupational Safety and Health Standards-Excavations; Final Rule. *Federal Register*, Tuesday October 31, 1989.

OSHA, *Selected Occupational Fatalities Related to Trenching and Excavation as Found in OSHA Fatality/Catastrophe Investigations*. July 1985.

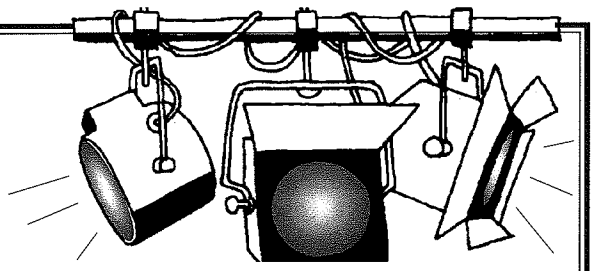
OSHA, *Accident Report* - Fatal Facts Number 52.

Bureau of Labor Statistics. *National Census of Fatal Occupational Injuries*. August 1994.

Matthew Fitzgerald , DrPH, CIH, is a Senior Industrial Hygienist with SCIENTECH Inc. in Rockville, MD. He is currently working on safety and health policy issues concerning the Department of Energy's mammoth effort to clean up the nuclear weapons complex and restore the environment. Matthew has written three other health and safety articles for LUSTLine.

Earth Café the Cable Way

Non-compliance Enforcement Action Begets EPA Region 8 - City of Denver Broadcast Partnership



At an EPA Region 8 Environmental Education Advisory Council meeting in October 1993, the assembled group was bemoaning the fact that the nation's adult population is not nearly as well educated on environmental issues as the school-age population. How can we reach this group?, they asked themselves. Newspapers? Newsletters? Videos? Region 8's Teri Bahrych, a member of the council, suggested cable television. The group liked the idea and asked Teri to present it to folks at the local cable station. She did. They weren't interested, but suggested that she try the City of Denver's municipal channel.

Teri had some contacts over at the city's environmental services department. A few years back she'd inspected several of their 130 USTs. The police station, fire station, fleet management center, and golf course had been out of compliance—no leak detection. But instead of leveling fines, Region 8 opted to employ an alternative enforcement measure—it required the city to come into compliance and then put on a one-day UST seminar for all the municipalities within a 60-mile radius.

Part of this seminar was to be devoted to why Denver had gotten into trouble and how it came into compliance. "For cities and towns, this was an important piece of information," says Bahrych. "Other cities just didn't know what to do about their tanks. We wanted Denver to tell their counterparts how they budgeted, how they worked it out with various city departments, and so on."

The seminar was a big success—over 100 government people attended. In the process, Teri met the head of Denver's environmental services department and his UST staff. So, when she found out the city had a cable channel, she knew whom to call. "To put it mildly, it was a strange request—me asking a favor of someone I enforced against," recalls Bahrych. "But when I told them what we wanted to do, they were interested."

The city agreed to help sponsor eight, half-hour cable shows on environmental topics, including one on USTs. EPA Region 8 provided a $60,000 grant for the project. The City and the County of Denver donated $150,000-worth of studio and production costs in kind.

The series, called *Earth Café*, was produced in a fast-moving and informative MTV-style format designed to help the general public understand some of today's environmental issues, find out how they can get involved, and learn what the city, county, and EPA are doing to correct environmental problems.

The first show, broadcast on February 1, covered air pollution and pesticides. Other topics that will be covered include the water cycle, recycling, water conservation, land toxins, energy conservation, environmental technology, and groundwater protection. The section on "land toxins" will include a segment on USTs and will focus on the 1998 deadline. Each show is broadcast 5 times each week, or 20 times each month. As of early May, after 4 shows had been broadcast, feedback has been "overwhelmingly supportive," says Bahrych.

For more information about *Earth Café*, contact Teri Bahrych at (303)293-1484.

CLU-IN: EPA's Electronic Bulletin Board

Log-On to OUST's New UST/LUST Communication Resource

THE EPA HAS ESTABLISHED AN electronic bulletin board, CLU-IN, which is designed as an information exchange system for hazardous waste cleanup issues. Over 6,000 registered users including regulators, consultants, technology vendors, contractors, researchers, community groups, and the regulated community currently use CLU-IN. Like other bulletin boards, the CLU-IN system provides specialized forums to facilitate more efficient and effective communication among participants. The CLU-IN system has a series of special interest groups (SIGs); one such SIG has been established by the Office of Underground Storage Tanks (OUST) for people in the UST/LUST universe. OUST is committed to maintaining this SIG as a useful, responsive resource and encourages all users to participate in the exchange of information on CLU-IN.

What Does CLU-IN Offer?

CLU-IN offers many different types of information from many sources. You can use CLU-IN to:

- Locate current hazardous waste (including petroleum) cleanup-related information that can be read, printed, or copied onto a computer disk.
- Exchange information including database files, spreadsheets, documents, and software.
- Post your own articles and other useful information for the benefit of others.
- Ask questions and conduct discussions directly with cleanup experts.
- Send and receive private messages and files with other users.

CLU-IN information is available in four general formats: Messages, News, Bulletins, or Files. Although material in the first three formats is intended to be read on-line, you can also "capture" this kind of information and save it on your hard disk or diskette by using your communications software. Files, on the other hand, must be downloaded to your PC before they can be used. Once downloaded, these files can be manipulated by the appropriate software package (e.g., word processor, spread sheet, database).

To Access CLU-IN...

To access CLU-IN, you need a PC or terminal, telecommunications software (e.g., CrossTalk, ProComm, Kermit), a modem (internal or external), a telephone line, and a password that you select. The phone number for accessing CLU-IN is (301) 589-8366. Before connecting to CLU-IN, you must set certain parameters in your software package so that your system "speaks the same language" as CLU-IN. These parameters are: No parity, 8 data bits, and 1 stop-bit. CLU-IN supports a range of modem speeds from 1,200 baud through 28,800 baud.

SIG File Directories

The SIG files, most of which are in WordPerfect Version 5.1 format, have been grouped into the following 12 directory topics.

[1] Above Ground Storage Tanks
[2] Corrective Action & Site Monitoring
[3] Cost Control Tools
[4] EPA/OUST Publications & Program Information
[5] Inspections, Compliance, & Enforcement
[6] Regulations & Requirements
[7] Risk: Assessment, Modeling, Decision Making
[8] Site Assessment & Analytical Tools/Methods
[9] State Assurance Funds
[10] State UST Programs
[11] Tanks & Piping: Installation, Upgrading, Leak Detection & Closure
[12] Underground Tank Technology Updates

To display the file directories from the Main Menu, type an "F" and then press <Enter>.

Joining SIG

The UST/LUST SIG is open to all interested parties—anyone who registers as a CLU-IN user is automatically a member. To access SIGs, you must first connect to CLU-IN using your PC, modem, and communications software. After you've logged on to the bulletin board system and have the Main Menu prompt, type a "J" and then press <Enter>. You will see the SIG menu; press "3" for the UST/LUST SIG. The next screen is typically the News file, which is automatically displayed for you if it has been updated since the last time you were logged-on. If the News hasn't been updated since your last log-in, you will go directly to the UST/LUST SIG Main Menu. The commands from this menu parallel those of the Main Board, except that messages, bulletins, and files are all specific to the UST/LUST SIG.

For Help...

Once connected to CLU-IN, you can navigate through the various options by using its user-friendly menus. Users can get detailed assistance for any CLU-IN command from on-line HELP screens, which can be accessed by first typing "H" followed by the abbreviation of the command for which you want help. For example, to get help on reading messages, type "H R" ("R" is the Read Message command). To get HELP at the sub-command level (e.g., "End of Message" command, "Message Read" command, or "Bulletin List" command), simply type "H." In addition to on-line HELP, the CLU-IN System Operator (SYSOP) is available at the CLU-IN Help Line (301/589-8368) from 9:00 to 5:00 EST.

Comments or Suggestions

OUST welcomes any comments or suggestions that you may have for improving the SIG/CLU-IN service. Comments or suggestions should be directed to OUST's SIG moderator, Hal White. Messages may be left for him on CLU-IN, or if a more immediate response is needed, you may call him at (703) 308-8885. ■

EPA HQ UPDATE

OSWER Directive On Risk-Based Decision-Making

EPA has published OSWER Directive 9610.17, *Use of Risk-Based Decision-making In UST Corrective Action Programs.* This policy statement encourages state and local agencies to move toward risk-based decision-making in their UST corrective action programs and offers guidance on implementing such programs. Through this direction, EPA specifically endorses remediation strategies that are flexible, cost-effective, and protective of human health and the environment. OUST has also prepared a short flyer that describes risk-based decision-making. The directive is available now from the Hotline*; the flyer will be available (also from the Hotline) in June.

1998 Compliance Strategy

OUST's Team 98 has prepared and distributed to the regions and states an 8-page *State-EPA Strategy For Encouraging Early Compliance With UST Upgrade/Replace/Closure Requirements* (EPA 510-B-95-004). Key elements of the strategy include enforcement of existing UST requirements to convince owners and operators that states and EPA intend to enforce the 1998 requirements and extensive outreach to ensure that UST facility owners are aware of the requirements. For copies, call the Hotline*.

DRAFT List of Leak Detection Evaluations

OUST has released a DRAFT *List Of Leak Detection Evaluations For Underground Storage Tank Systems.*
The DRAFT list, which is a regulators' review of third-party evaluations, has been distributed to vendors, EPA regions, state UST managers, and other interested parties for comment and correction. The final listing should be ready in hard copy late this summer. The DRAFT list is available on CLU-IN now. It is in the UST/LUST SIG File Directory #11 (Tanks & Piping: Installation, Upgrading, Leak Detection, and Closure) filename "LEAKDET.EXE". The files are in WP 5.1 format; they have been compressed to save space and decrease the time required to download. The file is self-extracting (i.e., you download the file then type "LEAKDET" and press <Enter>. The result is eight files. (Note: This listing replaces the Region 10 list which is being discontinued.) For a copy, contact Lillian Shelton (703/308-8859) or call the Hotline*.

Two New Corrective Action Chapters

OUST's Corrective Action Team has added two additional chapters to its manual, *How to Evaluate Alternative Cleanup Technologies For Underground Storage Tank Sites: A Guide For Corrective Action Plan Reviewers* (EPA 510-B-94-003). The chapters are entitled, "In-Situ Groundwater Bioremediation" and "Dual-Phase Extraction." OUST will send copies of these two new chapters to people who received a copy of the first part of the manual from either OUST or the Government Printing Office (GPO). OUST estimates that the two new chapters will be available in late June or early July. GPO will not carry the two new chapters alone; GPO will carry the new longer manual once it has printed copies. The new GPO stock number will be 055-000-00499-4; the price is yet to be determined. To be place on a waiting list for the new, longer manual, call the Hotline*

1998 Slide Show

OUST has expanded a slide show developed by Region 8. *Don't Wait Until 1998: A Slide Presentation* is for regulators and others to use to explain the options for upgrading, replacing, or closing existing UST's by December 1998. The slide presentation includes 30 text slides and 20 graphic slides, a suggested basic narration, and cover material. OUST is sending out one copy of the slide presentation to each state and region. If you need more information, contact OUST's Jay Evan at (703) 308-8888.

RACER

Eleven state representatives, OUST, the developers of RACER, and Air Force personnel met to evaluate and and make recommendations to modify RACER for leaking UST facilities. RACER, or Remedial Action Cost Engineering and Requirements System, is a software package that was developed by the Air Force that rapidly provides cleanup cost estimates on a site-specific basis. RACER users can vary site parameters or technology components at a site, and RACER will quickly calculate the new costs. For more information, contact Debby Trembley (703/308-8867).

Financial Responsibility Mechanisms Manual

Arizona produced a manual entitled *Reviewing Financial Responsibility Documents* to assist their inspectors in understanding and reviewing FR documents. Arizona "loaned" the guide to OUST, and OUST modified it, changed the title to *Financial Responsibility Mechanisms*, added to it, and then distributed the revised guide to all state UST programs in early May. It was sent out on disk so that states could add state-specific sections or otherwise modify the guide to meet their needs. Two versions are also available on CLU-IN in Directory #5 (Inspectors, Compliance, and Enforcement); the revised version has filename FRIHNDBK.EXE and the original (Arizona) version is AZFRMAN.EXE. For more information, contact Mark Barolo (703/308-8874).

Minnesota Handbook for UST Inspectors

Minnesota has placed a document in CLU-IN. *Minnesota Field Reference Handbook for UST Inspectors* is available in Directory #5 (Inspectors, Compliance, and Enforcement) as filename MN_FRHBI.IW6 (in IBM Word version 6.0).

* EPA's RCRA/Superfund Hotline is open Monday through Friday from 8:30 a.m. to 7:30 p.m. EST. The toll-free number is 800 424-9346; for the hearing impaired, the number is TDD 800-553-7672.

Coast to Coast is provided as a regular feature of LUSTLine to update state and federal UST, LUST, and cleanup fund personnel about the activities of the Association of State and Territorial Solid Waste Management Officials' (ASTSWMO) Tanks Subcommittee. If you want to learn more about the Tanks Subcommittee, contact the Subcommittee Chair, Michael Kanner (MN) at 612/297-8564, or Stephen Crimaudo (ASTSWMO) at 202/624-5828

Tanks Subcommittee

The ASTSWMO Tanks Subcommittee has been active on a variety of general tank program issues, including planning sessions for the March 1995 EPA National Tanks Conference and preparing a RBCA presentation at the ASTSWMO Mid-Year meeting in Austin, Texas. The task force has completed its *Tanks Subcommittee Peer Match Directory*. Last August, the subcommittee distributed a Peer Match Survey to state UST and LUST managers and fund administrators. The survey listed a number of tank program topics and asked state program managers to indicate their areas of expertise and areas where they were in need of assistance. The directory is a compilation of these results. Through the Peer Match Program, the Tanks Subcommittee provides limited funding to enable state program staff to obtain training by visiting other state program "experts." This program has successfully provided a number of states with hands-on experience and insight on a variety of subject areas.

LUST Task Force

During the ASTSWMO Mid-Year meeting, members of the LUST Task Force presented an overview of the ASTM *Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ES-38), which included a discussion on how the RBCA process can be used as a corrective action decision-making tool at UST release sites. The session was moderated by Michael Kanner, MN, and discussion leaders included Marc Fisher, NJ and Chet Clarke, TX.

LUST Task Force members have commented on and helped draft revisions to ASTM's RBCA standard and have evaluated ASTM's new Expedited Site Characterization procedure. The task force is also looking into issues associated with oxygenated fuel additives, specifically MTBE. The Delaware LUST program has been conducting an ongoing survey and bibliography search to determine MTBE action levels for groundwater and to better understand the risks. (MTBE issues will be covered in the next issue of *LUSTLine*.)

For more information on LUST Task Force activities, call co-chairs Scott Winters at (303) 692-3453 or Kevin Kratina (609) 633-1451.

UST Task Force

UST Task Force members have been working closely with EPA-OUST to develop strategies for the 1998 upgrade compliance deadline. Task force members finished a pre-publication draft of the *1998 Compliance Directory*, which was presented in March at the national UST/LUST conference in Savannah, Georgia. The directory is a compendium of 1998-related information. After final review, the directory will be distributed to all the states. The final version will be tabbed and prepared for a binder so that states can add updates as they are available.

Another document, the *State-EPA 1998 Compliance Strategy*, was approved by ASTSWMO's Board of Directors in January and has been revised according to recommendations and input from UST Task Force members and the "Team 98" state/EPA work group. The latest version (February 23) was distributed at the national conference. Copies can be obtained from EPA-OUST.

At a February meeting with several members of EPA-OUST, EPA staff discussed a number of program issues that are of major concern to the states, including the stability of UST/LUST funding and the impact of the upcoming EPA budget on regions, states, and tribes. During the meeting, the subject of "brownfield" sites as they relate to LUST sites was discussed. EPA is promoting a brownfields initiative that is designed to promote redevelopment of urban, previously industrialized sites, as opposed to development of undeveloped green fields. Many brownfield sites have leaking USTs that will need to be removed or brought into compliance. Lender liability was also discussed at the meeting.

The states and EPA also discussed the successes and difficulties of retrieving compliance data from state data bases. One task force member from Kentucky described how state staff had analyzed compliance data to develop trends from 1989 through 1998. Through this process, state staff were able to determine that, at present, 15 percent of existing active tanks meet the 1998 technical compliance standards. Eight other states shared their compliance data. Some states, however, have had difficulty in retrieving compliance data, an issue that will be examined further in a future *LUSTLine*.

The UST Task Force worked with EPA-OUST to collect information on state UST-related loan and grant programs. ASTSWMO distributed the resulting report, *ASTSWMO Tanks Subcommittee, Summary of State UST Financial Assistance Programs*, to the states. This document will also be included as a chapter of the *1998 Compliance Directory*.

For more information on UST Task Force activities, please call task force co-chairs Tana Walker, OK, (405) 521-3107 or Paul Sausville, NY, (518) 457-4351.

State Cleanup Funds Task Force

The State Cleanup Funds Task Force met in Denver in January to develop an agenda for the 1995 State Fund Administrators Conference, which will be held in Colorado Springs in June. This year's theme will be "Funds in Transition." The agenda will include updates on the RBCA standard, sessions on state funds in transition, accelerated site characterization, and surviving legislative moves to restructure funds.

The task force worked on a compendium of state fund information that expands on the existing state fund survey. EPA Region 4 is working on such a compendium for the states in that region. The task force continues to work with OUST on a *State Fund Cost Control Manual*. The group plans to use the ASTSWMO Special Interest Group (SIG) on the CLU-IN Bulletin Board to enhance information exchange and encourage participation of all state fund administrators in task force activities.

If you have questions or comments on State Cleanup Funds Task Force activities, please call Dennis Rounds, SD, (605) 773-3769.

TIE Task Force

The Training and Information Exchange (TIE) Task Force has set such goals as identifying state training and information needs, increasing communication among task forces and state members, and channeling information outreach to *LUSTLine*. Current TIE strategies include facilitating implementation and use of the CLU-IN Bulletin Board, creating a state newsletter exchange, and facilitating the Peer Match program and Directory. The task force has assigned its members to serve as liaisons to the UST, LUST, and State Cleanup Funds Task Forces.

If you have questions or comments on TIE Task Force activities, please call task force co-chairs Gary Kulibert, WI, (715) 369-8960) or Pat Jordan, WY, (307) 777-7684).

Tank Bits

1995 Cost Guide for UST Remediation Equipment

The revised and updated *1995 Cost Guide for Remediation Equipment at UST Sites*, originally researched and prepared by EPA-OUST, is now available. This 1995 rate schedule, published by K-III Directory Corporation, provides current, comprehensive information on equipment costs associated with cleanup of petroleum hydrocarbons from soil and groundwater at LUST sites. It is especially useful for regulators and consultants who need to determine costs for time and equipment on jobs. The rates published in the guide represent an average allowance that an equipment owner should charge in order to recoup ownership and operating costs. Monthly, weekly, daily, and hourly rates in the guide reflect the actual costs incurred by remediation contractors and include allowance for such items as depreciation, equipment-related overhead, cost of facilities capital, repair and maintenance costs, and much more. The guide costs $125 and can be obtained by contacting K-III Directory at (408) 467-6700.

L.U.S.T.LINE

New England Interstate Water Pollution Control Commission
255 Ballardvale Street
Wilmington, MA 01887
Phone: 508/658-0500
Fax: 508/658-5509

To our Readers:

WE WANT TO HEAR FROM YOU...

If you have any mailing list business, please fill out this form and return it to us.

- ❑ **Please add my name to your mailing list** (Fill out name and address below).
- ❑ **Please take my name off your mailing list.** (Fill out name and address below).
- ❑ **Change of address**
- ❑ **Please send me back issues of LUSTLine.** Back issues now cost $2.50 per issue or $25.00 for a complete set. Please enclose a check, drawn on a U.S. bank, and made payable to NEIWPCC.

Name _____

Address _____
Street City/Town State ZIP

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

UPDATE: ASTM UST/LUST Standard Developments

The American Society for Testing and Materials (ASTM) is a large, voluntary consensus standard development system which has recently seen increased activity in the storage tank arena. ASTM serves as an organizational roof under which interested and knowledgeable parties gather to reach and document consensus on a particular system or process. Multiple small tank groups are currently working on ASTM standards under Subcommittee E-50.01 for storage tanks. Once successfully balloted, the resulting standards can be referenced in regulations and contracts.

A brief description of UST/LUST-related activities follows. For more information on a particular standard development effort, contact a chair listed below. For questions about ASTM activities in general, call ASTM's Patrick Barr at (215) 299-5400, or about EPA's involvement, call EPA's David Wiley at (703) 308-8877.

General and Emergency Standards

• **ES 38-94, Emergency Standard Guide for Risk-based Corrective Action Applied at Petroleum Release Sites,** is a standardized approach for using risk-based corrective action (RBCA) at petroleum release sites. Risk-based corrective action is a generic term for corrective action strategies that categorize sites according to risk, move all sites forward, and provide oversight that is appropriate for each site. ES 38-94 was balloted and approved as an emergency standard by Committee E50 on Environmental Assessments. ASTM anticipates that the RBCA standard will receive final approval from the entire society by September 15 and should be available shortly after that date.
Chair: Dennis Rounds, South Dakota Petroleum Release Compensation Fund - (605) 773-6048.

• **ES 40-94, Emergency Standard Practice for Alternative Procedures for the Assessment of Buried Steel Tanks Prior to the Addition of Cathodic Protection,** is a standard that describes what characteristics methods should have in order to assess the integrity of USTs to determine suitability for upgrading. A general standard (sequel to this emergency standard, which expires 11/15/96) is currently under development.
Chair: Jim Bushman, Bushman & Associates - 216) 769-3694.

• **E-1599, Standard Guide for Corrective Action for Petroleum Releases,** provides a logical, timely, and economic framework and general sequence for site assessment and remediation of subsurface petroleum releases. The standard also provides a model for streamlining regulatory processes. This general, 10-page standard was approved by ASTM in 1994. Price: $15.00.
Contact: Matt Small, EPA Region 9 - (415) 744-2078.

Standards Under Development

• **Remediation by Natural Attenuation**
Purpose: To produce a "Guide for Remediation by Natural Attenuation at Petroleum Release Sites."
Co—chairs: Matt Small, EPA Region 9 - (415) 744-2078, and Michael Barden, Wisconsin Department of Natural Resources - (608) 264-6007.

• **Accelerated Site Characterization at UST Sites**
Purpose: To produce a standard on the appropriate levels of data quality needed for varying tiers of site characterization at suspected or confirmed LUST sites.

Co-chairs: Chet Clarke, Texas Natural Resources Conservation Commission. (512) 908-2218, and Gilberto Alvarez, EPA Region 5, (312) 886-6143.

• **Statistical Inventory Reconciliation**
Purpose: To produce standards on the SIR approach to leak detection.
Chair: open.

L.U.S.T.LINE

New England Interstate Water Pollution Control Commission
255 Ballardvale Street
Wilmington, MA 01887

Forwarding and return postage guaranteed.
Address correction requested.

Non-Profit Org.
U.S. Postage
PAID
Wilmington, MA
Permit No.
200