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L.U.S.T.LINE

L.U.S.T.Line Celebrates 30 Years

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

USTfields to Healthfields

by Miles Ballogg, Dave Laney, Joseph Morici, and Roger Register

Despite extensive work by state environmental protection agencies over the last 10 to 20 years to assess and clean abandoned gas station sites, too many of these properties—sometimes called USTfields—remain abandoned. They contribute to blight, crime, declining property values, and health and economic disparities, all of which diminish our quality of life.

Fortunately, greater focus on property redevelopment for community economic vitality is drawing attention to this situation. This attention is helping elected officials, agencies, community organizations, and private developers come to appreciate the value of abandoned gas stations as a profitable investment. Communities are realizing they can derive tangible benefits by making constructive use of these sites. Providing low-income, underserved people access to improved community health projects is especially important where these disparities exist.

Transforming an abandoned gas station into a health clinic, healthy food market, or community garden—Healthfield—can improve environmental justice through better access to healthcare and healthy food. Local governments and organizations working together have initiated Healthfield projects, using resources from the federal government to plan, build, and staff health clinics, to support healthy food initiatives, and to demonstrate their economic viability to the private sector. Many of these projects exemplify best practices for transforming USTfields to Healthfields.

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The Mulberry Health Center in Mulberry, FL, which opened in April 2015, was built with redevelopment funding from state sources and the federal Health Resources and Services Administration. A USEPA grant was used to ensure that the adjacent active gas station was not impacting the proposed site of the health center.

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Such efforts are underway in many states. Work in Florida, Arizona, and California illustrates what can be accomplished when the need for redeveloping a gas station property coincides with the need to address health disparities.

What Makes an Abandoned Gas Station Ideal for Redevelopment?

Thanks to federal regulations governing USTs and LUSTs, abandoned tanks at former gas stations usually have been removed and the property certified clean by state agencies. Most have infrastructure already in place—water, electricity, and sanitary sewer. They typically occupy corner lots with cut curbs that provide easy access to pedestrians and vehicle traffic. Their shape is almost always square or rectangular; so remodeling a structure or building a new one is easier. If residual contamination exists or if a site has not been certified clean, today's technology can often clean up petroleum contamination easier than when the tank was in use. Under these market conditions, owners have an incentive to sell a property that would otherwise remain an eyesore.

Photo courtesy of Beth Norman, Cardno.

Tallahassee's Art Alley community garden on a former UST Site.

Thank You Willa Carson

In Florida, much has been done to turn USTfields into developments that improve access to healthcare and healthy food. It started in 1997 with the late Willa Carson, a retired nurse, whose passion for providing healthcare to those who did not have insurance or the means to travel long distances to the nearest hospital led to the creation of the Willa Carson Health and Wellness Center in Clearwater. She had the foresight to turn an abandoned gas station into a stand-alone clinic when the city designated the area a Brownfields Redevelopment Area in 1998. Many cite this as the beginning of the USTfields to Healthfields movement nationwide.

The most recent success in Florida is the 5,000-square-foot Mulberry Health Center, which opened in April 2015. The City of Mulberry, the Central Florida Resource Planning Council, USTfield specialists, and Central Florida Healthcare, a provider of comprehensive care, formed a partnership to secure a USEPA grant to establish the need to build the facility on a site adjacent to an active gas station. They used the grant to ensure that the gas station was not impacting the proposed site of the health center and then received redevelopment funding from the federal Health Resources and Services Administration and from state sources to build a Federally Qualified Health Center. (See photo on page 1.)

In Tallahassee, Florida, Art Alley is a USEPA grant-funded project that transformed a crime-infested alleyway along a city-owned easement 10 feet wide and 350 feet long, into a pedestrian-friendly environment. Part of this "Gaines Street Corridor" that had contained USTs and LUSTs located within a Brownfields redevelopment area was converted into a community public park garden (see photo above) that provides, among other amenities, a rain garden to collect, slow, and treat the flow of rainwater through the alleyway and nourishes various herbs and seasonal vegetable plants that nearby restaurants and residents use to cultivate a fresh food "farm-to-table" movement. Art Alley has captured the creativity of the local population, fostering a sense of a healthful community.

The success of these projects has facilitated Florida's broader community-driven Highways to Healthcare Initiative to turn abandoned properties with USTs across the state into health centers and public service facilities.

The Arizona Healthfields Initiative

In 2014, modeled on lessons learned from Florida, the Arizona Healthfields Initiative (AHI) was founded. AHI is a collaboration of federal,

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state, municipal entities, as well as non-profit healthcare and health advocacy organizations that want to create Healthfields throughout the state. Its members assisted the City of Phoenix with securing a three-year $400,000 grant from USEPA to convert Brownfields to Healthfields in low-income areas.

This effort, which began October 1, 2015, will start with an inventory of the city's Brownfields sites. The goal is to identify these properties, remove hazardous substances and pollutants that may still exist, establish land-use opportunities, and then redevelop them for healthcare facilities (permanent and mobile), healthy food markets, and community gardens. In addition to the City of Phoenix, participating organizations include:

- Arizona Department of Environmental Quality (ADEQ)
- Arizona Community Farmers Market Association

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A Hartford Community's Remarkable Transformation

by Paul Clark, Connecticut DEP, Emergency Response and Spill Prevention Division

Can't get any closer…an urban community garden and farmers market nestled next to a former industrial setting in Hartford, Connecticut. A growing theme with national importance, integrating assisted urban living with community gardens and associated supportive mechanisms, has blossomed at the historic former Billings Forge Company.

From 1870 to approximately 1970 Billings Forge was a stalwart in manufacturing pistol frames, drop-forged hand tools, and sewing machines. The manufacturing process entailed the use and storage of high-boiling-range quenching oils. The original owners, Charles Billings and Christopher Spencer, were renowned inventors, known for inventing the process of drop-forging and breach-loading repeating rifles.

In the early 1970s, the site of the old Billings Forge Company was resurrected as affordable housing. In 2005, it was acquired by the Melville Charitable Trust as part of their investment to revitalize the distressed neighbourhood surrounding the former industrial giant. From 2005 to 2013, the Trust invested more than $11 million in Billings Forge and several nearby properties, resulting in the making of 110 apartments.

In 2007, The Melville Charitable Trust established the nonprofit Billings Forge Community Works for community participation and empowerment in the neighbourhood. This philanthropic endeavour promoted access to healthy food, engaged children and youth, and developed earnest employment opportunities and economically sustainable social enterprises.

The resulting urban community garden and farmers market components are viewed today as integral in promoting healthy eating, sustainable agriculture, and local food within an urban environment. The local community benefits from the community garden and farmers market by providing access to healthy, nutritious locally grown foods, youth programming, community gardening, and engagement. ■

■ USTfields to Healthfields

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- Arizona Department of Health Services
- Arizona State University
- University of Arizona
- International Rescue Committee
- Keep Phoenix Beautiful
- PHX Renews
- Maricopa County Department of Public Health
- St. Luke's Health Initiatives
- Maricopa County Cooperative Extension.

Preliminary estimates indicate that more than 50 percent of all Brownfields properties in Phoenix, more than 3,800 sites according to data from the ADEQ and USEPA, are UST and LUST sites. This number is likely high because it assumes one release or tank per property and that registered USTs and LUSTs are not present on the same property. In reality, ADEQ and USEPA data might include multiple releases and tanks on one site. Nevertheless, the number of former gas station sites that are potentially available for redevelopment as Healthfields is significant.

"Phoenix is excited about the opportunity to have an impact on public health through the Brownfields to Healthfields Project," says Rosanne Albright, Brownfields Program Manager (Phoenix, AZ). "The city has successfully redeveloped Brownfields into a variety of commercial, industrial, and residential uses for a number of years. We're taking our efforts to the next level by focusing on improved access to healthcare and healthy foods through Brownfields redevelopment, which positively effects environmental and health equity."

UST/LUST redevelopment projects in Arizona also include recent efforts along Historic Route 66 in the northern portion of the state. Hundreds of tanks were present on gas station properties that were not cleaned up and had been abandoned for decades, contributing to the area's lack of economic development.

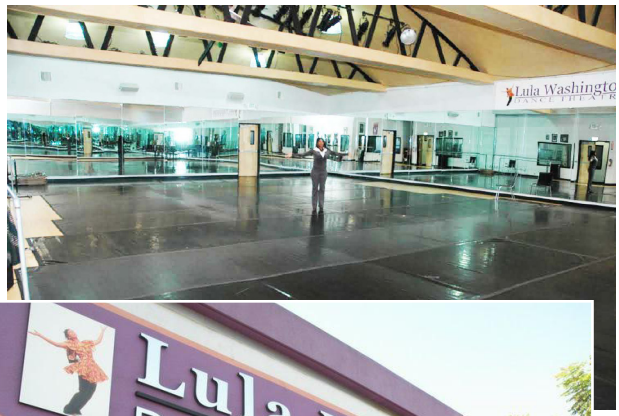
This changed in 2005 when USEPA and ADEQ started the Route 66 Initiative. Both agencies met with many Route 66 communities to discuss the problem. Many tanks were removed and gas station sites were cleaned and administratively closed. On many of these properties, however, redevelopment work remained stalled. This began to change in 2012 when USEPA awarded a three-year $700,000 grant to a coalition comprised of the Route 66 cities of Flagstaff, Winslow, and Holbrook and the Counties of Coconino and Navajo. Since that time the grant has been used to assess varying levels of contamination associated with petroleum and hazardous substances along the historic highway and to plan for tank site redevelopment. Some of the reuse planning discussions include creating new Healthfields.

California's Interstate 710 Corridor Initiative

In California, a dense cluster of abandoned gas stations near I-710 prompted USEPA, the state Water Resources Control Board, and local governments to form creative partnerships that have turned blighted properties into opportunities for community revitalization. Running north from the Ports of Los Angeles and Long Beach for 25 miles, the freeway passes through 19 cities and unincorporated areas with a population of more than 1 million, including many low-income and disproportionately impacted communities.

Launched in 2010, the initiative secured federal and state funding for field investigations and has assisted with the closure of more than 40 cleanup cases. Partners have had great success directing resources and attention to sites with immediate redevelopment potential—most notably through USEPA's Targeted Brownfields Assessment (TBA) Program—with additional funds leveraged from competitive Brownfields grants, the federal LUST Trust Fund, and state funding programs where applicable:

- Two popular restaurants, Café Camelia and Fronk's Gastropub, now operate on a former gas station site in Bellflower.
- Lula Washington Dance Theatre opened a new facility in the heart of South Los Angeles, providing low-cost and free dance classes to neighborhood children.



Lula Washington Dance Theatre, built atop a former ambulance repair facility, is a place where inner city young people can learn the art of dance, launch careers in dance, and where dance is used to motivate, educate, inspire, challenge and enrich lives.

- An abandoned UST site assessment facilitates the expansion of a South Los Angeles Church to include a community center.
- A non-profit group plans to build a basketball court atop a former fueling facility in Watts.
- The state Department of Toxic Substances Control received a $200,000 Brownfields Assessment grant in 2015 to address more petroleum sites in southern California.

Photo courtesy of City of Sommerville.

Allen Street Community Garden in Somerville, Massachusetts, before and after renovation. Using a USEPA Brownfields Assessment grant, environmental assessments were conducted revealing contaminants in the soil and water. In 2007, the city began to clean up the property using a USEPA Brownfields Cleanup grant. Throughout the process, the City of Somerville conducted special outreach efforts to encourage multi-cultural participation.

Experience in the I-710 Corridor led USEPA and the state Water Board to create a statewide Abandoned UST Initiative in 2013. After identifying 342 potential abandoned UST sites throughout California, efforts to identify, locate, assist, and in some cases compel site owners to to action has led to dramatic results that will surely accelerate redevelopment:

- 159 abandoned USTs have been removed in less than three years.
- 78 additional sites have provided evidence that UST concerns no longer exist.
- 50 additional sites have reopened as fueling facilities, or received temporary closure permits in anticipation of reopening.

Through both the I-710 Corridor and Abandoned UST Initiatives, USEPA and the state Water Board have worked to facilitate redevelopment of UST sites where opportunities exist. At sites without a clear plan, both agencies have continued to pursue assessment and cleanup activities, knowing that these activities will make future revitalization more likely.

Doing Communities Proud

All of the projects discussed above benefit their regions and communities by addressing environmental stigma, improving public health, and promoting economic development. Creating Healthfields is a positive "exit strategy" from USEPA's regulatory perspective. Healthfields are also an innovative way to address health inequities that are routinely associated with medically underserved populations and those coping with significant food insecurity.

At the national level, more states should be highlighting comparable accomplishments to capitalize on plans by the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) to update their *Compendium of Redevelopment Successes at Petroleum Underground Storage Tank Sites,* Volume 1, December 2014 (*http://astswmo.org/Pages/Policies_and_Publications/Tanks.htm*).

This ongoing ASTSWMO LUST Task Force effort is an excellent means of capturing, compiling, and demonstrating the return on investment (ROI) that states derive from the services rendered by their tanks programs. In these times when state legislatures are tempted to view available state fund balances as sources they can raid to help balance state budgets, state UST/LUST programs should seize the opportunity to provide petroleum revitalization successes to ASTSWMO so they are collectively better equipped to demonstrate results during fiscally constrained times.

A concerted USTfields to Healthfields effort that eliminates underused, abandoned, and/or contaminated gas station properties can bring many tangible benefits directly to communities:

- Reduce health disparities among our low-income population
- Eliminate contaminants to protect human health among the entire population
- Improve local economic conditions with more jobs and an expanded property-tax base
- Support sustainability by modernizing existing structures
- Protect surface water, groundwater, and drinking water supplies.

There are actually many petroleum revitalization examples, but states and communities need to provide examples to ASTSWMO so they can help other stakeholders gain a greater appreciation for LUST site revitalization opportunities at hand. ■

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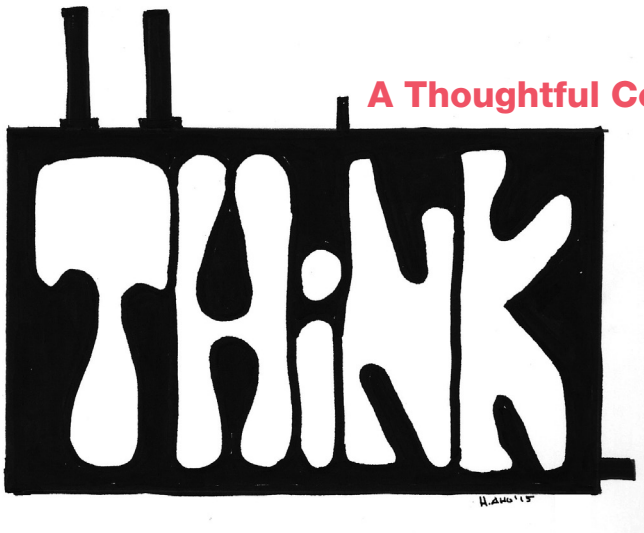

A Thoughtful Column Engineered by Mahesh Albuquerque

Mahesh Albuquerque, Director of the Colorado Division of Oil and Public Safety, is on the lookout for articles from creative thinkers and experts willing to share ideas, insights, and stories on a wide variety of issues related to underground storage tanks. Topics include policy, strategy, successes, failures, and lessons learned. "Now that we have been regulating USTs for 30 years," says Mahesh, "my hope is that this column will help stimulate readers to 'think outside the tank,' to ponder why we do what we do, and to consider and share creative ways to improve our effectiveness—as we strive toward environmental protection." Mahesh can be reached at mahesh.albuquerque@state.co.us.

ULSD'S DIRTY LITTLE SECRETS

The 19th century marked a significant shift in industrialization and human energy consumption, resulting in the dawn of the automobile era. Way back in 1807, François Isaac de Rivaz invented the world's first internal combustion powered automobile, and guess what fuel he used? Not gasoline, not diesel—he used hydrogen. Almost a century later, in 1886, Karl Benz invented the first petrol or gasoline-powered automobile; shortly after, in 1890, Rudolf Diesel invented the compression-ignition diesel engine. I wonder if Mr. Benz or Mr. Diesel could have foreseen the impact their engines would have on our lives, our environment, climate change, and our underground storage tank systems...

The Refinement of Fossil Fuel

Fossil fuel is the term given to energy sources such as petroleum, coal, and natural gas that formed in the geologic past and have a high hydrocarbon content that can be burned to release energy. Think of fossil fuels as "stored solar energy from the past," since they originate from living matter. Someday, I suspect we will go full circle to effectively utilize that original solar energy source.

While Monsieur de Rivaz may have been a century too early with his hydrogen engine, fossil fuels continue to be the dominant fuels used to power automobiles. For the most part, the formulation of gasoline and diesel has seen minimal change. Both of these fuels are obtained from fractions of crude oil utilizing basic refining processes. The more volatile fractions are used in gasoline while the less volatile fractions are used in diesel. The basic refining processes in a modern refinery include:

1. **Separation:** utilizes a distillation column, gases rise to the top over gasoline, kerosene, diesel, and heavier fractions.
2. **Upgrade:** hydrotreats or uses hydrogen and a catalyst to remove undesired compounds such as sulfur.
3. **Conversion:** breaks or "cracks" high boiling point (large molecules) into lower boiling point (smaller molecules). This is usually accomplished by heating with or without a catalyst, hence the terms thermal cracking or catalytic cracking.
4. **Blend:** blends available streams of fuel to meet all performance, regulatory, economic, and inventory requirements.

Evolving Fuel Formulation

Changes in fuel formulation have been driven by a variety of factors such as fuel performance, stability, safety, environmental impacts, supply-demand, and cost, to name a few. On the gasoline front we have seen the elimination of lead, the introduction of fuel oxygenates, the phase-out of MtBE, and the replacement of MtBE with higher blends of ethanol. As our demand for fuel continues to increase, new fuel formulations will be introduced into the marketplace. ASTM International has a preeminent role in setting standard specifications for petroleum products, liquid fuels, and lubricants that are widely adopted around the world.

Like gasoline, the formulation for diesel fuel has also changed. The most notable recent changes have been the reduction of sulfur and the blending of biodiesel. USEPA's Highway Diesel Rule was finalized in 2001 with the intention of making heavy-duty trucks and buses run cleaner. The rule required a 97 percent reduction in the sulfur content of highway diesel fuel from 500 parts per million (ppm) in Low Sulfur Diesel (LSD) to 15ppm in Ultra Low Sulfur Diesel (ULSD).

Refiners began producing the cleaner-burning ULSD for use in highway vehicles in 2006, and in accordance with the phase-in

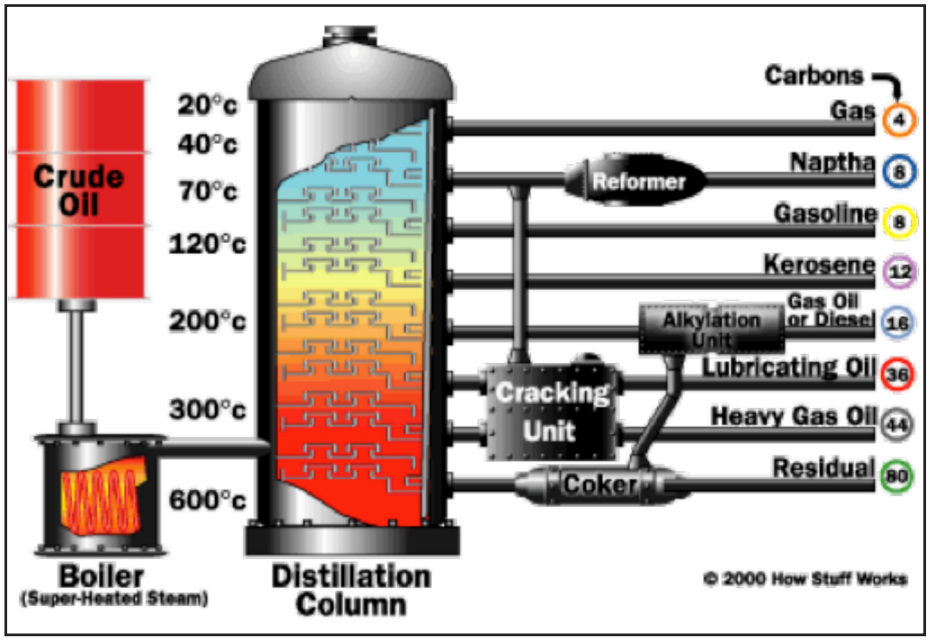

Photo courtesy of *Science: How Stuff Works.*

Figure 1. *How oil refining works.*

schedule all highway, non-road, locomotive, and marine diesel sold in the United States since 2014 should be ULSD. This rule has undoubtedly benefited air quality. However, as we have seen with the use of MtBE in gasoline, unintended consequences can occur.

In the case of ULSD, some of the first signs of unintended consequences began to make their appearance almost immediately following its introduction in 2006. Inspectors across the country began noticing fuel seeps and leaks around certain seals and gaskets in UST systems storing and dispensing ULSD. The fuel caused certain seals and gaskets to shrink; upon replacement with compatible gaskets the seeps and leaks stopped.

In addition, some tank owners began noticing that they were changing out fuel filters on their ULSD dispensing equipment more frequently than they did for their other fuels, due to clogging with particulates or biomass (Figure 2). Inspectors and service companies also began noticing erratic operation or failure of tank and line monitoring equipment due the rapid buildup of rust (Figure 3).

A 2012 hypotheses investigation conducted by the Clean Diesel Fuel Alliance and completed by the Battelle Memorial Institute (Battelle) on the *Corrosion in Systems Storing and Dispensing Ultra Low Sulfur Diesel (ULSD)* [Battelle Study No 10001550] found that a hypothesis worth further investigation is that ethanol identified in USTs storing ULSD is being consumed by bacteria that produce acetic acid as a result of its metabolic process. Ethanol is not a component of ULSD, so its presence in ULSD storage tank systems may be the result of fuel contamination with ethanol-blended gasoline during transportation.

Photo courtesy of NJ DEP.

Figure 2. *Sludge and biomass from ULSD tank.*

Photo courtesy of NJ DEP.

Figure 3. *Rust buildup on an STP shaft.*

In 2014 and 2015, USEPA worked on a field study of several dozen USTs storing the new diesel as a follow-up to the 2012 investigation. This study is pending peer-review prior to being released sometime in early 2016, but based on conversations with USEPA about preliminary results to date, corrosion of metal components in USTs storing diesel appears to be extremely common when using the sample population as a proxy. Also, according to USEPA, it appears from early results that this corrosion of metal could present a risk to the integrity or functionality of metal components in UST systems if it remains unchecked. Furthermore, microbiologically influenced corrosion is likely playing a role in the prevalence of the corrosion, as favorable conditions for microbial growth were found in most USTs examined in the study.

In October 2015, the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) published a document entitled *Compatibility Considerations for UST Systems*, which includes a section on ULSD and provides a compatibility evaluation toolkit, checklists, and links to helpful resources.

The Inside Skinny on ULSD

So why has it taken us so long to start taking a closer look at ULSD? I think it's partly because our inspections of ULSD sumps and piping usually look pretty good, especially when compared to the corrosion buildup sometimes seen on the surface of metal components in adjacent ethanol-blended gasoline sumps. The corrosion on ULSD systems has not usually been manifested externally, but rather internally on metal surfaces within the storage tank system. So unless we removed and inspected in-tank equipment such as the submersible

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■ ULSD's Dirty Little Secrets

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turbine pump (STP), automatic tank gauge (ATG) probes, or drop tubes, we would think everything was hunky-dory.

So let's take a closer look at a few notable properties of ULSD that may help us better understand the corrosion concerns:

- **Sulfur Content** As the name implies, ULSD contains a reduced amount of sulfur. The presence of sulfur in fuel can have an adverse effect on microbial growth. As the sulfur content in diesel dropped from 500ppm to 15ppm, the fuels "antibiotic" properties diminish, possibly allowing for more microbial activity.
- **Lubricity** The lubricity of diesel fuel decreases as sulfur is removed during the refining process. To compensate for this loss, lubricity additives are blended into ULSD to minimize engine wear. The net effect is that ULSD may not be compatible with certain non-metallic seals and gaskets. This is likely why we began seeing seeps and leaks on certain equipment such as meter housings soon after the introduction of ULSD.
- **Oxidation Stability** The natural anti-oxidation properties of diesel fuel also decrease as sulfur is removed during the refining process. ULSD, without the natural oxidation inhibitors that are removed by hydrotreating, may form peroxides during long-term storage. This can result in the buildup of oxidation products, commonly seen as rust or sediment buildup. (See Figure 4.)
- **Biodiesel Blend** Unknown to many, up to 5 percent biodiesel can be blended into ULSD without disclosure at the pump. Contrary to intuition, two fuels that, by themselves, have good stability may form a less stable blend when they are combined. Biodiesel is more susceptible to oxidative degradation than petroleum diesel, and may contribute to increased biological growth during storage.

Based on these properties you can see that ULSD has a higher susceptibility for microbial growth and related microbial corrosion than the diesel of old. Many of the issues we have seen in ULSD storage tank systems are related to microbial growth and microbial-induced corrosion, so until a solution is determined, minimizing the opportunity for heavy microbial growth is very important.

What Can We Do to Prevent Microbial Corrosion?

If there was just one thing you could do, I would suggest taking an aggressive approach to preventing water buildup in tanks storing ULSD. This means ensuring that all tank-top fittings are tight, drain plugs in spill buckets are closed, and surface drainage prevents water from ponding over spill buckets or other tank-top sumps. It also means checking for the presence of water in tanks periodically, a few hours after every delivery to allow water to settle out, as well as daily after heavy precipitation events, or in areas with shallow groundwater. Water can be detected by certain ATG probes or by the old-fashioned way with water-finding paste smeared on the end of a tank gauge stick. Any water accumulation over a quarter of an inch should be removed promptly.

Photo courtesy of NJ DEP.

Figure 4. *Rusted spring in line leak detector.*

Here are some best management practices related to the operation of ULSD UST systems:

- **Prevent Cross-Contamination Transport** Store ULSD in dedicated tanker compartments if possible to prevent cross-contamination with ethanol-blended gasoline.
- **Conduct Periodic Inspection and Maintenance** Monitor daily for the presence of water in tanks, and conduct monthly walk-through inspections of dispenser cabinets, spill buckets, and sumps.
- **Conduct Periodic Internal Tank Inspections** At least once every three years remove drop tubes, ATG probes, the STP, and line-leak detectors to check for the buildup of corrosion and the functionality of monitoring equipment.
- **Minimize Stagnant Product in Tanks** Emergency generator tanks and other tanks with low throughput are more susceptible to microbial growth as aged product degrades. The addition of appropriate stabilizers that contain antioxidants, biocides, and corrosion inhibitors may be necessary in these tanks.

UST systems storing ULSD provide a favorable environment for microbial growth, especially when the fuel is contaminated with water or ethanol or other food sources for microbes. Microbiologically influenced corrosion likely plays a significant role in the prevalence of the corrosion seen in ULSD UST systems across the country. The corrosion of metal presents a risk to the functionality of metal components. Through aggressive water management and the implementation of simple best management practices, microbial growth can be effectively managed to minimize the risk to UST functionality. ■

USEPA and ITRC Guides for Petroleum Vapor Intrusion

Similarities and Contrasts

by John Menatti and Hal White

The past year saw the publication of two guidance documents on petroleum vapor intrusion (PVI). In October 2014, the Interstate Technical and Regulatory Council (ITRC, 2014) released a web-based document, Petroleum Vapor Intrusion: Fundamentals of Screening, Investigation, and Management (http://www.itrcweb.org/PetroleumVI-Guidance). *In June 2015, USEPA released its* Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank (LUST) Sites (http://www2.epa.gov/sites/production/files/2015-06/documents/pvi-guide-final-6-10-15.pdf). *This article compares the guides and seeks to answer the most commonly asked questions about them, as well as other questions that are reasonably anticipated to arise.*

Why the PVI Guides?

Vapor intrusion (VI) has been recognized as a potential health risk for more than 30 years. Though not the first model to simulate vapor transport into buildings, the model developed by Paul Johnson and Robbie Ettinger (1991) can (arguably) be credited with making a very complex process accessible to a broader audience than was previously possible. However, though the model was relatively easy to use, it was not universally applicable. The model did not account for the aerobic biodegradation of petroleum hydrocarbons, which represent a significant percentage of the volatile and potentially toxic chemicals released into the subsurface. The vast majority of such releases were (and still are) from leaking gasoline USTs, which are regulated under Federal Regulations 40 CFR 280.

During the 1980s and 1990s some states developed guidance on how their leaking UST sites should be assessed for PVI. In 2002, USEPA published draft guidance on VI, but it did not cover PVI at UST sites, stating:

> *The draft guidance is suggested for use at RCRA Corrective Action, CERCLA (National Priorities List and Superfund Alternative Sites), and Brownfields sites, but is not recommended for use at Subtitle I Underground Storage Tank (UST) sites at this time. The draft guidance recommends certain conservative assumptions that may not be appropriate at a majority of the current 145,000 petroleum releases from USTs. As such, the draft guidance is unlikely to provide an appropriate mechanism for screening the vapor pathway at UST sites. (USEPA, 2002, p.2)*

Answering the Call

In 2009 the Association for State and Territorial Solid Waste Management Officials (ASTSWMO) LUST Task Force was asked by the USEPA Office of Underground Storage Tanks (OUST) to provide a list of high priority technical issues that needed support from the agency and could be addressed jointly by USEPA and states. The highest priority issue identified by the ASTSWMO LUST Task Force at that time was PVI. Although ITRC had produced a Technical Regulatory Guidance document on the topic of vapor intrusion (ITRC, January 2007), no petroleum-specific technical guidance existed. Jeff Kuhn, LUST Task Force Chair, suggested the reactivation of an earlier PVI interest group and recommended that the group be tasked with developing a PVI-specific technical guidance document to assist states, territories, and tribes.

OUST convened a workgroup in 2009 to develop guidance specifically for PVI. Further highlighting the need for information on PVI, USEPA's Office of Inspector General (OIG) later that year released an evaluation report, *Lack of Final Guidance on Vapor Intrusion Impedes Efforts to Address Indoor Air Risks* (EPA, 2009). The report included several recommendations, one of which was for USEPA to "issue final vapor intrusion guidance that incorporates information on how risks from petroleum hydrocarbon vapors should be addressed."

The workgroup began developing guidance through a series of meetings convened from 2009 to 2012. A draft guide was made available for public comment during the spring of 2013 and a revised final version was submitted to the Office of Management and Budget for interagency review in the fall of 2014. The USEPA OUST PVI guide was formally released on June 11, 2015. OUST hosted several webinars to provide partners and stakeholders with an overview of the guide this past fall.

ITRC formed a multi-disciplinary PVI team, consisting of consultants, state and federal regulators, responsible parties (RPs), and other stakeholders, to concurrently develop a PVI technical and regulatory guidance document (Tech/Reg) that would be broader in scope and provide a greater level of technical detail on field techniques and equipment. Many of the workgroup members for OUST's PVI guide were also members of ITRC's PVI guide workgroup. The ITRC published its PVI Tech/Reg in October 2014. ITRC PVI classroom training was recently initiated with a training course offered in Raleigh, NC, August 31–September 1, 2015. ITRC presented several PVI training webinars in 2015 and additional classroom training is scheduled for 2016.

The Similarities

Given that both guides were developed more or less concurrently and by workgroups with several members in common, it is not surprising that they are consistent with one another on a number of issues. For instance, both guides are founded on the premise that aerobic biodegradation of petroleum hydrocarbons (PHCs) is the primary factor that distinguishes PVI from vapor intrusion by chlorinated solvents. It is the biodegradability of PHCs that allows utilization of screening criteria to eliminate certain buildings from

■ *continued on page 10*

■ Guides for Petroleum Vapor Intrusion *from page 9*

further investigation for potential PVI.

Both guides promote the development of a detailed conceptual site model (CSM) comprised of site-specific data that informs decision-making at the site and acknowledges that addressing the vapor pathway is part of a response to any UST release. The CSM is continually refined as new data and information become available. Among the features of the CSM is identification of whether or not certain factors are present that may preclude the effectiveness of aerobic biodegradation to mitigate the threat of vapor intrusion.

Such precluding factors include:

- Soil properties that inhibit biodegradation (e.g., low soil moisture content, low permeability, high organic carbon content, especially peat)
- Large building size and/or extensive impermeable surface covering (e.g., asphalt, concrete) that may limit replenishment of oxygen and water to the subsurface
- Preferential transport pathways (including both natural and man-made) that increase the rate of travel of vapors through the subsurface, thereby reducing the time available for aerobic biodegradation to convert PHCs into harmless byproducts.

For PHC releases at LUST sites, both guides recommend vertical separation distances that are essentially the same. The vertical separation distance is the distance of vadose zone soil between the PHC source and an overlying building and is where aerobic biodegradation of PHCs occurs.

For a PHC source that is comprised of light non-aqueous-phase liquid (LNAPL) at a LUST site, both guides suggest a vertical separation distance of 15 feet. For dissolved sources, OUST's PVI guide recommends six feet compared to ITRC's five feet. These criteria are based on the results of a PVI database analysis published by USEPA (2013) and the difference stems from rounding the 95th percentile threshold of 5.4 feet (OUST rounded up the nearest whole number and ITRC rounded down).

Recommendations for soil gas sampling are consistent between the two guides. Both recommend sampling for PHCs (and other volatile organic compounds commonly present in petroleum fuels), oxygen, and carbon dioxide. Sampling locations are also essentially the same, with the minor exception that ITRC's guide distinguishes between exterior and near-slab samples. The difference between these is that the former are generally 10 feet or more away from a building and the latter are within 10 feet. OUST's PVI guide does not make this distinction.

The USEPA and ITRC PVI guides serve to complement each other. USEPA's guide provides a framework for decision making and the ITRC guide contains a greater level of technical detail along with a broader scope.

Both guides are consistent with regard to the use of models in assessing PVI, though ITRC's guide is somewhat more detailed. Models must be appropriate for the type of setting (i.e., the mathematical formulation needs to be consistent with conditions at the site and the CSM). If the computer model is not matched to conditions at the site, then error is likely introduced into the computer model results. This means that input parameters for the computer model must be representative of the actual physical, chemical, and biological properties of the site. Models should be calibrated and a sensitivity analysis should be conducted.

OUST's PVI guide explicitly states that model results are one line of evidence that can be helpful, but models should not be used as the sole rationale for determining that a building is not threatened or impacted by PVI. The ITRC guide doesn't make an explicit recommendation either way, but does note that several states allow the use of model results as the sole basis for eliminating consideration of the VI pathway.

Finally, both guides recognize the importance of community engagement. OUST's PVI guide emphasizes that engaging stakeholders early in the process, and keeping lines of communication open throughout the investigation, leads to better informed decision making and reduces conflict. The ITRC PVI guide provides detailed discussions of the various facets, including stakeholder concerns, community engagement plans (CEPs), tools for effective community engagement, risk communication, and public notification.

The Contrasts

The primary differences between the two guides are their scope and applicability as well as the amount of information and level of technical detail in each. The ITRC guide covers all types of PHC releases, including home heating oil tanks, refineries, bulk storage facilities, pipelines, oil exploration and production sites, manufactured gas plant (MGP) sites, coal tar/creosote, and drycleaners using petroleum solvents. The guide includes a vertical separation distance of 18 feet for releases from larger facilities such as refineries.

OUST's PVI guide covers releases of petroleum-based fuels (e.g., gasoline, diesel, jet fuel) from USTs regulated under 40 CFR 280 and is focused on the typical corner gas station site. The PVI database report (USEPA, 2013a), from which the vertical screening distances of six and fifteen feet are derived, includes a large amount of data from LUST sites. The data set studied did include a few larger facilities and the analysis calculated a separation distance of 18 feet for releases from large facilities such as refineries. However, the relatively small amount of data resulted in greater uncertainty for the 18 foot separation distance. The ITRC guide includes the 18 foot separation distance while the USEPA PVI guide does not.

While it is true that the same PHCs should biodegrade aerobically regardless of their source, the ability of subsurface microorganisms to biodegrade PHCs depends on, among other things, the volume of the release. Most releases from USTs are relatively small and micro-

organisms that can aerobically biodegrade PHCs are usually present. If the release is very large then there is a greater likelihood that the oxygen demand may exceed the rate of replenishment and aerobic biodegradation may not be able to mitigate the threat of PVI.

The OUST PVI guide also states that the "guide may also be helpful when addressing petroleum contamination at comparable non-UST sites." Determination of what constitutes "comparable" is left to the discretion of state decision-makers, though source volume and source composition would be two obvious points of comparison.

Petroleum contamination at sites that are not comparable to UST sites (e.g., refineries, petrochemical plants, terminals, aboveground storage tank farms, pipelines, and large-scale fueling and storage operations at federal facilities), or sites with releases of non-petroleum chemicals including comingled plumes of petroleum and chlorinated solvents regardless of the source, should be addressed under USEPA's more general vapor intrusion guide, *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway From Subsurface Sources To Indoor Air* (USEPA, 2015b). This more general guide was developed from USEPA's 2002 draft VI guide.

The ITRC and USEPA PVI guides present different approaches for establishing a lateral inclusion zone. The PVI lateral inclusion zone is the area where PVI is most likely to be a concern and where a PVI investigation should focus. ITRC's PVI Tech/Reg recommends a default 30-foot lateral inclusion distance from the edge of the plume.

USEPA's PVI guide notes the inherent difficulties and uncertainties associated with defining the precise location and extent of contamination. Plumes are dynamic, three-dimensional, and can exhibit seasonal and temporal variations. The guide acknowledges that there are different approaches for establishing the lateral inclusion zone at a LUST site and refers readers to an issue paper developed by USEPA's Office of Research and Development (USEPA, 2012) as one possible approach.

The paper describes a method for defining a lateral inclusion zone based on the proximity of a structure to the presumed maximum extent of the contamination plume. The presumed maximum extent of contamination is defined by a perimeter of clean monitoring locations that are arranged around the known source of contamination. The lateral inclusion zone is extended beyond the presumed maximum extent of contamination to allow for uncertainty of the concentrations of contaminants in the space between monitoring locations.

Both guides discuss direct and indirect indicators of LNAPL. Both acknowledge that such indicators (especially indirect criteria) are useful as general guidance rather than absolute thresholds and allow decision-makers flexibility to apply their own criteria as they deem appropriate. Concentration thresholds for dissolved benzene and TPH in groundwater are similar (1 to 5 mg/L benzene and >30 mg/L TPH) in both guides (though USEPA's PVI guide notes the lower threshold of 1 mg/L in the legend to Table 3, presenting 5 mg/L in the body of the table). For benzene in soil, both guides recommend 10 mg/Kg.

The guides differ for the TPH soil concentration. USEPA's guide is more conservative. It also makes a distinction between fresh gasoline and weathered gasoline (or diesel) vapor sources. For fresh gasoline the recommended threshold is 100 mg/Kg; for weathered gasoline (or diesel) the threshold is 250 mg/Kg. ITRC's guide uses a range of 250 to 500 mg/Kg for gasoline-related TPH without distinguishing whether it is fresh or weathered. These differences are within the same order of magnitude.

The last difference we'll touch on in this article is that the ITRC guide is generally much more detailed and contains more technical information that would be useful to those involved in assessing PVI. In contrast, OUST's guide is not intended to be a "how to" guide. It is more a policy guide intended to provide a framework that can be used by USEPA, states, tribes, consultants, and contractors to address PVI decision-making.

A Win–Win for PVI Guidances

In summary, the USEPA and ITRC PVI guides serve to complement each other. USEPA's guide provides a framework for decision making and the ITRC guide contains a greater level of technical detail along with a broader scope. Implementation of the policy recommendations and technical procedures in these guides at leaking UST sites will help ensure that sites where PVI is a potential concern will be efficiently and effectively assessed and that scarce resources are directed to where they are needed. ■

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Wander LUST

....a walkabout with Jeff Kuhn.....

Jeff Kuhn is with the Montana Department of Environmental Quality (MDEQ) and a venerable veteran of petroleum remediation at the state and national levels. Through this column he takes us on "walkabouts" across the fascinating world of underground storage tanks. Jeff welcomes your comments and suggestions and can be reached at jkuhn@mt.gov.

Getting to a Balance on LNAPL Recovery

In 1988, when many state programs were completing their first draft of state UST rules and navigating USEPA's State Program Approval process, a phrase appeared in the final Code of Federal Regulations: "remove free product to the maximum extent practicable." Hmm, sounded a bit vague. USEPA attempted to clarify the intent in its 40 CFR Section 280.64 response:

> *Owners and operators must remove free product to the maximum extent practicable as determined by the implementing agency.* And in 40 CFR Section 280.64 (b)*: Use abatement of free product as a minimum objective for the design of the free product removal system.*[1]

These statements functioned as a metric to guide states on how to approach remediation of floating petroleum product at petroleum release sites. However, the phrase "maximum extent practicable" (MEP) has been freely interpreted by each state and later modified as states gained experience in the use of innovative remediation technologies. In fact, the development of the national program led states to freely interpret the meaning of MEP based on project managers' experience (the "implementing agency") with new technologies and a lot of common-sense discussion among states about which technologies worked best.

Looking back at state guidance documents of MEP at the time, it implied all of the following:

- LNAPL cleanup to the limit of existing technologies
- Recover product to the thickness of a sheen
- Recover product to .01 feet
- Recover product to the point at which an asymptotic recovery curve is attained

As thousands of LUST sites moved to active remediation and project managers became increasingly overwhelmed with the sheer number of leak sites, states struggled to find good LNAPL (Light Non-Aqueous Phase Liquid) recovery technologies and were often left with many old sites with seemingly unrecoverable petroleum product.

Clearly, the advent of new technologies increased the limits of LNAPL recovery. Yet the development of more cost-effective technologies has still not solved the problem inherent in recovering product in challenging geologic environments—the same environments that still limit hydraulic recovery of LNAPL today.

LNAPL and the "Backlog"

Has the backlog of open LUST sites changed in recent years? Although most state backlogs contain a variety of sites, states have more and more "high-hanging fruit"—often the oldest sites on state "backlogs" that represent their most difficult and costly sites, many of which still contain some level of residual LNAPL preventing closure. Many of these older releases were already decades old when state programs began. USEPA acknowledged this on many levels in its 2011 "National LUST Cleanup Backlog" study[2]. For example:

> *The Backlog is composed of many old releases with groundwater impacts that take longer to clean up, and Current open cleanups of older complex releases are more costly than cleanups completed in the past.*

Can these sites be managed with low annual fiscal needs? Are they mostly monitored natural attenuation (MNA) sites? If so, what is the drive to close them? How many old (> 25 years) sites are still around? Do they represent a greater risk than newer releases? The remaining very difficult sites often represent those involving larger and longer-term releases. Many of these sites also occurred in fine-grained soils that are difficult to remediate.

Legacy sites with residual LNAPL contamination can often take a huge effort to clean up and close. The extent and magnitude of releases

at many of these sites has been completely defined and the sites have stable and/or shrinking plumes. New LNAPL releases often represent immediate environmental and human-health hazards and should be given financial priority based on risk determination. In most cases, newer releases may be the least expensive (per cubic yard) releases to clean up, since the release may be quickly contained and the extent of contamination limited.

Now Comes the ITRC LNAPL Guidance

In 2009 the Interstate Technical and Regulatory Council (ITRC)[3] provided states with new "TechReg" tools to assist with the dilemma of what to do with sites containing hydraulically unrecoverable LNAPL. The concepts of LNAPL Transmissivity (Tn) and Natural Source Zone Depletion (NSZD) were described in ITRC's Technical Regulatory "TechReg" Guidance Documents (2009a, and 2009b).

The documents specifically described these additional lines of evidence and provided analytical tools to more accurately measure decreasing LNAPL recovery and the conditions that create ever-decreasing recovery rates. It's also important to note that earlier LNAPL Transmissivity guidance published by the American Petroleum Institute (API)[4] and the American Standards of Testing and Methodology (ASTM)[5] set the stage for much of the ITRC guidance.

The ITRC's guidance document strongly suggests that use of the LNAPL Tn and NSZD should be employed as additional "lines of evidence" to cease hydraulic recovery of LNAPL and move to another remediation technology. Evaluating "multiple lines of evidence" resonates with state technical staff and in my view represents a sound technical approach for managing LNAPL remediation projects.

Recognizing the Changing Landscape

So how do states reach a balance between the old guidance of MEP and understanding and properly applying new guidance (e.g., ITRC, API, ASTM) that, in some cases, could move a site with measureable LNAPL to closure consideration?

In reviewing recent journal articles on LNAPL I found what I felt were positions that recognized the changing landscape between the new guidance and previous state policies on LNAPL recovery. A paper by Suthersan et al.[6] points out inconsistencies between regulatory agencies using old guidance and those states that are incorporating the latest scientific approaches to LNAPL:

> *While we do not expect that every regulatory agency will adopt the same standards, we hope for resolution of the dissonance between states that regulate based on a 0.01 feet LNAPL thickness standard and states that have technical guidance to allow closure of sites with a satisfactory demonstration that LNAPL poses no risk to human health or the environment.*

The term "dissonance" recognizes the current flux involved in reaching regulatory consensus on the issue. In my view, LUST programs expended huge resources over the last 30 years to understand and develop state-specific petroleum cleanup standards and technical guidance. Much of this follows the evolution of the field of remediation science and innovation in engineering practices. The current flux in state policy change is another step in that process. ITRC LNAPL guidance and classroom training is largely responsible for much of that flux. That training effort has been invaluable in disseminating the latest science and technology innovation. So let's acknowledge the dissonance for what it is—the evolution of understanding wrought by continuous improvement in an emerging science.

The paper also points out the recurring limitations of LNAPL recovery but does so in the context of a large midwestern railroad site. Although the primary contaminants are the same, the magnitude of contamination at such sites occurs on a vastly different scale than the typical LUST site. Accordingly, the authors point out the huge, long-term costs associated with the quest to recover hydraulically unavailable LNAPL at large sites.

Another paper by Don Siegel[7] discusses the quandary of achieving groundwater cleanup as a "Black Swan"—something that is very rare, or improbable. Although the focus of the paper is larger, complex contaminant sites, he concedes that petroleum sites may achieve a cleanup standard:

> *I see little evidence that we can clean up seriously contaminated groundwater to drinking water standards and keep it that way, except where residual contaminant plumes naturally attenuate after we remove an original source and treat the contamination—particularly that generated by hydrocarbons (e.g., gasoline)—in oxygenated water-table aquifers.*

The paper describes the very challenging and costly task of addressing large contaminant cleanup sites. But the danger lies in states applying this logic to include much smaller LUST cleanups. So, use of the word "except" becomes critical. Petroleum (e.g., gasoline) represents one of the largest sources of groundwater contamination in the country.

If the premise of the paper is simply "Why bother? We are waiting for the Black Swan," then we are ignoring 30 years of successful petroleum cleanups and closures. In fact, innovation in petroleum remediation across all sectors has largely been driven by the need to address the volume of sites represented by the national underground storage tank problem. Fortunately, the paper does not suggest we should cease remediation at large contaminant sites. But similar to the Suthersan et al. paper, it questions what level of effort is necessary to achieve a cleanup endpoint.

The paper raises another point of concern worth mentioning:

> *Groundwater in the context of drinking water standards for all practical purposes also has been lost to humanity locally in places because of point source contamination.*

I think the residents of many western cities that use shallow alluvial groundwater (rather than surface water) as a primary drinking

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■ **LNAPL Recovery** *from page 13*

water source (e.g., Los Angeles, Denver) value their water as a critically scarce resource that cannot be lost to humanity. In the future, such groundwater resources may become even more sensitive to environmental contamination due to the effects of climate change, and thus further drive the need for better LNAPL remediation technologies. Certainly under any regulatory program such resources require a higher level of attention and protection. Santa Monica's mid-1990s experience with MtBE-impacted public water supply wells illustrates this point very well.

With the hope of striking a good balance, I believe we can strategically clean up many petroleum-contaminated sites, including smaller retail facility-sized sites, as well as larger refinery and refinery terminal sites, and continue to contribute to advances in remediation technology that expand the number of cost-effective cleanup alternatives available for LNAPL recovery.

Are Today's Closures Tomorrow's Openers?

Despite my confidence in a deeper understanding of the science of LNAPL and the availability of new tools, I keep returning to the same nagging question: are we prematurely closing some sites with residual LNAPL that will be reopened in the future due to real-estate transfer and property redevelopment? More importantly, what about the development of more stringent federal and state drinking water standards that could drive additional cleanup at sites?

Also, my observation from many years of state discussions on the financial limitations of state petroleum funds is that states with insufficient funding sources are more apt to use mechanisms that require less money on cleanup. More money does not necessarily mean more or better cleanups. But less money definitely translates to less overall remediation and in some cases, perhaps, a drive to close out sites—sometimes prematurely.

Could these sites utilize alternate funding, such as Brownfields, since some state petroleum funds may not be able to address total cleanup costs? In the past, states have formulated a variety of creative funding options to make up the shortfall. And periodic supplemental funding made available by the federal government (e.g., American Recovery and Reinvestment Act) has arrived at opportune moments to further shore up state program funds.

The pressure to close sites is based on federal and state closure goals and state-specific interpretations of when sites are ready for closure. It is also driven by overall resource availability, real-estate values, and redevelopment goals in different areas of the country.

Generally speaking, that pressure is good and keeps us focused on strategies that foster successful cleanups and site closures. But are combinations of these factors driving the need/desire for some states to interpret the ITRC and other LNAPL guidance documents as a fait accompli to closure? That is certainly not how the current classroom-training course is designed (verbal communication, John Menatti, Utah DEQ, ITRC LNAPL Team trainer). My own experience at the recent ITRC classroom training in Austin is that the course offered excellent technical tools and did not seek to provide participants with a policy roadmap on LNAPL.

Further validation comes from a recent 2015 ASTSWMO survey (in progress)[8] that asked the question: "Does your regulatory agency use LNAPL transmissivity as a metric to define when LNAPL has been removed to the maximum extent practicable in accordance with CFR 40 Section 280.64?

- 0 of 17 state respondents said "Yes, as a sole determining line of evidence"
- 7 of 17 state respondents said "Yes, as one of multiple required lines of evidence"
- 10 of 17 state respondents said "No"

This seems to indicate that states value "multiple lines of evidence" and use LNAPL Tn as one line of evidence—a better tool, not a silver bullet for site closure.

Final Thoughts

I've already touched on a few points (e.g., funding limitations, older more difficult sites) that are obvious to all stakeholders in the remediation world. However, some of the project drivers, such as real-estate values, are transient, difficult to understand and balance, and could not be fully considered in the USEPA Backlog Study. Also the role of additional funding sources cannot be forgotten. Leveraging state funding through the use of the Federal Brownfields Program funding has become a substantial game-changer for many petroleum cleanup sites that might otherwise never be cleaned up and closed. This is good news for the world of LUST sites and may help expedite closure of some sites that might be either placed on the back burner or prematurely closed and later reopened for the reasons described above.

Simply put, legacy LNAPL sites are challenging and currently experience a large variety of state approaches to move these sites from cleanup to closure. It's a complex issue, as noted by the responses in the ASTSWMO LNAPL survey. In my opinion, states should begin using LNAPL Tn and NSZD as tools to determine if hydraulic recovery of LNAPL can cease, and funding shifted to other feasible remediation alternatives, or moved to an MNA status, where sites can be managed through annual monitoring efforts at a greatly reduced cost. A few states have begun to weave these tools into a risk framework with long-term management approaches using more well defined instuitional control mechanisms as an endpoint.

However, each state must use its own unique approach that recognizes state laws, financial constraints, real-estate values, and many other parameters that are difficult to weigh and often difficult to compare from state to state. In my view, the jury is still out on how best to cost-effectively address these sites and move them to an end-point that does not result in a future reopening due to changed site conditions.

In closing, my quest for balance and understanding on the issue of LNAPL led me to a recent, well-written paper by Beckett and Huntley. It's a must read for all regulators and

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A Message from Carolyn Hoskinson

Director, USEPA's Office of Underground Storage Tanks

More Frequent Inspections = Improved Compliance + Increased Release Prevention? We're Analyzing the Data

Have you ever had a gut feeling about something… but without the hard facts or data, you couldn't prove your feeling was on target? For years, many of us working on underground storage tank (UST) issues had a gut feeling about the positive impact of inspections on compliance and preventing UST releases. Yet data to support that feeling was not readily available.

Historically, the federal UST program saw wide variations in inspection frequencies in states and territories (referred to as states in this article)—from as often as once a year to as infrequently as once every ten years or more. Then in 2005, Congress passed the Energy Policy Act, which along with other prevention measures, required states to inspect all facilities in their jurisdictions at least once every three years. This requirement was a significant boost to getting facilities onto routine and frequent inspection cycles.

Preventing Releases Through Improved Operational Compliance

A key element in preventing UST releases is to increase a facility's operational compliance with UST regulations. Compliance rates are higher today than they were a decade ago before the three-year inspection requirement. In 2005, 66 percent of facilities were in operational compliance, and in 2015, 10 years after the Energy Policy Act, compliance rates reached 72.6 percent. This improvement is good news!

But, in order to more closely link and understand the impact of increasing inspection frequency on compliance and release prevention, we needed to examine the data more closely to account for other factors that could also impact the compliance of UST owners and operators. More specifically, we needed to examine data on inspection, compliance, enforcement, and confirmed releases at the UST facility level before and after implementation of the three-year inspection cycle. And that is just what we are doing, with support from the Center for Program Analysis in USEPA's Office of Solid Waste and Emergency Response.

Partnering with States to Study Impacts of the Three-Year Inspection Cycle

As you may know, states report limited data to USEPA as part of their semi-annual performance measures reporting. States roll up UST facility level data into a few key state-level prevention metrics, such as percent of facilities in significant operational compliance with release prevention requirements, release detection requirements, and both; inspection actions; and delivery prohibition actions. States report cleanup data as well.

States do not provide USEPA with inspection, compliance, enforcement, and confirmed release data at the UST facility level. But we needed that facility level data to statistically analyze the impact of the three-year inspection cycle on noncompliance and releases. As a result, USEPA reached out to state UST programs, who are the keepers of the data, to see if any were interested in sharing their data and working with us to learn about the impact the three-year inspection cycle was having on compliance and confirmed releases in their states.

We realized that, for this study, a good state candidate is one that had an increase in inspection frequency after the Energy Policy Act was implemented. Furthermore, the state's data needed to be available electronically dating back to several years prior to the Energy Policy Act.

Initially, several states expressed interest in sharing their facility-level program data and working with us on this analysis. Yet after gaining a better understanding of the details of those states' inspection frequency change and data availability, we realized many did not have enough data from years before the Energy Policy Act or did not experience increased inspection frequency.

Fortunately, one state, Louisiana, was a good candidate and met the criteria for our study. Louisiana had enough before and after data; there was an increase in the frequency of their inspection cycle; and their data was available electronically.

Results from Louisiana's UST Program Data

So, we began working with Louisiana starting at the end of 2014; we prepared and analyzed their 2001–2012 inspection, compliance, and confirmed releases data, as well as their 2004–2012 enforcement data. We linked those data by UST facility location to socioeconomic data from the

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U.S. Census 2009–2013 American Communities Survey and soil data from the USDA's Soil Survey Geographic (SSURGO) Database. Our final data set included more than 10,000 inspections, which occurred between 2001 and 2012 at about 4,600 facilities.

The compiled dataset helped us estimate a statistical model, which allowed us to directly examine the relationship between inspection frequency, defined as the days since last inspection, and compliance, while accounting for other factors that may impact a facility's compliance behavior. Those factors include: a facility's compliance, enforcement, and release history; characteristics of the facility, such as the average age or capacity of tanks onsite; or socioeconomic characteristics of the communities living near the facility such as population density and average income.

Our preliminary results suggest that increasing inspection frequency from roughly every six years to every three years as required under the Energy Policy Act has improved UST compliance in Louisiana. Our statistical model using Louisiana's UST data shows a positive and statistically significant effect of increased inspection frequency on facility compliance. Although we are still running some additional analyses to check the robustness of the results, these early results are exciting and reinforce our gut feeling about the impact of inspections on compliance...at least in Louisiana. We expect to complete our analysis on compliance in Louisiana and submit it for publication in early 2016. Then we will analyze the relationship between increased inspection frequency and confirmed releases in Louisiana.

The Analysis Continues with Additional States

Are these results in Louisiana unique to that state? Has the increased inspection frequency had similar effects on compliance in other states? USEPA will delve into those questions over the next year by evaluating the suitability of data from some additional states. In summer 2015, we made a second data call and several more states expressed interest in collaborating with us. We are working with those states to determine if they are good candidates for the study, so we can conduct an analysis like the one for Louisiana. We are beginning to compile and organize data. This initial step will help us determine whether we will be able to include other states' data in our analysis.

How Does This Analysis Help the UST Program?

The real value in this statistically rigorous, objective data evaluation study is that it is providing us with data-based evidence. Reassuringly, Louisiana's evidence supports what we've had a hunch about all along... more frequent inspections equal improved compliance and increased release prevention. The data is confirming to us that, despite continuing declines in our budgets, it is extremely important for us to invest resources—both money and people—to continue performing regular and frequent inspections at least every three years.

I think the results from this analysis are fascinating. And when I have more information and results about this ongoing study, I will share it with you as soon as I am able to do so. ■

USEPA presented information about this study at the September 2015 National Tanks Conference in Phoenix. Access the presentation: *http://www.neiwpcc.org/tanksconference/tanks2015presentations/2-Monday/Improving%20Compliance/sullivan.undergrdcomplinace.monday.pdf*.

OUST Moves from Virginia to D.C.

Effective January 19, 2016, USEPA's Office of Underground Storage Tanks (OUST) will be located in Washington, D.C.: no longer Arlington, Virgina. This means an address change as well as new phone numbers and room numbers. OUST's employee e-mail addresses and website, *www.epa.gov/ust*, remain the same. Go to *www.epa.gov/ust/underground-storage-tank-ust-contacts* for a list of OUST employees, their new phone numbers, and room numbers. OUST's general phone number will be 202-564-0663.

When visiting OUST offices and for overnight or hand-carried deliveries, the new address is:

Office of Underground Storage Tanks
US Environmental Protection Agency
Ronald Reagan Building (RRB)
1300 Pennsylvania Avenue, NW, 7th Floor
Washington, DC 20004

OUST's Mail Code will change to 5401R, but the rest of its mailing address remains the same:

[employee's name]
Office of Underground Storage Tanks
US Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Mail Code 5401R
Washington, DC 20460

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.**

What Will the New UST Rules Bring?

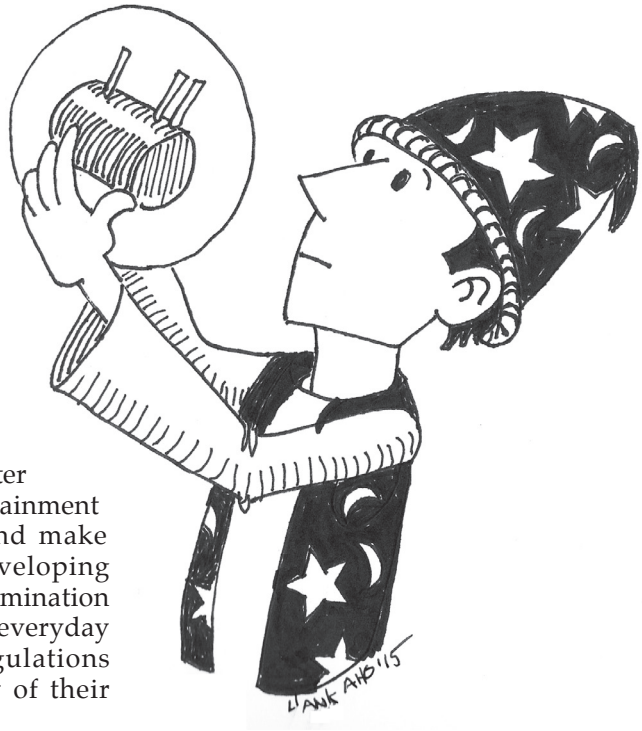
The 1988 UST regulations have had a remarkable run. For over a quarter century they served as an unwavering compass to the UST world. The rules have shepherded the nation's USTs through a remarkable transformation from a "bury it and forget it" mentality, where leaks were a part of doing business, to a time when leak-free storage is a primary concern for many tank owners.

Due, in part, to regulations, we have witnessed a major consolidation of the industry as multitudes of small, low-throughput garages and gas stations fell by the wayside and were replaced by fewer, larger, more efficient convenience stores. The regulations have demonstrated their flexibility by surviving virtually unscathed from a world where people handling wooden gauge sticks in rain, snow, and dark of night were the rule, to a world where a tank manager with a smartphone can see how much fuel is in his tanks in Maine while sunning on the beach in Waikiki.

Although the main body of the 1988 UST rule lives on in the content of the recently published UST rule revisions, there are now new sweaters, scarves, and bling in the UST rule wardrobe. New UST systems will have secondary containment, operators will be trained, and equipment will be routinely inspected and tested. Field-constructed USTs and airport hydrant systems will be fully incorporated into the UST fold, and emergency generators will finally be required to have leak detection.

Change...and Some "Uh-Oh" Moments

By their nature, regulations induce change. They are meant to provide a specific direction to a particular segment of society into the future. So it was in 1988, when the need was to divert the path of the UST world from a continually reoccurring cycle of bare-steel-tank failures and piping leaks into a world where tanks and pipes had much longer leak-free life expectancies. The 1988 rule was designed to implement better hardware for primary containment of petroleum products and make vigilance against any developing leaks and cleanup of contamination a part of the tank owner's everyday world. The 1988 UST regulations have accomplished many of their intended goals.



But as is often the case when such widespread change takes place, new issues arise. To a certain extent the 1988 rule carried forward the "bury it and forget it" mentality to an "install it and forget it" mentality. With the exception of annual testing of line leak detectors and cathodic protection monitoring, the rule took for granted that once new equipment was installed, it would operate flawlessly forever, and knowledgeable people would oversee its operation. As the 1988 rule became widely implemented in the 1990s, a rude awakening occurred in the regulatory community.

It became apparent that someone had to be overseeing the operation of the improved hardware and responding appropriately to information provided by leak detection equipment in order for the full benefits of the equipment to be realized. The new rule makes universal what the Energy Policy Act of 2005 had widely encouraged: upgrading the knowledge level of UST operators. The new rule also formalizes how operators are to manage their UST equipment by describing specific tasks (i.e., walkthrough inspections) that they must periodically complete.

As for the equipment end of things, the intent of the new rule is to be sure that this equipment continues to function over time (i.e., annual inspection of leak detection equipment, tri-annual inspection of overfill equipment, testing of containment sumps and spill buckets).

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That Crystal Ball Again

Rules sometimes lead us down paths that are detours on the road to progress. For example, it is my suspicion that ball-float valves have likely caused more delivery spills than they have prevented in the last quarter century. In any case, the new rule will eventually phase out the use of ball-float valves as overfill-prevention devices.

As I gaze into my crystal ball, I don't see any ball-float-type issues lurking in the recesses of the new rule, but I do see some things that bear watching and some things that may turn out to be less than optimal—at least in the short term. So the following is my take on some of the things that will be happening in the UST world as the changes envisioned in the upgraded UST rule come to pass.

Inspecting Overfill Prevention Will Have Its Pitfalls

I have a feeling that this requirement is going to elicit a great many curses from tank workers.

Let me be clear: I'm all in favor of inspecting overfill-prevention devices for proper installation and operation. I'm only pointing out that this will not be easy (at least the first time through), and there are a number of pitfalls that will need to be avoided.

Many ball floats and flapper valves have been languishing in tanks, undisturbed for many years, perhaps even decades. For these devices, removal will not be an easy task. Corrosion will have virtually welded drop tubes to fill risers. Likewise, the extractor fittings in which ball floats are typically installed will be corroded in place. In addition to curses, removing these devices will require ingenuity and a fair amount of muscle. In many cases, removing these devices will ruin them and replacements will need to be installed.

Those Pesky Ball Floats Will Continue to Cause Problems

If a replacement is called for, ball floats will need to be replaced with flapper valves since ball floats may not be replaced under the new rule. I see the demise of the ball float as a good thing, but there will need to be some education among tank workers about this issue. I see tank workers resorting to two simple solutions when ball floats resist removal: 1) removing only the ball, and 2) leaving the ball float assembly in place.

Why Removing the Ball from the Ball Float Isn't Enough

With the ball float stuck in place, it will be tempting to merely force the ball out of its cage with a gauge stick and leave the pipe portion of the ball float in place. "After all," thinks the tank worker, "with the ball gone, the ball float has effectively been disabled." It is true that with the ball gone the ball float will no longer function as an overfill device. But leaving the pipe portion of the ball float in place may have dire (but not obvious) consequences for the delivery driver.

Let's assume the old ball float (now minus the ball) was correctly installed at the 90 percent level of the tank and the new flapper valve is correctly installed at the 95 percent level. If the pipe portion of the ball float is left in place, the air and fuel vapor in the top 10 percent of the tank will be trapped in the tank once the fuel level rises above the lower end of the ball float pipe. As a result, when a fuel delivery exceeds the 90 percent level, fuel will flow up the pipe portion of the ball float and into the vent line (and the Stage I vapor recovery hose if one is in use) before the flapper valve ever has a chance to stop the delivery.

In this situation, if the tank vent is not manifolded to other tanks, the vent line will fill with fuel until the fuel level in the vent pipe is equal to the level of the fuel in the truck. If a Stage I vapor recovery hose is in use, this hose will be full of fuel as well. And of course, the delivery hose itself will be full of fuel too. The fuel delivery driver will not know what happened. He will be back to the bad old days before overfill prevention with lots of fuel in his hose(s) and nowhere to put it. This will create many opportunities for delivery spills to occur as drivers discover that they have hoses full of product that will not drain.

On the other hand, if there are multiple tanks with vents that are manifolded together, fuel will flow through the vent line into an adjacent tank. If the adjacent tank is a gasoline tank, the facility owner will scratch his head over his inventory records as he finds he is missing fuel in one tank and has excess fuel in another. If the adjacent tank is a diesel tank that used to be a gasoline tank and the diesel vent line has not been isolated from the other tanks, the diesel fuel will be contaminated with gasoline (or vice versa if the diesel tank is the one that is filled beyond the 90 percent level).

None of these scenarios is desirable, and some are downright scary. But I'm sure punching the ball out of the ball float will seem like a very practical solution to the problem posed by inspecting stuck-in-place ball floats to some tank workers.

Why Leaving the Ball Float in Place Is Not a Solution

There are also likely many ball floats still in service that were never installed in extractor fittings and so are inaccessible from grade without excavation. Excavating to find and remove these will be expensive. It will be tempting to leave these ball floats in place and merely install a flapper valve without removing the ball float. This approach creates problems because if the flapper is installed at 95 percent of tank capacity and the ball float is set at 90 percent of tank capacity, the flapper valve will be ineffective. This is because the flapper valve relies on a rapid flow of fuel down the fill pipe to operate properly. If the ball float closes first it will have severely restricted the flow of fuel down the fill pipe and the flapper valve will not close. Because of this, the Petroleum Equipment Institute's PEI RP100-11, *Recommended Practices for Installation of Underground Liquid Storage Systems*, specifies that ball float valves not be used when flapper valves are installed.

An intrepid tank technician, however, may think that this problem can be overcome by having the flapper valve set below the ball float (say at 88 percent) so the flapper valve operates first. While the flapper valve may now operate properly, this situation will confuse delivery drivers who see that a flapper valve is present and expect to be able to

fill the tank to 95 percent. And three years later when a tank technician who is unaware of the presence of the ball float checks the level of the flapper and finds it at 88 percent, he may decide that this is inappropriate and reset the flapper at 95 percent. Now the flapper valve will be ineffective and the ball float will become the overfill device again.

Flapper Valves Have Their Own Issues

Even if ball floats are not present, there will still be issues with the flapper valves. All this removal and reinstallation activity with flapper valves will create many opportunities for improper installation of the devices. A private study of the installation of flappers by a Northeast tank owner found that only about a third of flapper valves were properly installed. Some of the installation errors were attributed to incomplete installation instructions, while others reflected UST component design issues. Unless a substantial effort is made to upgrade the installation instructions for these devices and the tank technicians' understanding of how to properly install them, the verification of operation will have little effect in improving our overfill prevention efforts.

Testing Secondary Containment Could Be an Expensive Aggravation

I have a feeling that secondary containment testing will decrease secondary containment usage.

History has shown that half of secondary containment structures will fail testing (see "What States Should Expect with Secondary Containment Testing," presentation by Laura Fisher of the California Water Resources Control Board, at the National Tanks Conference, September 15, 2015). Some sump leaks will perhaps be easily repaired, but even so, many owners in areas where secondary containment is not required will find the cost and trouble of repeated testing burdensome.

In addition, a great many under-dispenser sumps will have penetration fittings for the piping that will need to be made liquid-tight in order to test the dispenser sump. Access to these fittings in many sumps is very limited because the dispenser blocks access to the sump below. Removing a dispenser in order to conduct a test will be costly and disruptive to fueling operations, creating additional incentives to use an alternative method of leak detection where secondary containment is not required

My sense is that many tank owners, when faced with the trouble and expense of repeated containment-sump testing, will revert to line-leak detection and line-tightness testing as a cheaper and more hassle-free method of leak detection. The secondary containment advocate in me says this is a bad thing, but a more pragmatic part of me says that it is better to have functioning leak detection than to indulge in a fantasy that a storage system is securely contained when in reality the secondary containment would be ineffective in containing and detecting releases.

While the 1988 UST rule focused on installing better equipment, the 2015 rule focuses on implementing behavior changes. Because of the huge number of owners, operators, and workers in the UST world, it will be a challenge to keep these behavior changes moving in the direction of continuous improvement while avoiding counter-productive detours.

Requiring New Tanks to Be Double-Walled May Slow Down Replacement

I have a feeling that the universal mandate for secondary containment will have the effect of slowing down the replacement of existing single-walled systems by increasing the cost of replacing UST systems. California's experience, as discussed by Laura Fisher, has been that 10 percent of its tanks are still single-walled some 30 years after the state mandate that all replacement tanks had to be double-walled went into effect. California has finally set a deadline of December 31, 2025 for the closure of all remaining single-walled tanks. This forced-removal deadline came 40 years after the installation of single-walled tanks was first outlawed.

Walkthrough Inspections May Lead to Check Off Issues

In the new USEPA regulations, monthly walkthrough inspections are pretty straightforward. At most facilities, they will basically involve checking fill openings for issues and ATGs for alarms. However, I suspect some regulators may be tempted to formulate detailed checklists describing a multitude of UST elements for inclusion in the walkthrough inspection. It is my sense that this will lead to widespread "pencil whipping" of the forms, where UST personnel merely check off all the required items from the comfort of their offices rather than actually conducting an inspection.

This is an area where incremental improvement will likely be more effective than attempting to mandate immediate perfection. In Utah's experience it was more productive to create a simple checklist containing only the most important items. The Utah UST program found that its original checklist, although more comprehensive, was viewed as overwhelming, impractical, and too much of a bother to complete by UST operators. Utah regulators concluded that a slimmed down, more operator-friendly checklist had a better chance of being completed, and therefore more likely to be effective in identifying problems. ("UST Operator Inspections – Utah's Experience," presentation by Doug Hansen of the Utah DEQ at the National Tanks Conference, September 15, 2015.)

Bottom Line?

The new federal rule is intended to produce changes in the UST world. While the 1988 UST rule focused on installing better equipment, the 2015 rule focuses on implementing behavior changes. Because of the huge number of owners, operators, and workers in the UST world, it will be a challenge to keep these behavior changes moving in the direction of continuous improvement while avoiding counter-productive detours. As states move forward toward implementation, everyone should keep a wary eye out for developing problems and ways to address them. ■

At Long Last, a Respected Industry Standard for Marinas!

by Ted Unkles

"Ted, we have a problem." My heart sank when I heard those words from one of my inspectors as he returned from a day of field inspections. The inspector went on to tell me how he had inspected USTs at four marinas that day, and while he didn't find any obvious violations of Vermont's UST regulations, each facility had several issues that posed very real dangers that a major spill or leak could go directly into Lake Champlain. "We need to do something in our regs to address these marina systems," the inspector told me.

Like many northern states, Vermont has very cold winters. Lakes freeze over, which means that most marinas remove their docks in the fall and reinstall them each spring. It is perhaps understandable why so many systems have the appearance of being cobbled together, since most docks with dispensers have to be removed and reinstalled seasonally.

But not all docks are removed in the winter. In 1998, a dock that remained in the lake throughout the year, and a gasoline dispenser located at the end of that dock, were severely damaged by large blocks of ice during the springtime ice breakup. The UST, which was buried well upslope of the lakeshore, contained more than 2,000 gallons of gasoline, and when the ice damaged the dispenser nothing was spilled because a solenoid-operated anti-siphon valve was closed.

However, as the marina was preparing to open in the spring, at the end of his workday, a contractor working on another component of the marina inadvertently flipped the circuit breaker that controlled the solenoid valve. Overnight, more than 2,000 gallons of gasoline siphoned into Lake Champlain. Only after that major spill did we learn that the solenoid valve was wired incorrectly. It was supposed to remain closed at all times, except when the dispenser was activated and ready to dispense fuel. Instead, this valve was wired such that (during the operating season) it was only closed at night. As soon as the marina opened for business every morning and the clerk flipped on the circuit breaker, the valve opened and remained open until the marina's evening closing time. The contractor working at the marina had accidentally flipped open that same circuit breaker.

That 1998 fiasco was the worst marina spill we had dealt with but it was certainly not the only incident. When the inspector told me about his concerns (in 2009), we had known for a long time that USTs at marinas were unconventional installations, and we were painfully aware of the very serious environmental threat they posed. But we weren't sure how to address the problem.

And Then There Was PEI's RP 1000

As it happened, in 2009 we were also starting the process of revising our UST rules, so the timing was right to reduce the threat of marina fueling systems. But exactly how to go about it remained a big stumbling block…until that very same year the Petroleum Equipment Institute (PEI) published RP 1000: *Recommended Practices for the Installation of Marina Fueling Systems.* At long last, a respected industry standard had been established for marinas.

RP1000 does not dictate exactly how marina fueling systems should be designed and constructed. Because each marina is different, the publication gives objectives that need to be achieved, and provides examples of how that can be done. The section dealing with gangway piping, for example, says in part:

> *The piping design should also include appropriate valves and fittings to improve safety, provide for leak detection, facilitate maintenance, permit draining and disconnection of piping for seasonal removal of the dock, and/or prepare for a severe storm event. In all cases, the piping should include double-walled construction provided by the manufacturer or field-installed secondary containment approved by the authority having jurisdiction.*

(Before) The gasoline system at this marina was especially alarming. The dispenser on the lakeshore was equipped with a sump, but the plastic was not UV stabilized, and the sump was not completely buried. The rubber hose extending from the bottom of the dock into the water—yes, into the water—is the pressurized line that delivered gasoline to another dispenser at the end of the dock.

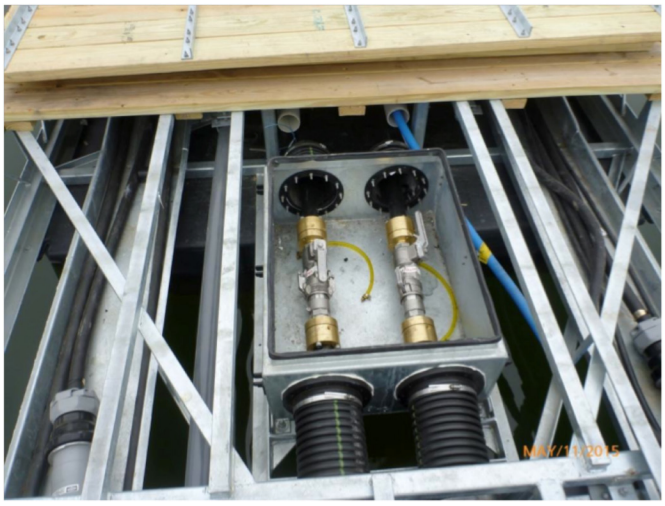
The publication then provides several examples of how these objectives can be accomplished with different dock configurations.

In 2011, Vermont's new UST Rules went into effect, and those rules contained a requirement that any new tank system installed at a marina had to be installed in accordance with the provisions contained within PEI's RP1000, and that all pre-existing tank systems at marinas had to be retrofitted to meet those standards no later than the marina's opening date in the spring of 2014.

Hellooo Marina Owner

We thought that with the new industry standard established, and with the regulatory requirement in place, that marina owners would tighten up their fueling systems, and everything would be good. Naturally, the reality turned out not to be so simple. We received no permit applications, which meant that marina owners were not taking the initiative

(Before) When our inspector pulled the skirt off the dispenser to check the shear valve, he was alarmed to find no containment at all. Any leaks or drips from the inner workings of the dispenser would fall directly into the lake.



(After) The fuel piping is contained within stainless steel sumps wherever the dock is broken into sections.

to modify their systems. It was clear that, we needed to explain the new requirements to marina owners, and Vermont's Environmental Assistance Program played a crucial role in helping the UST program reach the community of marina owners.

By their very nature, marinas operate in very sensitive environmental conditions. Marinas in Vermont (and everywhere else) face many environmental challenges in addition to the UST issue (e.g., storm water runoff, hazardous waste management, wastewater, and huge amounts of plastic shrink wrap used for winterizing boats).

After rebuilding the dock and replacing all the piping, the marina owner installed these cam-lock dry disconnects. The cam locks allow easy assembly and disassembly every spring and fall, and the built-in poppets prevent spillage of any fuel that may remain in the piping.

Fortunately for us, Vermont's Environmental Assistance program already had a voluntary Clean Marina Program whereby assistance personnel worked directly with each marina to implement best management practices in order to minimize environmental degradation. These environmental assistance personnel were very happy to help us reach marina owners in order to reduce the threat their fueling systems posed to the lake.

The Mishmash

Once we had established better lines of communication with the marina industry, things picked up considerably. Marina owners started calling us, needing ideas and suggestions to improve their tank and piping configurations. We quickly realized that in Vermont, there is no such thing as a typical marina. Each facility has a unique setting and dock design, and these factors have a major influence on how fueling systems can best be configured. This meant that we had to spend a lot more time making site visits and reviewing proposed designs and permit applications—but it was time well spent. In almost every case, by working closely with UST contractors and the marina owners, we were able to work out designs for piping and dispensers at the ends of docks that were much more protective of the environment than the previous installation had been, and at a cost the marina owner could afford.

One marina that previously had a very alarming fueling system was sold, and the new owner installed a brand new dock, which was equipped with a state-of-the-art fueling system. (The "before" and "after" photos that accompany this article are all from that one facility.) Previously, the system had a rubber hose that carried gasoline under pressure to an uncontained dispenser—needless to say, it was very vulnerable to impact. Today that same marina has secondarily-contained piping that is protected from impacts, and stainless steel sumps under the dispenser and at all points where different sections of piping are connected.

A Worthwhile Work in Progress

So is everything now perfect with marinas located in Vermont? Of course not. Some marina owners with ample financial resources have been able to completely replace their piping and sumps, while others could afford only modest retrofits. But in every case, the newly modified fueling systems are much more protective of the environment than what had been in place previously. The program is very much a work in progress, as several marina owners still have more work to do. But already, we consider our marina initiative a great success. ■

Ted Unkles is Vermont UST Program Coordinator with the Vermont Department of Environmental Conservation's UST Program. He can be reached at ted.unkles@vermont.gov.

Field Notes

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

PEI Recommended Practices and the New UST Rule

The new underground storage tank (UST) rule issued by USEPA in July 2015 added two relatively new PEI publications to its referenced codes of practice.

USEPA included PEI's *Recommended Practices for the Inspection and Maintenance of UST Systems* (PEI/RP900) as a code of practice that may be used to meet the walkthrough inspection requirement. PEI published the first edition of that recommended practice in 2008 and held off revising the document until after USEPA published its 2015 regulation. Once the regulation was issued, PEI set October 30 as the deadline to receive comments from persons suggesting revisions to the document. In all, nearly 100 comments submitted by 13 people were forwarded to PEI's UST System Inspection & Maintenance Committee for review. The committee will meet early in 2016 to act on the comments. A revised PEI/RP900 should be available during the summer of 2016.

The other PEI publication found by USEPA to be adequate for the periodic testing of spill prevention and leak detection equipment, as well as the inspection of overfill prevention equipment is PEI's *Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment* (PEI/RP1200). First published in 2012, PEI/RP1200 is being revised a full year ahead of PEI's typical five-year review/revision scheme to get the most up-to-date information in the hands of tank owners and state UST regulators before amended regulations are proposed by the states. PEI is accepting public comments to that document through January 29, 2016.

Although not a new document, the Institute's PEI/RP100, *Recommended Practices for Installation of Underground Liquid Storage Systems*, is due for revision in 2016. Updated six times since it was first written in 1986, RP100 is certain to be revised to reflect changes in the 2015 federal UST rule that eliminated the use of flow restrictors (ball float valves) in vent lines as an overfill protection option for new UST system installations, as well as to incorporate other changes to industry installation procedures.

In 1986, PEI's RP100 Fills a Much Needed Function

PEI has been in the "recommended practice" business since 1986 when it published PEI/RP100. What is not widely known—or at least remembered—is that PEI began work on RP100 in 1985 only after USEPA urged us to publish an UST installation document and offered us a grant to do so. From USEPA's perspective, they needed another national trade association besides the American Petroleum Institute (API) to write an installation document. Remember, back in the mid-1980s, API members owned hundreds of thousands of USTs and USEPA believed relying only on an oil industry recommended practice was akin to the "fox guarding the hen house."

And it made sense that PEI should get involved in this manner. PEI members were, after all, regularly engaged in the installation of underground liquid storage systems. It was a process with which our members had developed an intimate understanding. They knew what needed to be done to ensure the installation of systems that would not leak, and which met tested operational and environmental criteria. For a small organization such as PEI to be asked and paid by USEPA to write a recommended practice was a heady experience for the PEI Board of Directors, and they willingly agreed. Since USEPA was going to pay for the recommended practice, PEI consented to provide it free to anyone who requested a copy. Everyone involved considered it a win-win situation.

A PEI Tank Installation Committee was formed and members met nine times during the early years to perfect the document. While the meetings were being held, the Gramm-Rudman-Hollings Act was passed by Congress. That U.S. budget-deficit-reduction measure took away USEPA's ability to provide the promised grant to PEI, and left us with a lot of expenses and few alternatives to pay them. But committee members pressed on at their own expense, and we published PEI/RP100 in 1986 and then again in 1987. And to recoup our expenses, we changed course and charged for the publication.

The rest—as they say—is history. Because USEPA now had two documents (PEI's RP100 and API's 1615) that were in substantial agreement, the agency was comfortable with backing away from a portion of its 1987 proposed regulation that called for tank owners to install tanks and piping in accordance with the manufacturer's instructions plus nine specific USEPA proposed requirements that few in the industry could agree to.

Those requirements and many more were covered in the PEI and API recommended practices and were deleted from the 1988 final rule. The agency deemed them unnecessary and replaced them with more general performance standards that simply required owners and operators to ensure that their UST systems be installed in accordance with nationally accepted codes of practice and the manufacturers' instructions (if any).

Over the following 30 years PEI has published 14 more recommended practices on a variety of topics of interest to the petroleum- and liquid-handling industry. Updated every five years, the industry has grown accustomed to accepting, using, and relying on PEI's documents as fair and consistent standard practices. We were honored and grateful to be of service to the industry in 1986 and remain so today. ■

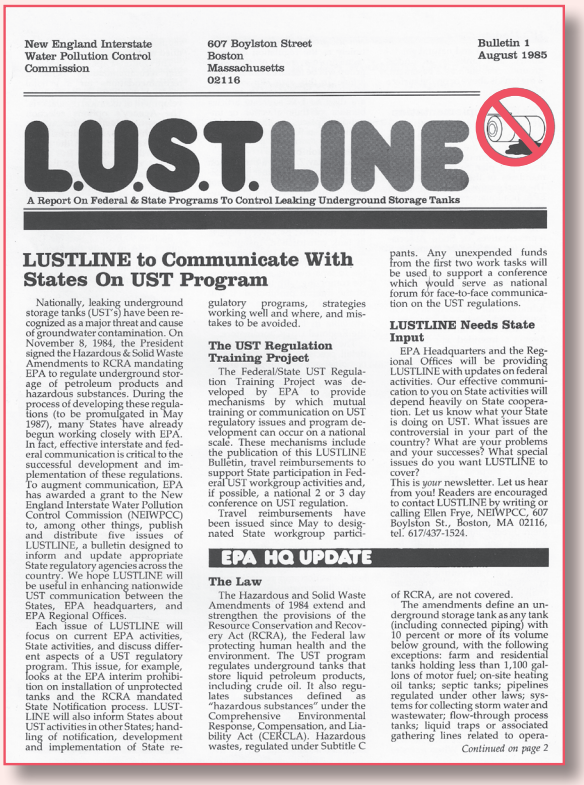
L.U.S.T.LINE: A 30-Year Chronicle

by Ellen Frye

At the plenary session of the recent National Tanks Conference in Phoenix, Arizona, OUST Director Carolyn Hoskinson asked for a show of hands for those who had attended the first such conference—five or six of us raised our hands. In contrast, many hands were raised when she asked if this was their first conference. During the course of the conference I spoke with a number of friends who have been with their state programs from way back and are about to retire; I will likely never have occasion to see them again. Sadly, folks are leaving and the UST/LUST program's institutional memory is thinning out.

The reason I have attended these conferences is because I have been producing LUSTLine*, a publication of the New England Interstate Water Pollution Control Commission (NEIWPCC) and funded by the USEPA OUST, since its inception in 1985. Many of the people I have come to know in the UST/LUST program, are the folks who helped make* LUSTLine *what it is today—a 30-year chronicle of the national UST program, archived in its entirety at neiwpcc.org/lustline.*

The lion's share of articles in LUSTLine *are written by state and (to a lesser extent) federal UST/LUST program personnel…as if they don't have enough to do. Other articles are written by folks with expertise in a particular UST/LUST-related topic. No one is paid. There would be no* LUSTLine *without the caring and generous spirit of these authors. I have been extremely fortunate and want to raise a glass and say: Here's to YOU!*



New England Interstate Water Pollution Control Commission
607 Boylston Street Boston Massachusetts 02116
Bulletin 1 August 1985

L.U.S.T.LINE

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

LUSTLINE to Communicate With States On UST Program

Nationally, leaking underground storage tanks (UST's) have been recognized as a major threat and cause of groundwater contamination. On November 8, 1984, the President signed the Hazardous & Solid Waste Amendments to RCRA mandating EPA to regulate underground storage of petroleum products and hazardous substances. During the process of developing these regulations (to be promulgated in May 1987), many States have already begun working closely with EPA. In fact, effective interstate and federal communication is critical to the successful development and implementation of these regulations. To augment communication, EPA has awarded a grant to the New England Interstate Water Pollution Control Commission (NEIWPCC) to, among other things, publish and distribute five issues of LUSTLINE, a bulletin designed to inform and update appropriate State regulatory agencies across the country. We hope LUSTLINE will be useful in enhancing nationwide UST communication between the States, EPA headquarters, and EPA Regional Offices.

Each issue of LUSTLINE will focus on current EPA activities, State activities, and discuss different aspects of a UST regulatory program. This issue, for example, looks at the EPA interim prohibition on installation of unprotected tanks and the RCRA mandated State Notification process. LUSTLINE will also inform States about UST activities in other States; handling of notification, development and implementation of State regulatory programs, strategies working well and where, and mistakes to be avoided.

The UST Regulation Training Project

The Federal/State UST Regulation Training Project was developed by EPA to provide mechanisms by which mutual training or communication on UST regulatory issues and program development can occur on a national scale. These mechanisms include the publication of this LUSTLINE Bulletin, travel reimbursements to support State participation in Federal UST workgroup activities and, if possible, a national 2 or 3 day conference on UST regulation.

Travel reimbursements have been issued since May to designated State workgroup participants. Any unexpended funds from the first two work tasks will be used to support a conference which would serve as national forum for face-to-face communication on the UST regulations.

LUSTLINE Needs State Input

EPA Headquarters and the Regional Offices will be providing LUSTLINE with updates on federal activities. Our effective communication to you on State activities will depend heavily on State cooperation. Let us know what your State is doing on UST. What issues are controversial in your part of the country? What are your problems and your successes? What special issues do you want LUSTLINE to cover?

This is *your* newsletter. Let us hear from you! Readers are encouraged to contact LUSTLINE by writing or calling Ellen Frye, NEIWPCC, 607 Boylston St., Boston, MA 02116, tel. 617/437-1524.

EPA HQ UPDATE

The Law

The Hazardous and Solid Waste Amendments of 1984 extend and strengthen the provisions of the Resource Conservation and Recovery Act (RCRA), the Federal law protecting human health and the environment. The UST program regulates underground tanks that store liquid petroleum products, including crude oil. It also regulates substances defined as "hazardous substances" under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Hazardous wastes, regulated under Subtitle C of RCRA, are not covered.

The amendments define an underground storage tank as any tank (including connected piping) with 10 percent or more of its volume below ground, with the following exceptions: farm and residential tanks holding less than 1,100 gallons of motor fuel; on-site heating oil tanks; septic tanks; pipelines regulated under other laws; systems for collecting storm water and wastewater; flow-through process tanks; liquid traps or associated gathering lines related to opera-

Continued on page 2

The Topics du Jour

NEIWPCC published its first issue of *LUSTLine* in August 1985. In developing the new federal UST regulations, USEPA saw such a publication as a means to help broadcast UST-related information to state and federal agencies and other relevant parties. The second issue of *LUSTLine*, December 1985, headlined: "EPA Creates OUST."

In perusing the *LUSTLine Index* I was reminded of the many compelling topics that shaped the concerns and discussions of the day. For example, when the 1988 rule came out, besides the fact that most state programs were new to the world of USTs and needed to learn anything they could from USEPA and other knowledgeable entities, regulators needed to know about safely removing these tanks and what to do with them once removed. Early *LUSTLine*s addressed these issues, and then moved on to other unfolding concerns, such as (in no particular order):

financial responsibility/state funds • investigation and remediation • Energy Policy Act • lead scavengers • cleanup backlogs • alternative fuels/oxygenates • ethanol in fuel/compatibility • operator training • tank system installation • enforcement strategies • facility inspections • MtBE • corrosion prevention • home heating oil tanks • operation and maintenance • leak detection issues • sources and causes of releases • microbial contamination in UST systems • USTfields redevelopment • piping issues • spills and overfills • legal issues • new technologies • cleanup cost control • petroleum vapor intrusion • institutional controls • LNAPL recoverability/transmissivity • analytical and sampling methodologies • lender liability • tanks on tribal lands • insurance fraud prevention • risk-based corrective action (RBCA) • groundwater cleanup levels • pay-for-performance • Ultra Low Sulfur Diesel (ULSD) • the 2015 UST Rule (40 CFR part 280) • ghosts at LUST sites …

To name a few.

Now Let Us Praise Our Esteemed Columnists

Over the years, several people have taken on the task of writing their own *LUSTLine* columns, addressing a variety of issues associated with their knowledge and experience in areas such as leak prevention, LUST investigation and remediation, financial responsibility/insurance, and abandoned LUST sites. USEPA OUST Director Carolyn Hoskinson promptly took up the pen for the From the Director column started by her predecessor, Cliff Rothenstein, in 2004.

■ *continued on page 24*

■ L.U.S.T.Line: A 30-Year Chronicle *from page 23*

One of our most recent columns is THINK: A Thoughtful Column Engineered by Mahesh Albuquerque. Mahesh is Director of the Colorado Division of Oil and Public Safety. As stated in the introduction to his column: "My hope is that this column will help stimulate readers to 'think outside the tank,' to ponder why we do what we do, and to consider and share creative ways to improve our effectiveness—as we strive toward environmental protection." Mahesh does this by either writing the column or a inviting guest author to do so.

Mahesh filled a void when Gary Lynn (New Hampshire Department of Environmental Services) had to drop his Cleanup Corner column to assume the position of Administrator of the Department of Environmental Service's MtBE Remediation Bureau, administering the state's MtBE court settlement funds. In a future *LUSTLine* he will let us know what is happening on that front.

The WanderLUST column, created to explore LUST issues, was the brainchild of USEPA OUST's Hal White. He began writing the column in 2001. Patricia Ellis of the Delaware Department of Natural Resources and Environmental Control later picked it up. She was a member of the Blue Ribbon Panel on Oxygenates in Gasoline, the Interstate Technical and Regulatory Council (ITRC), and other national committees. Her columns were quirky, humorous, and packed with depth and substance. Her passing in 2013 was for me, the loss of a good friend, for the LUST program, the loss of a key player, and of course, for *LUSTLine*, the loss of a highly valued contributor.

Thankfully, WanderLUST is now in the hands of another team player, Jeff Kuhn of the Montana Department of Environmental Quality. He also serves on the ITRC board and has led numerous technical task forces and work groups. Jeff leads readers into a world of thoughtful discourse in and about the LUST remediation terrain.

For many years, various people provided articles related to financial responsibility and state insurance funds, but by 2012, I felt *LUSTLine* could use a column owned by someone who was really current on that track. Jill Williams Hall stepped up to that plate with a column called Unlocking the Mystery of FR.

Lest we forget, we had Tanks Downeast, written by David McCaskill of Maine DEP, which ran for several years. Maine was one of the earlier states to get its tanks program off the ground, and David's musings on some of those experiences and lessons learned, including those about home heating oil tanks, were rich. You'd never know he was originally from Mississippi until he opened his mouth.

In 2004, I was approached by Curt Johnson (Alabama DEM), Chairman of the National Work Group on Leak Detection Evaluation (NWGLDE), with an offer to write a regular column consisting of short articles explaining various leak detection concepts and issues associated with leak detection evaluation. This volunteer work group is made up of state and federal UST program personnel. Their column, FAQs from the NWGLDE, has turned out to be a great resource for both state regulatory programs and leak detection equipment vendors. See the LL #74, June 2014, issue when the group celebrated its 20th anniversary. The column provides a short history of the group's beginnings and a list of its past and present members. In upcoming *LUSTLines*, the group will address their work vis-a-vis the new UST rule.

Okay, I haven't forgotten *LUSTLine's* two longest-running columns—"TANK-nically Speaking" by Marcel Moreau and "Field Notes" from Robert N. Renkes—so read on.

TANK-nically Speaking

I first met Marcel Moreau while he was still with Maine DEP's tanks program; he had been documenting and investigating UST problems since 1983. He was the "go-to" expert back then when I was working at NEIWPCC and preparing a brochure and slide/tape show called "Here Lies the Problem." NEIWPCC's information outreach efforts coupled with regular meetings during which the New England states and New York shared their UST/LUST information eventually prompted USEPA to pitch the idea of developing a bulletin on tank developments—that bulletin became *LUSTLine*.

Marcel knew a lot about the tank issues then and never stopped learning. The second issue of *LUSTLine* (December 1985) included a short piece titled "Maine Geologist wins European UST Study Award." He had received a German Marshall Fund of the United States fellowship to study European approaches to the leaking underground storage tank problem. By the third issue of *LUSTLine* he had written an article titled "LUST in Germany."

Marcel left Maine DEP at the end of 1986 and after a stint with an environmental engineering firm, started a consulting business, Marcel Moreau Associates. He also began writing articles for *LUSTLine* as well as reviewing articles by other authors…an invaluable means for ensuring the integrity of the information we published. (For many years Pat Ellis performed the same function

LUSTLine Bulletin 50 • August 2005

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

I've Looked at Tanks from Both Sides Now

Some years ago, I was speaking about UST inspections at an UST conference to a roomful of several hundred tank owners and operators (O/Os). To try to warm up the audience, I was foolhardy enough to ask for a show of hands of those who thought that regulatory inspections were a useful thing. I was soon gazing at a roomful of the stoniest faces I have ever seen from a podium. The chill in the air was palpable.

Sensing I had perhaps succeeded in creating an instant iceberg where I had hoped to break some ice, I said with somewhat of a gulp, "Nobody, huh?" Fortunately, I was rescued by one brave soul who finally raised his hand and said, "I think inspections are great. They let me know what I'm doing right or wrong, and I know that they help keep my competition honest too." I thanked the man and, with not much enthusiasm, launched into my talk.

That day, I became painfully aware of the depth of my misunderstanding of my O/O audience. Since then, I've recognized the importance of trying to see things from both sides of the table.

So when John Cochran (New Mexico Environment Department UST Program) called to see if I wanted to talk about inspections at this year's UST/LUST National Conference in Seattle, we began to brainstorm about creating an opportunity for inspectors and O/Os to share their views about inspections, and for each side to try their hand at guessing what the other side would say.

effort to determine how representative they were of the inspector or O/O general populations. This was not intended to be a statistical study, but rather a vehicle for fostering discussion.

We gave the panel some basic questions to think about ahead of time, but we didn't really know what they were going to say. During the session, we asked three questions:

- What is the purpose of an UST compliance inspection?
- What are the benefits of an UST compliance inspection?
- What are the problems with UST compliance inspections?

…lists were asked to answer …swering their …and presented to the group via a computer projector. The answers we received are summarized in the tables that accompany this article. My thoughts upon reviewing the answers are as follows.

What Is the Purpose of an UST Compliance Inspection?

Speaking from their respective points of view, inspectors and O/Os agreed on many of the purposes of an inspection. Noticeably lacking from the O/O perspective was protection of human health and the environment (although this thought did show up as a compliance inspection benefit when O/Os were speaking as inspectors). A key concern of O/Os that came out in these answers, even

for LUST-related articles.) By Bulletin #13 it occurred to me to offer Marcel a full-fledged column which we called TANK-nically Speaking. It stands as a significant body of work.

While much has changed in the UST/LUST world, I feel it is important to note that Marcel's columns remain timely, valid, and informative. He is a born teacher. Over time, where technologies may have changed, Marcel's columns have addressed them and explained them. But the basics of science and technology remain intact. Hey, check out Marcel's latest column on page 17 of this issue.

Field Notes

The Petroleum Equipment Institute (PEI) has been a pivotal player in the evolution of the UST regulatory program. PEI's Executive Vice President, Robert Renkes, recalls that partnership in his Field Notes column on page 22. His columns became a *LUSTLine* staple beginning with issue #10 in February 1989. In that first little column Bob reminded us of how important information outreach is "not only to tank owners, but also to the consultants, contractors, and testers who seek to provide services to the regulated community."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March
2004

L.U.S.T.LINE

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

FINISHING STRONG

A Glance Back, A Look Forward at the UST/LUST Program

by Robert Renkes

I run marathons to stay in shape. Marathons are 26.2 miles long and, for most runners, the last 6.2 miles (or 10 kilometers for you metric fans) means you're close but also that the toughest part is yet to come. In fact, many runners consider the marathon two races in one: the first 20 miles and the last 10-K. That's because during the last 10-K, you're exerting the most effort. Your legs are complaining, your body has run out of glycogen, and your head feels like a typical day in Seattle (i.e., cloudy). Some call it [illegible] others

UST 20 LUST

20 YEARS

Inside

Celebrating 20 Years

More Flux to Improve Cleanup Decisions

Since President Reagan signed the Solid Waste Disposal Act of 1984 into law, creating the federal underground storage tanks program, Bob Renkes' antennae have been fully fixed on the ins, outs, ups, and downs of the UST system world. Besides keeping readers up-to-date on the comings and goings of PEI Recommended Practices, he often raises a red flag early on about issues we may need to be aware of, such as potential problems with Ultra Low Sulfur Diesel.

Bob wrote the cover article for the *LUSTLine* #46, March 2004 issue, recognizing the 20-year anniversary of the federal UST/LUST program. The title of the article is "Finishing Strong—A Glance Back, A Look Forward at the UST/LUST Program." Read that article now and see how "right on" he was. Under the subhead "Change the Rules, or It Won't Happen," he wrote:

> *If you have a problem with something and your rules don't require doing anything about it, change the rules and require it. Otherwise it won't get done. That goes for secondary containment, licensing of contractors, leak-detection standards, equipment-testing schedules, spill-containment buckets, dispenser pans, and other similar issues.*

How prescient! Thanks Bob.

30 Whole Years?

Yes, 30 whole years, with a lot of help from my friends. I will not name every single person who contributed to this publication over 30 years, but I really need to mention the names of some authors who did not have columns but over the years wrote a number of articles, including:

Carol Eighmey, Executive Director, Missouri Petroleum Storage Tank Insurance fund; Kevin Henderson, formerly Mississippi DEQ, now Kevin Henderson Consulting, llc; Ben Thomas, formerly Alaska DEC, now in the UST Training business; Jim Weaver, USEPA Office of Research and Development; John Wilson, formerly USEPA R.S. Kerr Environmental Research Center, now Scissortail Environmental Solutions, llc; Patrick Rounds, R&A Risk Professionals; Tom Schruben and Bob Cohen, American Cost Recovery Management, llc; Blayne Hartman, Hartman Environmental Services; Marshall Mott-Smith, formerly Florida DEP, now Mott-Smith Consulting Group.

Once again, I and NEIWPCC extend our heartfelt thanks to all who have helped give life to *LUSTLine*. And, hey, thanks to you our readers. Don't forget, if you have a story that might grab hold of our readers or if you have comments on any of our articles, please let us know at: *lustline@nweiwpcc.org*.

Tanks a bunch,
Ellen

That Oh So *LUSTLine* Look

Hank Aho (left), LUSTLine *cartoonist, has provided a boatload of endearing characters over the years. Ricki Pappo (right) has worked her design and layout magic to each issue, lending accessibility to an otherwise not-ready-for-prime-time subject.*

Two New Documents from ASTSWMO

The Association of State and Territorial Waste Management Officials (ASTSWMO) has released the following two new UST-Related Documents:

Compatibility Considerations for UST Systems

The Emerging Fuels Task Force developed this report as an update and replacement to the 2013 ASTSWMO Alternative Fuels Workgroup's *Compatibility of UST Systems with Biofuels* report. This document serves as a resource for state and territorial UST program staff, UST owners and operators, equipment manufacturers, and contractors and consultants for the evaluation of equipment compatibility pursuant with USEPA's compatibility requirement (40 CFR 280.32) specifically when storing motor fuels. The document includes information on product and operational compatibility, properties of biofuel blends, and considerations for the storage of biofuel blends. Also included are several policy and technical resources, a template for creating a compatibility evaluation checklist for state programs, and a compilation of case summaries from several states.

An Analysis of UST System Infrastructure in Select States

In 2014, ASTSWMO formed the Aging Tanks Workgroup to examine issues related to aging UST systems and the potential impacts to owners, operators, and state UST programs. The workgroup's objective was to analyze whether aging UST infrastructure poses a higher risk of leaks, thus creating higher risks for state tank funds and private insurers and, ultimately, higher costs for tank owners/operators. The final report includes an analysis of UST system data from eight participating states as well as information on potential risk factors of fuel leaks, state policies and initiatives for mitigating risks of aging tanks, and state fund and financial insurance considerations.

These documents can be accessed at: *www.astswmo.org*. ■

New Targets for Biofuel Use

USEPA has finalized targets for biofuel use for 2014–2016, raising the controversial Renewable Fuel Standard (RFS) for total renewable fuel to 18.11 billion gallons in 2016, an increase over what was originally proposed in May but far short of the 22.25 billion gallons envisioned by the 2007 statute. The final figure includes 14.5 billion gallons of undifferentiated biofuels (corn ethanol) and 3.61 billion gallons of advanced biofuel. In addition, the rule sets the 2016 biodiesel volume at 1.9 billion gallons and the 2016 cellulosic ethanol level at 230 million gallons. USEPA said it formulated this policy based on more than 670,000 comments from the public.

The Agency has been walking a tightrope between the demands of the ethanol producers, who have generally supported the requirements of the 2007 statute passed by Congress, and the petroleum and refining industries, which maintain that practical obstacles prevent them from blending ever-increasing volumes of biofuels with petroleum fuels. For instance, refiners have argued that blending biofuels in concentrations greater than 10 percent is unsafe because it can damage car engines and the infrastructure that transports, stores, and dispenses the blended fuel.

The finalized rule is likely to trigger a wave of lawsuits from oil companies, ethanol producers, and environmentalists that have lobbied on both sides of the controversial policy. Industry analysts expect that any court challenge will prolong and aggravate the uncertainty concerning the country's biofuel program. ■

And the 2015 Tanks Conference Poster Session Awards Go to...

Henry Haven (left), Navajo EPA, epitomizes the kind of scientific leadership that moves the LUST program forward at the tribal level. He has been working to create Navajo Nation-specific cleanup levels that incorporate Navajo cultural values, experimenting with various remedial methods to enhance bioremediation (in collaboration with local professors).

Matthew Lahvis (right) manages the Soil and Groundwater R&D Program for Shell Global Solutions. He focuses on vapor intrusion and did a lot of the early work on biodegradation of petroleum vapors in the unsaturated zone. He developed some of the key ideas USEPA uses to communicate the fundamental processes in vapor intrusion to the regulatory community.

Hal White, Ph.D, (not shown), USEPA OUST, led the effort to produce the *Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites* EPA 510-R-15-001. He collated input and recommendations from experts with USEPA, state agencies, the regulated community, and environmental consultants. He produced most of the text in the working drafts. He made the USEPA Guide for PVI a reality. ■

■ LNAPL Recovery *from page 14*

seems to provide a good conclusion to this article:

> *Logically the real question we should be asking is not whether a certain LNAPL recovery rate can be achieved for a given Tn, but rather, is that recovery in any way useful in protecting the environment or restoring aquifers to beneficial uses? Where yes, it is one potential tool, where no, it should be abandoned for other more appropriate management methods.*[9] ■

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1 40 CFR Section 280.64.

2. USEPA – "The National LUST Cleanup Backlog," EPA 510-R-11-003, pg .6.

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   - Evaluating Natural Source Zone Depletion at Sites with LNAPL, (LNAPL-1), April 2009.
   - Evaluating LNAPL Remedial Technologies for Achieving Project Goals (LNAPL-2), December 2009.

4. American Petroleum Institute, LNAPL Resource Center, *http://www.api.org/lnapl*.

5. ASTM E2856, Standard Guide for Estimation of LNAPL Transmissivity, 2011.

6. Suthan Suthersan et al., "The New ROI: Return on Investigations by Utilizing Smart Characterization Methods," *Groundwater Monitoring and Remediation*. 35, no. 1, Winter 2015.

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8. ASTSWMO 2015 LNAPL Survey (17 states responding).

9. G.D. Beckett and David Huntley, "LNAPL Transmissivity: A Twisted Parameter," *Groundwater Monitoring and Remediation*, Summer 2015.

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USEPA Releases Two New 2015 UST Documents

EPA's Office of Underground Storage Tanks (OUST) has released electronic versions of two new documents associated with the Agency's recently revised underground storage tank (UST) regulations.

MUSTs for USTs provides the reader with a broad understanding of the recent changes made to the UST regulations, as well as some useful tips to ensure compliance with these requirements. Be aware that this publication, available in draft version since July, has changed since its initial release.

UST System Compatibility with Biofuels provides a detailed overview explaining the 2015 compatibility requirements contained in the federal regulation.

Three additional documents are in the process of being prepared by OUST to help the regulated community better understand the new UST rule: *O&M, Straight Talk on Tanks,* and *Field Constructed Tanks/Airport Hydrant Systems*. OUST will let you know when those documents become available. ■

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NEW L.U.S.T.Line Index

August 1985/Bulletin #1 – December 2015/Bulletin #79

Download the Index at www.neiwpcc.org/lustline/ then click on LUSTLine Index.

Oops!

For those of you who receive paper versions of *LUSTLine*, we want to bring to your attention an "oops" in Jeff White's (Iowa DNR) article "Getting to That High-Hanging Fruit" beginning on page 13. The story is about building consensus through corrective conferences; however, toward the end of the article, page 14, column 3, a 7 went missing where the sentence states "In over ten years, 9 percent of the conferences have been successful." That is NOT success! It should say: "97 percent of the conferences have been successful." That IS success. The error was corrected in the online version. ■

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Lest We Forget Ms Frye!

For all of its 30 years and 79 issues, Ellen Frye has been the unassuming captain of the *LUSTLine* ship. She has continuously scanned the horizon for emerging issues, traveled many a weary mile to national tank conferences, and relentlessly polled her many contacts in the UST world to identify topics that are important to the UST community. She has unfailingly found willing (or sometimes mildly unwilling) knowledgeable people to write about these issues, coaxing and coaching her volunteers through the writing process. She has carefully edited submitted articles with an eye toward clarity and accuracy, yet still managing to let the author's style and voice come through. Ellen is without doubt the glue that holds *LUSTLine* together. That *LUSTLine's* history extends across three decades is a tribute to Ellen's dedication and her success in making *LUSTLine* both the institutional memory of the OUST program and a forward-looking searchlight into the UST world.

Thank you Ellen,
Carolyn H., Bob R., and Marcel M.