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L.U.S.T.LINE

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

USTs—A View from Europe

by Jamie Thompson

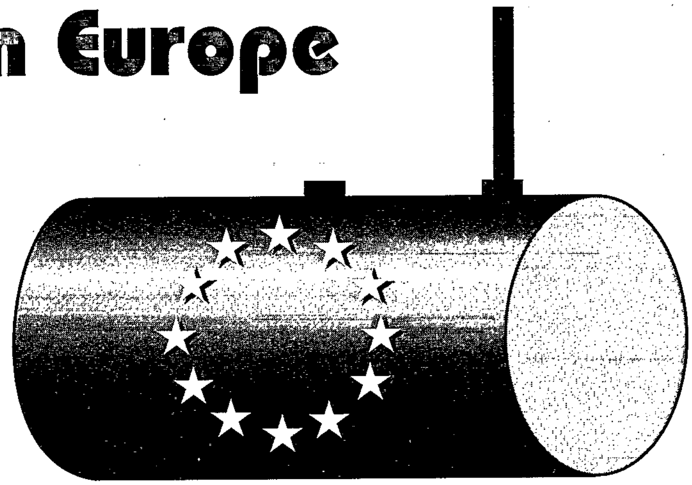
For some 60 years, fuel storage systems remained virtually unchanged. During those years, the oil industry made vast progress aboveground in modernizing their retail gasoline sites. But below ground, where the fuel storage system is buried, it was quite another story. In Europe, we estimate that a mere 5 to 7 percent of the total development cost of a gasoline station was spent on underground tanks and pipes—"out of sight, out of mind." More recently, however, spurred on by regulators and public opinion, the oil industry has recognised the need to safeguard the environment.

In the 1980s it appeared that the UST situation in the U.S. was far worse than in Europe—U.S. standards of construction and installation were such that leaks were relatively common. Federal UST legislation and the resulting regulations enabled manufacturers to provide some unique solutions to the industry, some of which we were also able to consider in Europe. We found ourselves "cherry picking" the best solutions from the U.S., using them along with some of the tried and tested systems developed in Europe.

The European Union

In the late 1980s, many of us in the U.K. were taking our first tentative steps into Europe. Although we had some knowledge of what was going on in the U.S., we knew far less of what was happening right on our doorstep. The fact that each country in Europe had completely different standards of installation came as a surprise to some of us. Others in the industry who'd been trying to build the same filling station design across national boundaries had suffered with this issue for many years.

Perhaps the most important unifying catalyst in the early 1990s was the issuing of a number of Directives (the same as federal law in the U.S.) from the European Union (EU). In addition, there was the formation of Central European Norm (CEN), the largest regional standards body in the world, which was given the task of developing standards for the effective international operation of



the industrial and service sectors, breaking down trade barriers, and stimulating competitiveness in the largest emerging trading block in the world—Europe.

In addition to this harmonization of standards, the industry itself was also changing. Oil companies were becoming more European (rather than national) in their outlook. Many began forming European operations in which common standards of construction, purchasing, and operations were to help in the harmonization process.

■ *continued on page 2*

Inside

■ USTs—A View from Europe

from page 1

In my opinion, Germany had one of the more advanced systems as far as tank standards were concerned. They have required double-walled steel tanks with proactive leak detection since 1968, although they later inherited many single-walled installations in the East following reunification.

Reflecting on Change

No matter how odd some might appear, each of the varying standards and methods of construction and installation of tanks and pipes among European countries had been developed for a seemingly good reason...or other. One such oddity was the U.K.'s insistence that all underground tanks and pipes be surrounded by concrete. Research now confirms that although the concrete surround did delay corrosion, it was only a delay, and eventually the tanks and steel pipes leaked.

As in the U.S., galvanized pipe used to be standard. These pipes acted as a sacrificial anode to the unprotected steel tanks. Hence, leaking pipe work systems were the norm. It was not until the late 1980s that regulators and industry started to look seriously at the problems we were creating and asked the reasons for such specifications.

No doubt, the largest influence for change and the uniting of construction methods across the 19 EU countries involved in CEN has been the development of common European standards for gas station equipment. This work started 10 years ago and is now coming to fruition.

No doubt, the largest influence for change and the uniting of construction methods across the 19 EU countries involved in CEN has been the development of common European standards for gas station equipment.

There is now a European standard on underground gasoline tanks, both fiberglass reinforced plastic (FRP) and steel. Equipment standards are being written on overfill prevention devices, dispensers, fuelling nozzles, leak detection equipment, submersible pumps, tank gauges, oil separators and underground pipe work. All of these, when completed, will replace all the national standards.

U.S.A. Versus Europe

I'll discuss the European experience with UST systems in a future issue of *LUSTLine*. In fact, if you have any questions that you'd like me to address, please send them on, and I'll include them in my discussion. For now, to whet your interest, I'll provide a brief comparison between European and U.S. UST systems.

■ Tanks

The development of European standards for both FRP and steel USTs effectively provided a choice for the industry. It is a fact, however, that FRP tanks, though widely used in the U.S. without much problem, have not succeeded in Europe. In the U.K., 2,000 FRP tanks were installed over a 15-year period. Now, no major oil company or user is installing these tanks. I can give no reason as to why the technology has not transferred across the Atlantic, as the manufacturers made tanks under licence from U.S. manufacturers.

The preferred UST is a double-walled steel tank that has dished ends, unlike the flat-ends standard on U.S. counterparts. These tanks have a corrosion-protective coating that is applied to the outside, and they are installed with a backfill of gravel or sand. Leak detection in double-walled tanks is accomplished by filling the interstitial space with liquid and monitoring the level of this liquid over time or by establishing a pressure or vacuum in the interstitial space and watching to see whether the pressure or vacuum can be maintained over time.

These types of leak detection systems have the advantage of monitoring both walls of the tank rather than just the inner wall, as is often the case in the U.S. I am not aware of any incident where a leak from such a storage tank has found its way into the environment, and this technology has been in use for over 30 years in parts of Europe.

One area where the U.S. is more advanced is the development of aboveground storage tank technology. At present, the demand for such tanks in Europe is quite small, but I do envisage a growth in this market, and no doubt the technology will be imported from the U.S.

■ Pipe Work

With the exception of Germany, underground steel pipe work is no longer used in Europe. German officials appear to have an aversion to anything plastic, but they will be compelled to look at the alternatives once the standard on underground pipe work is completed.

The use of FRP pipe was popular 15 years ago as the alternative to steel. This was followed by the import of U.S.-produced flexible piping systems, some more successful than others. The first flexible piping systems coming out of Europe were a

LUSTLine

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polyethylene type with fuel-resistant linings. At present, European industry has found these to be the most cost-effective way of meeting their own requirements and those of the environment and safety agencies. I believe that these pipe types will be seen in the U.S. market in the future; they have proven to be robust and liquid-tight over a 20-year period.

■ Dispensing Systems

The most significant difference between the U.S. and European UST technologies is that the U.S. almost exclusively uses pressurized pumping systems, whereas in Europe the vast majority of fuel dispensing is accomplished with suction systems.

The suction system is seen in Europe as a better safeguard against product loss into the environment. If a breach appears in a pipe, and the nonreturn valve is positioned under the dispenser, then the dispenser will fail to work and the product will drain back to the tank.

When first used in Europe some decades ago, the pressure system was not well understood, and some large product releases caused their popularity to drop. In 1987, a site in Denmark with pressurized piping systems leaked, resulting in an explosion that killed the manager and injured eight customers. Earlier this year, a pressurized system in Spain pumped 200,000 liters into the ground as a result of poor installation.

There is, however, a trend by some of the major oil companies to move in the direction of pressure systems. These systems are more popular in some European countries than others. The use of double-walled piping is the norm for pressurized systems, while suction systems may still use single-walled piping.

■ Drainage

In Europe, drainage requirements for gas stations have been in force for many years. All sites must provide drainage, and all areas such as the refueling area and the road tanker delivery stand must be effectively drained to a separator. These separators must be sized to accept a 7,600-liter spill. An independent test house, in accordance with the European Standard, must test the efficiency of operation of the separator. These separators must be cleaned regularly to ensure that no pollution enters the sewer or water systems. In some European countries the use of gasoline-resistant paving systems are an additional requirement.

The Future?

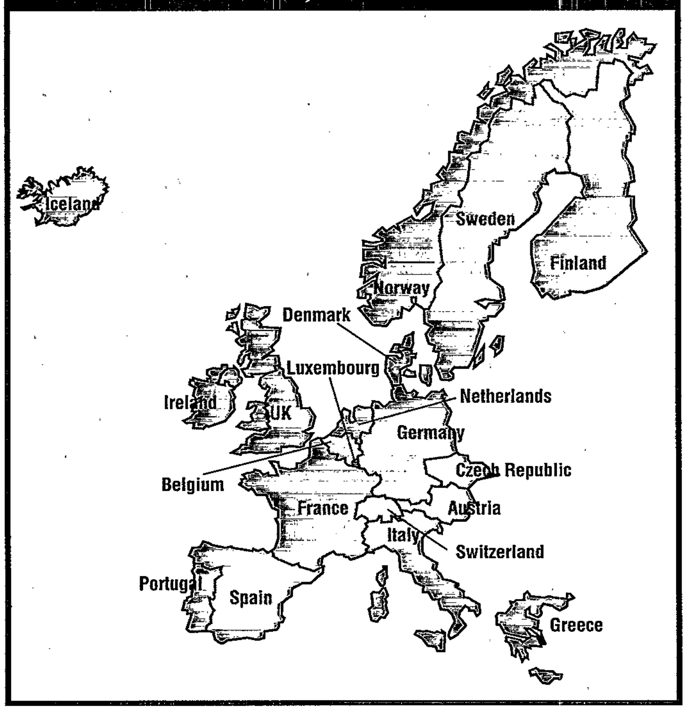
In most developed countries, the number of gasoline stations has been shrinking. Within the U.K., for example, there were 50,000 gas stations in the 1950s. By 2000 that number had fallen to 13,043. This reduction is also reflected across Europe.

I believe the trend will be toward larger, more efficient sites where the investment in the underground facilities can be better justified. We are still left with concerns about the operation of the site. From the information I have learned, both across Europe and the U.S., this is frequently where we share the common problem of people not understanding the facility for which they are responsible.

One thing for sure, the world is much smaller and the exchange of information provides us all with the opportunity to examine alternatives so that we can try to make petroleum storage and dispensing as safe as possible.

For more information about the CEN standards, go to www.cenorm.be. *The Web site does not allow you to view the standards, but it shows what is standardized, what work is in progress, and how the standards can be purchased.* ■

CEN PARTICIPATING COUNTRIES



Jamie Thompson was the Principal Petroleum Inspector for the London Fire Brigade from 1961 to 1999. He is now a consultant to the petroleum industry. He has been involved in writing the European Guidance on Petrol Filling Station Installations. *He sits on various British standards committees and European technical committees, and is chairman of a number of European Standards (CEN) committees that are writing standards for Europe on equipment to be used at petrol stations. Jamie can be reached at* **jamiethompson@msn.com**

In Memoriam

As we endeavor to heal the wound that pierced our collective soul on September 11, 2001 …

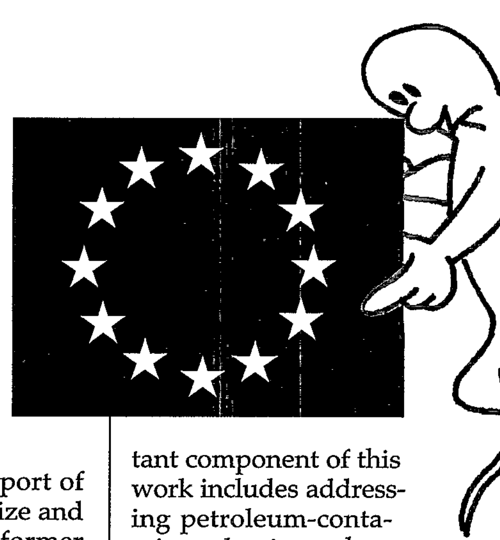
We extend our thoughts and prayers to the victims, their families, and those who survived and

Our unending gratitude to those who risked their lives to save others and those who continue to provide aid and comfort.

Oxygenates

The Use of Fuel Oxygenates in the European Union

by Jeff Kuhn, Martin Bittens, and Mario Schirmer



In light of the national debate in the United States, European researchers have recently begun focusing efforts on studying the impact of oxygenates within the European Union (EU) as well as former East Block countries. The severity of contamination from fuel oxygenates in Europe has been the subject of recent discussion. It is widely perceived that fuel oxygenates are not a significant issue in most European countries.

For the most part, the enforcement of strict environmental laws in western Europe has minimized petroleum contamination of soil and groundwater. Suction systems and mandatory installation of double-walled tanks and lines in western Germany has helped prevent the magnitude of problems seen in the U.S. Furthermore, most western European countries have relied more heavily on diesel than on gasoline to fuel a large portion of their vehicle fleets.

On the other hand, there is currently no requirement to test for fuel oxygenates in soil or groundwater in most EU countries, with the exception of the United Kingdom (U.K.) and Denmark. Germany uses MTBE up to 15 percent by volume, depending on the brand and grade of gasoline. We should note that octane ratings in Europe are typically much higher than the octane ratings of gasoline sold in the United States. Typical octane ratings for unleaded gasoline sold in Germany and other European countries are 92, 96, and 98.

As there has been no comprehensive testing program in most EU countries, estimates of MTBE contamination are probably speculative. In view of this, there is a high probability of finding some concentration of MTBE at many European service stations, even though releases have been minimized due to more tightly regulated tank storage systems.

Political changes in Europe since the fall of the Soviet Union have also led to a greater focus of attention on many environmental issues. Many western European countries, with the support of the EU, have begun to prioritize and cleanup industrial sites in former East Block countries, such as the German Democratic Republic (GDR), the former East Germany. These countries have had a substantial number of petroleum releases at both retail service stations and large refinery and petroleum distribution sites. Poor environmental standards and a lack of more sophisticated cleanup technologies are significant obstacles to remediation.

As there has been no comprehensive testing program in most EU countries, estimates of MTBE contamination are probably speculative.

ANCORE

Through the efforts of the Center of Applied Geoscience at the University of Tuebingen, Germany, academic contaminant research work in Europe has recently been organized under an oversight group called ANCORE—The Academic Network for Contaminated Land Research in Europe. ANCORE is a unique partnership of academic researchers who are focusing on soil and groundwater contamination issues.

ANCORE maintains close connections to European regulators (the CLARINET Network) and industry (the NICOLE Network). These three groups work closely together to coordinate oversight and direction on contaminated soil and groundwater issues throughout the EU. An important component of this work includes addressing petroleum-contaminated sites that contain fuel oxygenates. ANCORE also hopes to provide training to former East Block countries (Central East European (CEE) Accession States) to develop local technical expertise, and thereby enhance remediation capabilities.

European MTBE Workgroup

A European MTBE workgroup led by Dr. Mario Schirmer of the the Environmental Research Center (Umweltforschungszentrum, or UFZ) in Leipzig, Germany, includes the UFZ, the University of Sheffield (U.K.), the Finnish Environment Institute (FEI), the U.K. Environment Agency, the Technical University of Denmark, the University of Tuebingen (Germany), EAWAG (Swiss Federal Institute for Environmental Science and Technology), the Transport Research Centre (TRC) in the Czech Republic, VTT Biotechnology (Finland), Risk and Policy Analysts Ltd. (U.K.), EFOA (European Fuel Oxygenate Association), and CONCAWE, the oil companies' European organization for environment, health, and safety. The European MTBE workgroup receives technical support from North American groups, such as the University of Waterloo (Canada) and Sierra Environmental Services, Inc.

Goals of the workgroup include the following:

- Determine the current extent, future development, and significance of water contamination by MTBE in Europe;
- Assess and develop cost-efficient

remediation technologies for MTBE contamination of groundwater and water supply wells;

- Improve the science, information, and knowledge base used in environmental impact and risk assessment and integrate socioeconomic factors into risk management for fuel components in the EU; and
- Disseminate the results and knowledge gained from the project and provide a forum for all key stakeholders for the discussion of the regulatory, industrial, and policy implications of MTBE in the European environment

A proposal entitled the "Assessment of the Long-Term Behavior, Environmental Risk. and Remediation Technologies for MTBE" (ALBERICH) is currently under review by the European Commission (EC). If the proposal receives funding, ALBERICH will be responsible for establishing cleanup standards, implementing cost-effective remediation technologies, and examining the socioeconomic impacts of contamination from MTBE. The EC is reviewing a draft of the Finnish Environment Institute's (FEI) assessment of MTBE. (Contact Timo Assmuth at FEI for more information—**Timo.Assmuth@vyh.fi.**) Further decision from the EC on the use or potential banning of MTBE in the EU may occur in the near future.

One European country, Denmark, has already moved forward to ban MTBE. The ban was scheduled for implementation for the summer of 2001. MTBE has recently been discovered at a large percentage of petroleum release sites in the country. It will be interesting to see what effect the ban of MTBE in Denmark has on other EU countries and what Denmark will use to replace MTBE. ■

Jeff Kuhn is with the Montana Department of Environmental Quality and a member of the ASTSWMO MTBE and Fuel Oxygenates Workgroup. Martin Bittens is executive director of ANCORE at the Center for Applied Geoscience at University of Tuebingen, Germany. Dr. Mario Schirmer is with Umweltforschungszentrum (UFZ) in Leipzig, Germany.

EXPEDITED SITE ASSESSMENT CD WINS AWARD

Gary A. Robbins, Professor of Hydrogeology, was given a University of Connecticut Chancellor's Information Technology Award for the Development of *Expedited Site Assessment: The CD*. The CD, produced by the Connecticut DEP, provides technical guidance on conducting expedited site assessments at LUST sites. For more information visit: *http://www.esacd.uconn.edu.*

Veeder-Root Discriminating Sensor Reclassified

Veeder-Root has discovered that a small percentage of 794380-341 Discriminating Interstitial Sensors for fiberglass tanks can incorrectly report fuel conditions as liquid alarms in some instances. The affected sensors will alarm where liquid is present; however, they may not distinguish between fuel and water. The sensor has undergone additional third-party certification in a nondiscriminating mode and has been reclassified in the list compiled by the National Work Group on Leak Detection Evaluation.

In the listing, the vendor has made it clear that it has identified "a failure mode in the sensor that sometimes results in an inability to determine if the liquid is fuel; the default mode of this failure is water. Thus, any alarms initiated by the 794380-341 sensor should be treated as nondiscriminating."

The vendor is curently upgrading installed 794380-341 sensors but cautions that those that have not yet been upgraded remain in the field under the following conditions:

- The TLS-350 console has software version 20B or higher, which can handle any alarm generated from the 341 sensor as a liquid alarm; and
- Water alarms generated by the 341 sensor are responded to in a fashion equivalent to a fuel alarm.

California Concerns

Currently, California discourages the use of discriminating sensors, in general, for new installations. The State Water Resources Control Board (SWRCB) has been concerned about inconsistencies with third-party certification results of such products and the applicability of the standard third-party protocol to these systems. There are also concerns about the wide range of response and recovery times observed by local agencies in the field, the reusability of sensors, possible incremental deterioration of sensors upon repeated exposure to fuel, and the reliability of the discrimination feature.

While not suggesting the removal of existing discriminating sensors at this time, the SWRCB says that if a sensor is discovered to be nonfunctional or is not performing in accordance with third-party testing results, it should be replaced, preferably with a nondiscriminating sensor. As with the Veeder-Root 341 sensor, the SWRCB suggests that it is appropriate to reprogram discriminating sensors so that the alarm response to hydrocarbon and water is identical, or nondiscriminating. Reprogramming should only be done if the manufacturer of the equipment authorizes it, and a factory-trained contractor performs the reprogramming. ■

For more information about the Veeder-Root 794380-341 sensor, contact Alan Betts at (860) 651-2782. For more information on California's List of Leak Detection Equipment and Methods for USTs (LG 113-15), go to **http://www.swrcb.ca.gov.**

Oxygenates

WanDer LUST

by Hal White

***This is the first in a series of articles by Hal White that explores "a dimension as vast as space and as timeless as infinity ... representing the middle ground between light and shadow, science and superstition ... between the pit of man's fears, and the summit of his knowledge" (to shamelessly paraphrase Rod Serling's* Twilight Zone).**

MTBE Taste and Odor Thresholds ... The Myth of Protectiveness

Two often-touted "beneficial" characteristics of MTBE are its low taste and odor thresholds, reputed to be significantly lower than levels to which exposure might produce toxic effects (if any) in humans. While taste and odor thresholds vary from person to person, several studies indicate that most people can detect MTBE in water by either taste or odor (or both) at concentrations in the range of 10 to 40 parts per billion.

Such a range must surely be low enough to provide a high degree of protectiveness from exposure to MTBE-contaminated drinking water, right? As a prelude to answering this question, consider the following scenario, which is based on two real-life cases (and embellished only slightly in order to meld them together):

> In Somewhere, U.S.A, a community where drinking water comes from domestic groundwater wells, some of the residents have noticed that unless they shower with their windows open, they experience dizziness, headache, and nausea. Beyond this inconvenience, however, no one has noticed anything out of the ordinary about his or her water. But, over a holiday weekend, one family is visited by in-laws from out-of-town. Upon their arrival, the guests are given refreshing glasses of ice water and immediately gag in response to the turpentine-like taste. As their visit progresses, they become dizzy and nauseous any time any tap in the house is turned on. At the insistence of their guests, the homeowners contact the state health department, which promptly dispatches a crew to investigate. Water samples are collected and analyzed and found to contain several tens of milligrams per liter of MTBE—several hundred times higher than the supposed taste and odor threshold and high enough to account for the dizziness, nausea, and headaches experienced by many in the neighborhood. By the time the investigation is completed, many households in the neighborhood are found to have MTBE-contaminated water.

Many of you who work in state leaking underground storage tank programs can probably recall similar examples from your own experience. And many of you may have scratched your head and wondered: Considering the low taste and odor thresholds for MTBE, how is it possible that people living with MTBE-contaminated water can blithely drink water that must obviously have an offensive taste and smell?

The answer to this question is a function of dispersion and desensitization. In our scenario, MTBE concentrations in the domestic wells increased gradually over time so that the people in the neighborhood became desensitized to the foul smell and taste of their water. Even when showering, the neighborhood residents didn't notice a bad smell, although they did experience physical illness caused by exposure to high concentrations of MTBE, symptoms that were somewhat relieved by opening the bathroom windows. The out-of-town guests, who were not desensitized, were immediately able to recognize that the water smelled and tasted bad.

Transport of Dissolved Contaminants

Now, let's get a bit more technical. First, it is important to understand that dissolved contaminants migrating in the subsurface through porous media do not travel as a concentrated, discrete slug that ultimately enters a well and instantaneously raises the concentration of the extracted water to that of the slug. The leading edge of a contaminant plume is typically very dilute, with concentrations increasing upgradient back toward the source. As the plume continues to expand, concentrations gradually rise in the wells located downgradient from the source.

This basic behavior holds true even if the plume detaches from the source. A detached plume will migrate as a "pulse" or slug, but concentrations will still be lower around the periphery and higher in the core. If a detached plume continues to migrate past wells that intersect it, then at some point concentrations in these wells will decrease as the plume moves even further downgradient.

Transport of dilute dissolved contaminants is a function of advection, hydrodynamic dispersion, and other chemical, biological, and physical reactions. Advection refers to the movement of molecules (or particles) imparted by flowing groundwater. The advective rate of transport is generally defined (imprecisely, as will be shown later) as the *average* linear groundwater velocity.

Hydrodynamic dispersion occurs as a result of molecular diffusion and mechanical mixing and causes the dissolved contaminant plume to spread out with distance from the source. Molecular diffusion is generally only significant when groundwater movement is very slow. Mechanical mixing occurs as groundwater flows through the aquifer matrix, twisting around individual grains and passing through interconnected pore spaces at differing velocities.

The movement of some dissolved contaminants may also be affected by chemical, biological, and physical reactions, such as sorption and biodegradation, which act to decrease the transport velocity and reduce concentrations in the plume. MTBE is only minimally affected by sorption processes and degrades very slowly in many (but not all) subsurface environments—as such, in some environments its behavior is substantially similar to that of a nonreactive tracer.

Calculating Travel Time

Classical tracer studies devised to study advection-dispersion phenomena typically employ a cylindrical column that is filled with porous media. A continuous supply of tracer at a specified concentration is introduced at one end of the column under steady-flow conditions, and outflow concentrations are measured at various times after the tracer is injected.

A graph of the outflow concentration with time is known as a breakthrough curve (Figure 1). Initially concentration of the tracer in outflow samples is zero. Beginning with the time of first arrival of the contaminant front, tracer concentrations increase gradually at first then accelerate before reaching a steady-state equal to the concentration of the source. The inflection point of this curve (the vertical dotted line) represents the hypothetical arrival time of an undiluted slug of contaminant moving at the *average* linear groundwater velocity.

There are two problems with the comparison of true contaminant transport and an undiluted slug. First, due to the presence of the porous media, slug (or plug) flow is impossible. Even at a relatively small scale (i.e., these cylindrical columns) the "plume" of tracer would be dispersed with distance in the column due to molecular diffusion and mechanical dispersion.

No matter how low the MTBE-contaminant thresholds, they cannot be relied on to provide any measure of protectiveness from exposure.

Second, some of the tracer molecules are moving faster than the *average* linear groundwater velocity, and some are moving slower. This is also true for the water molecules—it's just that we do not measure the velocity of individual water molecules. Hence, a common misconception is that due to dispersion, contaminants may move faster than groundwater. A more correct statement is that some contaminants may move faster than the *average* linear velocity of the groundwater.

This distinction concerning velocity is very important. It also leads us to another realization: if some contaminant molecules are traveling faster than the average linear groundwater velocity, then the *maximum* linear groundwater velocity rather than the *average* linear groundwater velocity should be used to calculate the time it will take contaminants to first reach a receptor. (How significant a difference this will actually make will be discussed in a later article written in collaboration with Jim Weaver of the EPA's Office of Research and Development.)

Take-Home Message

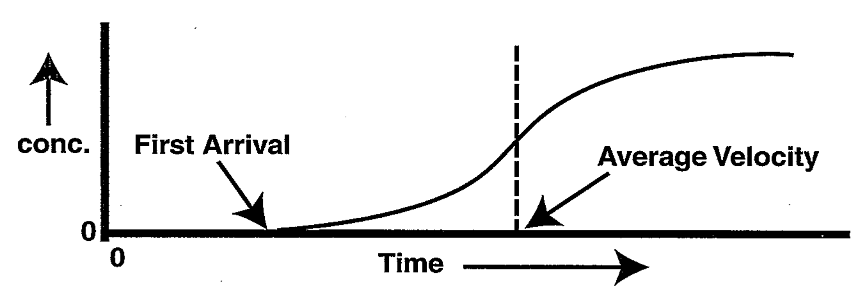
So, back to the original question of the protectiveness of taste and odor thresholds. The take-home message is that no matter how low the MTBE-contaminant thresholds, they cannot be relied on to provide any measure of protectiveness from exposure. Why?

- Contaminants initially arrive at receptors at low concentrations and increase gradually, and the rate of increase may be slow enough to allow those affected to become desensitized. Then, when the presence of contamination is finally realized, concentrations may be high enough to cause adverse health effects.
- Contaminants may be transported at rates that exceed the *average* linear groundwater velocity. In order to calculate contaminant travel time (i.e., the time required for contaminants to first reach a receptor), it is the *maximum* linear groundwater velocity that is relevant, not the *average* velocity. ■

This article was written by Hal White (EPA OUST/HQ) in his private capacity. No official support or endorsement by the Environmental Protection Agency or any other agency of the federal government is intended or should be inferred. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Figure 1

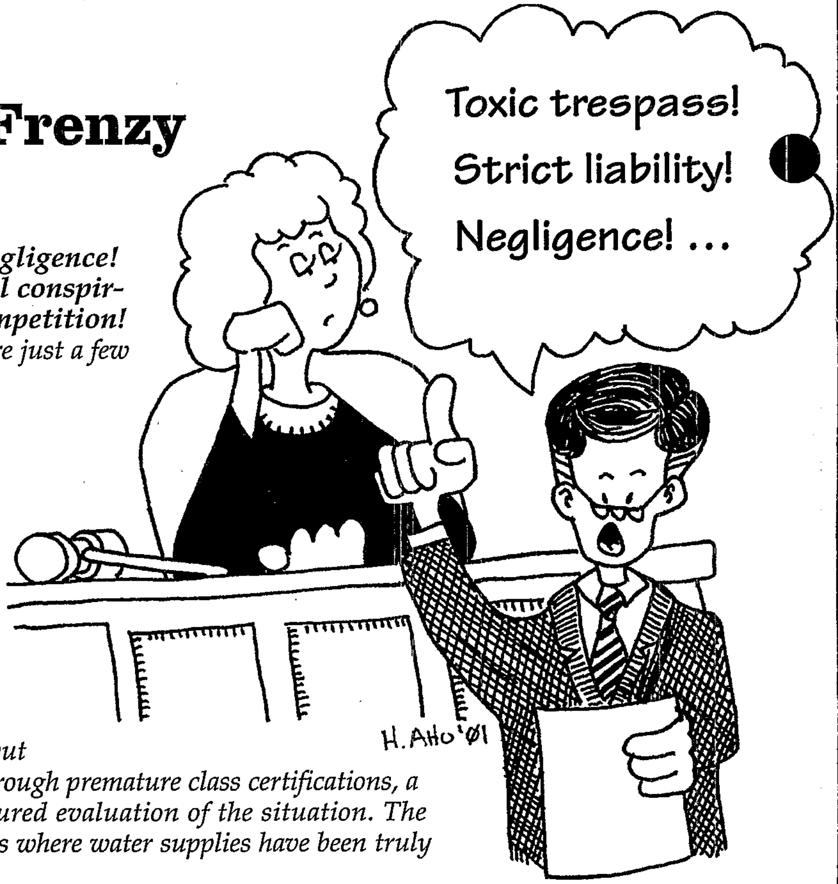
BREAKTHROUGH CURVE OF A NON-REACTIVE TRACER



Oxygenates

The MTBE Litigation Frenzy

by Patricia Ellis



***Toxic trespass! Public and private nuisance! Negligence! Strict liability! Fraudulent misrepresentation! Civil conspiracy! Personal injury! Property damage! Unfair competition! Known or should have known! Conspiracy!** These are just a few of the claims in the multitude of lawsuits involving MTBE.*

In a March 2001 article in the Journal of Environmental Forensics, *titled "Salem Revisited: Updating the MTBE Controversy," authors R.O. Faulk and John S. Gray decry the current frenzy of MTBE lawsuits, the class-action suits in particular. They consider the current MTBE controversy to be "an example of American regulatory and legal hysteria," rather than a real public health and environmental crisis, "an unsubstantiated crusade destined to waste millions of dollars and unnecessarily preoccupy judicial resources."*

They believe that the MTBE crisis has been created by the pending and future class-action lawsuits that allege—but do not document—nightmarish scenarios, and that seek, through premature class certifications, a "rush to judgment" that precludes a reasoned and measured evaluation of the situation. The authors state that there are very few demonstrated instances where water supplies have been truly impaired.

I thought it would be easy to sit down and summarize this current "frenzy" of MTBE litigation, until I realized how much of it there really is, and how many different types of cases there are. So I've managed to summarize a representative (and certainly not exhaustive) chunk of cases to give you some idea of what's going on out there. Please keep in mind that I am a mere geologist/hydrologist and unhampered by any real legal knowledge or training. My information does not come from a search of any legal database, but primarily from newspaper articles and press releases. At the end of this summary, I've thrown my own two cents into the frenzied fray.

CALIFORNIA CASES

MTBE Ban

Methanex, a Canadian corporation, has filed suit against the U.S. State Department because of the California phase-out of MTBE. Methanex alleges that under Chapter 11 of the North American Free Trade Agreement (NAFTA), the California ban violates the foreign investment guarantees of NAFTA. An amendment to the claim also contends that ethanol producer Archer Daniels Midland (ADM) misled and improperly influenced the State of California to ban MTBE in favor of the ethanol industry.

Another suit that came out of the California MTBE ban is the *Oxygenated Fuels Association (OFA) v. California Governor Gray Davis and the California Air Resources Board.* In January 2001, a federal judge tossed out the lawsuit, ruling that there is nothing in federal Air Quality regulations that precludes the ban. Federal legislation exempts California from the law that precludes states from imposing their own rules on fuels and additives because the state's air regulations preceded federal regulations. OFA plans to appeal the ruling, arguing that Congress's grant of autonomy to California does not apply to the MTBE ban because it was enacted to protect water, not air.

Also related to the California MTBE ban is a suit filed in August by the California Air Resources Board against the EPA because of its decision in June mandating the continued use of oxygenates in reformulated gasoline. The suit had to be filed within 60 days of EPA's announcement of its rejection of California's waiver request. The suit argues that EPA overlooked scientific evidence that California gasoline does not need oxygenates to meet federal pollution reduction standards.

Other Cases

Continuing with California litigation, a California State Superior Court judge signed off on an agreement in August 2001 in *Communities for a Better Environment (CBE) v. Unocal,* forcing five major oil companies to clean up MTBE-contaminated sites that they own. CBE, a San Francisco–area environmental group, charges that the companies violated the state's Unfair Competition Act by using MTBE in such a way that it contaminated groundwater.

In 1998, CBE sued Shell, Chevron, Texaco, Equilon Enterprises, Unocal, ARCO, Tosco, Exxon, and Mobil under that act because the chemical is not on a list for the state's Safe Drinking Water and Toxic Enforcement Act. Had it been on the list, the state would have been able to force the companies to clean up their sites. The first five companies have settled. ARCO, Tosco, Exxon, and Mobil are still in litigation.

Current California law requires companies to clean up MTBE leaks, but the regulations lack any penalty provisions. Under the settlement, state agencies will be able to enforce their compliance orders *and* ask courts to impose penalties of up to $6,000/day for cleanup costs. Many confidential memos from the companies were filed under seal in 1998, but the presiding judge has unsealed the documents, which provide many new details about industry and EPA knowledge of the potential dangers of MTBE use.

South Lake Tahoe

Trial began in early October 2001 in a lawsuit brought by the South Tahoe Public Utility District (STPUD) against a group of gasoline producers, distributors, and dealers, and Lyondell Chemical, the country's largest MTBE producer. The water district holds seven companies responsible for contaminating 12 of its 34 wells.

Among other payments, the utility is demanding $40 million to cover the costs of removing MTBE from its wells. Twenty-four of the original 31 defendants in the case have settled with STPUD for a combined $32 million. Chevron settled recently for $10 million, and Exxon settled for $12 million. The remaining seven defendants are Shell, Lyondell, Texaco, Tosco, Ultramar, and two Tahoe gas stations, Tahoe Tom's and Terrible Herbst.

According to subpoenaed internal corporate records, Shell, Texaco, Exxon, and Chevron had mounting evidence during the 1980s that MTBE posed a greater threat to drinking water than gasoline's other components. The companies did not disclose this information to the EPA in response to the agency's mid-1980s call for information on the chemical's environmental and health effects. Industry officials even assured EPA that its concerns were unfounded in deciding whether to regulate MTBE as a contaminant in drinking-water supplies. The companies had documented dozens of sites in New Jersey and in several other states before 1988.

Santa Monica

The City of Santa Monica filed suit in June 2000 against 18 oil industry companies, including refiners, manufacturers, owners, operators, and suppliers responsible for contaminating city wells at the Charnock well field. The city worked extensively with several companies to devise a plan for cleaning up the contaminated wells, but in January 2000, the oil companies walked away from the negotiating process.

Cleanup of the five Charnock wells, which produce 60,000 gallons/minute, is anticipated to cost between $150 and $200 million and take at least 10 years to complete. In 1998, the City of Santa Monica settled a suit with Mobil Oil Corporation to pay for the cleanup of its Arcadia well field wells and to buy residents water piped in by the Metropolitan Water District.

NEW YORK CASES

MTBE Ban

In 2000, New York Governor Pataki signed a law banning the sale of gasoline containing MTBE starting in 2004. A federal judge upheld the ban on MTBE, paving the road for a full-blown court battle. The OFA, which represents MTBE manufacturers, argued in federal court that the state measure conflicted with the federal Clean Air Act. In May, a U.S. District Court judge ruled that federal laws controlling vehicle emissions do not preclude a state law designed to stop groundwater from being contaminated by MTBE. He denied a request for summary judgment by OFA, which had sued to have the law declared invalid. A trial date has not been set.

CLASS-ACTION SUITS

Numerous class-action suits concerning MTBE have been filed. A number of lawsuits have been grouped into a consolidated complaint by private well owners against nearly every major petroleum company. The consolidated complaint charges oil companies with strict liability for design defect, failure to warn, deceptive business acts and practices, public nuisance, negligence, breach of notification duty under the Toxic Substances Control Act (TSCA), and conspiracy to market an unsafe product. The plaintiffs seek damages for contamination or threatened contamination of their well water by MTBE, and seek a court-supervised program of MTBE testing, monitoring, education, and where necessary, the provision for clean water and remediation. The defendants have sought to dismiss all claims except the federal cause of action under TSCA.

Originally, there were five classes of plaintiffs:

- *Berisha* – Two New York property owners who claim their properties have been devalued due to existing or past contamination in their well water. This is an individual action.
- *Berrian* – Three New York property owners whose wells contain MTBE and who seek to represent a class of well owners in New York whose wells contain MTBE.
- *England* – Two Illinois property owners whose wells contain MTBE, a California well owner whose wells contains MTBE, and two Illinois property owners whose wells have been tested but were not found to contain MTBE. The first three seek to represent a class of well owners in California, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Texas, Wisconsin, and Virginia, whose wells are contaminated with MTBE. The last two seek to represent a class of well owners in the same states whose tested wells have not been found to contain MTBE.
- *La Susa* – A New York property owner whose well has not been tested for MTBE, who seeks to represent a class of well owners in New York whose properties, while allegedly at risk for MTBE contamination, have not yet been tested for MTBE.
- *Young* – A Florida property owner whose well is contaminated with MTBE, who seeks to represent a class of private well owners in Florida where wells have been contaminated.

One portion of the class-action lawsuit was dismissed in August 2001 by a New York judicial panel on

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■ MTBE Litigation *from page 9*

multidistrict litigation for lack of standing. The remaining four classes of plaintiffs will be permitted to proceed. For the plaintiffs to have standing in court, they must prove that they have suffered an injury-in-fact, the injury must be traceable, and it must be likely that the injury will be remedied by the court.

Portions of the lawsuit involving La Susa, Bauer, and McMannis (the wells without MTBE) "have not alleged a present threat of imminent harm," wrote the court in dismissing the entire La Susa class and the portion of the England class pertaining to the two Illinois well owners whose wells were tested but found uncontaminated. The suit names 20 oil companies and 100 "John Doe" defendants. The judge in the case has established a Web site (www.MDL 1358.com) that contains many of the court documents. Fascinating reading!

North Carolina

In January 1999, five people sued 13 major oil companies and distributors in a class-action suit on behalf of all North Carolinians who get their water from private wells *(Maynard v. Amerada Hess Corp.)*. They called the action an effort to combat water contamination that they characterize as "one of the greatest wrongs ever visited upon the people of this state." The plaintiffs said that the oil companies conspired to distribute a potentially dangerous chemical through a system of underground storage tanks and pipes they knew to be leaking. They allege negligence, strict product liability for failure to warn, and fraud. Certain in-state distributors were dismissed by agreement after early discovery.

In June 1999, the judge granted the plaintiffs' motion to divide the proceedings. Under the resulting case management plan, the first phase of the case will decide questions of the defendants' liability to the state's well owners and whether to certify for water testing only. Certification of a class of owners of contaminated wells for damages will be addressed in a subsequent phase of the investigation. Half of the state's 7.4 million residents get their drinking water from private wells, according to data from the N.C. Division of Environment and Natural Resources, hundreds of which are known to be contaminated with MTBE. Of the state's 100 counties, at least 82 have wells with MTBE contamination, according to the lawsuit.

Maine

In March 2001, a judge denied formation of a class action in a case involving a 1997 automobile accident in Standish, Maine, that caused MTBE to leak into well water *(Millet v. Atlantic Richfield)*. Millet sued Atlantic Richfield, Lyondell Chemical, API, and the Oxygenated Fuels Association following an automobile accident in which 8 to 10 gallons of gasoline were spilled in front of the home of Michael Millet. MTBE contamination as high as 6,000 ppb was found in his well water. At least a dozen other wells in the area were also found to have MTBE-contaminated water, with the accident as the likely source. An out-of-court settlement was reached, with the driver's insurance paying $25,000 and Atlantic Richfield paying $10,000. Millet received $22,000, another party whose well was contaminated by an unknown source received $10,000, and two other individuals received $1,500 each to cover the costs of testing their well water.

New Jersey

A New Jersey class-action suit filed in August 2000 *(Holten et al v. Chevron U.S.A. et al)* named 1,000 plaintiffs and "John Does" seeking to create funds to remediate spills and cover medical monitoring for MTBE and BTEX exposure. The judge granted Chevron and Gulf Oil's motion for summary judgment, explaining in part, that "because Congress required that gasoline contain an oxygenate and specifically designated that MTBE would be one of the most common and effective oxygenates…gasoline containing MTBE cannot be deemed a defective product."

In October, the judge agreed to reconsider her grant of summary judgment to Chevron and Gulf on the negligence claim because she may have "overlooked" the defendants' duty to warn service station owners such as Cumberland Farms, Inc. of the properties of gasoline with MTBE.

Connecticut

A Connecticut suit filed in 1999 *(Catherine Martin v. Shell Oil Co. et al.)* sought status as a class-action suit. The suit alleges that contaminated well water caused diminished property and personal damages. The complaint alleges that Shell Oil knew about a release from USTs at a service station and failed to stop it or alert the public and government agencies.

Shell asked for summary judgment. In a response, at the end of September 2001, the plaintiffs requested that the court impose the burden of proof on the issue of causation on the defendants because of their egregious failure to test the product before putting it on the market and to test the marketed product after they had clear evidence of human health hazards.

The plaintiffs cite that when gasoline with MTBE was introduced in 1979, the defendants knew that UST systems routinely leaked, that the defendants learned "almost at once" of the propensity of MTBE to spread "like lightning in groundwater," and that the defendants "learned very soon that MTBE might have adverse health effects on humans." Despite their knowledge, the defendants "made a conscious corporate decision to leave the product on the market, presumably because it was profitable."

Because of the "egregious" behavior of the defendants, the plaintiffs requested that the court modify the Daubert principles and allow evidence used by toxicology and hydrology experts to formulate the court's opinions that the plaintiffs have been exposed to gasoline containing MTBE in well water contaminated by a known leaking UST.

OTHER TYPES OF LITIGATION

Another major type of litigation involving MTBE concerns suits filed by municipalities or water districts over impacts to water supplies (e.g., the Tahoe and Santa Monica cases). The following are examples of such cases:

- A case was filed in **Orange County, California,** by county officials against Atlantic Richfield and others and Lyondell Chemical for conspiring with API and the petroleum industry to sell MTBE with knowledge of its risks to water quality.
- The City of **Dinuba, California,** filed suit against Unocal and others in 1999 for impacts to the water supply of more than 15,000 Dinuba residents, seeking to recover costs for alternative water supplies and water treatment.
- The City of **Cambria, California,** filed suit against Chevron alleging the company contaminated a source of its drinking water.
- The Village of **East Alton, Illinois,** has filed suit against companies that manufactured and sold MTBE when they knew or should have known that it would reach groundwater and pollute public water supplies.
- The **Plainview** Water District in Nassau County, New York, has filed suit against ExxonMobil. The water district is worried that the company's 1997 gasoline spill may result in MTBE entering its drinking-water wells. The lawsuit contends that the company's use of MTBE was negligent because the company "knew or should have known" that the chemical is water soluble and is a potential carcinogen inappropriate for use in the kind of underground tanks where it was stored."
- The Town of **Sturbridge, Massachusetts,** filed suit in December 2000 against Mobil, Atlantic Richfield, and Shell for contaminating one of the town's three wells.

A **Marysville, California,** lawsuit, filed by two Marysville property owners who alleged that their land was contaminated by MTBE and other chemicals from a leaking gas station, was dismissed in July by a federal judge. William and Billie Kuneman sued the Marysville Water Service Co., two oil companies, and others, alleging that leaking USTs had contaminated one well that supplied water to city residents. The suit sought damages and a fund so that Marysville could own and operate its own water supply. In dismissing the case, the federal judge said that the Kunemans had mistakenly sought recovery of cleanup costs under the federal CERCLA Act of 1980, which excludes petroleum-related contaminants, and that they failed to give 90-day notice of their intention to sue the EPA and the California Attorney General under provisions of RCRA. Since no case remained under federal law, the case was also not continued on the state claims.

Due to a release at a gasoline station in **Pascoag, Rhode Island,** the state's Department of Environmental Management (DEM) filed suit in September 2001 against the owners and operators of a Mobil gas station, charging that they have not done enough to address a gasoline leak on their property that might be contaminating Pascoag's drinking water supply. They are already under order from the DEM to investigate and clean up the spill. The leak is the prime suspect in the contamination of the district's wells, which lie about 1,700 feet away. The complaint asks the court to force the defendants to do more to investigate and clean up the gasoline and to fine the defendants up to $25,000/day dating back to September 13, 2001 for failing to obey DEM's original orders. The water district may become a party to the case, rather than filing separate litigation.

In August 2001, two **Hyde Park, New York,** residents filed suit in state Supreme Court, seeking $1.76 billion each, alleging that MTBE leaked from nearby gasoline stations and created a health hazard. Sixteen companies were named in the suits and amended claims were expected to name additional codefendants. The suits state that the families will suffer health problems as a result of their exposure and that their properties have been devalued to the point where they are "worthless." The suits ask that the companies be found negligent for contaminating the groundwater and for failure to warn of the potential dangers of MTBE exposure. Toxics Targeting, an environmental consulting firm that specializes in MTBE matters, stated that government agencies discovered extensive contamination in 1979 and never told the community about the problem. The state was not named as a defendant in the lawsuit due to restrictions placed on lawsuits against governments and because the state didn't cause the contamination. In February 2001, five residents in the affected area filed a class-action federal lawsuit against 11 major oil companies, claiming that their drinking water had been contaminated with MTBE. As of August 2001, 77 homes have had carbon filters installed.

The **Suffolk County, New York,** legislature has retained a law firm to force major oil companies to clean up the county's water supply. The county has chosen the law firm of Weitz and Luxemberg, who recently won a settlement against Exxon in the Tahoe area. The firm will work on a contingency basis, footing the bills and taking its fee out of any settlement that may be reached. Long Islanders are totally dependent on groundwater. Last year, former EPA Administrator Carol Browner said the island "faces one of the worst situations." There are at least 300 individual spills in Sussex County alone. In August, a Manhattan judge handling several MTBE cases rejected an oil company motion to dismiss a case, deferring until a trial this question of fact: Were there safer additives to use? Suffolk County may join this lawsuit.

In the **Doylestown, Pennsylvania,** area, Tosco Refining and ExxonMobil are facing two lawsuits over groundwater contaminated with MTBE. Local lawyers filed a class-action suit over contamination at Pools Corner in 2000. The owners of 32 private wells near the gas stations filed the suit, and the lawyers hoped to represent a class of as many as 10,000 plaintiffs.

In August 2001, another suit was filed in a Bucks County Court by the Texas law firm that recently won a major California settlement. The recent suit, filed on behalf of the owners of four properties, said Tosco and Exxon, the owners of the stations that impacted their wells, should pay them at least $300,000 for violating state and federal environmental laws and putting their health at risk.

According to the latest lawsuit, Exxon officials knew as early as the mid-1980s that putting MTBE in gasoline was potentially dangerous. The suit claims the companies failed

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■ MTBE Litigation *from page 11*

to properly monitor wells around two gas stations at Pools Corner. The suit also names a local environmental firm, Groundwater Technology, Inc. of Philadelphia, as liable.

In November 2000, the *Doylestown Intelligencer* published a three-part series on MTBE, and at least 50 additional articles within the next few months. The series discussed recent discoveries of well contamination in eight or nine towns north of Philadelphia, where large numbers of domestic wells have been impacted by MTBE. I expect that many other lawsuits have been or will be filed in these towns.

In November 1983, 300 to 400 gallons of gasoline leaked out of an UST at a Conoco-owned gasoline station in **Wrightsboro, North Carolina.** In May 1995, MTBE and benzene were found in 11 of 12 wells that provide water to two mobile home parks, with some 178 of these residents reporting illnesses. In 1997, Conoco settled out of court for $36 million. The jury had already found Conoco liable for negligence and fraud in covering up gasoline spills at its Wrightsboro station. This was one of the first MTBE cases to be decided.

MY TWO CENTS

Obviously the water supplies of Santa Monica and Tahoe have been seriously impaired, and scores of "smaller" examples can be cited. The Maine study, for example, shows that approximately 15 percent of public water supplies tested contained detectable levels of MTBE, and 1 percent exceeded the state drinking water guideline. Costs for treating impaired water sources should fall to those causing the contamination, not the innocent customer, and these treatment costs can run to millions of dollars.

Consider the number of domestic wells that are in close proximity to gasoline stations—wells that may never have been tested for MTBE and other gasoline components. Whether or not health risks effects can be demonstrated from exposure to MTBE or its breakdown products, the American consumer should have the right to drinking water that is uncontaminated by unnecessary chemicals—water without a turpentine taste or odor. The consumer should also not have to face a lifetime of worry over whether the chemical that they have consumed for an unknown number of years may have some long-term effects that haven't yet been identified.

As a member of EPA's Blue Ribbon Panel, which issued its recommendations in July 1999 and its final report in September 1999 calling for the elimination or substantial reduction of the amount of MTBE in gasoline, I had great optimism that we would quickly see some action towards that end. But it wasn't until March 2000 that EPA Administrator Carol Browner or Dan Glick of the Department of Agriculture first commented on the report, and here it is November 2001 and there has still been little progress made towards eliminating MTBE.

So here we sit, in our oxygenate rollercoaster, anticipating action on eliminating MTBE, only to be disappointed again. Actions that seem to be pending in Congress tend to be politically rather than scientifically influenced. As much as I dislike lawyers and lawsuits, they seem to be the only way to move the process ahead, keeping the issue in the public eye and potentially bringing compensation to those who have been impacted. If we were to manage to eliminate MTBE tomorrow, we will still be dealing with MTBE cleanups 10 years from now. Some of the lawsuits attempt to shift the costs of the cleanups and water-supply replacements to those who are responsible for the problem. ■

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The ASTSWMO MTBE and Fuel Oxygenates Workgroup Newsletter *contains a section on MTBE litigation that attempts to keep current on MTBE litigation activities. References to most of the cases cited can be found in the newsletters, which are posted at* **http://www.astswmo.org/Publications/Revbkshlf.htm#Tanks.**

EPA Issues Boutique Fuels Report

On October 24, 2001, U.S. EPA released its "Study of Boutique Fuels and Issues Relating to Transition from Winter and Summer Gasoline" (EPA420-R-01-051) The study was conducted in response to a May 17, 2001, directive contained in the National Energy Policy Report requiring EPA to "study opportunities to maintain or improve the environmental benefits of state and local 'boutique' clean fuel programs while exploring ways to increase the flexibility of the fuels distribution infrastructure ..."

In its report, EPA identifies several regulatory changes that can be made in the near term that could help to moderate gasoline price spikes during future transition periods when fuel producers switch from winter- to summer-grade cleaner-burning gasoline. In both 2000 and 2001, gasoline prices rose sharply during this transition period, particularly in the Midwest.

In examining the current situation and future outlook for boutique fuels, EPA consulted with over 40 stakeholder groups, including gasoline refiners, distributors and marketers, pipeline operators, auto manufacturers, state and local government officials, and environmental and public health organizations.

EPA identified two issues that need to be addressed. The first is the need for greater flexibility in the process by which fuel marketers make the transition from winter- to summer-grade reformulated gasoline (RFG). The second issue is the number of state and local boutique fuels programs and the challenges that this presents to the gasoline distribution system.

The report discusses the actions that EPA will take in the near term to ensure a more orderly transition from winter- to summer-grade RFG. EPA is prepared to act quickly on this set of administrative and regulatory actions to provide new flexibility to refiners in advance of next

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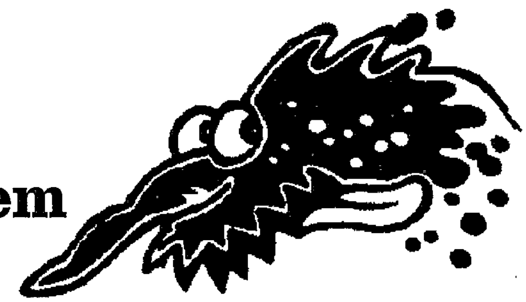
Leak Prevention

Microbes and Fuel Systems
The Overlooked Corrosion Problem



by Fred Passman

Microbes play an indispensable role in cycling both organic and mineral molecules essential to maintaining life on earth. We depend on the activities of microbes to breakdown wastes and convert them into nutrients to sustain the food chain. We use microbes to produce foods ranging from bread to sausage. Microbes within our intestinal tracts enable us to derive nutrition from the foods we eat. Suffice it to say we derive tremendous benefit from the various processes by which organisms break down both organic and inorganic materials.

When discussing material breakdown in positive terms, we use the terms of either *biodegradation* or *bioremediation.* Biodegradation includes all processes by which organisms break down materials. Bioremediation specifically refers to processes with which microbes or other organisms are used to fix a problem. With respect to leaking underground storage tanks (LUSTs), bioremediation uses microbes to degrade fuel that has seeped into the ground.

It's a short leap of understanding, then, to recognize that the same processes that serve our needs may also cause problems. The same biological processes that enable us to clean up spilled fuel using bioremediation can also degrade fuel stored in tanks. This undesired biodegradation is called *biodeterioration.*

During the past decade, government and industry have directed considerable effort and resources toward reducing the risk of soil and groundwater contamination from LUSTs. Although leak prevention technologies don't overtly presume that tanks fail from either inside or outside, most of the preventive measures address mitigation of the risk of failure due to corrosion or other insults working from a tank's outside towards its interior. In particular, leaks caused by galvanic corrosion have received considerable attention.

But there is another underappreciated corrosion process that I'd like to discuss. It takes place in all types of UST systems, and microbes play a key role. It's called *microbially influenced corrosion* (MIC).

Fuel and Corrosion Microbiology

The first report of gasoline biodeterioration was published in 1895 [1]. Subsequently, researchers demonstrated that microbes could degrade crude oil and all grades of liquid fuel. (See Davis's excellent 1967 monograph [2] and the 1984 compilation of papers edited by Atlas [3].) Fuel biodeterioration can be grouped into four general groups of processes:

- Microbes can attack the hydrocarbon and non-hydrocarbon fuel molecules directly, thereby changing the fuel's chemical and performance properties.
- Microbes growing in bottoms-waters or within biofilms (more on that in a bit) produce biosurfactants—detergent molecules—which can transport water-soluble molecules into fuel and disperse fuel molecules into water.
- Low molecular weight molecules excreted as microbial wastes may react with fuel molecules and accelerate particle formation. Some of these waste molecules are acidic and can make the fuel more corrosive.
- Microbial metabolism of sulfur molecules can make fuels more *sour* (fuel souring is directly related to the effect of reactive sulfur on its corrosivity as measured by the Doctor Test [4]).

Clearly, several of these processes change the chemistry of fuels to make the fuels potentially corrosive to materials used in UST construction. These are examples of indirect MIC.

Much of the seminal research on MIC was conducted in the 1940s. In 1945, Professor John Starkey proposed a model for MIC [5]. Starkey's model assumed that during MIC, iron ions dissolved from the metal at anodic sites on its surface. Electrons flowing from the anodic site to the cathodic site would attract hydrogen ions (protons), which would accumulate at the cathode. Were this hydrogen layer left undisturbed, electron flow would be arrested and the galvanic cell *passivated.*

According to Starkey, sulfate-reducing bacteria (SRB) used the hydrogen ions that would otherwise have accumulated at the cathodic end of a galvanic cell. This process, known as *depassivation,* accelerated the galvanic corrosion rate. As with most models, Starkey's was an oversimplification of the process; however, it was a major contribution to our understanding of MIC.

Research on the causes and dynamics of MIC remains a vital branch of microbial ecology. Today, we recognize a variety of processes that contribute to MIC. A number of microbes, in addition to SRB, depassivate metal surfaces. All of these microbes share a common class of enzymes called *hydrogenases.* The very process of colonizing surfaces creates chemical and electropotential gradients that drive corrosion. Moreover, weak organic acids can react with dissolved chloride salts to create locally high concentrations of hydrochloric acid that can acid-etch metal surfaces [6, 7]. Microbes most commonly create patterns of corrosion pits, as illustrated in Figure 1.

Microbial communities can attack polymers used in composites such as fiberglass-reinforced plastic (FRP) used for UST construction. As the polymers are attacked, gaps form between resin and fiber. Fluid seeps into these gaps and subsequent weakening of fiber integrity follows

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as the fluid goes through repeated expansion and contraction (freeze-thaw) cycles [8]. In contrast to the pitting pattern seen in steel tanks, MIC in FRP tanks is more likely to cause structural failure along a line of activity (more on this below).

How Do Microbes Get into Fuel Systems?

Microbes can get into fuel systems in various ways:

- **Vent lines:** All tanks are vented. As product is drawn from the tank, it creates a vacuum. Air drawn in through the tank's vent restores the air pressure within the tank to equilibrium with the air pressure (atmospheric pressure) outside the tank. Normal atmospheric air is full of water droplets and dust particles that carry microbes. Consequently, tank venting, essential to keep tanks from collapsing under atmospheric pressure, is a major entry route for contaminating microbes.
- **Fuel transport:** Microbes can be transported from refinery tanks or barges through pipelines and terminal tanks throughout the fuel distribution system.
- **Water in the system:** Relatively small volumes of water can support localized pockets or niches of microbial growth wherever a few milliliters of water can accumulate in the system.
- **UST fill-pipe sumps:** These are an excellent source of water containing high numbers of microbes. When surface water fills the sump and is subsequently drained through the overflow return valve, the fuel within the UST receives a significant dose of both water and microbes.

Where Do Microbes Grow in Fuel Systems?

Once a microbe has arrived within a fuel system, water is its key to survival. Good fuel may carry as much as 0.1 percent water. Most of this water remains dispersed in the fuel as *bound* or *associated* water. The amount of bound water that dissociates from the fuel depends on the fuel's additive package, its residence time in the tank, and the fuel's temperature. Some additives, such as ethanol, increase water's solubility or dispersiblity in fuel.

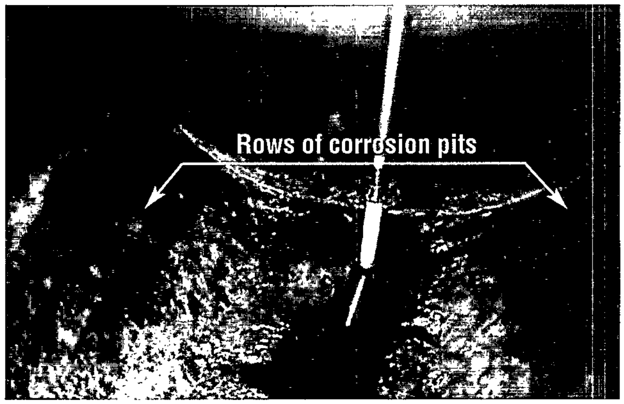

Figure 1. Corrosion pit pattern in UST. Notice concentration of pits in rows at the approximate low inventory level. Flash evaporation typically prevents biofilm development above this level.

As product stands, water will continue to dissociate—the longer the residence time in a tank, the greater the volume of water that is likely to fall out. Water's solubility in fuel increases with temperature. As fuel cools, it tends to reject water. It's the nature of fuel, then, to transport water into tanks at each stage of distribution, from refinery to end-user service tank.

Most of the water that dissociates from fuel during storage in a tank will fall to the bottom. Some will condense on the interior tank shell surface. If the surface is free of biofilm, the condensed water will run down the sides of the shell and accumulate as bottoms-water. Where biofilm is present, the condensed water is more likely to become entrained within this film.

If we were to follow our newly arrived microbe, we would see that initially it settles slowly down through the fuel, along with the particle with which it rode into the tank. If the particle's specific gravity (weight relative to that of water) is greater than that of the fuel, but less than that of water, the particle may come to rest at the fuel-water boundary (*interface*).

Alternatively, convection currents within the fuel may transport the particle to the fuel-shell interface. If the microbe is a slime-former, it will attach itself to the surface and begin reproducing. Similarly, at the fuel-water interface, it will begin to form a biofilm layer, sometimes referred to as a *skinnogen* layer. The slime enables the microbe to create a *microenvironment* that permits further growth and proliferation. The slime also traps other microbes that may be settling through the fuel.

Over time, a *consortium* develops. A consortium is a group of unrelated microbes that form a community that is able to carry out bioconversion processes that none of its individual members could carry out alone. For example, the SRB, mentioned earlier, require an oxygen-free environment in order to grow. Microbes that require oxygen do at least two things to create conditions favorable for SRB. First, they consume the available oxygen, creating the requisite oxygen-free conditions deep within the biofilm. Second, they metabolize large organic molecules that SRB can't use as food and excrete the smaller molecules on which SRB thrive. By consuming these small molecules, SRB prevent them from accumulating within the biofilm and becoming toxic to the microbes that generated them as wastes.

For microbes to thrive within fuel systems, they need to aggregate within biofilms that can form consortia, trap water and nutrients, and protect the resident populations from the potentially hostile outside environment. Biofilm communities are most likely to develop at the fuel-water interface, lower portions of the tank shell surface, and within bottom sludge and sediment.

In diesel and heavier grade fuel tanks, biofilms can cover the entire tank surface. Gasoline is more volatile. In this case, as product is drawn from the tank, exposing surfaces, gasoline evaporates from those surfaces fast enough to also dehydrate them. Consequently, biofilms tend to form at and below the tank's normal low ullage level. At most fuel retail sites, this is the bottom third of the tank (assuming 3,000 gallon [11,340 liters] minimum inventory in a 10,000 gallon [37,854 liter] UST).

Heaviest biofilm development is typically at the level where the fuel-water interface intersects with the shell surface. Most often this is the zone between 10º and 20º arc, on either side of bottom dead center.

How Do Microbes Attack Fuel System Components?

Steel USTs

With an understanding of how microbes enter fuel systems and where they tend to accumulate, we can revisit the biodegradation processes mentioned earlier. Some microbes can use fuel hydrocarbons as their sole source of organic nutrition. Others can use fuel additives and other non-hydrocarbon fuel molecules as food. Some microbes that thrive in fuel systems may not be able to use any molecules in fuel as food. As I illustrated above, for the SRB, these microbes rely on the byproducts of other microbes for nutrition.

In steel tanks, MIC is primarily an incidental consequence of microbial activity. Biofilms create chemical and electropotential gradients, thereby inducing galvanic corrosion. Conditions within biofilms are typically acidic and reducing, contributing further to metal dissolution.

Within corrosion tubercles, strong inorganic acids, particularly hydrochloric, can form from the reaction between chloride salts and weak organic acids. The tubercle crust prevents the aggressively corrosive hydrochloric acid from diffusing into the system outside the tubercle. Consequently, severe acid etching proceeds within the tubercle.

Additionally, if SRB are present, they generate hydrogen sulfide. The hydrogen sulfide then reacts with free iron ions to form ferrous sulfide. The net result is a characteristically spherical corrosion pit, resulting in a pinhole leak as the outer margin of the pit breaks through the tank's exterior.

Fiberglass-Reinforced Plastic USTs

As mentioned earlier, the dynamics of FRP UST biodeterioration are quite different. At this point, it is not certain whether microbes use composite polymers as food or if enzymes intended to break down other molecules (actually used as food) attack the polymers.

In the studies performed to date, other nutrients have always been available to the microbes degrading FRP. In the case of fuel USTs, the point is perhaps moot. Microbes colonizing FRP surfaces have the same cornucopia of nutrients available as those colonizing steel tank surfaces.

Regardless of whether FRP polymers are used as food, the end result is shortened polymer chain lengths. This translates into weaker structure and increased brittleness. It's possible for the bottom few inches of an FRP UST to separate from the rest of the tank (recall my comment about maximal biofilm development at the level where the fuel-water interface meets the tank shell).

Lined USTs

Steel USTs that have been lined with a coating are subject to a third type of biodeterioration. If a coating has even a single holiday (break in the coating's uniformity), water and microbes can gain access to the coating-shell boundary. Colonization begins at the holiday and spreads out from there. Biofilm development between coating and shell is particularly insidious because it's so difficult to detect until the coating begins to blister away from the shell. Although the process has not been studied thoroughly, it is likely that the biodeterioration mechanisms described above for both steel and FRP USTs are active when microbes live between coating and tank shell materials. Both the coating and underlying steel are attacked.

Detecting Microbial Contamination

My earlier discussion of where microbes tend to grow within fuel systems also illustrates the difficulty of recognizing microbial contamination before system components are destroyed. It is nearly impossible to retrieve swab samples of slime from tank walls without gaining direct access to the tank.

The methods described here cannot provide information as conclusive as that obtained by entering a tank, making observations, and collecting samples directly. However, the preentry process of making a tank safe for entry is costly and time consuming. Moreover, it destroys much of the evidence that would be useful to a microbiologist. The only practical alternative is to pull fluid samples and use them as surrogates to assess what may be happening on the tank shell surface.

Samples traditionally collected for fuel quality testing yield little information about either the presence of microbes or whether significant biodeterioration in underway within the tank. Moreover, many of biodeterioration's symptoms mimic those of non-biological deterioration. Notwithstanding these challenges, it is possible to monitor fuel systems for both microbial contamination and biodeterioration.

I refer readers to ASTM's *Standard Guide to Microbial Contamination in Fuels and Fuel Systems* (D6469 [9]) for a more detailed discussion of the topics covered in this section.

Sampling

Monitoring begins with collecting the best possible sample. A full chapter of the forthcoming ASTM *Manual on Microbial Contamination of Fuels and Fuel Systems* (due to be published in early 2002) is devoted to sampling strategies and techniques. Bottom samples from the low end of a UST are most likely to provide useful microbiological information. This is often the first challenge.

Regardless of the intentions of UST installers, many USTs settle by the tank's turbine (submerged pump) end. A well-designed system will have a sampling port or other access fitting near the turbine distribution manifold to permit both sampling and water removal from this end of the UST. I am always delighted on the rare occasions when I encounter such systems. More often, the turbine must be pulled in order to get a bottom sample from this end of a UST.

Unless the UST's trim has been measured (fuel ullage at fill and turbine ends) and determined to be trim (low) at the fill-end, bottom samples should be taken from both ends of the UST.

Samples should be collected with a Bacon bomb or similar true bottom sampler. Each sample is dispensed through a clean funnel into an unused glass sample bottle. The advantage of using glass will become

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evident in the next section.

If dispensers calibrated to deliver 10 gpm (38 liters/min) are delivering < 7 gpm (27 liters/min), pull the dispenser filter and save it for examination. Test the dispenser flow rate after installing a fresh filter. If the rate hasn't returned to normal (the actual rate may be < 10 gpm if customers are taking fuel while you are running the test), corrosion may have degraded valve operation. (Hint: if you discover corroded components between the UST and the dispenser, suspect UST biodeterioration.)

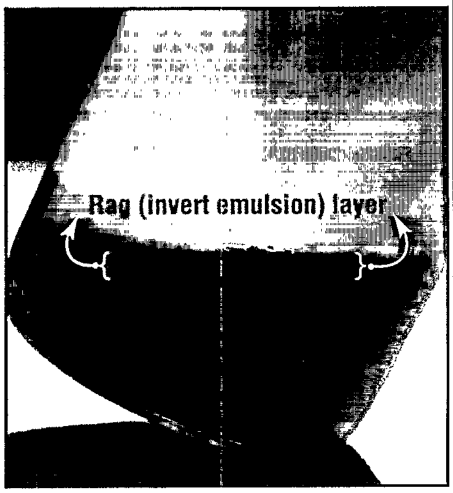

Figure 2. Fuel tank bottom sample showing haze 5 fuel over bottoms-water. Note the rag layer that has developed between the fuel and water phases. Similar to the tank shell biofilm, the rag layer is home to dense microbial populations.

Gross Observations

There are a number of simple observations that provide excellent indications as to whether significant biodeterioration is occurring within a particular system. Figure 2 illustrates a heavily contaminated bottom sample. Note the well-defined region between the bottoms-water and fuel. This invert-emulsion (water in fuel) zone is called the *rag layer*. It's caused by the production of biosurfactants and skinnogens at the fuel-water interface.

Rag layers may also be caused by chemical incompatibilities within the fuel. However, rag layers produced by microbes will (a) tend to adhere to the jar's side if you tilt the jar gently; (b) have stalactites of slime protruding into the water phase, stalagmites of slime projecting into the fuel phase, or both; and (c) will often be membranous or difficult to disperse. A well-defined rag-layer biofilm is a strong indicator of biofilm development on tank walls.

To determine if the sample's sediment contains lots of rust particles, dip the magnetic end of a stirring bar retriever into the sample bottle and swirl it gently on the bottom of the bottle for a few seconds. (A stirring bar retriever is a long, plastic-coated wand with a magnet that is encapsulated into one end; lab technicians use stirring bar retrievers routinely to pull magnetic stirring bars from test flasks.) Remove the retriever from the bottle and look for magnetic particles on its tip. If magnetic debris covers more than half of the bottom of the stirring bar retriever, then rust accumulation is significant and should be investigated further.

Bottoms-water samples from heavily infected tanks may also have distinctive odors. Strong sulfide or ammonia odors are characteristic of sulfate and nitrate reduction, respectively.

Open plugged filters for inspection. If the filter is plugged with rust or if the housing is corroding, suspect MIC activity within your system.

Other Tests

A complete diagnostic evaluation of biodeterioration in a UST requires a battery of physical, chemical, and microbiological tests [9]. Of these, the traditional microbiological tests—inoculating growth media to see what grows—are often the least useful. Many microbes that are perfectly content and thriving in the contaminated system may (a) not get captured in the sample; or (b) not grow in the medium into which we transfer them. Negative test results obtained with the various commercially available growth test kits may provide encouraging but misleading information. If MIC is suspected, a microbiologist trained in fuel and fuel system biodeterioration should be called in to perform a thorough assessment.

Controlling Microbial Contamination

Good housekeeping goes a long way toward preventing UST biodeterioration. Recognizing that water and sediment is going to be delivered with product, UST owners should institute regular monitoring and dewatering programs. As noted above, to be effective, samples and water draws need to be taken from the tank's low-end.

Although dry tankage is theoretically possible, it's impractical. Even in the aviation industry where fuel is filtered and dewatered at each step of the distribution process, water still reaches aircraft fuel tanks where it is dealt with through the use of deicing additives. Even if USTs were designed to permit water draw from the their lowest point, tank wall biofilms will entrain significant water (a 1/8-inch thick biofilm, covering 30 percent of the surface of a 10,000 gallon UST, can hold several gallons of water—a veritable ocean from the perspective of microbes). This means that over time, most tanks will develop microbe biofilms.

In fuel systems, biofilms may take three to six months to develop [10]. Since UST biodeterioration is unlikely to occur in the absence of a biofilm consortium, it makes sense to minimize the risk of biofilm formation. Periodic treatment with an antimicrobial pesticide can prevent biofilm maturation. I generally recommend treating tanks two or three times per year, depending on test data. All treatments should be data driven. If there's no evidence of biofilm development, the interval between treatments can be extended. If samples show that a rag layer forms within two months after treatment, I recommend treating more frequently.

The U.S. EPA approves only a limited number of antimicrobial pesticides for use in fuel systems. Before treating a UST with an antimicrobial pesticide, contact either a manufacturer or manufacturer's representative who is knowledgeable about treatment protocols, dosing, handling (all antimicrobial pesticides are treated as hazardous materials), and product selection.

Some products are primarily fuel soluble; others are only water soluble. The most effective products have at least some solubility in both fuel and water. Products also differ in their respective ranges of microbicidal activity. A few of the products approved for use in fuel systems have a secondary function as corrosion inhibitors. A reputable professional can help you determine what products and treatments are most likely to give you successful control.

If a tank is already heavily contaminated, chemical treatment alone is unlikely to be satisfactory. First, all antimicrobial pesticides are used up as they kill microbes. If a tank is coated with a thick biofilm, the microbicide is probably going to be used up before the tank is disinfected. Some microbicide molecules will get trapped in the biofilm without ever coming into contact with their targets.

Second, a successful microbicide treatment will disrupt the biofilm sufficiently to cause large pieces *(flocs)* of biofilm material to slough off of the tank's walls. A significant percentage of these flocs will be transported to the dispenser filters, which will consequently plug prematurely.

Heavily contaminated tanks should be cleaned within 24 hours after an initial "shock" treatment. There are a number of commercial systems for cleaning tanks. Some require direct access; others use tubing or hoses that are inserted into the tank.

The most effective systems recirculate and polish the fuel at high (> 200 gpm) flow rates and use directional nozzles to scour tank surfaces. Systems designed to operate at < 100 gpm are fine for pulling water, sludge, and sediment off of tank bottoms, but are ineffective against tank shell biofilms. Aggressive tank cleaning, as a biodeterioration control measure, should only be needed once every five to ten years, if it's accompanied by periodic preventive treatment.

Microbes ... in a Tank Shell

Left undetected and untreated, microorganisms can infect fuel systems, develop consortia communities, and cause fuel system component failures ranging from premature dispenser filter plugging to leaking USTs. Most UST installations do not make it easy to pull the bottom samples that are most useful for monitoring biodeterioration risk. Optimally, all USTs should be fitted with sample collection and dewatering access near each end of the tank. Currently, most USTs can only be sampled at the fill-pipe, unless service engineers pull the turbine, the electronic gauging device, or both. Consequently, significant volumes of water can accumulate in tanks undetected.

Microbes find all of the water and nutrients they require in fuel tanks. The erroneous conventional wisdom that gasoline is less susceptible to microbial attack is based on several decades of experience with product containing tetraethyl lead. Once tetraethyl lead (itself an effective unregistered microbicide) was removed from automotive gasoline, microbes reinhabited gasoline systems. In my experience, gasoline tanks support considerably higher numbers of microbes than do diesel tanks.

Microbes find all of the water and nutrients they require in fuel tanks.

The mere presence of microbes does not necessarily mean that system biodeterioration is occurring. Symptoms of system change are better biodeterioration indicators. Look for rag layer development or accumulation of rust particles in bottom samples. Smell for sulfide or ammonia. Keep track of filter-plugging rates. In a clean system, filters can process (filter) 250,000 gal or more without affecting flow rate. In an infected system, filters may start plugging before having processed 50,000 gallons of fuel.

Historically, MIC in USTs has received relatively little attention. Leakage caused by MIC probably accounted for 10 to 20 percent of all leaking USTs. Several watershed events over the past decade, however, may change these statistics. LUST regulations have reduced the risk of leaks caused by galvanic corrosion from the UST's exterior. The fuel industry has also changed.

While consumer demand has grown steadily at 5 to 7 percent annually, shell capacity has shrunk at approximately the same rate. This *means that product throughput rates* have climbed 10 to 14 percent annually. In other words, there's less time for water and sediment to settle out of the fuel at each stage of the distribution system. More water and sediment (along with passenger microbes) get transported through from refinery to end-user.

In response to clean air regulations, fuel chemistry has also changed. Although there is no general agreement so far, it's likely that the net effect of these chemical changes (in both basic product and additive packages) has been to make fuels more susceptible to biodeterioration. In short, history is not necessarily a good predictor of the future likelihood of UST biodeterioration.

Steel, composite, and lined tanks are all susceptible to biodeterioration. In the recent past, most UST owners invested heavily to ensure that their systems complied with LUST regulations. Relatively inexpensive good housekeeping, coupled with periodic preventive treatment, can minimize the risk of uncontrolled microbial contamination wiping out the return on the upgrade investment. ■

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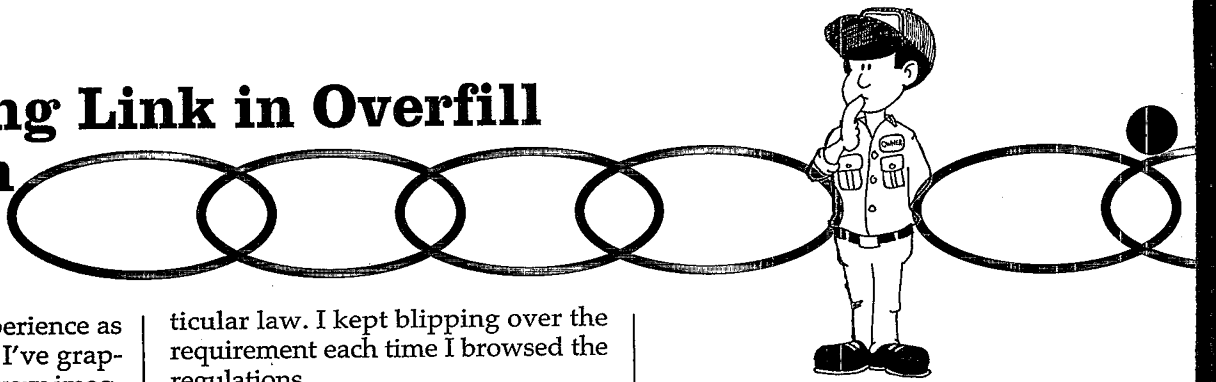
Leak Prevention

The Missing Link in Overfill Prevention



by Ben Thomas

Having 13 years experience as an UST regulator, I've grappled with nearly every imaginable topic pertaining to UST prevention equipment and operations. Frustrating and convoluted topics, such as heating oil tank exemptions, leak detector testing "per manufacturer" specifications, or the secret language of insurance reporting requirements are just day-in-the-life fodder for tank bureaucrats like myself and others around the country.

But I must confess I met my match when I uncovered a little regulation that I had somehow missed all these years—a regulation that has gone quietly unnoticed by government and industry alike. It's a seemingly docile regulation that, when taken at face value, could have saved a number of lives in the past 10 years had it been taken seriously.

I'm talking about overfill prevention—not the "must-have-overfill-device-or-high-level-alarm" aspect. That much we know. It's equipment. Must be there. What I'm talking about is the regulation that is supposed to prevent human error from causing an overfill—40 CFR 280.30(a). You know, the regulation that says the owner/operator must ensure that there is enough room in the tank prior to delivery and make sure the transfer is completely monitored...you know that rule, right? You enforce it, right? You look for proof of this thing every time you inspect an UST, right?

Blip Blip

If this regulation is news to you, take heart, it was news to me until last year when I came across it by accident. I had been reading the National Transportation Safety Board (NTSB) report on the 1998 Biloxi, Mississippi, tank overfill tragedy in which five people were killed and found, among many things, a reference to that particular law. I kept blipping over the requirement each time I browsed the regulations.

That's weird, I thought. I didn't think there was a requirement for the fuel delivery itself. I started asking around to see how to handle this requirement. Here are some of the responses I received:

- "I never look for that." (state inspector)
- "I don't know how you could measure that." (federal inspector)
- "I think it's a worthwhile issue, but we have no jurisdiction in that area." (industry representative)
- "Expecting UST operators to monitor fuel transfers is an inconvenience." (industry representative)
- "We can't enforce this requirement unless there is a spill. (federal official)

> ***The fundamental gap in preventing overfills lies not in the overfill equipment of the UST system or the safe highway transport to a gas station, but rather in the routine delivery of product to the tanks.***

The Problem

Federal UST regulations currently require owners and operators to perform two important tasks related to preventing overfill. The two requirements state: "The owner and operator must ensure that *the volume available in the tank is greater than the volume of product* to be transferred to the tank before the transfer is made and that the *transfer operation is monitored* constantly to prevent overfilling and spilling." [Emphasis added.]

Currently there is no recommended practice, industry standard, or code that provides effective guidance to owners and operators for *measuring*, much less *achieving*, these two things.

But wait, you cry, there is guidance referenced in the regs, I've seen it. Well, yes, the regulations do provide references in 40 CFR 280.30(a) by stating:

> The transfer procedures described in National Fire Protection Association Publication 385 may be used to comply with paragraph (a) of this section. Further guidance on spill and overfill prevention appears in American Petroleum Institute Publication 1621, "Recommended Practice for Bulk Liquid Stock Control at Retail Outlets," and National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code.

Have you ever read these three documents? They really don't have much to do with the issue. I reviewed the three recommended documents and found nothing of substance that would provide guidance to help UST operators meet these two obligations. Specifically, none of these documents provide procedures on measuring tanks prior to delivery or how to monitor the transfer.

Okay, I know you're probably thinking that everybody and their uncle knows that drivers do these things, not the owners and operators. Unfortunately, it's not that simple. One astute regulator recently pointed out that the lines of responsibility are sharply defined in the preamble of 40 CFR 280. I quote: "Thus, regardless of whether the owner and operator decides to share (by contract) responsibility for the monitoring of the transfer with the carrier, under today's final regulations the owner and operator will continue to be responsible in the event that there is a release during delivery."

Observations

As UST equipment becomes more sophisticated, and as states start looking more closely at operational compliance of UST systems, outstanding problems are emerging. I believe overfills due to human error—not equipment error—will be the next big challenge in preventing environmental and safety hazards from USTs.

National tank expert Marcel Moreau recently led a series of UST operator workshops in Alaska. He told audiences that based on his experience, the equipment alone will not stop overfills. The fundamental gap in preventing overfills lies not in the overfill equipment of the UST system or the safe highway transport to a gas station, but rather in the routine delivery of product to the tanks.

The magnitude of this issue extends well beyond the boundaries of Alaska. I forecast that this issue will surface sooner or later nationally. Indeed, the high-profile overfill and subsequent fire in Biloxi, Mississippi, should have been a wake-up call to industry and government. Related to the incident was a recommendation from the NTSB to the UST owner R.R. Morrison and Sons, Inc. It stated:

> No Fast Lane employee compared the amount of gasoline scheduled for delivery with the amount that the station's monitoring system indicated was in the underground tanks to determine whether the quantity intended for delivery would fit in the underground tanks; *such a comparison, in this case, would have prevented the overfill.* [Emphasis added.]

I encourage you to get a copy of the NTSB report. It's chilling. Download the full report from **http://www.ntsb.gov/Publictn/1999/HZM9902.htm.**

I believe this failure to provide adequate guidance and training, and the lack of an articulated position from industry and government, will add fuel to the next generation of UST problems. These problems arise from UST systems that are deemed safe by regulator and regulated alike, but that continue to be overfilled.

Now some might call this matter trivial, in that overfills happen less frequently than they used to, so why put so much effort into a problem that only happens now and then? My response is that while I agree that overfills don't happen every day, when they do, they happen big time, and the consequences are, or can be, catastrophic.

Wanted: Recommended Practices

The Alaska Department of Environmental Conservation (ADEC) recently responded to an overfill at a convenience store in Anchorage that illustrates the nature of the problem. It appears that the overfill resulted in a synergistic combination of problems that I suspect are typical of overfill incidents. The driver miscalculated the available ullage, the operator *did not monitor the delivery, the* overfill device failed to activate in time, and product escaped out an opening no one suspected—the loose cap of the automatic tank gauge probe. This investigation reinforces the notion that equipment alone will not prevent overfills from occurring. We as a community need to look at the human element of the problem.

Since 2000, the inspection of UST systems in Alaska has been privatized. This is a good first step in identifying and preventing problems such as overfills. ADEC has provided extensive guidance on how inspectors should measure operational compliance of UST systems. While much guidance is in place for our inspectors, none exists for evaluating the operational methods that operators use to prevent overfills.

We need a way to measure the requirements put forth in state and federal regulations that require UST owners and operators to measure the

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New API Loading and Unloading Cargo Tank Motor Vehicles Recommended Practice Available

The American Petroleum Institute (API) has published a new recommended practice to help ensure the safe and efficient loading and delivery of petroleum products to retail gasoline outlets and bulk storage facilities. The publication provides detailed procedures for top loading and bottom loading tank trucks as well as unloading to both underground storage tanks and aboveground storage tanks and to aboveground tanks located within vaults (pits) or within dikes or walls.

The publication, API Recommended Practice (RP) 1007, *Loading and Unloading of MC 306/DOT 406 Cargo Tank Motor Vehicles, First Edition*, has been published in a new laminated and tabbed format designed especially to facilitate use by truck drivers.

RP 1007 was prepared by a joint task force with representatives from API, the U.S. Department of Transportation, the National Association of Convenience Stores, the Petroleum Marketers Association of America, the Society of Independent Gasoline Marketers of America, and the National Tank Truck Carriers. The U.S. Environmental Protection Agency also reviewed the document.

RP 1007 is available for $12.50 per copy for API members and $25 for nonmembers. It may be ordered from TechStreet of Ann Arbor, Michigan, by phone at (800) 699-9277 or (734) 302-7801; by fax at (734) 302-7811; or online at **http://www.techstreet.com/**. For additional technical information about the new RP, contact Prentiss Searles at (202) 682-8227 or at **searlesp@api.org.** ■

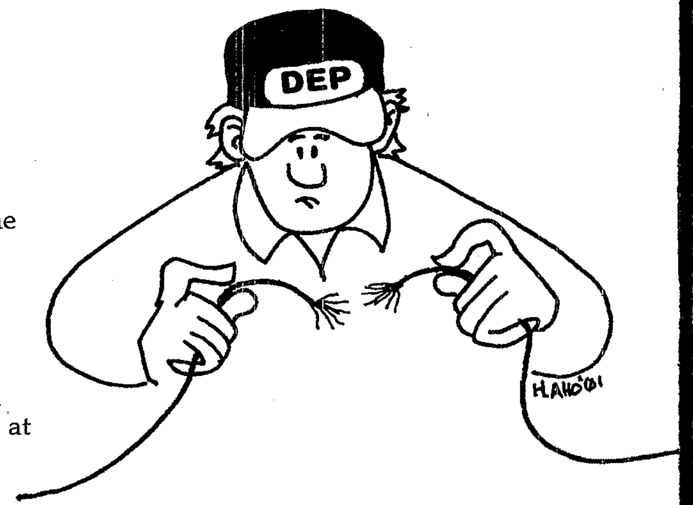
Leak Prevention

Tank-nically Speaking

by Marcel Moreau

*Marcel Moreau is a nationally recognized petroleum storage specialist whose column, **Tank-nically Speaking**, is a regular feature of* LUSTLine. *As always, we welcome your comments and questions. If there are technical issues that you would like to have Marcel discuss, let him know at* **marcel.moreau@juno.com**

Continuous or Isolated? This Is the Question



When the testing of cathodically protected tanks is mentioned in regulatory circles (usually accompanied by some scratching of heads and sighs of frustration), the number that pops into the collective consciousness is the venerable -.85 volts. Most folks recognize that this number constitutes a "structure-to-soil" potential measurement—a measurement that is fundamental to evaluating whether a cathodic protection (CP) system is functioning properly. How to conduct and record structure-to-soil measurements has been the topic of previous "Tank-nically Speaking" articles. (See *LUSTLine* #25, "Testing Cathodic Protection Systems," and #32, "Combatting CP-Test Heartburn.")

A recent query from a perspicacious regulator, however, brought to my attention a much-neglected topic associated with the testing of cathodically protected tanks and piping—continuity. Or did he mean isolation? Hmm, what do we mean?

To say that two components of a cathodically protected structure are *electrically continuous* means that electrons are able to move freely between the two components. (In electrical terms, the resistance is low.) To say that two components of a cathodically protected structure are *electrically isolated* means that electrons are *not* able to move freely between the two components. (In electrical terms, the resistance is *very* high.)

Continuity/isolation problems are one of the most frequently found causes for the failure of both impressed and galvanic CP systems to perform properly. Electrical continuity/isolation is often the first measurement that is taken when a storage system fails a structure-to-soil cathodic protection test. But *how* you measure the continuity or isolation of a buried structure is the question at hand.

The first thing to remember is that the exact same procedures are used to measure both continuity and isolation. To determine whether the readings obtained on a particular cathodically protected structure are "good" or "bad," you must keep in mind whether you are testing an impressed or a galvanic CP system. Electrical continuity is a critical element in the design of impressed current cathodic protection systems, while its opposite, electrical isolation, is a critical element of commonly used galvanic cathodic protection systems.

Tools and Methods

The resistance (ohm meter) circuit of traditional multimeters used to measure voltage, amperage, and resistance is generally not suited for making electrical continuity/isolation measurements among the various buried metallic components of an underground storage system. Instead, continuity/isolation measurements are typically made with the same equipment and procedures used in structure-to-soil cathodic protection measurements.

To the casual observer, the measurement of continuity/isolation may appear identical to the structure-to-soil measurement. Likewise, because the results are recorded as voltages on the CP monitoring record, continuity/isolation measurements can be readily confused with structure-to-soil measurements unless they are properly identified.

To confuse matters even more, several methodologies may be used to evaluate the continuity/isolation of cathodically protected systems. The following are descriptions of three different methods for evaluating the electrical continuity/isolation of buried metallic structures:

1. FIXED REFERENCE, MOVING GROUND The theory here is that if two buried metallic structures are electrically continuous, they will both be at the same potential (voltage) relative to a stable reference.

Procedure

Place the copper/copper sulphate reference cell (CRC) in a fixed location, attach one of the voltmeter test leads to the CRC, and then make contact with the storage system or other components that you wish to evaluate (e.g., fill pipe, ATG riser, submersible pump, vent pipe, tank shell, building electrical ground) with the second voltmeter test lead. The critical elements in this procedure are: (a) the CRC must not budge (at all!) during the entire continuity/isolation testing procedure, and (b) the voltmeter test lead must make solid metal-to-metal contact with each component that is to be evaluated.

Tips

- It is good form to place the CRC at some distance from the structure(s) being evaluated, but I have had quite good luck placing the CRC in a central location near the storage systems being evaluated.
- Use a sharp probe on the voltmeter test lead to achieve metal-to-metal contact with the various storage system components. Do not touch the metallic components of the probe while making the measurement.
- Be sure the voltage on the storage system is stable. If you cannot get a good stable reading on your voltmeter, this test will be difficult to utilize. With an impressed current system, the rectifier may be on or off, but the rectifier should have been turned on or off a day or more before the continuity/isolation measurements are made.

Interpretation of Results

The actual voltage that is measured using this procedure is not important. The voltage will vary depending on the location of the CRC, but the purpose here is not to evaluate the structure-to-soil potential. The *only* factor being evaluated here is whether the voltage measurements made with the test lead contacting different storage system components are identical or nearly so (plus or minus a few millivolts) to one another.

Whether the voltmeter reads -1.4 volts or -.80 volts or -.43 volts is *not* relevant. What is relevant is the relationship of the various readings to one another. Readings from different storage system components of -.654 volts, -.655 volts and -.653 volts indicate that the three components are electrically continuous. Readings of -.654 volts, -.593 volts and -.730 volts indicate that the three components are electrically isolated from one another. Readings that are different from one another but not by much (e.g., -.654 volts, -.666 volts, -.648 volts) are inconclusive. Use test method #2, if possible, to tell for sure what is going on. Readings that are more than about 20 millivolts different from one another generally indicate that structures are electrically isolated.

2. CURRENT ON/CURRENT OFF POTENTIALS The theory here is that when the cathodic protection current is repeatedly turned on and then off, structure-to-soil potentials of the components that are electrically continuous with the CP system will show large variations in potential that follow the cycling of the CP current.

Procedure

The reference cell is placed in a fixed location, a voltmeter test lead is attached to the CRC, and the other voltmeter test lead is placed in contact with the various storage system components or building electrical ground, just as for the fixed-reference/moving-ground technique described above. Rather than making a single voltage measurement at each storage system component, however, the CP current is cycled on and off at intervals of five seconds or so, so that both current on and current off measurements can be recorded and compared.

Tips

- It is good form to place the CRC at some distance from the structure(s) being evaluated, but I have had good luck placing the CRC in a central location near the storage systems being evaluated.
- Use a sharp probe on the voltmeter test lead to achieve metal-to-metal contact with the various storage system components. Do not touch the metallic components of the probe while making the measurement.
- This method can only be used where the CP current can be conveniently turned on and off. The method could be applied to a CP system with permanently attached anodes, however, by installing a temporary CP system that can be turned on and off.

Interpretation of Results

As with the fixed-reference/moving-ground technique, the magnitude of the current on and current off readings is not important. What is important is that the current on and current off measurements for each location are approximately the same. In this case, however, there are two indicators of continuity—the current on and current off voltages *and* the shift in the voltage created by the cycling of the CP current. The current on and off voltages should be reasonably close, but they do not need to be identical. Continuity would still be indicated if the voltage shift from the current on to the current off condition was of a similar magnitude.

This technique is useful in identifying relatively high resistance connections that cause the readings in method #1 above to be 20 millivolts or more different. Despite relatively high resistances among the components, these connections still provide enough continuity so that a significant amount of CP current is flowing to the component being tested. If turning the CP current on and off has little effect on the potential of the component being tested, then it is likely that the structure is isolated from the CP system.

3. STRUCTURE-TO-STRUCTURE POTENTIAL The theory for this method is that if two buried metallic structures are electrically continuous, there will be no voltage difference between them.

Procedure

This procedure does not require a reference cell. The two leads of the voltmeter are connected to different components of the storage system or building electrical ground. If the two components are continuous, the voltage should be zero. Typically, one lead of the voltmeter is fixed to a single storage system component (e.g., a tank shell) and the other lead of the voltmeter is moved around to the different storage system components.

Tips

Be sure that the voltmeter test leads achieve metal-to-metal contact with the various storage system components. Do not touch the metallic components of the probe while making the measurement.

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■ Tank-nically Speaking *from page 21*

Interpretation of Results

The interpretation of results for this method is essentially the same as for the fixed-reference/moving-ground method described above, except that continuity is indicated by a voltage of zero or a few millivolts between different components of the system. Voltage differences in the range of 10 to 20 millivolts are inconclusive, and procedure #2 above should be used to make a definitive determination of continuity or isolation. Voltage differences greater than about 20 millivolts generally indicate that the components are isolated.

Which Method to Use

As far as I can tell, all of these methods are valid (if done properly), and each may have advantages/disadvantages under certain circumstances. I can see where method #2 would be the most forgiving in terms of execution, as the other methods rely on relatively perfect connections of the voltmeter leads to the structure. In my experience, this can be difficult to achieve on a rusty riser. However, method #2 does require that the CP current be easily interrupted. This would be a problem for most galvanic systems and for impressed current systems where an extra person or an automatic current interruption device is not available.

When to Test for Continuity

I believe that continuity testing is essential for impressed current systems. I have seen too many such systems with continuity problems. Knowing the continuity status of a particular storage system component is a great help in interpreting the structure-to-soil potential measurements that are made using that component as the structure contact.

I would check the continuity status of any newly installed galvanic CP system. For a galvanic system that has been in service for awhile, I would check the continuity only if the system failed to meet criteria for cathodic protection. In my experience, galvanic systems that have been in service for a while and meet criteria are unlikely to have continuity problems. ■

■ Missing Link *from page 19*

ullage in the tank prior to delivery and monitor the transfer. I know for a fact that most operators do neither on a regular basis, if at all. Most operators automatically defer the responsibility to the driver.

API has recently published a new standard, API 1007, *Loading and Unloading of MC306/DOT 406 Cargo Tank Motor Vehicles*. Section 4 of this document deals with unloading USTs. While brief, it does begin to address the issue by standardizing procedures. The EPA Office of Underground Storage Tanks document, *Operating and Maintaining Underground Storage Tank Systems: Practical Help and Checklists*, also addresses delivery briefly. The problem with both of these documents is that they don't provide adequate guidance on owner and operator responsibility.

What Alaska hopes to achieve is a recommended practice that we can provide to UST owners and operators to institute a safe, consistent, and common-sense approach to fuel delivery management. In an effort to begin addressing this issue, we created a Fuel Delivery Log that our third-party inspectors will begin circulating among tank operators this year. If nothing else, the introduction of this log will help stimulate discussion on this matter.

ADEC is working with the company whose overfill incident was previously mentioned and will be analyzing the overfill data from over 50 stores to try and ascertain some trends. Based on what we find, we also hope to hold a fuel delivery "summit" meeting later this year to attempt to build a coalition of tank operators, fuel delivery companies, and government officials that will be tasked with quantifying the problem as well as proposing some solutions.

NTSB Recommendations

There is currently not an organized regulatory voice to address this issue, although the NTSB Biloxi report asserts some broad recommendations:

- Develop loading and unloading procedures for cargo trucks with the policing of such procedures by the federal government;
- Improve compliance and enforcement by U.S. EPA;
- Revise delivery driver manuals;
- Establish procedures for UST operators; and
- Use national petroleum associations to help deliver the message.

I believe that an industry-based recommended practice for safe fuel delivery practices could address these recommendations. Defining responsibilities and guidance for UST operators could very well be the missing ingredient to an effective overfill prevention program. Some standardized items could include:

- Proper methods for measuring product levels;
- Use of tank charts;
- Understanding how much product is legally allowed in a tank;
- Procedures for monitoring transfers;
- Designation of whom should monitor deliveries;
- Warning about pressurized deliveries and ball float valves;
- Procedures for responding to overfill alarms or incidents; and
- Recordkeeping options.

In Short ...

I believe there is sufficient evidence to support the claim that there is no standardized method for helping UST owners and operators meet operational compliance conditions for preventing UST overfills. Overfills will continue to plague good tank management practices until the real culprit is addressed, namely human error.

This overfill issue can be addressed effectively by standardizing fuel delivery practices through the development of a nationally recognized recommended practice. To be effective, the standard must be based on common-sense practices, easy to implement by operators, and easy to enforce by regulators. ■

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Pay for Performance

The Pay-for-Performance Public/Private Partnership

The Win-Win Scenario

By Robert S. Cohen

The Pantry, Inc. (d.b.a. Kangaroo Stores and various other names) was faced with serious financial exposure resulting from the acquisition of a large chain of Florida convenience stores—a self-insurance obligation on 70 LUST sites with potential liability in the millions of dollars. The first $150,000 or $300,000 of cleanup liability for petroleum contamination was covered by the Florida Trust Fund, but the remaining of the $1,000,000 federal financial responsibility obligation per site was covered by a self-insurance pool. The average cleanup cost in Florida is well in excess of $300,000.

The problem: How could The Pantry control costs, ensure prompt cleanups, and use the trust fund contribution in the most efficient manner?

The solution: Use pay for performance [1] (PFP) at these sites, and use competitive bidding techniques to establish the lowest market price in a cooperative effort among The Pantry, the Florida Department of Environmental Protection (DEP), and carefully selected consultants.

Let's look at the circumstances leading up to the partnership, the controversial regulatory issues, the process, and the results. It is important to note that although this partnership was specific for Florida, the concept can work in most jurisdictions.

The Problem

The Florida State Legislature decided to phase out the trust fund as a financial assurance mechanism. Beginning in 1996, the coverage was reduced to $300,000 per incident, then to $150,000 per incident, and finally entirely phased out by December 31, 1998. In order to meet federal financial responsibility requirements (40CFR 280), The Pantry set up a self-insurance fund to cover the difference between the trust fund cap and $1,000,000.

The Pantry owns or operates approximately 500 convenience store/gasoline stations in Florida and manages remedial or assessment activities on 400 sites with reported discharges (some no longer in operation). Seventy sites had trust fund caps of $300,000 or $150,000.

If The Pantry chose to follow the normal pathway, DEP would have preapproved assessment and remedial activities and paid the costs (after a $10,000 deductible) up to the $150,000/$300,000 limits. After the limit was reached, The Pantry would have to pay 100 percent of all cleanup costs with no limits. With average cleanup costs well in excess of $300,000, The Pantry was quite concerned about the potential liability and the cost of maintaining significant environmental reserves on the balance sheet to cover this liability.

The Solution

The Pantry's solution was to use PFP and competitive bidding to minimize the amount it would have to pay above the $150,000/$300,000 from the trust fund. Data demonstrate that PFP produces less expensive, faster cleanups with guaranteed environmental results. When PFP cleanups are priced by market-based bidding among cleanup consultants, the price for final cleanup is dramatically reduced.

The Pantry decided to set a maximum price for cleaning up each site, using competitive bidding in a PFP approach. The Pantry invited qualified cleanup contractors to bid the price of cleanup beyond the $150,000 or $300,000 maximum state fund coverage for a bundle of sites. The thirty-five $150,000-limit sites and the thirty-five $300,000-limit sites were to be awarded as two "bundles" — as two multi-site PFP cleanup contracts to the winning contractor. The Pantry released its request for proposal (RFP) to prequalified consultants for the two bundles of sites.

After the RFP was released, the respondents had two weeks to review The Pantry's and DEP's files and identify any sites that did not have sufficient assessment data to estimate the site's total cleanup cost. Some assessment work had been completed at most of the sites. A few sites had remediation systems in place.

Eleven consultants responded to the RFP. Upon review of the data, each consultant suggested, in order of priority, sites where more data was needed so as to price confidently. The Pantry then retained an independent consultant to do Phase II-type investigations to collect additional data on 17 sites and provide the data and maps to the bidders. The consultants then submitted sealed proposals with a formal bid opening.

The bids were evaluated on three considerations and rated on a scale of 100 points:

1. 50 points—lowest bid for total dollar above trust fund cap
2. 25 points—qualifications and experience
3. 25 points—financial mechanism or guarantee to assure completion of contract for cleanup.

Results

The respondents to the RFP actually submitted two bids: (1) 35 sites with a $150,000 cap and (2) 35 sites with a $300,000 cap. The range in bids was quite typical of the experience of various PFP bidding projects conducted in several states. The high bid for the $300,000-cap sites was $3,350,000 with several low bids of zero over the

■ continued on page 24

■ PFP *from page 23*

trust fund limit. The high bid for the $150,000-cap sites was $5,500,000 with a low bid of $100,000 over the trust fund limit. Half the consultants bid zero or less (i.e., at or below the $300,000 trust fund coverage on the $300,000 cap sites). Note: the consultant was required to supply the cost estimate for each site, though only the total bid over the cap [for the bundle of sites] counted for the scoring of the RFP.

The eleven bids were evaluated, and three finalists were selected. All finalists participated in an oral presentation, which consisted of answering one question: "Since the average cost of cleanup is historically greater than $300,000, how will you implement cost savings to meet your bid?"

Working in Partnership to Resolve Regulatory Issues

There were complex legal and administrative obstacles to The Pantry's planned RFP process for selecting consultants and setting PFP cleanup prices. These were resolved via a working partnership between The Pantry and DEP.

An obstacle was found in the Florida statute's prohibition against remuneration from the consultant to the responsible party for the privilege of assigning sites. Since The Pantry had many sites with varying caps—$150,000 to $1,000,000+—it had to avoid assigning high-cap sites to a consultant in turn for the consultant taking a loss on low-cap sites. Therefore, The Pantry's RFP was set up to be independent of any other consulting relationship. The $150,000 and $300,000 sites were judged independently to prevent any appearance that the $300,000 sites were supplementing the $150,000 sites. The DEP actively observed The Pantry's bidding process to assure compliance with statute.

Another issue of concern was the relationship between the responsible party (The Pantry, Inc.) and the DEP. Though the consultants were assuring The Pantry of a maximum total cost, the DEP was going to pay the bills up to the state-fund cap. Thus the state considered each site to be an entirely independent project with its own funding limit. The Pantry intended to bank its awarded bid amount and provide that dollar amount to the consultant on any site that went over its state-fund cap. In this way, the consultant had the freedom to negotiate the cleanup cost with DEP using The Pantry's funds when required.

Although The Pantry solicited bids, the Florida program sets prices by negotiating. The Pantry bid set the maximum price for a set of sites; however, the consultant had to negotiate each site with the DEP, as each site has a separate trust-fund limit. As discussed below, PFP bundling techniques allow the consultant to negotiate with DEP a group of sites at a total fixed price; a specific price is then assigned to each site.

Analysis

The range of bids was both remarkable and expected. Remarkable was the large spread of cleanup prices for very typical sites. With 10 years of historical data we would expect a much smaller spread. On the other hand, we expected that cleanup costs would vary considerably based on the efficiency of the consultants. On any individual site there may be a considerable margin of error in estimating costs. For a collection of sites, the total cleanup cost can be estimated accurately, even without complete assessments. The RFP data suggest several conclusions (see Figures 1 and 2 [2]):

- Cleanup costs can be reasonably estimated for a bundle of sites, even without thorough assessment data;
- Some consultants are consistently and considerably more expensive than others;
- Competitive bidding of bundles of sites can result in substantial savings while maintaining desired environmental goals and timetables; and
- The average cost of a cleanup per site is significantly reduced by competitive bidding.

What distinguishes the consultants' approach from the high bid to the low bid? The low-bid consultants leverage the "volume discount" by managing their work and resources more effectively across all 35 sites. Due to the nature of the trust funds, consultants typically treat each site as an individual project in all regards. There is little motivation to manage the projects using volume discount techniques such as:

- Reusable skid-mounted remediation equipment;
- Top quality remediation equipment that will have a useful life span for several sites; and
- Coordinated mobilization at many sites.

Figure 1

RANGE OF BIDS ABOVE CAP

$150K	$300K
$0.00	$0.00
$146,996.35	$0.00
$147,168.08	$0.00
$383,325.83	$0.00
$400,000.00	$0.00
$589,141.95	$0.00
$827,700.94	$0.00
$837,011.63	$160,369.50
$947,525.59	$218,442.98
$1,523,950.94	$289,922.97
$5,498,239.90	$3,357,092.22

The most effective way for the consultant to take advantage of the volume discount is to bundle sites together for negotiating PFP agreements. Negotiating many sites as a bundle has several distinct business advantages:

- Much faster negotiations;
- Spreading of risk among a group of sites;
- Introduction of innovative technology without having to prove efficiency (though safety must always be demonstrated beforehand); and
- Considerably reduced paperwork and time to obtain DEP preapproval of costs.

One consultant took a particularly innovative approach in pricing sites. He won a majority of the $300,000 sites and proposed to DEP to clean up all sites at a fixed price per site. The fixed price is determined simply by the contamination level as related to the cleanup target. For example, the highest cost per site is $175,000 for contamination considerably above targets, while the fixed costs for monitor-only sites is about $115,000 for five years of natural attenuation monitoring.

Winners and Losers

Who won?

It seems that just about everyone did.

- The Pantry saved $2 million to $3 million dollars in self-insured (above cap) cleanup costs.
- DEP's cleanup costs will be at levels considerably below historical averages. For the $300,000-cap sites, this represents millions of dollars of anticipated savings to the department.
- Consultants obtained a large block of sites with minimal marketing effort. By using volume cost-containment methods, along with considerably reduced paperwork via PFP, the consultants are in a position to book a considerable profit.
- Citizens of Florida gained a faster and more efficient cleanup of environmental impairment.

Who lost?

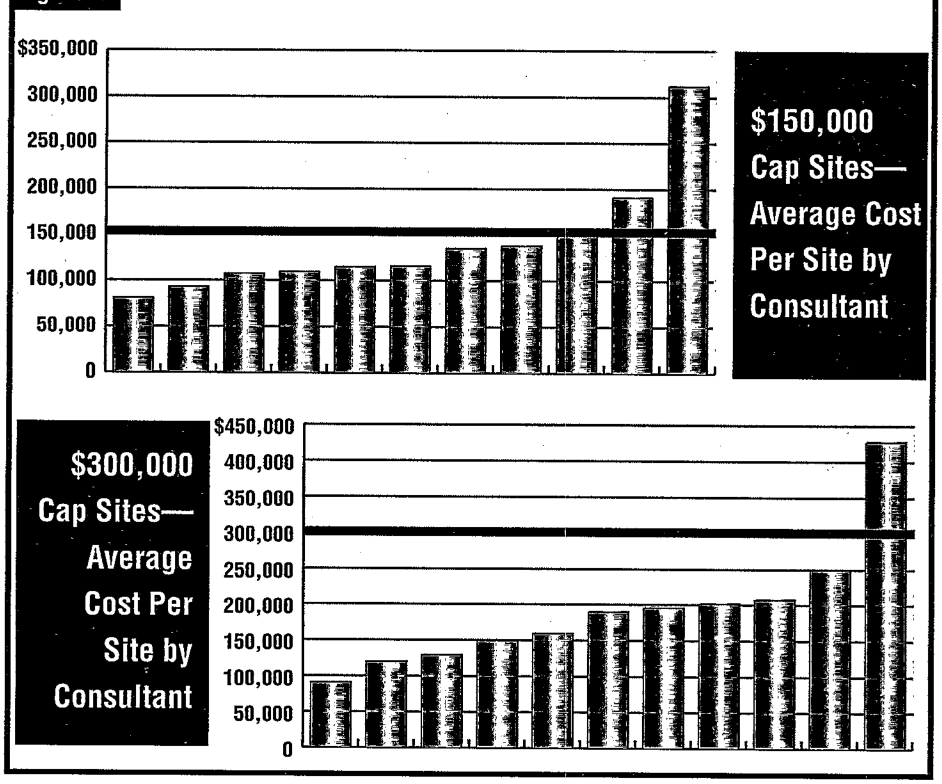
Consultants who were not adept at PFP contractual techniques and not able to tightly control costs.■

Robert S. Cohen, BS, MS, is a professional geologist specializing in LUST cost-containment issues. He is a consultant in both the public and private sectors. In Florida, he proposed and implemented the Florida Department of Environmental Protection's first PFP cleanup and is the environmental advisor to a convenience store chain of 1,400 facilities. He has conducted over 30 PFP workshops and studies on behalf of the EPA Office of Underground Storage Tanks. For more information, contact Bob at **bobcohen@ivs.edu** *or (352) 337-2600*

[1] Pay-for-performance is a contractual mechanism by which the cleanup consultant is paid upon achieving agreed-upon environmental milestones. The cleanups are typically faster and cheaper than the ordinary time and materials approach. PFP has been described in previous *LUSTLine* articles (see bulletins 38, 36, 34, 33, and 32), and more information is available at the EPA Web site: **http://www.epa.gov/swerust1/pfp/index.htm**

[2] Figure 1 is the consultants' bid above the cap of $300,000 or $150,000. Figure 2 is the average price for the bundle by consultant. Although the average price may be less than the cap, individual sites may be greater than the cap, resulting in a bid amount over the cap.

Figure 2



■ **Boutique Fuels** *from page 12*

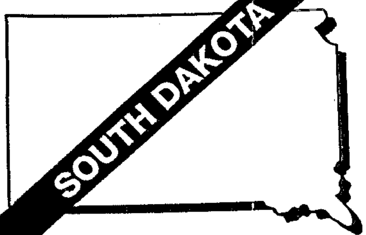
year's spring transition season, while maintaining the environmental benefits needed during the summer smog season.

The second boutique fuels issue is the growing number of state and local governments that have adopted their own fuel programs that are different from the federal RFG program. EPA has identified several reasons why states have adopted their own boutique fuel requirements, including reduced cost compared with the federal RFG program, local air pollution control needs, concerns about the oxygenate mandate in the RFG program, and concerns about the use of MTBE. A number of states want to avoid the use of MTBE in their gasoline because it has been found to contaminate water supplies in some areas.

Despite the number of state and local fuel programs, EPA has found that the current gasoline production and distribution system is able to provide adequate quantities of boutique fuels, as long as there are no disruptions in the supply chain. If there is a disruption, such as a pipeline break or refinery fire, it can be difficult to provide gasoline supplies because of constraints created by these boutique fuel requirements. In addition, fuel providers are concerned that recently enacted state laws that ban the use of MTBE in future years may proliferate the number of boutique fuels and present new challenges to this country's fuel production and distribution system.

EPA staff have also prepared a white paper, "Study of Unique Gasoline Fuel Blends, Effects on Fuel Supply and Distribution and Potential Improvements" (EPA420-P-01-004), which explores a number of possible approaches that could reduce the total number of fuels in the longer term. This white paper, which will be released for public review and comment, lays the groundwork for needed future study into these and other possible approaches. ■

For more information on the "Boutique Report" and related documents, go to **www.epa.gov/otaq/whatsnew.**



USTfields

South Dakota's Antidote to Abandoned Tank Anxiety

by Ellen Frye

Having abandoned underground storage tanks in the ground can be a major source of anxiety for property owners who can't afford the costs associated with cleanup and potential liability. Dennis Rounds, executive director of South Dakota's Petroleum Release Compensation Fund (PRCF), didn't realize how bad that anxiety was until recently, when the state's unique Abandoned Tank Removal Project set out on an ambitious tank removal and cleanup effort—at no expense to the owners.

"People told us how glad they were the tanks were taken out," says Rounds. "Homeowners—particularly the elderly—and farmers, ranchers, and owners of abandoned service stations have worried about this for years but were not sure what to do."

As do most states, South Dakota has a large population of unregulated and regulated tanks that are no longer in service, many of which were abandoned as far back as the 1920s and 1930s. This project was an opportunity for those owners to get those tanks removed.

"So far, about 2,400 tanks located at 1,700 sites have been removed statewide," says Kristi Honeywell of the South Dakota Department of Environment and Natural Resources (DENR). "Those tanks contained more than 450,000 gallons of product and contaminated water that are no longer a threat to the environment. Getting these tanks out of the ground not only removes a potential source of contamination, it also removes the liability factor, allowing property to be back on the tax roll, and increases property values for the landowners."

Sprucing Up

The Abandoned Tank Removal Project grew out of Governor William Janklow's larger Spruce Up South Dakota Program, designed to make it easier for citizens and local governments to rid the landscape of things like old tires, appliances, batteries, old cars, and abandoned buildings—things that are very visible and aesthetically unpleasing and often health threats. The program is set up to help communities and local governments find ways to leverage cleanup funds, encourage communities to recognize the need to do this, and find ways to get it done, often with volunteer groups.

The Abandoned Tank Removal Project came about during the 2000 legislative session. The legislature modified the Petroleum Release Compensation Fund, creating a new program within the program that allowed the state to remove tanks and do the cleanups at no expense to the owner. This is in contrast with the fund's regular program, for which there is a $10,000 deductible.

> **"So far, the average cost per site is below $3,000. That efficiency comes from the packaging."**
> — Dennis Rounds

The legislature did place some restrictions on this new program. Tanks that are regulated and that were properly abandoned prior to 1998 or that are unregulated and have been taken out of service qualify for the program; service stations that were or have been in commercial operation since 1998 do not.

The Economy of Cluster Bid Packaging

The project has successfully moved forward thanks to the teamwork of the PRCF and the DENR and the decision to cluster a large number of applications together within a certain region or within a county.

"We tried to get them into a sizable bid package," says Rounds. "We tried very hard to keep the cost under $50,000 per bid package in many of the cases to encourage smaller local contractors who were knowledgeable about tank removal to do the work. We bid it in a manner that incorporated the tank removal and decommissioning, soil disposal, and fill all in one package. We would then hire soil scientists or environmental professionals to come in and do the actual testing and observe the pulled tank. We had a standardized report form for every tank. So far, the average cost per site is below $3,000. That efficiency comes from the packaging."

"Placing the sites into groups of 10 to 20 and requesting bids from local contractors worked surprisingly well," says Honeywell. "This really lowered our overall costs and gave local contractors an opportunity to help clean up their own communities."

The PRCF receives and approves the applications and verifies that the information is accurate so that when the bid package is put together it is as accurate as can be. In general, the DENR clusters the applications into bid packages and bids them out. They work the contracts and oversee the contractors. The invoices for the work that is done are passed through the DENR for approval and are passed back to the PCRF with a recommendation for payment.

"The project took off very fast and was very aggressive," says Rounds. "Most of our contractors had done tank work before. We have criteria within the bid document to make sure that the person is capable of doing the work, understands the safety requirements, and is willing to work and coordinate things with the environmental people. We take the lowest responsible bid."

"I've never had a state program go as smoothly as this," Mayor Craig

Runestad remarked after the project removed five abandoned USTs in Mount Vernon.

"We are finding that there are a lot more tanks than we anticipated," Rounds notes. "We are bidding with the understanding that the final number of tanks and site conditions might actually be different. The contractor is expected to charge for additional removals at the same bid unit rate."

The PRCF is funded with tank inspection fee revenue, a two cents per gallon fee on all petroleum motor fuel products entering the state assessed at the rack. The fund receives 50 percent of that. While no additional money was provided for the new program, the fund was in good enough shape to handle the additional costs. There is no sunset date for the tank removal project, but the goal is to have them all done within the next year. ■

For more information about South Dakota's Abandoned Tank Removal Project, contact Dennis Rounds at (605) 773-3769. Or visit the project's Web site at **http://www.state.sd.us/denr/DES/Ground/TankYank/index.htm**

USTfields

USTfields at Brownfields 2001

by Gary Lynn

EPA's Brownfields 2001 conference concluded at Chicago's mammoth McCormick Place Convention Center on September 26. Although the conference was affected by the tragic events in New York, thousands of people from the private sector and state, federal, and local governments attended. There were a variety of interesting developments, not the least of which that nearly everyone, from Christine Todd Whitman on down, mentioned abandoned gas stations when discussing brownfields sites. The recognition of any class of petroleum sites as a brownfields problem marks a significant change in the brownfields landscape.

Two sessions at Brownfields 2001 were devoted to USTfields issues. These sessions dealt with the progress that is being made by the existing 10 EPA/state USTfields pilot projects and EPA USTfields assistance efforts. Most of the 10 state projects are in the process of completing field work, such as site investigations and/or remedial actions, at the pilot sites. Case studies of the pilots are being prepared; available case studies can be viewed at **http://www.epa.gov/swerust1/ustfield/index.htm.**

New Round of Pilots Announced

EPA has announced that it is accepting proposals for a new round of up to 40 pilot projects. The grants will be awarded on a competitive basis with at least one award for every EPA region and for a tribal or intertribal consortia. The deadline for sending the proposal to EPA has been extended to November 19, 2001. Each applicant (state or tribe) can send up to three proposals. The money must be spent at a federally regulated UST site, and the site must be eligible for LUST Trust Fund expenditures. LUST Trust Fund cost recovery provisions apply to the grant funds.

Proposed Brownfields/Petroleum Sites Legislation

At the conference, proposed federal brownfields legislation was dis-

■ *continued on page 28*

■ **Brownfields** *from page 27*

cussed. Senate bill 350 includes a package of liability clarifications and authorizes up to $250 million of spending annually (thru 2006) on brownfields grants, loans, and State Voluntary Cleanup Programs. The good news is that 25 percent of the funding is targeted to petroleum sites. The targeted money could go to any type of petroleum-contaminated site, not just federally regulated UST sites.

The bad news is that there is a big difference between authorizing and appropriating money. It is very likely that in light of changes in the economy and increased defense spending that what is actually appropriated will be significantly less than the $250 million that the legislation would authorize. Additionally, although the legislation enjoys widespread support and passed overwhelmingly in the Senate, last-minute negotiations on whether Davis Bacon Act provisions (having to do with grant recipients ensuring that contractors pay prevailing union wage rates) should apply to the money may result in the legislation being scuttled.

According to EPA staff, plans are being finalized for the implementation of SB 350. Plans are also underway should the brownfields legislation not pass. Clearly, there are a number of key choices that will have to be made if the legislation passes. For example, money targeted for petroleum sites could go through a separate grant process that emphasizes participation by state LUST programs. Or, there could be some type of consolidated brownfields application for municipal or state entities that contains a petroleum component to the funding and work. In any case, it will be important to track developments over time because a significant amount of money may become available and because of the real need to address abandoned or underutilized petroleum sites. ■

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SNAPSHOTS FROM THE FIELD

Photo by: Gary Robbins, UConn

Long on expedience ... but short on safety.

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

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