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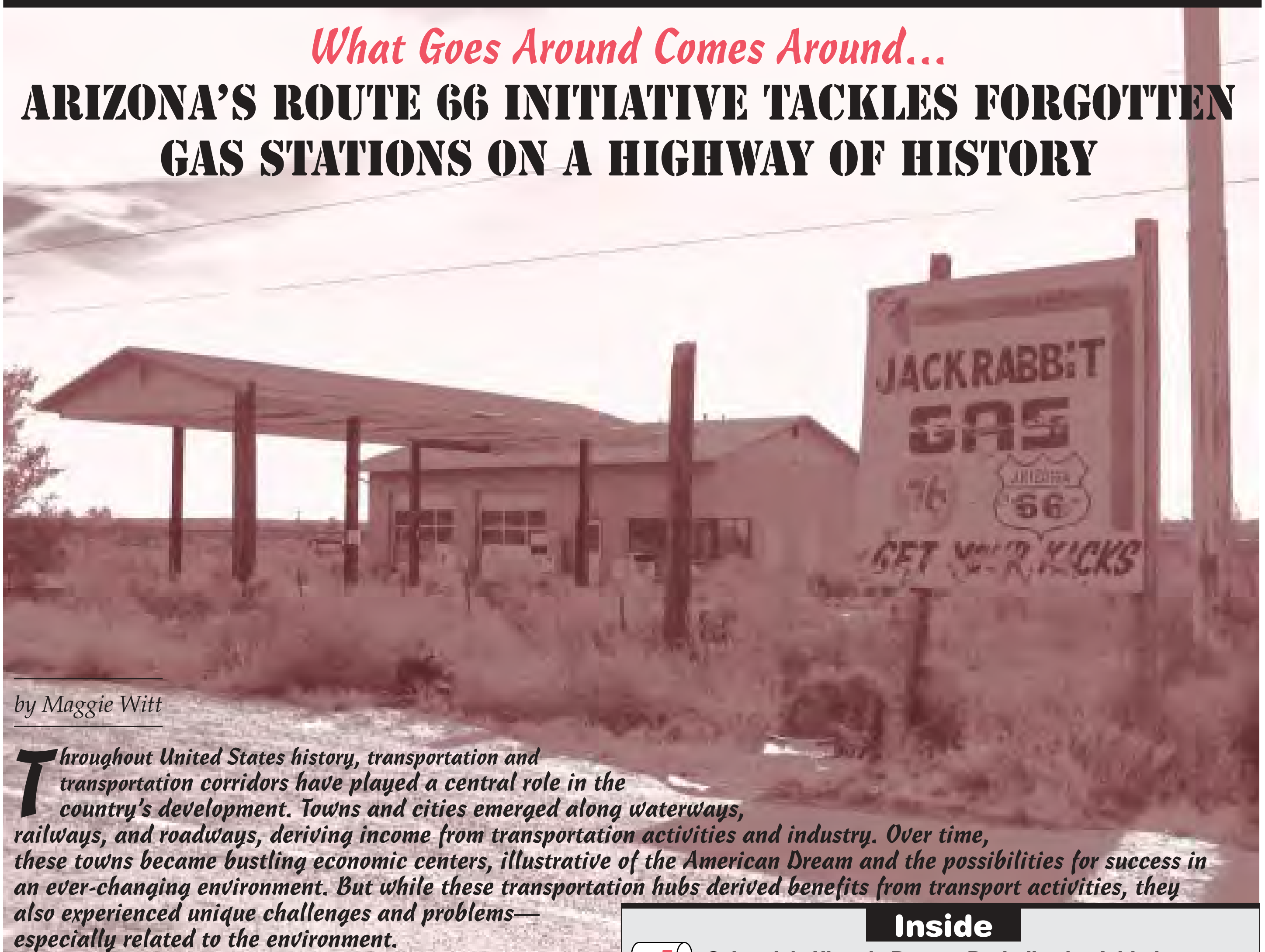
L.U.S.T.LINE

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



What Goes Around Comes Around...

ARIZONA'S ROUTE 66 INITIATIVE TACKLES FORGOTTEN GAS STATIONS ON A HIGHWAY OF HISTORY

by Maggie Witt

Throughout United States history, transportation and transportation corridors have played a central role in the country's development. Towns and cities emerged along waterways, railways, and roadways, deriving income from transportation activities and industry. Over time, these towns became bustling economic centers, illustrative of the American Dream and the possibilities for success in an ever-changing environment. But while these transportation hubs derived benefits from transport activities, they also experienced unique challenges and problems—especially related to the environment.

Transportation Corridors and the Environment

Many of these environmental challenges stemmed from contamination generated by USTs. When considering some of the country's most famous highways and byways and the number of gas stations that line these routes, the prevalence of LUST contamination is not surprising. This contamination or potential contamination has resulted in protracted cleanups and brownfields—defined by U.S.

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Inside

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EPA as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

Recently, U.S. EPA, states, and local governments have initiated new programs to address LUST contamination and petroleum brownfields. These programs have helped many communities along major transportation corridors assess and cleanup contaminated properties. Additionally, many of these programs are now looking at ways to propel the effort to the next level—exploring opportunities for brownfields redevelopment at cleaned-up properties. Take, for example, Route 66…

Remember Route 66?

Route 66 is one of the most famous and recognizable historic transportation corridors in the United States. For over four decades, Route 66 operated as the country's main east-west artery, connecting Chicago and Los Angeles and everything in between with over 2,400 miles of continuously paved roadway. Like other communities along major waterways, railways, and highways, cities and towns along Route 66 reaped the benefits of the highway and thrived. Motels and diners sprang up to cater to travelers. Gas stations became the new icon for America's transition to an increasingly mobile society. With the growing number of cars and trucks on the road, some Route 66 towns sported gas stations and fuel pumps on virtually every corner.

But by the 1950s, rapidly changing transportation needs in the country foreshadowed the demise of Route 66. Influenced by the speed and safety of four-lane highways in Europe, President Eisenhower's administration promoted federal sponsorship of a nationwide interstate system. Congress responded with the Federal Highway Act in 1956. Within 14 years, nearly all segments of Route 66 were bypassed by modern, divided highways. In 1986, Route 66 was officially decommissioned. Though parts of it are no longer drivable, 85 percent of the highway is still used by tourists and local traffic. The downtowns of many small cities and towns are still located on the historic route.

As traffic moved to new and neighboring interstates, communities along Route 66 experienced economic and environmental hardships. With fewer travelers, many businesses closed down, leaving behind neglected, abandoned properties. Abandoned gas stations were especially problematic, largely due to the buried bare-steel tanks and the fuel that remained in them. In many cases, these tanks corroded and leaked their contents into the soil and groundwater.

Today, LUSTs left over from Route 66's heyday continue to cause problems. The bypassed communities are struggling as it is and do not have the necessary funds to cover the cost of environmental assessment and cleanup. The result? Brownfields and abandoned properties that blight communities and pose potential environmental and health hazards.

Arizona's Route 66 Initiative

Arizona contains over 200 miles of original Route 66 roadway. Along this stretch of highway, approximately 350 LUST sites have been reported. To address contamination in small and economically challenged Route 66 communities, some states have developed programs and assembled applicable state resources. In Arizona, the Department of Environmental Quality (ADEQ) has allocated resources for a program called the Route 66 Initiative.

ADEQ launched the program in 2004 to help with assessment and cleanup efforts at LUST sites located along the historic highway. Since the inception of the Initiative, ADEQ has assisted UST owners, operators, and property owners in completing site investigations, initiating cleanup efforts when necessary, and closing LUST sites. ADEQ has also performed LUST assessments and cleanups through the State Lead Program, which addresses situations in which UST owners or operators are unknown or unable to perform the necessary cleanup activities. Through its Brownfields State Response Grant (SRG) Program, ADEQ has also highlighted the availability of SRG funding to assist with the economic development and revitalization of eligible sites along the Route 66 corridor.

Prior to ADEQ's Route 66 Initiative, 250, or 70 percent, of these LUST sites had been successfully closed, with cleanup either completed or not needed. After two years of the implementation of the Route 66 Initiative, 77 sites currently remain open—22 fewer than when the Initiative was launched. Many of these remaining sites pose unique challenges due to site-specific issues, including hydrogeologic conditions.

About half of these sites are located in three small towns in northeastern Arizona—Winslow, Holbrook, and Joseph City, all of which reside in Navajo County. Through the Route 66 Initiative, ADEQ has been focusing special attention on these three towns and working closely with LUST site owners, consultants, and the communities to move LUST sites into the cleanup phase and eventual closure. To facilitate close working relationships,

Cover photo courtesy of Maggie Witt

L.U.S.T.Line

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ADEQ assigns project case managers to each of these towns, and ADEQ's rural representative, based in St. Johns, Arizona, frequently meets with stakeholders, local officials, and other interested parties.

Opportunities and Barriers to Cleanup and Redevelopment in Arizona

While over three decades have passed since Interstate 40 bypassed Route 66 in Arizona, the towns of Winslow, Holbrook, and Joseph City continue to face economic challenges initiated by the shift from the highway to the interstate. Based on 2000 Census data, Winslow, Holbrook, and Navajo County (which includes Joseph City) exhibit lower median household incomes, lower per capita incomes, and higher rates of unemployment and poverty than the national average.

ADEQ's Route 66 Initiative has helped to relieve the burden of addressing and improving environmental conditions in these communities. Because ADEQ's Route 66 Initiative provides assistance for assessments and cleanup at LUST sites, property owners and municipalities are no longer left with the full responsibility for expensive cleanups. However, due to unfavorable economic circumstances, barriers to redevelopment at closed LUST sites and abandoned tank sites remain.

The Route 66 Partnership

Images of idle and unproductive gas stations in Winslow, Holbrook, and Joseph City have spurred questions about the barriers to redevelopment and ways to overcome these barriers. In October 2005, ADEQ and U.S. EPA partnered to explore the answers to these questions and examine redevelopment opportunities at former LUST and abandoned tank sites.

The collaboration—called the Route 66 Partnership—also aims to link ADEQ's work to U.S. EPA's past efforts to revitalize petroleum-contaminated sites. In 2000, EPA's Office of Underground Storage Tanks created the USTfields Initiative to promote revitalization at LUST sites and gas stations. The success of the USTfields Initiative contributed to provisions in the 2002 Brownfields Law that designated EPA Brownfields grant money for petroleum-contaminated sites. The USTfields pilots also generated examples of successful gas station redevelopment projects that petroleum brownfields grant projects have since emulated.

The goal of the Route 66 Partnership is to combine the success of ADEQ's ongoing Route 66 Initiative with lessons learned from the USTfields Initiative and subsequent petroleum brownfields projects to identify solutions that can be implemented in Arizona and elsewhere. To achieve its objective, the Route 66 Partnership combines research, stakeholder interaction, and partnerships to explore viable opportunities for community revitalization. For this initial project partnership, ADEQ and U.S. EPA chose to focus on the same communities on ADEQ's Route 66 Initiative agenda—Winslow, Holbrook, and Joseph City.

The goal of the Route 66 Partnership is to combine the success of ADEQ's ongoing Route 66 Initiative with lessons learned from the USTfields Initiative and subsequent petroleum brownfields projects to identify solutions that can be implemented in Arizona and elsewhere.

LUST sites and abandoned gas stations located on this portion of Route 66 come in a variety of shapes, sizes, ages, and conditions. Realizing this, ADEQ and U.S. EPA have acknowledged that plans for community revitalization must take Route 66's heritage and historic significance into consideration. For this reason, the Partnership also includes local and national historic preservation programs, ensuring that historic sites and gas stations will be preserved whenever possible. Additionally, the National Park Service Route 66 Corridor Preservation Program—a program dedicated to preserving and protecting the things that make Route 66 special—has been a key player in the Partnership since October 2005.

Since the beginning of the Partnership, ADEQ and U.S. EPA have also acknowledged the importance of local buy-in and involvement. For the effort to be successful, action and execution must occur at the level of government that encompasses each site. To make sure that the goals of the project align with local goals and interests, ADEQ and U.S. EPA have also formed partnerships with Winslow, Holbrook, and Navajo County. Fortunately, local government agendas include plans to prioritize redevelopment as a means to achieve community beautification and economic development.

Recent projects in both Holbrook and Winslow reflect redevelopment plans and goals. The City of Holbrook recently launched a project to restore and preserve its historic downtown district with money from the State Heritage Fund Grant. This grant is made possible by $20 million in Arizona Lottery revenues set aside annually for parks, trails, and natural areas, historic preservation, and a full range of wildlife conservation activities.

Winslow also recently initiated the Renaissance Downtown Redevelopment. Mayor Allan Affeldt, elected in 2005, has used his past experience in historical renovation and redevelopment to propel the project. Prior to his mayoral run, Allan purchased and renovated the historic La Posada Hotel, originally constructed in 1929 as one of Fred Harvey's famous Harvey Houses.

Resources and Partnership Opportunities

In spite of these local projects and initiatives, however, the economic atmosphere in Winslow, Holbrook, and Joseph City continues to generate obstacles to redevelopment. How will these communities fund revitalization and make redevelopment projects at LUST sites and abandoned gas stations attractive to redevelopers and investors? Furthermore, with few resources in terms of both money and manpower at the local level, how will these governments track down assistance from outside sources?

Partnerships—like the Route 66 Partnership—can provide viable solutions. By working with other

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organizations and agencies, these communities can take advantage of a wide array of available resources—both technical and financial. In the first few months of the Route 66 Partnership, ADEQ, U.S. EPA, and local governments worked together to identify potential partners for the cleanup and redevelopment effort. Initial research revealed that a wide spectrum of state, federal, and local agencies and organizations implement programs and offer tools and resources that can be utilized for redevelopment projects.

To bring these potential partners together to discuss applicable programs and to "kick off" the Route 66 Partnership, ADEQ, U.S. EPA's Pacific Southwest Regional Office, and local government agencies held a two-day meeting on January 26 and 27, 2006, in Winslow and Holbrook. More than 60 people attended the meeting, including representatives from approximately 20 agencies and organizations, local press, private industry, business owners, bankers, community members, and UST and LUST site owners.

At the meeting, participants learned about various programs, agencies, and organizations that offer financial and/or technical assistance for potential redevelopment projects. Additionally, speakers from Washington, D.C., Texas, and Washington State discussed success stories from other parts of the country. Overall, presentations, breakout discussions, and Q &As helped the group grasp a better understanding of their respective challenges, options, and possible next steps for cleanup and redevelopment. By assembling the various stakeholders at the outset of the Partnership, key players were able to meet face-to-face and establish allies that they can comfortably turn to in the future.

Next Steps

Since the Route 66 kick-off meeting, ADEQ, U.S. EPA, local governments, and Route 66 Partners have collaborated to take the next steps on the road to successful redevelopment. Armed with the information presented at the meeting and with new networks in the state agencies, Winslow and Holbrook have taken the initiative to explore available tools and resources. In March, the City of Holbrook secured a grant from the Arizona Department of Commerce to conduct a business inventory along Route 66. The inventory is intended to attract new business and incorporates a list of sites available for reuse, including cleaned-up LUST sites.

In June, ADEQ announced the award of $96,000 in State Response Grant funds to help pay for cleanup at the "Standin' on the Corner" monument in Winslow. Access to the monument has been restricted since a fire destroyed the adjacent building in October 2004. Concerns about asbestos and other hazardous substances in the debris have complicated cleanup and led to the implementation of access restrictions. These SRG funds will allow Winslow to proceed with the cleanup so that the site can be restored and tourists and visitors can once again visit the famous Route 66 landmark.

In the future, key players in the Route 66 Partnership will continue to lay the foundation for redevelopment at LUST sites and abandoned gas stations along the historic highway. Tools like EPA Brownfields Grants and others resources highlighted at the Route 66 kick-off meeting present clear opportunities to utilize federal and state funding. Additionally, stories of successful redevelopment at abandoned gas stations and LUST sites around the country provide examples and lessons learned that can be applied in Arizona and beyond.

Since the Route 66 Partnership's inception, several states and other U.S. EPA Regions have considered opportunities for similar projects to address petroleum contamination at LUST sites and abandoned gas stations. Even non–Route 66 states have begun to craft initiatives to help communities located along transportation corridors—whether they are highways or railways—identify environmental challenges and develop solutions. Those involved in the Route 66 Partnership hope to both provide lessons learned and draw from lessons learned elsewhere to facilitate successful redevelopment projects. ■

Photo courtesy of Steve Linder

Vestiges of the good old days on Route 66, Arizona

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Colorado Embarks on a Brownfields Historic Byways Revitalization Initiative

by Marilyn Hajicek

The Colorado Division of Oil and Public Safety (OPS) Petroleum Storage Tank Program is partnering with the Colorado Department of Public Health & Environment (CDPHE) Voluntary Cleanup Program and the Colorado Brownfields Foundation (CBF) on the Colorado Brownfields Historic Byways Revitalization Initiative. The Initiative is a statewide partnership intended to provide recreational, educational, and economic benefits to Coloradans and visitors.

Heritage travelers make up a healthy share of Colorado's visitors and represent some of the most important tourist traffic. By spending money in localities off the beaten track, heritage travelers help spread economic benefits throughout rural areas.

Heritage-area development initiatives not only build an atmosphere of creativity and cooperation, they promote the evolution of major economic development assets, especially in smaller towns. In many communities, the historic areas and byways contain abandoned and underutilized properties with real or perceived contamination. These brownfields properties often include abandoned gas stations or other commercial or industrial properties with petroleum contamination.

For years OPS and CDPHE have worked somewhat independently on a few petroleum brownfields efforts. The difficulty has been to establish a mechanism to leverage the available funding and resources from both agencies to identify and implement a focused approach for assessing and cleaning up brownfields-eligible petroleum-contaminated properties. The Initiative has provided the opportunity for OPS and CDPHE to explore their common objectives and brainstorm ways to more effectively assist in revitalizing Colorado communities by working together.

One goal of the Initiative is to improve coordination among Colorado's state agencies, nonprofits, and communities working on brownfields revitalization efforts. The various sources of available funding have become one of the main issues delaying or impeding these efforts. CDPHE receives the annual Section 128(a) Brownfields grant, while OPS oversees cleanup of contamination from regulated petroleum UST sites. To date, OPS brownfields funding has consisted of a $100,000 USTfields grant in 2002 and a competitive $200,000 Brownfields Assessment grant currently being administered.

The not-so-scenic places along Colorado's highways and byways.

Another goal of the Initiative is to improve coordination of services. CBF will take the lead on the public outreach efforts by helping to prioritize sites using the economic and community development goals set by the communities themselves. An innovation of the Initiative will be to develop a set of reporting criteria to highlight community progress toward redevelopment and environmental cleanup success.

The development of this Initiative is the culmination of years of effort to coordinate agency resources on petroleum brownfields projects. Steven McNeely with the the U.S. EPA Office of Underground Storage Tanks, Tracy Eagle with the U.S. EPA Region 8 Groundwater Program, Karen Reed with the U.S. EPA Region 8 Brownfields Program, and Jesse Silverstein with the Colorado Brownfields Foundation have all been instrumental in providing the support and resources to OPS and CDPHE in the development of this project.

Where do we go from here? OPS and CDPHE are developing an interagency agreement (IA) to formalize roles and procedures for future brownfields coordination. The key element of the IA will be the process by which OPS will utilize funding from the CDPHE Section 128(a) Brownfields grant for petroleum-contaminated sites. This IA will be comprehensive for petroleum brownfields projects, as part of this Initiative and beyond.

An immediate goal of the Initiative was to identify two geographically oriented pilot sites along a scenic byway or in a historic district to assess for environmental concerns and remediate if necessary to help position the properties for defined or potential reuse. Two former gas stations, located on the "Highway of Legends Scenic Byway" in Walsenburg, are being targeted as the first pilot sites. The model for future projects will be based on the successes and lessons learned from these pilot projects. ■

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Reconnecting with Those Wayside Gems of Yesteryear

The National Park Service Sees Opportunity in Reusing Many Abandoned Gas Stations

by Chad Randl

Gas stations are icons of the twentieth century—the products of the transportation revolution and America's affection for the automobile. They illustrate both the romance of the open road and the drive toward corporate standardization. Over the one hundred-year-long history of the gas station, every architectural phase and fancy seems to have made its way into the design of these facilities. English Cottage and Colonial Revival stations from the 1920s, streamlined "ice-box" forms of the 1930s, and postwar Space Age themes reflect once-popular trends and cultural priorities. Some stations were one-of-a-kind whimsies shaped like icebergs, teakettles, and tepees; others were stock units, mass produced by oil companies promoting uniform branding and seeking customer loyalty.

Today many of these stations sit empty, abandoned when new highways siphoned off customers, when the stations were declared outmoded by the petroleum industry and its customers, or when environmental cleanup costs exceeded an owner's resources. In response, historic preservationists have organized local rehabilitation projects, listed gas stations in the National Register of Historic Places, and raised awareness about the gas station's importance to the sense of place in many local communities. In 2004, the Alabama Preservation Alliance and the Alabama Historical Commission even included that state's historic gas stations on their annual list of "places in peril."

Abandoned historic gas stations represent not only a lost connection to the past, they can also represent a found opportunity for the future. Abandoned, they are a significant hindrance to community redevelopment, generate no local taxes or employment opportunities, and in some cases are accompanied by ongoing environmental contamination. But as federal, state, and local cleanup programs continue to mature and develop holistic approaches that incorporate both site reclamation and economic development, these sites have the potential to reemerge as unique and functioning historic landmarks. As Edward Chu noted in the December 2005 *LUSTLine* bulletin, "we are shifting our focus from cleanup only to cleanup and reuse."

Photo courtesy Central High School National Historic Site.

Former Magnolia Mobil gas station in Little Rock, Arkansas, now restored as the Central High School Museum and Visitors Center.

Reusing the Building

Often, reuse refers specifically to the land alone, while the surviving gas station structure is slated for demolition. However, a growing list of rehabilitation projects has shown that many aging gas station buildings still have life in them and that their reuse can benefit both investors and the community. The National Park Service's Technical Preservation Services branch has recently published a *Preservation Brief* (*http://www.cr.nps.gov/hps/tps/briefs/presbhom. htm*) entitled "The Preservation and Reuse of Historic Gas Stations" that describes successful approaches to rehabilitating these properties for continued use as service stations or adapting the buildings for new uses. It shows how stations can be reused as a distinctive setting for a new business while retaining a sense of historical continuity and limiting disruption to the existing built environment.

Guidance in the NPS *Brief* is based on the Secretary of the Interior's Standards for Rehabilitation. These ten general principles call for a conservative approach to work on historic buildings, including an emphasis on reuse over demolition, repair rather than replacement, honesty in interpreting the building's past, and sensitivity to significant historic features.

A historic gas station usually has a number of "character-defining features" starting with the overall form and scale of the building, often including exterior material, the interior layout, distinctive windows and doors, canopies, signage, and the organization of structures, pump islands, landscape features, and lighting fixtures on the site. Deciding whether these features are important to the building's history and, when significant, planning how they will be retained are crucial first steps in any rehabilitation project.

This cycle of abandonment and reuse is typical of gas station history. Frequently they were converted to other automobile-related purposes such as repair shops or used car dealerships, changes that required little more than switching signs and removing the pumps.

Photo courtesy Past Perfect

Before: 1200 Wealthy Street, Grand Rapids, Michigan

Photo courtesy M Buck Studios

After: 1200 Wealthy Street, now Sandmann's Restaurant

While the best use for a historic gas station is its historic use—regular maintenance and well-considered repairs help ensure that existing historic gas stations continue to survive while retaining those elements that help give them historic integrity—more often, landowners or municipal governments are dealing with vacant gas stations.

When new functions are found, gas station buildings have proven remarkably adaptable. As Ben & Jerry's Homemade Ice Cream showed when they opened their first store in a converted gas station in Burlington, Vermont, these buildings are often ideal for new start-up companies with limited resources. New owners have also reused stations as art galleries, like the Station 66 gallery in Providence, Rhode Island, and The Station Pure Art in McMinnville, Tennessee, as well as bakeries, pet stores, medical supply shops, and numerous other functions.

Restaurants and Coffee Shops

While the introduction of a kitchen, freezer, and other restaurant facilities always requires some change to a historic structure, the basic configuration of many historic gas stations has been shown to be well suited for reuse as an eatery. In modest cafes and coffee shops, the former sales area is reworked into counter, prep, and limited seating space. The service bays in larger stations are easily converted to open seating areas. Where more space is required for the kitchen or storage, service bays are reorganized for this use or an unobtrusive addition is constructed at the rear of the building.

The gas station at 1200 Wealthy Street in Grand Rapids, Michigan, was constructed in 1929 and enlarged and refaced with steel panels during a 1950s remodeling. It served as an auto repair shop for a number of years before being abandoned in the 1990s. In 2004, a new owner rehabilitated the boarded-up station for use as a neighborhood carry out restaurant called Sandmann's.

The old sales area was reused for customer ordering, pick up, and a small seating area, while the service bays were converted to food preparation, storage, and office spaces. To meet current ADA and building code requirements, the two historic restrooms were merged into one accessible unisex restroom. To accommodate a new barbecue grill while retaining the historic size and shape of the original structure, the new owners placed an inconspicuous masonry addition onto the rear.

Other restaurant examples include Sherman Perk in Milwaukee, Wisconsin; The Coffee Station in Minerva, Ohio (which features coffee beans in the vintage glass pumps out front); the Fuel Pizza Cafe in Charlotte, North Carolina; and Cruiser's Café in Mount Pleasant Mills, Pennsylvania.

Offices and Community Centers

Former gas stations can also be converted to offices and community centers. The West Broadway Neighborhood Association in Providence, Rhode Island, rehabilitated a classic 1930s porcelain enamel station for their office and meeting space. Another example is the Spruce Street Standard gas station in Ogallala, Nebraska, which was restored in 2003 for use as the Main Street program office and community meeting space. In 1997 the statewide group Preservation North Carolina finished restoring a Shell gas station in Winston-Salem for use as its regional office. Constructed in 1930 with a concrete finish over a bentwood frame, it was one of eight shell-shaped stations built by a local gasoline distributor to lure curious customers from the roadside.

Museums and Visitors Centers

In recent years, a number of historic gas stations have been converted to museums and visitors centers. The structures are often fully restored to replicate their appearance during a formative period of local history. Surviving remnants of historic roads like Route 66 include a number of gas stations that were bypassed by the interstate system and are now restored and patronized by tourists and locals. As public interest in heritage tourism continues to grow, projects like the Reed/Niland Corner Filling Station along the former Lincoln Highway in Colo, Iowa, are proving to be a viable way of preserving historic gas stations while increasing tourism revenue and enhancing the visitors' experience.

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A MESSAGE FROM CLIFF ROTHENSTEIN

Director, U.S. EPA Office of Underground Storage Tanks

Update on Energy Policy Act Implementation

Exhilarating, intense, exhausting—those words come to mind as I think of the past 12 months. Since August 2005, when Congress enacted and President Bush signed the Energy Policy Act of 2005, we've all been working at a fast pace to implement the underground storage tank provisions in the act. I know states, tribes, and other UST partners have worked tirelessly to share their input, expertise, and advice as we developed grant guidelines and the tribal strategy. Together we've achieved major milestones. Yet over the next few years, we still have much more to accomplish.

We Met Statutory Deadlines

Sections 1527 and 1529 of the Energy Policy Act provide requirements regarding a prohibition on product delivery and a strategy for implementing the UST program in Indian Country, respectively. Both of these requirements have the statutory deadline of August 8, 2006. With significant effort from state and tribal representatives on the work groups, as well as input from other UST partners, EPA met the deadline and issued the delivery prohibition grant guidelines and tribal strategy. States now have the important job to implement the guidelines.

Delivery Prohibition – The delivery prohibition grant guidelines describe the process and procedures that states must use for prohibiting fuel delivery to underground storage tanks that are ineligible to receive product. They include definitions, criteria, examples, options, and requirements for states implementing the delivery prohibition provision. States receiving federal funds under Subtitle I of the Solid Waste Disposal Act must implement the delivery prohibition requirements described in the guidelines by August 8, 2007. EPA consulted with states and representatives from the UST and fuel delivery industries to develop the guidelines.

To ensure that the guidelines are implemented with minimal disruption, EPA is giving states considerable flexibility to establish their own delivery prohibition programs. At the same time, the guidelines establish several important safeguards to ensure that states have a process for notifying deliverers when an UST is not eligible to receive product. To ensure the delivery prohibition guidelines are effectively implemented, EPA will continue to work with states and the delivery industry to share information on delivery prohibition programs developed and used by states.

See: *http://www.epa.gov/oust/fedlaws/final_dp.htm* to view the delivery prohibition grant guidelines, which are posted on EPA's website.

Tribal Strategy – The strategy for implementing the UST program in Indian Country identifies key issues and actions to: strengthen the relationships between EPA and tribes; improve information sharing; enhance tribal capacity; and further the cleanup and compliance of USTs in Indian Country. The tribal strategy is the foundation for future UST work and collaboration between EPA and tribes. Over the next year, we will work with our tribal partners to implement the strategy. EPA developed the strategy with considerable input from tribal representatives, as well as EPA regional and headquarters staff. EPA is required to report to Congress by August 8, 2007, on our progress in implementing the strategy.

See: *http://www.epa.gov/oust/fedlaws/final_ts.htm* to view the tribal strategy, which is posted on EPA's website.

All federal agencies are required to report directly to Congress and EPA's Administrator by August 8, 2006, on the compliance status of federally owned USTs. OUST, along with EPA's Federal Facilities Enforcement Office staff, is compiling a checklist of federal agencies' progress in submitting their compliance reports to Congress and determining how best to share that information with tank partners and stakeholders. Additionally, this reporting requirement applies to tanks EPA owns or operates. EPA's Office of Administration and Resources Management developed the Agency's compliance report, in which the Agency states that its USTs have been inspected and are in compliance with applicable regulations. EPA provided its report to Congress on August 9.

We Resolved All or Nothing and Issued Drafts

All or Nothing – On August 10, we shared with EPA regions and the ASTSWMO tank subcommittee an opinion from EPA's Office of General Counsel clarifying the issue of EPA's enforcement remedies when a state does not comply with one or more of the requirements for receiving Subtitle I funding specified in the underground storage tank provisions of the Energy Policy Act. We commonly refer to this as *all or nothing*. Our Office of General Counsel advised us that EPA may consider a wide range of remedies for noncompliance under its grant regulations, and that the Agency is not

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■ **Energy Policy Act** *from page 8*

under a legal obligation to automatically terminate or withhold future funding when a state does not comply with one or more Energy Policy Act requirements.

Issued Drafts in Spring – As a result of the hard work by states and EPA staff, we developed and issued for public comment draft guidelines in spring 2006. Those drafts covered requirements for secondary containment, financial responsibility and certification, and public records.

There's More to Come

This summer, we've been reviewing public comments on the draft guidelines. In autumn 2006, we plan to issue final grant guidelines for secondary containment, financial responsibility and certification, and public records. All the while, work groups responsible for other Energy Policy Act provisions are busy analyzing and evaluating many issues so we can continue our progress. Also this fall, keep a lookout for EPA to issue draft grant guidelines on provisions such as inspections and government-owned tanks in states.

States Have a Big Job Ahead

I acknowledge that, while this past year has been an exciting time, states are now (and will continue to be) faced with a huge workload and some difficult challenges ahead to implement the grant guidelines just issued, as well as those that will be issued in the coming months and years. I realize states have genuine concerns regarding the need to balance meeting the new requirements with very real resource constraints in today's climate of tightening budgets and limited resources. And I understand that the meeting schedule of states' legislatures may be obstacles to states' progress in implementing new requirements.

We hear your concerns, and they are legitimate. We're identifying ways—such as flexibility in the delivery prohibition grant guidelines, the all-or-nothing issue, and additional funding to meet the two-year inspection requirement—to help states as they work to implement the new requirements. And I pledge that we will continue to work with states to find opportunities to help.

With Great Appreciation

I sincerely appreciate the hard work and dedication of state and tribal work-group representatives who've helped us achieve so much in implementing the UST provisions of the Energy Policy Act. And I also thank state and tribal tank managers and staff—our partners—for your work to implement the new requirements as well as your ongoing work to keep our environment safe from the threat of UST releases. I respect your commitment to our tank work, and I value your support of our partnership. ■

■ **NPS Reusing Abandoned Gas Stations** *from page 7*

Restored gas stations can also help tell other stories. In the 1950s, a Magnolia Mobil gas station was located down the street from the Little Rock Central High School, scene of the 1957–1958 battle over school desegregation. Decades later, the disused station was purchased and restored it to its appearance during those historic events. Mobil's Corporate Archives provided original specifications for the vintage signage, the paint scheme, and the restored gas pumps. Renamed the Central High School Museum and Visitors Center, the station today provides exhibit and interpretation spaces serving the many tourists and school groups that visit the area. (See photo on page 6.)

Funding Rehabilitation

Gas station rehabilitation projects often rely on financing assembled from numerous sources. Owners converting historic stations for use as restaurants, leasable offices, and other income-producing functions may be eligible for grants or no-interest loans sponsored by local business development agencies and chambers of commerce. In some states, project costs may be eligible for state historic rehabilitation credits.

If a property is listed or eligible for listing in the National Register, rehabilitation may be an eligible option for Federal Historic Tax Incentives, a tax credit program administered by State Historic Preservation Offices (SHPO) and the National Park Service. Some gas station rehabilitation projects have received grants through the federal transportation enhancement (TEA-21) program.

Parties interested in rehabilitating or restoring a historic gas station have formed new ad hoc organizations or worked with an existing nonprofit organization. In either case, such groups can sponsor fundraisers, write grant proposals, seek private and institutional donations, and serve as leaseholders or even owners of the building.

Where Are Your Gems?

Abandoned gas station site cleanup, economic revitalization, and building rehabilitation go hand in hand. To further their overlapping goals, preservationists, developers, local officials, and LUST program administrators should more closely coordinate their efforts. As the projects highlighted in the *Preservation Brief* show, it is feasible to retain and return to service former gas stations in ways that benefit the community's economic stability and sense of place, while providing a return for money spent cleaning up contaminated sites. Gas station rehabilitations reflect an inclusive understanding of conservation—one that embraces the varied appearance, dynamism, and complexity of the American landscape, one that recognizes the stored energy contained in existing construction, and one that sees the reuse of buildings as recycling. ■

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Los Angeles Adopts New Expedited Agency Oversight Program

Completes Multisite Agreement with Five Oil Companies

by Yue Rong and Matthew Small

There are currently about 117,000 ongoing leaking underground storage tank (LUST) cleanups nationwide (EPA, 2006a). U.S. EPA has placed a strong emphasis on cleaning up these sites to reduce the national caseload and return the contaminated properties to productive use. To achieve this objective, U.S. EPA's Government Performance and Results Act (OMB, 1993) cleanup goals for fiscal year 2006 include completing 13,600 cleanups and decreasing newly reported confirmed releases to fewer than 10,000. To meet these goals, it is important to enhance cleanup rates in the states with the largest caseloads.

With more than 14,000 LUST sites, California has the second-highest caseload in the country. The Los Angeles Regional Water Quality Control Board (LARWQCB) is responsible for regulating more than 4,000 of these sites. So, with a staff of only 20 environmental scientists, geologists, and engineers, LARWQCB was looking for ways to improve the efficiency of their cleanup process. The program landed the idea of leveraging private-sector expertise and resources by allowing major oil companies to conduct self-directed cleanups at their lower-priority/lower-risk sites within a specified time frame using a modified regulatory oversight approach. Thus the Expedited Agency Oversight Program (EAOP) was born.

Program Structure

The LARWQCB program staff have prioritized all cases and classified them into four categories (A, B, C, D), based on the presence of MtBE and proximity to drinking water wells. Category A and B sites have priority for regulatory oversight. Given the reality of limited staff and resources, lower-priority cases often receive less attention and cleanups may slow down or stall.

The EAOP was created to help move lower-priority cases (D cases) through the cleanup process more efficiently. The EAOP allows major oil companies, as responsible parties, to conduct self-directed site assessment, monitoring, and cleanup with expedited regulatory oversight. Expedited oversight consists of quarterly face-to-face meetings with LARWQCB staff to review cleanup progress for each company's portfolio of low-risk sites, deferring review of a formal written report until cleanup is complete and site closure is requested. The responsible parties are also required to provide an estimated time line for implementing site assessment and completing cleanup.

EAOP eligibility criteria include:

- Low-risk/low-priority sites
- Agreed-upon time frame for cleanup (usually two to three years)
- Major oil company sites (proven cleanup expertise allows self-directed cleanup)
- Regularly scheduled verbal portfolio and progress reviews with LARWQCB
- Sites listed with the state fund to allow reimbursement of costs without work plan preapproval from regulatory agency
- Final report when requesting closure must describe site work and data collected.

The EAOP was made possible due to a number of supporting factors, including cooperation of the State Cleanup Fund; site tracking through the statewide Geotracker database; nonnumerical, or performance-based, closure criteria for low-risk sites; and the experience and expertise of major oil company cleanup consultants working closely with LARWQCB staff. (Note: the self-directed cleanup approach requires a responsible party with proven cleanup expertise, such as a major oil company).

Program Benefits and Limitations

The EAOP multisite cleanup agreement groups sites by ownership (i.e., major oil companies) and by geographic area (i.e., LARWQCB) *(U.S. EPA, 2006b)*. This grouping is an effort to achieve greater results by addressing sites that have common characteristics or issues. The EAOP takes advantage of economies of scale to save time and resources. Table 1 outlines some potential additional benefits of the EAOP.

There are some possible limitations to this approach. For example, the self-directed cleanup process requires experienced, capable responsible parties as well as trust between the regulatory agency and the responsible parties. Waiver of preapproval for work plans could potentially create problems with state fund approval of expenditures. However, the benefits currently appear to outweigh the limitations.

Program Status

Since inauguration of the EAOP in February 2005, about 250 LUST sites have been included in the program. LARWQCB has also established a process to add new cases that meet the EAOP criteria described above.

Currently, LARWQCB meets with responsible parties and their consultants on a quarterly basis. During these meetings, staff and responsible parties review cleanup progress of EAOP portfolio sites with the oil company. These meetings provide a forum to discuss any issues encountered during site assessment or remediation and to check the progress for each site. Again, the meetings are an expedited verbal review process—no written reports, preapproval, or work plans are required prior to performing work at EAOP sites.

TABLE 1 Expedited Agency Oversight Program Benefits

(Rong, 2006, EPA, 2004, 2006b)

Stakeholder	Benefits
REGULATORY AGENCIES	Move low-priority sites through the cleanup process and increase closure rates
	Reduce staff time on low-risk sites and provide more time for higher-risk sites
	Leverage private-sector resources and cleanup expertise
	Reduced report review time by eliminating work plan preapproval requirements and reducing reporting frequency
	Focused, regularly scheduled portfolio review with regulated community
	Provides an incentive for responsible parties to review their low-priority case portfolio and make a plan for managing these sites in a timely manner
	Clear communication of cleanup time frame expectations and closure criteria
	Increased communication with regulated community streamlines cleanup
REGULATED COMMUNITY	Remediated sites can be reused or resold
	Remediated sites reduce liability
	Reduced reporting requirements, no work plan preapproval required, which can result in cost reductions as well as faster site assessment and cleanup
	Increased communication with regulators improves understanding of regulatory closure process, expectations, and criteria
	Input and agreement on cleanup time frames
	Focused, regularly scheduled portfolio review with regulators
	More efficient regulatory interface for multiple sites

lems and issues that may be common to a number of sites, allowing regulators and oil companies to make appropriate programmatic changes to streamline the cleanup process. Equally important, these discussions have helped the regulated community to gain a better understanding of the criteria and requirements for site cleanup and closure. This allows responsible parties to focus on the important issues at each site, potentially saving a tremendous amount of time and resources.

Negotiated cleanup time frames are a key to the success of this program. The LARWQCB reviews each company's portfolio of category D sites and assigns an estimated cleanup time frame for each site. The company can propose a modification, but must supply a realistic estimated time to achieve cleanup. The program has already resulted in closure for 17 sites and, based based on estimated cleanup time frames, over 200 additional sites are in the "pipeline" for closure in the near future. These low-priority cases are starting to

TABLE 2 EAOP Case Status and Progress Summary

MAJOR OIL COMPANY	NO. OF TOTAL EAOP CASES	NO. OF CASES IN REMEDIATION STAGE	CLOSURE PROJECTIONS 2006	2007	2008	TOTAL
Company 1	32	30 (94%)	8	6	10	24
Company 2	53	32 (61%)	5	12	12	29
Company 3	34	6 (18%)	4	5	8	17
Company 4	67	31 (46%)	7	6	11	24
Company 5	65	48 (74%)	2	10	17	29
TOTAL	**251**	**147 (59%)**	**26**	**39**	**58**	**123**

In addition, these discussions create an opportunity for the oil companies to better understand LARWQCB cleanup criteria. The EAOP gives major oil companies an incentive to review their low-priority case portfolio and make a plan for managing these sites in a timely manner. Table 2 summarizes portfolio review and cleanup progress to date for each major oil company.

The numbers in Table 2 indicate that 59 percent of the major oil company low-priority cases are in the remediation stage—an advanced stage toward case closure. This indicates that the majority of the low-priority case portfolio is in a relatively "mature" stage. As of June 30, 2006, a total of 17 cases under the EAOP have been granted case closure. Also, about 123 EAOP cases are projected for closure during the next three years (2006, 2007, and 2008). Although not all cases can be closed in the three-year period from the start of the EAOP, it is a big success to have each major oil company working on its low-priority cases and estimating a closure time frame for each site.

Though the number of cases closed under this program is small in comparison with the total caseload for LARWQB, it is important to remember that this is a pilot effort. In addition, progress is now being made on low-priority cases that otherwise would be given much less attention and would probably move much more slowly through the cleanup process. This approach is being evaluated for potential expansion to other areas in California.

Thumbs Up!

Increased face-to-face communication between regulators and the regulated community is probably the largest single benefit that has come out of the EAOP. The program provides a forum for discussing prob-

move more quickly through the cleanup process.

Expedited regulatory oversight helps us address limited regulatory resources by reducing the staff time needed to manage low-risk, lower-priority cases, allowing more time to be spent on higher-priority sites. To make this approach work, the EAOP leverages existing industry cleanup expertise combined with self-directed cleanup of low-priority, low-risk sites. Cleanup progress is still monitored regularly, but preapproval and reporting requirements are dramatically reduced. ■

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TANKS ON TRIBAL LANDS

Prioritizing and Targeting UST Systems at Risk Using GIS

by Frank Harjo

The Inter-Tribal Environmental Council (ITEC) is a tribal consortium consisting of 40 member tribes from Oklahoma, New Mexico, and Texas. The ITEC staff is committed to providing technical assistance and support to ITEC member tribes through programs funded by EPA Region 6. The ITEC Underground Storage Tank Program works with member tribes that currently have or are proposing to have an UST system installed on tribal land. The goal of the ITEC UST Program is to assist member tribes in complying with federal regulations and remediating leaking underground storage tanks.

While all tribes strive to achieve these goals, various factors contribute to the release of product or deterioration of an UST system. As each UST system is unique, the potential for a release is determined on a case-by-case basis. As our UST population increases, the need for UST inspections grows. In order to prioritize our inspections, it is important that we identify the UST systems that are prone to failure and could have a negative impact on our natural resources. Currently, ITEC assists 19 member tribes at 31 different locations and over 90 USTs in three states.

Using Geographic Information System (GIS) technology, ITEC has developed a screening tool, the Cumulative Risk for Underground Storage Tank (CRUST) model, to assess the risk of a given UST, based on criteria used to model the UST and surrounding environment. It is the goal of the ITEC UST program to use this information to prioritize sites that have a high potential to leak and impact the environment.

The CRUST Model

The CRUST model is based on an EPA Region 6 model developed by Dr. Gerald Carney and others. To assess risk, the model uses a scoring system whereby criteria from five sets of data categories are ranked and then combined to yield an overall score from 1–5.

The five categories are:

- Community
- Topography/geology/
- Physical UST characteristics
- Compliance
- Facility

So, for example, when considering the age of an UST, under the physical UST characteristics category, a newly installed UST would score much lower than an UST that has been in service for ten years. A score of 1 indicates a low risk, or minimal concern. As the score increases, the risk factor for a particular criterion increases as well, with a maximum score of 5. More than 70 items are currently factored into the overall analysis.

The community category consists of a compilation of all the criteria that best fit the makeup of a particular community—census data, health, land use, and other quality-of-life criteria. The topography/geology category includes data that best describe the natural resources (including water resources) and geology of the environment around a particular UST. The UST criteria are divided into three categories that best describe the UST system—physical UST characteristics, compliance, and facility. These sets of criteria give us the information we need to describe the UST system with regard to potential risk.

The GIS Tool

GIS technology has become readily available to the tribal community. In fact, the affordability of and access to GIS technology and global positioning systems (GPS) have made the two applications an essential tool to manage our natural resources As tribal expertise and use has grown, more GIS applications are becoming apparent. Tribes are becoming accustomed to managing their natural resources in a way that was not possible just a few years ago. GIS provides the foundation for the organization of spatial data and placing this data onto a flat surface, such as a map or computer screen.

GIS features are represented by point, line, and polygon feature classes. Layering features on top of each other allows spatial relationships to be formed and an analysis of the data to be constructed. Within any given feature class there is an attribute table that contains information about that feature. For example, the location of a building can be represented as a polygon feature class and have specific attributes or information related to that building, such as type, color, and other information pertaining to that particular feature.

It is the combination of the spatial and tabular data of a feature class that makes GIS analysis possible. With two or more features, relationships such as proximity and areas of interest can be established. Using the location of an UST as the point feature of concern, other features can be overlaid with the UST, and the level of risk associated with other features can be analyzed.

GIS is not just a map-making tool, it is also a powerful data processing and analysis tool that can be used to do complex work. Manual GIS computation with individual USTs and features could take hours. The CRUST application does this work by automating the GIS analysis and processing more than 70 sets of criteria for a single UST location. The processing of data by automation is what separates this GIS application from any other GIS analysis. This tool gives the user immediate results and allows high-risk UST facilities to be prioritized as quickly as data is received for a particular site.

The GIS analysis is made possible by having our predetermined criteria gathered as scripts or small programs in the GIS. The scripts score the data based on the values obtained from the location of the site or the data collected in the field. The scripts are the 1–5 criteria ranking and as data is evaluated for each set of criteria, a score of 1–5 is returned for that particular piece of criteria.

After all of the criteria are scored on a 1–5 ranking, they are grouped into one of the five categories, and a cumulative score is calculated. The cumulative score indicates the overall priority for an UST facility. However, the CRUST model is flexible to allow weighing of either a specific category of criteria or a single piece of criteria to standout in the overall GIS analysis.

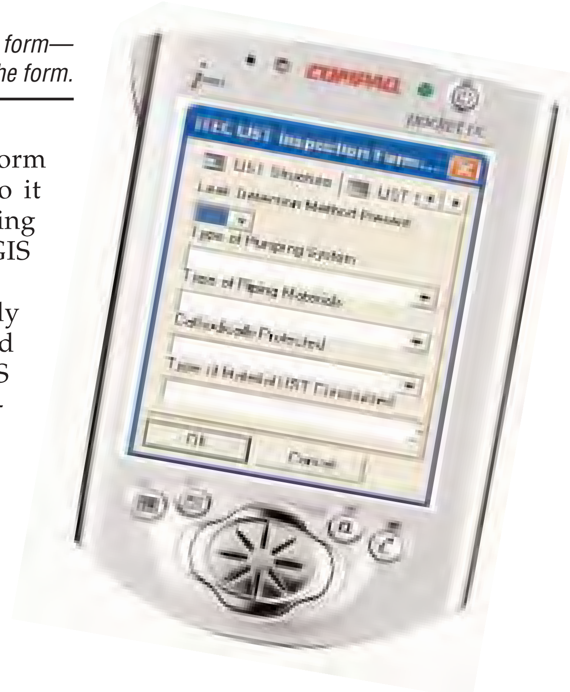
The model consists of three GIS applications or tools that combine to facilitate a system of collecting, analyzing, and viewing data. These applications enable the ITEC UST program to maximize resources in a number of ways in order to focus our resources on troubled or high-risk UST facilities.

In the Field

We collect our site-specific data in the field during routine UST inspections at the tribal UST facilities. The data are collected using a customized GIS ArcPad application that allows us to have all of the UST criteria built into the software. Currently, ITEC has developed 25 sets of criteria that pertain to an UST system and facility that make up three of the five overall categories. The information gathered in the field during the actual UST inspections makes up three-fifths of the overall risk analysis. The information collected during the inspection is also used in the GIS analysis.

To ensure quality control of the data collected by the UST inspector and consistency with the GIS analysis, it was necessary to create an application that matched the information that the UST inspector would collect in the field. With the field application and office GIS application in sync, the UST inspector could use a customized inspection form that had the values loaded into it that matched the criteria ranking used back in the office for the GIS analysis.

Custom ITEC UST inspection form—criteria are built into the form.



The UST inspector can easily choose from a dropdown list and collect the data on site in a GIS format using the ArcPad software and, at the same time, capture spatial information from each of the USTs on site. This ensures that the data collected is consistent and that there is no transfer from paper to the database.

This is done by capturing the location of the fill tubes. Since compartmentalized USTs are counted as individual USTs, the fill tube location gives us the most accurate information about a particular UST and the layout of an UST facility.

The ITEC UST inspection form allows us to have the same consistent form available for all UST site inspections and provides an easier mechanism to download the data back into the GIS desktop for analysis.

One advantage to having the spatial information of an UST facility is that the data can be entered into the GIS program and constructed into a three-dimensional model of the actual facility. Having the spatial data associated with a site allows ITEC to track active and nonactive USTs at that site. The big advantage of using the ArcPad software is that GPS can be utilized, and the form is customizable to any changes that may be needed.

Back in the Office

Back in the office, data are downloaded from the field unit into the desktop GIS for analysis. Using the predetermined criterion that is already in our system, a radius of a quarter-mile is set to determine the extent of our analysis. The GIS program reads the spatial location of the UST fill tubes and begins to analyze data collected in the field, scoring each set of criteria. After all of the UST data are read, the community and topography/geology categories are analyzed, based on UST location and using the same quarter-mile buffer. After all of the data are read and scored, a table showing the 1–5 scoring results is displayed.

Displayed Results

The tabular results are converted and submitted to an ArcIMS data viewer where the data is mapped and viewed internally through an ArcIMS data viewer. An ArcIMS data viewer gives non-GIS users the ability to view spatial relationships between different objects. Different layers of data can be applied to the ArcIMS data viewer to distinguish features that an UST facility may impact if a leak does occur.

It is this type of GIS program, in which results can be added after a GIS analysis or update of data, that makes this tool valuable to the tribal community. Access can be granted to anyone who may wish to utilize these data to protect human health and the environment surrounding an UST facility.

Thus far, the highest scoring facility was a 3.62 and the lowest scoring facility was a 1.75. However, the full potential in this program is not the cumulative score but more important, the ability to see the high scores of 4 and 5 for each set of criteria where risk or concern is elevated. This can be easily seen in the ArcIMS data viewer for each of the five categories. For instance, if a user would like to know which criteria are

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How to Collect Reliable Soil-Gas Data for Risk-Based Applications—Specifically Vapor Intrusion

Part 4 – Updates on Soil-Gas Collection and Analytical Procedures

by Blayne Hartman

Since I wrote Part 3 of this "Collecting Reliable Soil-Gas Data" series in LUSTLine *#48, Nov 2004, the subject of vapor intrusion has continued to be a "box-office blockbuster" throughout the environmental community. The EPA-OSWER draft vapor-intrusion guidance is currently being rewritten and is expected to be released in the first half of 2007. The Interstate Technology and Regulatory Council (ITRC) has written a vapor-intrusion guideline document that is currently out for review and is due to be released in early 2007. ASTM International has entered into the fray and has convened a workgroup to amend the Phase I guidance to include assessment of the vapor-intrusion pathway and to write a standard on how to do it. Individual states continue to release their own policy/guidance on this pathway (e.g., CA, NY, NJ, MO). Many others are working on their own guidance. The concern about vapor intrusion extends to the United Kingdom (U.K.) and Australia. Since soil-gas data are preferred by the majority of agencies in evaluating the pathway, much debate has surfaced over some of the collection and analytical procedures. In this article, I present some of the results from recent studies that address some of the pertinent issues. I refer you to Parts 1 (*LUSTLine *#42) and 3 in this series for a good introduction to this article and for more information on some of the topics covered herein.*

The Two Most Common Errors

Vapors and vapor intrusion are unfamiliar territories for many practitioners in this field (regulators, stakeholders, consultants, subcontractors, attorneys). Here are two of the most common errors that people make with soil-gas programs or data.

- **Confusion with Units**

  One common error that people make with soil-gas programs or data is thinking a ppbv is equivalent to a µg/L or a µg/m3. The units are not equivalent, and the conversion depends on the molecular weight of the compound. Converting between units (e.g., µg/L to µg/m3, percent to ppmv) is also causing headaches. As I advised in Part 3, make your life simpler by:

  – Instructing your lab in what units and detection levels you want the data reported.

  – Going to *www.handpmg.com* for a handy-dandy and easy-to-use unit conversion spreadsheet.

- **Required Soil-Gas Target Levels**

  The other error I see too often is the regulator or consultant using incorrect soil-gas target levels. Residential values are erroneously applied at commercial sites, incorrect attenuation factors are being used to determine target values, or values determined from predictive models are incorrect. The soil-gas target level ultimately determines the required analytical method and the need for additional assessment. Determining the proper value is often an unfamiliar exercise for both regulator and consultant. So, consultants need to ensure that regulators are asking for the proper values, and regulators need to ensure that consultants are proposing the proper value.

Sample-Collection Issues

Probe Installation Method

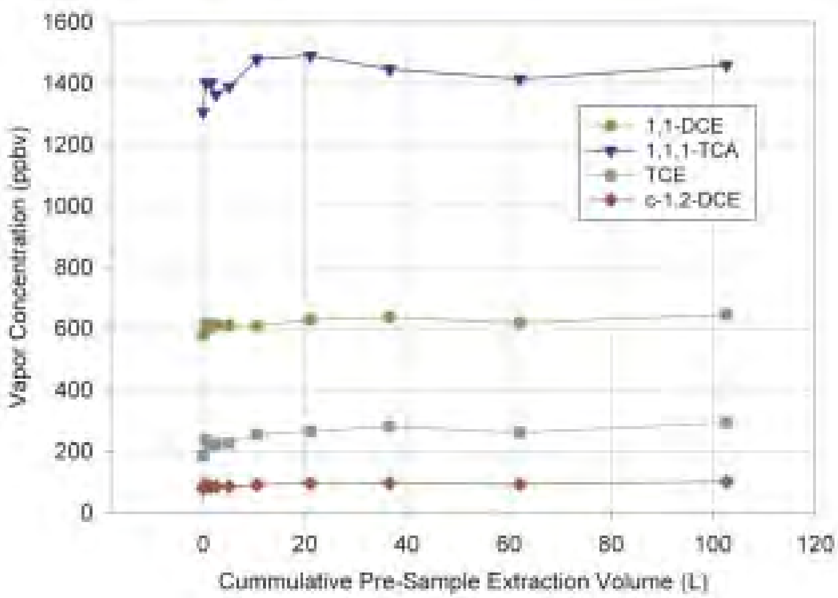
I have not seen a significant difference in results among samples collected either through the probe rod while the rod is still in place or through tubes that are buried in the ground after the rod is removed. This observation is based on data from hundreds of sites where we have made repeated measurements using different methods. While I have never compiled these data, a recent report by U.S. EPA (DiGiulio et al. 2006a) provides data that addresses this very topic. Although small differences were detected, the study showed that data collected using hand-driven probes, direct-push rods, and buried tubes show good agreement, generally about the same as analytical precision.

The bottom line is that the probe installation technique does not matter so long as you do it right. So, the choice of which method to use should depend upon the site, access, and project goals. Typically, sampling through the probe rod is faster and less likely to disturb the insitu soil gas. For limited-access areas, a hand probe may be all that is applicable. For deeper depths, direct-push probes are more convenient. For repeated sampling, burial of small-diameter tubes offers advantages. If the probe-rod methods are used, samples should be collected through small-diameter inert tubing that runs down the probe rod so the sample does not contact the inside of the probe rod.

Extraction Volume

Three published studies are now out that compare soil-gas concentrations collected from volumes ranging from 0.5L to 100L (DiGiulio et al. 2006a; McAlary and Creamer, 2006; DiGiulio et al. 2006b). The results of these studies, done in relatively coarse-grained soils, show no significant difference in concentrations. (See Figure 1.) I have reviewed data from countless sites comparing on-site analysis from 50cc

FIGURE 1 **Soil Gas Concentration vs. Volume Extracted**



No significant effect is seen on volumes from 500 c (0.5L) to over 100L. Study conducted by EPA-ORD at an EPA test site. (DiGiulio et al. 2006a.)

syringe samples to off-site analysis done on samples collected in canisters (1L to 6L). I rarely see differences greater than 20 percent.

However, in finer-grained soils, large volumes are often not possible or difficult to collect. If larger sample volumes are attempted, the potential for leaks around fittings increases. I also have witnessed higher concentrations where large volumes are "forced" from tight soils, presumably due to contaminant desorption off the soils.

Finally, the larger the volume extracted, the greater the uncertainty of where the sample is located. The more complex the sampling system, the greater the chance of drawing air from the surface and the longer it takes to collect a sample. These factors increase the potential for sampling errors, nonrepresentative values, and increased costs. It is best to collect a sample volume that is no larger than that required by your lab and no larger than 1L.

Sample Flow Rate

Many state agencies have put a limit on sample flow rate (typically <200ml/min) because they are concerned that excessive flow might create turbulent flow at the probe tip and influence the soil-gas concentrations. DiGiulio et al. (2006b) addressed this topic using airflow modeling and concluded that this general limit was reasonable. However, McAlary and Creamer (2006) actually measured soil-gas concentrations over different flow rates ranging from 100ml/min to 100L/min at a hydrocarbon contamination site. They saw no significant difference in measured concentration. This suggests that for relatively coarse-grained soils, flow rate does not appear to be an important variable on soil-gas concentrations. Allowing faster flow rates increases sample throughput and eliminates the cost and potential blanks of additional hardware (e.g., flow restrictors).

Tubing Type

Two studies have been done to evaluate different types of tubing. Air Toxics (Hayes et al. 2006) conducted tests of three tubing types (Teflon, nylon, PEEK) that showed little difference in the tubing type. Low-level blanks were detected in nylon, but the values were far below required soil-gas risk-based screening levels. An earlier study presented at a conference in 2004 (Ouellette, 2004) compared the adsorption of a hydrocarbon standard by five tubing types (Teflon, nylon, polyethylene, vinyl, and flexible tygon). Nylon and Teflon showed insignificant losses (<10%), but the others showed higher losses, especially the flexible tubing, where losses were up to 80 percent.

Flexible tubing should be avoided. For rigid-wall tubing, in practice, the type of tubing is not nearly as important as where the tubing is stored and how it is handled. Any type of tubing will become contaminated and contribute to false positives if it is stored in the back of a truck unsealed or near the truck exhaust. My preference is 1/8" nylon tubing, which is easier to work with than the 1/4" tubing if soil-gas sampling is your only need. It has a smaller dead volume and is much less expensive than Teflon.

Tracer/Leak Compound

Most agencies are now requiring that a tracer compound be used to ensure there are no leaks around the installed probe and/or the soil-gas sampling train. There are methods using gases (e.g., helium, propane, SF6, freon) or liquids (e.g., freon, isopropanol, butane in shaving cream). Both types of tracers have pros and cons.

Gaseous tracers offer some advantages, but they are more of a pain logistically, especially if you are trying to cover leakage in the sampling train as well. Plus you need tanks, regulators, and other hardware. The entire process becomes much more cumbersome and time-consuming, resulting in higher sample-collection costs.

Helium offers a nice advantage in that it is readily measured on-site with a field meter, but due to its small molecular size, helium more readily permeates sampling materials than larger molecules typical of VOCs, so it may indicate a leak when there really isn't one.

Volatile liquid tracers offer logistical simplicity and accomplish the primary goal: detecting any leaks in the probe or sample train. The tracers are easily and quickly supplied at multiple locations (probe, sampling rod, and sampling train) simultaneously using paper towels or clean rags. This method is particularly better suited for sampling through the probe rod since it can be applied at the base and top of the rod.

This method is also qualitative since the concentration at the point of

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■ Soil Collection and Analytical Procedures *from page 15*

application is typically not measured (although it can be). One disadvantage is that small leaks (as low as 100µg/L) can cause a lab to raise its their detection levels depending on the tracer compound, especially if the toxic organic (TO) methods are being used. When on-site analysis is used, leaks can be found in real time and samples can be recollected as necessary.

With deeper soil-gas samples (>3 feet bgs), the likelihood of surface air being drawn down the length of the probe and into the sample is small, especially if small (<1L) volumes are collected. I suspect that most detected leaks are from poor sample collection procedures and poor tracer application procedures. To minimize these issues, collection personnel should keep sample volumes small and collection assemblies and protocols as simple as possible.

Finally, it is important to recognize that a small amount of tracer in a sample does not indicate a significant leak. If the concentration of the tracer indicates a leak of less than 10 percent, then the leak should be considered insignificant and the sample should be considered valid. For liquid tracers such as isopropanol, a 10 percent leak would give a value in the sample of ~10,000µg/L, assuming a starting concentration equivalent to the vapor pressure of isopropanol.

It is best not to limit your options to any one method. Let the choice be made by the soil-gas collector for a given site, based on his or her comfort with either method, the availability of on-site analysis, and the compounds of concern.

Equilibration Time

In the process of burying sampling tubes in the ground, in situ soil gas is displaced and the tip is buried in a sand pack that contains atmospheric air. How long does it take for the sand pack to equilibrate with the surrounding soil gas? DiGiulio et al. (2006b) calculated and plotted equilibration times for different distances and soil water contents. For a 2″ outer diameter borehole, the plot shows a required time of a few minutes to less than a few hours. A recent test performed at a U.S. EPA test site in Indianapolis showed that the sand pack equilibrated within three hours for a 1.5″ borehole. In practice, I advise clients to include the volume of the sand pack in their purging if samples are collected the same day as installation, but not to include the volume of the sand pack if samples are collected on a different day.

Temporal Effects

This is a big issue for regulators and stakeholders. Do we need repeated sampling events, similar to monitoring wells? There have been a number of studies on this issue, and more are currently under way or planned. Dr. Thomas McHugh of Groundwater Services recently conducted a research program for the Department of Defense and saw variations of chlorinated hydrocarbon concentrations in shallow soil-gas samples of less than 30 percent over a 48-hour period (McHugh 2005).

Todd McAlary of Geosyntec has shown results from a site in the U.K. with hexachlorobenzene variations over seasons less than 40 percent (McAlary, 2002). Data from a site in Endicott, New York, presented by Dr. William Wertz of the New York Department of Environmental Conservation, show *maximum* variations of chlorinated hydrocarbon concentrations in shallow soil gas (~5 feet bgs) over a period of 16 months (8/04 to 12/05) of a factor of four, but typically less than a factor of two. The variation from the average or mean concentration is far lower.

At a site in Casper, Wyoming, Dr. Paul Johnson and others have monitored soil-gas concentrations of hydrocarbons using an auto-analyzer (Luo et. al. 2006). Variations in soil gas at four feet or deeper were less than a factor of two over a period of 70 days from September to December. Variations in sub-slab samples were on the same order except near cracks. This study is still on going, and a companion study is planned for a hydrocarbon site in Ohio. I have seen little temporal variation in southern California based on repeated sampling at thousands of houses with methane in the shallow soils. Unfortunately, there is no compiled database.

U.S. EPA just awarded a contract to TetraTech to study temporal variations at a chlorinated hydrocarbon site. The testing is to be conducted this fall/winter and the results will be reported in 2007.

Looking at the big picture, the soil-gas concentration variations in these datasets, even for northern climates, are insignificant compared with the overprotectiveness of the risk-based screening levels. I suggest that if soil-gas values are a factor of five to ten times below the risk-based screening levels, there is no need to do repeated sampling unless a major change in conditions occurs at the site (e.g., elevated water table).

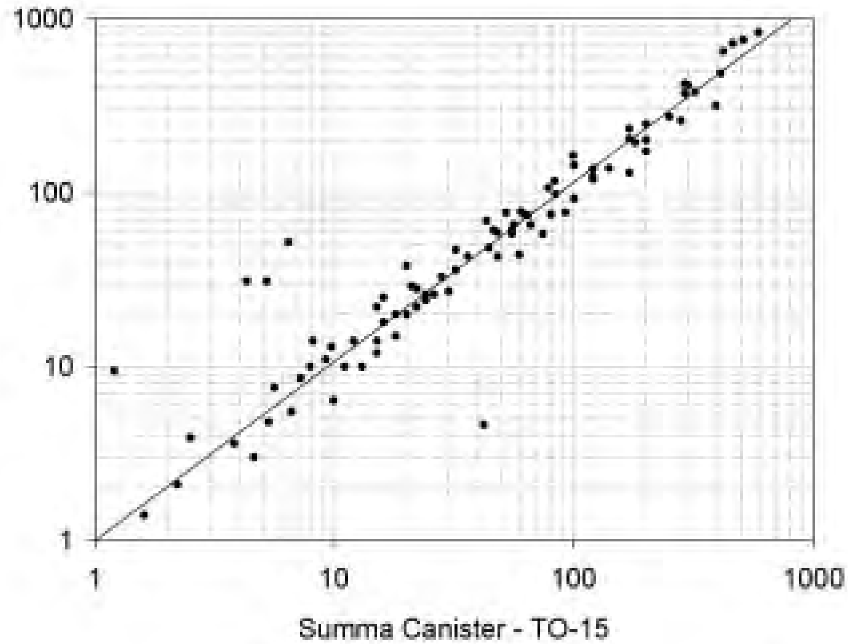
Sub-slab vs. Exterior Soil-Gas Samples

In another hotly debated issue, some agencies are concerned that exterior soil-gas samples may not be reflective of soil-gas concentrations under the slab, and they are struggling to decide what to allow in their guidances. Going inside structures, especially personal residences, can be a Prozac moment, so there is strong incentive to try to use exterior soil-gas concentrations to assess the vapor-intrusion risk. U.S. EPA-OSWER, based on limited data and some recent 3-D modeling, is feeling that deeper, exterior soil-gas data (10′ to 15′ below the receptor) may be more representative of concentrations under a slab than shallower soil-gas data. Currently, there is no comprehensive database to reach a definitive conclusion.

For petroleum hydrocarbons, a significant amount of bioattenuation can occur in the upper 10′ (see Davis, 2006, *LUSTLine* #52 for a good summary), so collecting only deeper samples would not give an accurate picture of the vapor-intrusion risk. For chlorinated hydrocarbons, bioattenuation is not as prevalent, so collecting deeper samples may be justified if the contamination source is directly below. If the source is spatially away from the receptor, exterior soil-gas concentrations on the side of the receptor will likely be higher than concentrations below the receptor.

I recommend that for hydrocarbons, shallow (3′ to 5′ bgs) exterior soil-gas samples around the receptor should be representative of sub-slab samples if oxygen levels are high (>6%) and the contamination source

FIGURE 2 **A Comparison of On-Site Analysis of TCE by 8021 out of a Tedlar Bag vs. Off-site Analysis by TO-15 Out of a 6 Liter Summa Canister Collected by EPA-ORD at a Test Site**



The correlation is excellent down to values as low as 2 ppbv. Units for both axes are ppbv. (DiGiulio et al. 2006a.)

is not too high (<50,000µg/L in the soil vapor, based on 3-D modeling results by Lilian Abreau, 2006). For chlorinated compounds, if the source is below the structure, collect samples around the receptor as close to the source as possible. The sub-slab concentration can be no higher than the source concentration (e.g., immediately above the saturated zone if groundwater is the source). If the source is so deep that samples can not be readily or inexpensively collected, collect vertical profiles to at least the mid-depth as discussed in Part 3 of this series. If a consistent pattern is obtained around the structure you can likely safely extrapolate the data to below the structure. If not, it will be time to go inside.

Sample Analysis Issues

Use of Tedlar Bags for Soil-Gas Samples

A number of published studies (e.g., Denly & Wang, 1995) have been done over the years on the stability of compounds in tedlar bags. All of the studies I've seen, and some tests we've done, show the bags are reliable for the common VOCs for storage times of 24 to 36 hours (less than 15% over 24 hours), but the fall-off gets greater after 48 hours (30% to 40%). The other primary concern is blanks from the new bags. New tedlar bags can have low levels of VOCs in them. However, they are typically less than 10µg/m3, which is also below most soil-gas risk-based screening levels (Hayes et al. 2006).

Sample collection in tedlars offers some sampling advantages. They are easier to handle and less expensive, spares are readily available, they eliminate the potential of blanks from dirty canisters, and there are a variety of simple ways to fill them. In tight soils or soils with high water contents, I prefer that samples be collected in tedlar bags to avoid the potential for leaks at fittings and water being sucked into the sampling system or canisters. If the samples cannot be analyzed within 24 or 48 hours, the sample can easily be transferred into a canister either in the field or when received by the laboratory.

I suggest that you consider using tedlar bags when collecting soil gas samples. Depending on the allowed storage time, either ship samples to the lab overnight for them to transfer or analyze, or transfer them into canisters in the field. For high-profile projects or projects in later stages, stick to the 24- to 36-hour storage time. For initial assessments or projects where a potential 40 percent error is not of concern, use the 48-hour storage time.

TO-14/15 Analysis Method: The Gold or Plastic Standard?

If you're a regulator who believes the TO-15 method is the gold standard of VOC analytical methods, you're in for a shock when you read this section. Before I begin, it is important that you understand that my firm conducts both 8260 and TO-15 analyses, so I am not writing this because I have a conflict of interest or a bias toward either method. My purpose in writing this is to inform you of a number of QA/QC deficiencies in the standard method so you can ensure that the TO-15 data you are getting are of sufficient quality. This is of growing concern as the number of laboratories offering TO-15 is rapidly increasing to meet the vapor-intrusion market.

In truth, QA/QC criteria in the standard TO-14 and TO-15 methods are below the requirements of U.S. EPA SW-846 VOC methods (e.g., 8021 and 8260). A few states have realized this (e.g., NJ, NY), and their laboratory certification groups have stipulated additional QA/QC requirements for the TO methods (some EPA regions have done the same although they do not certify labs). Following are four of the most pertinent issues.

- **Lack of a Second-Source Standard.** The TO-15 method does not require a second-source standard. Second-source standards are required by the SW846 VOC methods and by most state standards (e.g., Cal-EPA/DTSC soil gas advisory) to be analyzed after the initial calibration to validate the calibration curve, and in some instances, daily with each batch as a laboratory control sample (LCS). Without a second-source standard there is no validation or check that the calibration standard is accurate.

  The lack of this requirement for the TO method becomes even more shocking when you realize that the method allows use of the same standard for up to a year!

■ continued on page 18

■ Soil Collection and Analytical Procedures *from page 17*

Further, there are no criteria on the canister type for the standard. In other words, a lab is fully method compliant if it uses only one calibration standard stored in an aluminum cylinder for up to a year.

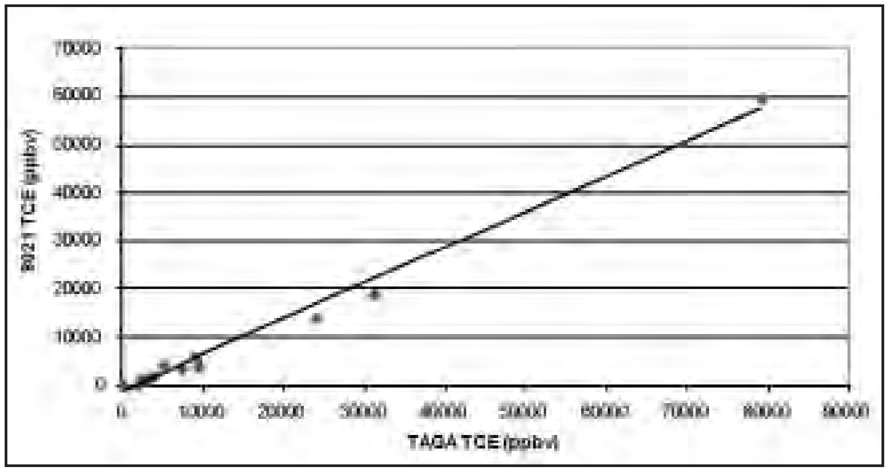
In contrast, most states only allow samples to be held in polished or glass-lined canisters for up to 14 days (Cal-EPA/DTSC only allows 3 days). You can see the obvious contradiction that the same hold-time criterion for samples is not applied to the single-calibration standard. So, how do you know your standard is still good after six months if you are not checking it?

I suggest that states require a second-source standard analysis with the initial calibration and each analytical batch and require this analysis to be part of their data report. Further, if states are interested in naphthalene, they should require labs to have naphthalene standards, since they are not part of the standard TO-14 or TO-15 calibration mix (some labs report naphthalene based on the calibration of a similar compound).

- **Lack of Surrogates.** The standard TO-15 method does not require surrogates. The SW-846 VOC methods require surrogates within lab-derived recovery ranges. Surrogates are used to give an indication if a sample ran "properly." If the surrogates aren't measured within an acceptable range, say +/–30 percent, then the results for the other compounds are considered suspect. Without surrogates, you have no information as to whether sample recovery was 10, 50, 100, or 200 percent. Quality labs reanalyze samples if the surrogates do not report within the acceptable range.

  It is best to require surrogates (at least three) in all samples. Require that surrogate recoveries be reported on each analysis with recovery acceptance limits similar to SW-846 methods.

FIGURE 3 **TAGA vs. 8021 TCE Concentrations**



A comparison of on-site analysis of TCE by method 8021 from 60cc syringe samples to on-site analysis by the EPA TAGA mobile laboratory from1L tedlar bag samples collected at an EPA test site in Indianapolis in August 2006. The correlation is excellent (R2 = 0.998) and the values agree within analytical precision.

- **Calibration Acceptance Windows.** The standard TO-15 method calibration standard recovery windows for some compounds are larger than the SW846 VOC methods and do not meet some state soil-gas guidelines (e.g., Cal-EPA/DTSC). The solution to this problem is to ensure that the laboratory's calibrations fulfill any state requirements and require that the continuing calibration analysis be included in the lab report.

- **Lack of Certification (Beware the "Wal-Mart" TO-15).** As the vapor-intrusion market increases, so too do laboratories offering TO-15, especially since the analyses command three to four times the price of soil and water VOC methods. The TO-15 QA/QC criteria are less stringent, and most states don't have a certification for the method, so it is very easy for a lab to quickly set up and offer TO-15 analyses. In other words, a lab can be running the method with no regulatory oversight/checks on whether the lab ever could or is currently running the method properly. I recently reviewed a lab report in which a lab posted its state certification number on its TO-15 lab report even though the state didn't certify the method!

Strong Recommendation: To ensure that you are getting a quality analysis that can withstand both the regulatory and legal challenge, use only a lab that can show it has upgraded the method QA/QC as described above and has a certification for the method from either NELAC or a state agency. Most high-quality laboratories have upgraded the published TO-15 method to correct the issues raised above.

The Ongoing Debate on VOC Analysis by TO-14/15 vs. Methods 8260 vs. 8021

This debate has been going on for many years now and much confusion and controversy still exist. There have been two recent presentations and published papers comparing method TO-15 to method 8260, one by Air Toxics (Hayes et al. 2005) and one by my company (Picker, 2005). Both studies reached the same conclusion: the methods match up quite well for the common VOCs. However, the jury is still out regarding naphthalene.

Figure 2 shows a comparison of on-site analysis of TCE by method 8021out of a tedlar bag to off-site analysis by TO-15 out of a 6L Summa canister from a U.S. EPA test site (DiGiulio et al. 2006b). The correlation is excellent down to values as low as 2 ppbv.

Another comparison study was done this August at a U.S. EPA test site. The values I measured on-site by method 8021 from 60cc syringe samples matched analysis by EPA's mobile Trace Atmospheric Gas Analyzer system from tedlar bags within analytical error. (See Figure 3.) We see similar agreement between on-site analysis using method 8260 from 60cc syringes and samples collected in 6L canisters and analyzed off-site by TO-15.

These studies prove that the soil and water VOC methods and the TO methods give equivalent results down to levels as low as 10µg/m3. The decision on what analytical method to use should be based primarily on the required detection level, expected contaminant level, project scope, and cost…in this order.

The TO methods and hardware (e.g., canisters, flow chokes, adsorbents) are designed for measuring low levels in ambient air. They are not designed for the high concentrations we commonly see in soil gas. Typical soil-gas concentrations at LUST, dry cleaner, and industrial-solvent sites are in the 100,000s to 1,000,000s of µg/m3. High concentration samples can lead to system carryover, large dilutions, and contaminated canisters, increasing the potential for false positives, raised reporting levels, and other logistical problems, such as canister management. Due to these potential problems, programs using off-site analysis should include canister trip-blank samples and sampling equipment blank samples.

In practice, a combination of these methods is the best approach. Most soil-gas risk-based screening levels can be reached with all of these methods. If expected values are high, then the 8021 and 8260 methods are more advantageous to use than the ultra sensitive TO methods. If expected values and risk-based screening levels are low, then the TO methods offer advantages. Further, the 8021 and 8260 methods can be run in the field, allowing real-time information. Refer to Part 3 for a summary table of the available methods.

The Need for TO-15 SIM for Soil-Gas Samples

Too frequently, we get asked for TO-15 SIM analysis for soil-gas samples. TO-15 SIM (selected ion mode) is used to get to lower detection levels (< 1µg/m3) than the typical TO-15 SCAN analysis (1 to 5µg/m3). But for almost all compounds at any collection depth, including sub-slab, soil-gas risk-based screening levels are higher than 5µg/m3. So TO-15 SIM is not necessary. Save your client (or the state reimbursement fund) the extra expense.

Experience Goes a Long Way

A final topic of concern among the regulatory community is the spatial variability of soil gas, both around structures and under structures. In many cases, soil gas, like soil, is not homogenous. We have accepted this fact about soil data and have adjusted our site investigation methods, sampling plans, and interpretation accordingly. But for some reason, we are not yet comfortable with soil gas variability. Many of the interpretation problems I see people dealing with come from a lack of data. It's simply not possible to sort out the variations with a handful of analyses collected on a couple of occasions.

Since some variability is to be expected, you need enough data to give decent coverage near, around, and under the receptor. I encourage simpler collection systems that enable higher production per day (>20 samples per day) and the use of less expensive analytical methods (e.g., 8015, 8021, 8260) enabling more analyses for the same cost. I also encourage field analysis, when possible, as it allows for real-time decisions on additional sampling needed to sort out variations and recognition of inconsistent data and tracer leaks while you are still in the field.

The last important ingredient needed for high-quality, cost-effective, and efficient vapor-intrusion investigations is the experience of the consultant and the subcontractors. I advise consultants to use firms experienced in soil-gas collection and use labs experienced in soil-gas analysis. The stakes are simply too high with vapor intrusion to do anything else. ■

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Wander LUST

by Patricia Ellis

A roving column by reporter Patricia Ellis, a hydrologist with the Delaware Department of Natural Resources and Environmental Control, Tank Management Branch. Pat served as a member of U.S. EPA's Blue Ribbon Panel on MtBE. She welcomes your comments and suggestions and can be reached at *Patricia.Ellis@state.de.us*.

Are We to Become "Children of the Corn"?

The great civilizations of Mesoamerica – the Maya, Aztec, Toltec, Zapotec, Mixtec, Olmec, and others – could not have existed without corn. It was basic in their diet and a revered crop. According to the Popol Vuh, the sacred book of the Maya, humankind itself was made of corn. Some say that the god of corn was defenseless—a victim of birds, insects, and rodents—who depended on the help of the god of rain for survival. Man, too, was an ally, making rituals and offerings to attract rain, weeding out other plants that might crowd corn, scaring off predators, and giving life to the god by planting him. The Mayans were Children of the Corn. They believed that they were created by gods who added their own blood to flour made from corn, and they worshipped the tall grass that fed them. (1) Should we also be worshiping the corn from which we produce the ethanol that will keep our mighty steel beasts running?

Popcorn, corn on the cob, corn flakes, corn oil, corn chips, corn fritters, corn tortillas, corndogs, cornbread – by golly, it's one of our staple foods! Cows eat corn, pigs eat corn, chickens eat corn—as a matter of fact, we raise somewhere around 350 million chickens per year in Delaware, so that's a lot of chicken feed! And ethanol is to be our great savior in terms of reducing our dependence on foreign oil. Food, feed, or fuel, that's the dilemma. According to Lester Brown, president of the environmental research group Earth Policy Institute, "This is shaping up as a competition between the 800 million people in the world that own automobiles and the two billion low-income people in the world, many of whom are already spending over half their income on food." (2)

For the last 15 years, I've wanted to see MtBE eliminated from gasoline because of the impact that it can have on groundwater. We've spent a small fortune drilling replacement wells, installing and maintaining carbon filters, and extending water lines to provide safe drinking water for Delaware residents. That's in addition to the extra costs for more complex, detailed groundwater investigations, and extra expenses for remediation.

The chemical and physical properties of MtBE make it something that just doesn't belong in gasoline, primarily because we seem to be unable to keep the gasoline in the tanks where it belongs. At times, MtBE has confounded us because of its ability to escape from seemingly tight tank systems and because it could race along underground and manage to find its way into the only well in the area.

Goodbye MtBE, Hello Ethanol

Finally, with MtBE bans passed in more than 25 states, and with no defective product lawsuit protection in the 2005 Energy Policy Act (EPAct), MtBE seems to have disappeared or is disappearing from gasoline in the United States. For the states that were still using MtBE, the transition to ethanol earlier this year got off to a little bit of a rocky start. When Delaware was notified about the changeover date, we had a short three or four months to educate ourselves, our station owners and operators, and the public. Some station owners heeded our advice about tank cleaning, filters, and eliminating water from their tanks, while others chose to blow off our recommendations and take their chances.

Luckily, in Delaware we had no reports of cars coughing to a halt right after getting a tank full of E10, although lately I've gotten a few "My boat engine sputters and stalls," and "My lawnmower hasn't run right all summer." Right at the time of the transition, we did have some shortages, with stations temporarily running out of certain grades of gasoline, and there were long lines at the terminals for a few days because USTs were pumped lower than normal to make the switch.

But, other than what has happened to the price of gas over the past few months, we weathered the changeover storm relatively well. Lately, we've had all sorts of complaints come in about the price of gasoline, particularly when Delaware residents notice that conventional gas on Maryland's Eastern Shore, just a stone's throw away, is running about 40 cents less per gallon!

Mileage has also gone down, with one resident claiming that his vehicle has lost between 5 and 7 miles per gallon, although that number seems unlikely. I just calculated a 9.7 percent decrease in the gas mileage for my car since ethanol-blended gas was introduced to the state, but that also corresponded to the time that I started turning on the air conditioner in the car more frequently. I'll see if my mileage improves in the fall when I'm not using the AC. On the other hand, the Valero refinery in Delaware tells us that it is adding between 6 and 9 percent ethanol, and is asking to drop that to 5.6 percent. I'm kind of glad that we're not using 10 percent!

Next, we'll see whether our tank systems do a better job of keeping the ethanol in the tank any better than they did for MtBE. Ah yes, those mysterious leaks from supposedly tight tank systems. Will those funky "MtBE only" hits start disappearing from our monitoring wells? At least in most environments, any released ethanol should degrade fairly rapidly.

In fact, in controlled releases, researchers had to sample quickly to find it at all. However, the rapid degradation of ethanol may reduce the oxygen levels in the soil and groundwater and may also deplete other electron receptors necessary for biodegradation of other components in the gasoline. The result may be longer plumes of other gasoline constituents, such as benzene.

It will be time soon to make the decision as to which sites we need to add ethanol to for the list of analytes and whether our area labs are equipped to do it. Maybe it will be time to take a look at other analytical parameters to see if more plumes are developing larger anaerobic shadows due to degradation of ethanol.

Corn: Food, Feed, or Fuel?

So, since the lion's share of ethanol in the United States is made from corn, let's talk about corn. Department of Agriculture studies of ethanol production from corn find that an acre of corn yields about 139 bushels. One bushel of corn will produce about 2.5 gallons of ethanol—about 350 gallons of ethanol per acre. (3) The fuel value of ethanol is lower than that of gasoline—1.4 gallons of ethanol in the tank equals about 1 gallon of gasoline in terms of energy output.

It also takes energy to produce ethanol (e.g., fertilizer, harvesting, corn processing). Some researchers claim that the net energy input of ethanol is

actually negative when all inputs are included—ethanol takes more energy to produce than it yields. According to Ted Patzek, a University of California, Berkeley, engineering professor, it takes six units of energy in farming, distillation, and transportation to yield one unit of energy produced by ethanol in a car. (4,5) Patzek and Cornell University's David Pimentel calculated that about 70 percent more energy is required to produce ethanol than the energy that is actually in ethanol. (6)

Other studies have shown a positive net energy from the production of ethanol. According to a 2004 USDA study, the production of ethanol creates more than 67 percent more energy than it takes to make it. (7) And other studies have come to similar conclusions. The American Coalition for Ethanol says that it takes 35,000 BTUs of energy to turn a bushel of corn into a gallon of ethanol, and that a gallon of ethanol contains at least 70,000 BTUs. (8)

Researchers at the University of Minnesota published a study in the July 11, 2006 "Proceedings of the National Academy of Sciences" showed that soybean biodiesel returns 93 percent more energy than is used to produce it, while corn grain ethanol currently provides only 25 percent more energy. Their study showed that dedicating all current U.S. corn and soybean production to biofuels would meet only 12 percent of gasoline demand and 6 percent of diesel demand. (9) There's no way I'm going to try to analyze these studies, but at least most recent studies indicate that you get more energy out of the ethanol than you have to put into its production.

The 55 million tons of U.S. corn going into ethanol this year represent nearly one-sixth of the country's grain harvest but will supply only

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3 percent of its automotive fuel. (10) The U.S. has 73 million acres of corn cropland. The entire U.S. corn crop would make 25.5 billion gallons of ethanol. We consume about 130 billion gallons of gasoline per year; therefore using the entire U.S. crop of corn to produce ethanol would still meet only a small percentage of our fuel needs. Some farmers are already switching from other crops, such as soybeans, to corn to meet the growing demand.

But wait – we must have been growing those soybeans for some purpose! What shortages will be created by switching the crops? Say goodbye to popcorn, corn on the cob, and all those other favorites? We can produce a little more ethanol using agricultural wastes, such as the corn stover, which is normally plowed back into the land and helps the soil fertility. According to the U.S. Energy Information Agency, using the crop residues from corn production could produce about 10 billion gallons of ethanol —ethanol equivalent to another 5 billion gallons of gasoline.

The Great Cellulosic Hope?

Cellulosic ethanol production is what President Bush was referring to in his State of the Union address when he mentioned "cutting-edge methods of producing ethanol, not just from corn but from wood chips, stalks, or switch grass. Our goal is to make this new kind of ethanol practical and competitive within six years."

Cellulosic ethanol production is in the demonstration stage. It uses enzymes to break down plants or other raw materials, making it easier to distill ethanol from them. This process generates far more energy with less energy input. So far, however, it is not economically feasible to produce ethanol from cellulose (e.g., wheat stalks, wood chips, straw, sawgrass). (11)

If we guesstimate that switchgrass could produce 1,000 gallons of ethanol per acre, more than twice what we get from corn stover, ethanol from 300 million acres of switchgrass could still not supply our current gasoline and diesel consumption, which is projected to double by 2025.

Energy Secretary Samuel Bodman has a goal of displacing 30 percent of 2004 transportation fuel consumption with biofuels by 2030. To meet this goal, annual U.S. production will need to increase from about 4 billion gallons of corn-based ethanol per year to about 60 billion gallons per year from a variety of plant materials. (12)

Iogen, one of the companies that is working on the process has estimated that a commercial-sized plant capable of producing 40 million gallons of ethanol per year would cost $320 to $350 million to build, which is roughly six times the cost of a corn-based ethanol plant of the same capacity. Obviously the economics need to change to make this a viable process. Iogen's demonstration plant produces about 1 million gallons of cellulosic ethanol from wheat straw, corn stalks, and switchgrass. (13)

The Department of Energy just released a "research roadmap" for developing new technologies into an economically viable, carbon-neutral transportation fuel. This report is available at *http://www.doegenomestolife.org/biofuels/b2bworkshop.shtml.*

On August 2, 2006, DOE announced a plan to invest up to $250 million, subject to Congressional approval, over five years to spur U.S. private industry and universities to find new ways of creating motor fuel from renewable sources such as soybeans, wood chips, and agricultural cast-offs. The plan would set aside $25 million a year for two separate biofuel research facilities that would conduct basin research on how to release energy from plant fibers, or cellulose. (14)

> ***"If the national policy construct remains as it was through the MTBE crisis—and if policy on a state level continues to be reactive, inconsistent, and based on outdated information or unsound science—a repeat environmental policy performance is almost certain to occur."***
>
> ***MTBE: Effects on Soil and Groundwater Resources***
> **edited by James Jacobs, Jacques Guertin, and Christy Herron**
> **Lewis Publishers, 2001, ISBN: 1-56670-553-3**

Tariffs and Credits

Currently, the U.S. provides the domestic ethanol industry with a 51 cent tax credit per gallon blended. This credit lasts until 2010, unless it is extended again, as it has been four times previously. At the same time, it slaps imported ethanol with a 54-cent-a-gallon tariff. This prevents refineries from buying it wherever it's cheapest on the global market.

During the ethanol crunch that we experienced around May this year, when the petroleum companies were coping with their voluntary removal of MtBE and the EPAct requirements to start using their required amounts of renewable fuels, there was talk in Congress of temporarily lifting the tariff on imported ethanol, so we could import some cheaper ethanol from Brazil.

Protests came largely from the corn states, which didn't want to lose the captive market for ethanol sales just when they were in the middle of a large expansion in capacity. On the other hand, many blame ethanol shortages and high prices for the increased gas prices that we are experiencing. U.S. distillers count on the tariff to shield them from cheaper Brazilian prices. Refiners imported 21,750 barrels of ethanol in February 2006, or enough to meet 6.7 percent of U.S. demand (DOE).

Energy Policy Act of 2005 Requirements

EPAct took away the oxygenate mandate for reformulated gasoline, while at the same time, it gave us a Renewable Fuels Program, which is essentially an ethanol mandate. The Renewable Fuels Program mandated the use of an increasing amount of renewable fuel between now and 2012. (See Table 1.) Bonus points are awarded for the use of cellulosic ethanol – one gallon of cellulosic ethanol or waste-derived ethanol is considered to be the equivalent of 2.5 gallons of renewable fuel!

TABLE 1
Renewable Fuel Requirements of EPACT 2005 by Year

CALENDAR YEAR	APPLICABLE VOLUME OF RENEWABLE FUEL (in billions of gallons)
2006	4.0
2007	4.7
2008	5.2
2009	6.1
2010	6.8
2011	7.4
2012	7.5

There are market guarantees for ethanol for a while. Under EPAct, we must increase the use of ethanol by an average of 11 percent each year through 2012. Today we use about 4.4 billion gallons of ethanol (3% of all gasoline used). By 2012, we must increase consumption to almost 5 percent. After 2012, the law no longer mandates an 11 percent or better boost in demand. Starting in 2013, biofuel demand growth will need to match that of gasoline, which DOE forecasts will be about 1.1 percent a year through 2020.

For distillers to expand rapidly after 2012, the price will have to be competitive with gasoline. And if the tax credit isn't extended, ethanol will lose that big advantage. According to Bloomberg, for the past eight years, ethanol has cost an average of 49 cents a gallon more than gasoline. Last year, the federal tax break brought the price of ethanol down to 32 cents a gallon less than gasoline (Bloomberg.com, May 25, 2006).

Chevron is investing in distilleries to guarantee steady supplies of ethanol. Exxon Mobil Chairman, Rex Tillerson, says "Pull the subsidies off and see how much ethanol gets made or used." Eric Holthusen, a Royal Dutch Shell executive, considers using food crops to make biofuels "morally inappropriate" as long as there are people in the world who are starving. (15)

Ethanol should be produced from renewable resources such as wood chips and plant waste, rather than the food crops that are typically used to make the fuels. For now, however, economics and legislation drives the decisions.

Use and Prices

According to the Renewable Fuels Association, between 85 and 95 percent of ethanol in the U.S. is sold under long-term contracts (6–12 months) negotiated between the ethanol producer and the oil refiner or gasoline blender. (16) Most of these contracts are "fixed price." Some contracts may be pegged to the price of gasoline (usually at a discount to gasoline), meaning the price of ethanol will change as the gas price changes, but the percentage impact will remain constant. (17) According to the JJ&A Fuel-Blendstock Report (6/16/06) most of the long-term contracts were established "well before the current short-term spot price insanity developed."

According to JJ&A, contracted ethanol is selling between $1.80 and $2.40 per gallon, once the tax incentive is figured in. Spot market prices were as high as $5.75 near the end of May. Many of the spot market purchases have been between refiners, when a particular refiner/blender has been caught short and will pay almost anything to cover a requirement. (See Table 2.)

TABLE 2
U.S. Fuel Ethanol Production/Demand for April 2006

(mg = million gallons; b/d = barrels per day)

Fuel Ethanol Production	363.5 mg	289,000 b/d
Fuel Ethanol Use	396.2 mg	302,000 b/d
Fuel Ethanol Stocks	381.7 mg	31.4 days of reserve
Fuel Ethanol Exports	0 mg**	n/a
Fuel Ethanol Imports	32.6 mg*	n/a

* Source: U.S. International Trade Commission.
**Jim Jordan and Associates.
http://www.ethanolrfa.org/industry/statistics/#B

New Ethanol Plants are Springing Up Everywhere

Lots more ethanol plants are coming on-line. Currently, there are 101 operating ethanol biorefineries nationwide, producing 4.8 billion gallons annually. There are 34 ethanol refineries and 7 expansions under construction with a combined annual capacity of more than 2.2 billion gallons. (18) There are even plans in the works for ethanol plants in the Northeast, where much of the ethanol demand currently is located.

In Maryland, at least three different groups are looking at construction, including the Maryland Grain Producers Association. (19) One or two plants are proposed for Delaware. New Jersey has at least one plant proposed—Garden State Ethanol in Cumberland County. The New Jersey Legislature has qualified the plant to receive a $1 million federal grant. (20) Pennsylvania has a couple of plants proposed in the southeastern part of the state, but I've been reading a lot of NIMBY stories about proposed locations.

One article that I read about the New Jersey plant is that they will use corn from New Jersey growers, and imports from Maryland and Delaware. Maryland proposes imports from nearby states, as does Delaware. We can't all produce ethanol from the same bushels of corn!

The American Coalition for Ethanol recently produced the "ACE Ethanol Handbook," a state-by-state reference guide that provides information about U.S. ethanol production, marketing, and use, public policies, and regulations that states have adopted affecting ethanol production and use, and state laws requiring ethanol use (available at *http://www.ethanol.org/*). The Handbook provides figures about the corn production for each state, the gasoline consumption based on 2004 figures, and the potential ethanol use if all gasoline sold in the state contained 10 percent ethanol.

I've calculated the ethanol production in millions of gallons per year that could be produced if all corn grown in the state was used to make ethanol. We're coming up a little short, and now we're also supposed to be adding E85 stations as well. I don't know how the volume of distillers mash that is a by-product of

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■ **Children of the Corn?**
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the ethanol production compares with the volume of chicken feed available if the corn is not used to produce ethanol, but I think we may have a few chickens going hungry.

One of the proposals for an ethanol plant in Delaware is for a plant with an annual ethanol production of 100 million gallons. To make that amount of ethanol would require an input of corn of about 36 million bushels or 1.5 times Delaware's current corn production (their estimate for gallons per bushel is higher than USDA estimates). I guess we'll have to buy some from our neighbors. Oh, but wait—they were going to buy some corn from Delaware to feed their proposed new ethanol plants! If we can find enough corn to feed the plants, at least we'll have plenty of chicken feed from the distillers mash that is a co-product of making ethanol, and enough CO_2—, also a byproduct, to carbonate lots of drinks.

If we take all of the corn grown in the states (287,977,000 million bushels—see Table 3), we should be able to produce about 800 million gallons of ethanol. The ethanol demand for these states, if all the gasoline used is E10, means that we need about 1,800 million gallons of ethanol. And we're starting to produce all those flex-fuel vehicles that can run on E85! I guess we're still going to be buying from the Midwest. New Jersey will help. They have plans for a waste-to-ethanol plant that will produce about 55 million gallons of ethanol per year from old tires. (21) I'm sure we'd have some scrap tires to sell them.

It's becoming more economical to produce ethanol—distillers now recycle the heat and steam used in fermentation and distillation for production of more fuel. The overall cost of production is less than half of what is was in 1986. Newer plants also use hardier yeasts, boosting the amount of ethanol that can be produced from each bushel of corn. One refiner in California says West Coast demand is now so high that it is cheaper to bring in trainloads of corn from the Midwest than trying to find spare tankers to haul finished ethanol from the same region. It's logical that the most viable ethanol industry is where you've got the greatest supply of raw materials and demand for the product, which keeps prices down.

TABLE 3
Corn Production, Gasoline Consumption, and Potential Ethanol Use and Production for EPA Region III States Plus New Jersey

STATE	Estimated Total Corn Production in bushels (2004)	Gasoline Consumption (2004)	Ethanol Production Incentives	Ethanol Use Volume Potential (based on 10% ethanol blend in 2004 gasoline consumption)	Ethanol Production in gallons (based on 1 bushel of corn producing 2.5 gallons of ethanol)
Delaware	23,256.000	0. 431 bgy	No	43 mgy	58 myg
Maryland	65,025,000	2.7 bgy	Yes	286 mgy	163 mgy
New Jersey	10,296,000	4.4 bgy	No	439 mgy	25 mgy
Pennsylvania	137,200,000	5.3 bgy	Yes	530 mgy	343 mgy
Virginia	52,200,000	4 bgy	No	402 mgy	131 mgy
West Virginia	0	0.86 bgy	No	85 mgy	0
District of Columbia	0	0.16 bgy	No	16 mgy	0
TOTAL	287,977,000	17.851 bgy		1801 mgy	720 mgy

http://www.ethanol.org/EthanolHandbook2006.pdf.pdf

"Poop to Pump" Ethanol

Panda Ethanol just announced plans to build an ethanol plant in Hereford, Texas that will be fired by mountains of manure. Panda's CEO said "We've located a project in what I would call the Saudi Arabia of manure." The plant will gasify 1 billion pounds of manure a year to make 100 million gallons of ethanol. The plant will also fuel more than 90 percent of its own energy needs by heating up manure until it releases methane, which it will then burn to make steam to fuel the plant. Ash from the process can be used to make cow bedding and cement. They also hope to build a plant using the same technology in Kansas. The CEO did warn, however, that when it comes to harvesting manure, timing is important. "It can't be too fresh and it can't be too old." (22)

E85, Flex-Fuel Vehicles, and CAFE Standards

One drawback of ethanol is that a gallon of ethanol generates only about 75 percent as much power as a gallon of gasoline. It takes about 1.4 gallons of E85 to get as far as one gallon of gasoline. That means that E85 would have to be about 25 percent cheaper per gallon than gasoline to be a bargain for consumers.

Federal tax subsidies are available to service stations that install E85 pumps, and some states are also subsidizing installation. Rules recently published by the IRS allow for a 30 percent federal income tax credit, up to $30,000 per property, for the installation of fuel pumps that dispense alternative fuels. Some states are also subsidizing E85 prices. GM has its advertising campaign "Live Green, Go Yellow" to push the sale of E85-compatible vehicles. (23)

Ever wonder why the big automakers are starting to churn out flex-fuel vehicles, even though most of the E85 pumps are still clustered in the Midwest? The answer is the mandatory Corporate Average Fuel Economy (CAFE) standards. Federal law requires that the cars an automaker offers for sale average 27.5 mpg; light trucks must achieve 22.2 mpg. Failure to do so can result in substantial fines. Relief, however, is available to manufacturers that build E85-compatible, or flex-fuel vehicles.

For CAFE calculations, the government only counts the 15 percent of E85 that is gasoline. By not counting the ethanol, which is the other 85 percent, you get a sevenfold increase in the rating. The calculations assume that you would fill up with E85 half of the time and gasoline the other half. The EPA window sticker mileage rating for a Chevy Tahoe flex-fuel vehicle is 20.1 mpg. Using the calculations allowed for flex-fuel vehicles, the CAFE mileage rating is 33.3 mpg. (24) Running on E85, the Tahoe should actually get between 14 and 15 miles per gallon.

Ever wonder why we don't see smaller, fuel-efficient vehicles available as flex-fuel vehicles? It's the larger vehicles with lower mileage ratings that are more readily available as flex-fuel vehicles. There are approximately five million flex-fuel vehicles on the road today in the U.S. It's estimated that only about 1 percent of them have ever had E85 in their gas tanks.

Almost all new vehicles in Brazil can run on E85. The figures that I've seen show that it costs about $100 to $200 more per vehicle to make a car compatible with E85. Why don't we require it, instead of giving out all these credits? In Brazil, stations carry gasoline, gasohol (E10), E24, and E85. If you have a flex-fuel vehicle, you can fuel your vehicle with whatever makes sense economically.

Earlier this year, the Big Three U.S. automakers said they plan to more than double annual production of vehicles capable of running on renewable fuels to two million cars and trucks by 2010. In a letter to members of Congress, the chief executives of the Big Three stated "Our hope is that with this commitment, fuel providers will have even more incentive to produce ethanol and other biofuels and install pumps to distribute them." The majority of the vehicles available now as flex-fuel versions are the gas-guzzling SUVs and trucks, not the gas-sipping smaller vehicles. (25) Will there be any flex-fuel compacts or subcompacts available by 2010?

And Back to LUST...

Section 1505 of the EPAct concerns the public health and environmental

impacts of fuels and fuel additives. Within two years of signing of the Act, studies are to be conducted to determine possible effects on public health, air quality, and water resources of the increased use of MtBE substitutes such as ETBE, TAME, DIPE, TBA, other ethers and heavy alcohols, ethanol, iso-octane, and alkylates. So, we'll have two years, at a minimum, to wait for

> ***One drawback of ethanol is that a gallon of ethanol generates only about 75 percent as much power as a gallon of gasoline. It takes about 1.4 gallons of E85 to get as far as one gallon of gasoline. That means that E85 would have to be about 25 percent cheaper per gallon than gasoline to be a bargain for consumers.***

information from which we can generate action levels and cleanup numbers for these chemicals.

Notice, this list doesn't include information for MtBE, which, while disappearing from most gasoline, has yet to disappear from the soil and groundwater at release sites. We still haven't seen the U.S. EPA risk assessment that cites MtBE as a "likely" human carcinogen, linking MtBE to cancers such as leukemia and lymphoma that have toxicological endpoints similar to known carcinogens, such as benzene and butadiene. The document was evidently completed some time in 2004, circulated through EPA for review, and approved by the Office of Research and Development's National Center for Environmental Assessment. It still needs signoffs by other EPA divisions and external review. (26)

I know people are busy. So the document's been sitting in someone's in-box for the last two years and is not a priority. I do know that during last year's EPAct hearings, some members of Congress asked to see the report. News reports at the time said that they didn't get to see it. So the states have each had to generate some sort of action levels and cleanup numbers for a chemical for which we are lacking health data. Are we erring on the conservative side, costing money for cleanups that are unnecessary, or are we erring in a manner that may be impacting people's health?

I'm sitting on a few sites where I have sky-high levels of TBA in monitoring wells and levels in potable wells that I don't know whether or not should be of concern. What about the TAME? I have a few sites where the TAME concentrations rival those of the MtBE concentrations. How much cleanup is necessary?

So, sometime around two years from now, we may have some numbers for ethanol, and for the other chemicals that we've been dealing with for years. Thank you for that, Congress. Now, if you could only appropriate a little more of the money you authorized in the Energy Bill…

As today's oil prices soar and ethanol becomes liquid gold, ethanol will soon consume more than 40 percent of Minnesota's corn crop. If the plants currently on the drawing board are built, that will rise to 50 percent or more. In Iowa, there are 55 ethanol plants open or proposed, and, according to Iowa State University economist Bob Wisner, if all those plants are built,"…it would use virtually all of the Iowa corn crop." (27)

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New Hope for Hurricane Fuel-Availability Problems...Portable Electric Pumps for UST Systems

by Marshall Mott-Smith

In summer 2004, Hurricane Ivan gave Florida a reality check on how major storm damage can adversely affect fuel availability to consumers, government, and commerce. Ivan destroyed and damaged bridges, large AST storage and distribution facilities, and UST facility infrastructure. Electric power was out for several weeks in some areas. The day after the storm, it became painfully clear to residents in storm-damaged areas of northwest Florida that the only fuel they would have for the near future would come from the product remaining in their vehicle gas tanks or portable gasoline containers.

Test run of GPI's portable electric pump system unit.

In addition, the remaining fuel stored in USTs at retail petroleum marketing facilities was not available since there was no electric power to pump it out. On top of that, no fuel could be delivered to the hurricane-ravaged coastal areas because of damage to bridges and the transportation network. However, because Florida's Emergency Response Program is experienced, well funded, and well managed, the state responded quickly and efficiently to these problems; nevertheless, there was a period of hardship and inconvenience for the local residents.

Two months after Hurricane Ivan, I attended the annual Petroleum Equipment Institute Trade Show to keep up with the latest advancements in technology. While visiting at a booth with portable electric pumps designed for ASTs, I had an idea that the concept could work for USTs as well. I spoke with the exhibitor, Great Plains Industries, Inc. (GPI), and they agreed that the concept was worth pursuing. I obtained their product literature and contact information and followed up several weeks afterwards. However, I had to put the effort on the back burner in the face of higher priorities with tanks program management issues.

One Year Later...

Hurricane Wilma hit Florida…right on the heels of Hurricanes Katrina and Rita which had crippled one-third of our nation's fuel-refining capacity and significantly disrupted petroleum distribution in Florida. Wilma was projected to hit Florida as a Category Three near Naples and exit the east coast as a Category One. But the projections were inaccurate—Wilma retained her Category Three status all the way across the state to the Atlantic Ocean. Once again, Florida faced serious problems with interruption of electric power and fuel availability. Although most had power within one week, some facilities were without power for nearly two weeks.

Components of GPI's portable electric pump system.

Shortly before Wilma hit, I was asked to help with the State Emergency Response Team's Fuels Desk (known as ES 12). ES 12 manages the pre-storm positioning of fuel tankers for first responders and other emergency response personnel and helps to match up critical-need facilities such as nursing homes, assisted-living facilities, and hospitals with petroleum distributors.

As Wilma hit, it became clear that we needed a way to increase fuel availability. In addition to the critical-need facilities, we were swamped with calls from consumers who couldn't get fuel for their vehicles and electric generators. There was an immediate and pressing need for the UST-pumping system we had contemplated the previous year.

Fortunately, Great Plains Industries had not shelved their plans and were able to respond quickly to our urgent requests for a portable electric pump system that could be used to pump fuel from USTs into vehicles. Three days after Wilma made landfall, the Florida Department of Environmental Protection (DEP) placed an order for 30 of the prototype units. Shipping took several days, and communication problems in the affected area slowed us down. By the time we got the units operational, the need for them had diminished.

During the winter, we worked with GPI to refine the prototype and make improvements, particularly with ease of use, cleanup, and safety considerations. The new units are portable, relatively lightweight, and easy to use. The unit includes a meter that can accurately quantify product dispensed for inventory needs and a filter for ensuring fuel quality. There is also a six-inch steel offset fitting at the bottom of the suction hose to prevent sludges and tank water bottoms from being pumped into the vehicle. The 20-foot suction hose is more than sufficient to reach the bottom of large-diameter USTs. Power is supplied through a 15-foot power cable with battery clips to the 12-volt battery of a nearby vehicle or the vehicle receiving fuel.

After conducting several successful field tests, and with a set up time of less than five minutes, DEP decided to exchange its 30 prototype units for the newer improved pump systems. We now have ten of the newest model portable electric pumps. Most likely, the units will be used for county and local government fleet management facilities where qualified personnel can operate the systems, but we know of several retail facilities that plan to use the units in a full-serve application. We plan to deploy six of the units to the DEP District Offices and retain four in Tallahassee to be predeployed before storm landfall for immediate use in affected areas.

We have notified the County Emergency Operations Centers to make them aware of these assets, and we will coordinate with the districts on pre-hurricane deployment and posthurricane return of the pumps. Next time Florida is affected by a hurricane like Ivan or Wilma, we will be better prepared to assist government and the public with posthurricane fuel-availability problems. ■

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We need to be thinking on a more global level. When MtBE was added to gasoline to help decrease air pollution, there was little to no consultation with water programs to see what the ramifications would be. The "butterfly effect" is a Chaos Theory phrase that explains how small changes in the initial condition of a system can cause a chain of events leading to large-scale phenomena. Had the butterfly not flapped its wings when we decided to make MtBE a major fuel component, the trajectory of the great global system might have been vastly different. As we move toward an ethanol economy, we need to be looking beyond the narrow view of just putting fuel into our vehicles. ■

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What About Those Temporarily Closed Tanks?

Are We Creating a New Generation of Forgotten Tanks?

by June Reilly

Recently, a flurry of e-mails circulated among various state UST program folks dealing with the question of what to do with tanks that meet post-1998 performance standards but that have been placed into temporarily out-of-service (TOS), or temporary closure, status for one reason or another. With this discussion on TOS tanks, comes the question of how closely we are keeping track of these tanks—whether we are in effect creating a new generation of out-of-service tanks.

It's not difficult to see how a state could lose track of some of these TOS tanks. Take this not-unusual scenario—a small country store closes, and the property is on the market for several years. The owner of a gas station dies, and settling the estate takes on a life of its own. Finally, when the property eventually changes hands and reopens for business, the new business does not sell gasoline, and the temporarily closed tanks remain in the ground.

Every program in the country has gone through the nightmare of discovering tanks that were abandoned prior to the inception of regulatory/permit programs. One advantage to today's temporarily closed tanks is that they have been taken out of service legally and that through this process the state UST programs know where they are located thanks to the notification requirements. But that still leaves us with a crop of these tanks. So what happens now?

It is worth taking a look at the federal requirements for temporary closure (40 CFR Subpart G, § 280.70) so we can keep in mind what is expected at the minimum:

> *(a) When an UST system is temporarily closed, owners and operators must continue operation and maintenance of corrosion protection in accordance with § 280.31, and any release detection in accordance with Subpart D [release detection]. Subparts E [release reporting, investigation, and confirmation] and F [release response and corrective action for UST systems] must be complied with if a release is suspected or confirmed. However, release detection is not required as long as the UST system is empty. The UST system is empty when all materials have been removed…so that no more than one inch of residue, or 0.3 percent by weight of the total capacity of the UST system, remain in the system.*
>
> *(b) When an UST system is temporarily closed for 3 months or more, owners and operators must also comply with the following requirements:*
> *(1) leave vent lines open and functioning; and*
> *(2) cap and secure all other lines, pumps, manways, and ancillary equipment.*
>
> *(c) When an UST system is temporarily closed for more than 12 months, owners and operators must permanently close the UST system if it does not meet either performance standards in § 280.20 for new UST systems or the upgrading requirements in § 280.21, except that the spill and overfill equipment requirements do not have to be met. Owners and operators must permanently close the substandard UST systems at the end of this 12-month period in accordance with §§ 280.71-280.74, unless the implementing agency provides an extension of the 12-month temporary closure period. Owners and operators must complete a site assessment in accordance with § 280.72 before such an extension can be applied for.*

Where Do the States Stand with Temporarily Closed Tanks?

The e-mail discussion was timely for states such as Vermont and Oregon, whose UST programs are dealing with the question of whether temporarily closed tanks have adequate financial responsibility mechanisms. The federal rule releases an owner or operator from maintaining financial responsibility "after the tank has been closed, or, if corrective action is required, after corrective action has been completed and the tank properly closed." So until the tank is permanently closed, financial responsibility must be maintained. But many insurance companies will not continue insurance at all on out-of-service tanks, or if they do, coverage is limited to only one year. This creates a dilemma for owners and operators

Some states have realized that most post-1998 TOS tanks are not coming back into service and need to be permanently closed, so they are addressing this requirement in their next rule change. Louisiana adopted rules in May 2005 that allow upgraded tanks to remain in temporary closure for 24 months; after that the owner/operator must either permanently close them or perform an environmental site assessment. Wyoming is considering changing its rules to require an environmental site assessment after three years if a temporarily closed tank not removed.

How adequately are states tracking the status of TOS tanks with regard to maintaining performance standards? For example, Wisconsin ordered the closure of a number of tanks when it was discovered that the power had been shut off by the local utility, thereby disabling the impressed current system.

Most states require annual tank fees to be paid on temporarily closed tanks if owners want them to remain in their state fund for financial responsibility. The requirement to pay the fee has promoted the removal of tanks in many cases. Prior to this year, Vermont did not collect the annual tank assessment on TOS tanks. However, this year we have notified temporarily closed tank owners of their financial responsibility requirement and will be billing them the annual tank assessment. So far, the notice of assessment has caused three tank owners to remove their tanks, and one owner, following certification by a tank contactor as being compliant with the rules, brought his tank back into service!

Based on the e-mail responses, it appears that many state UST programs are tracking how long tanks have been in TOS mode. If owners and operators of out-of-service tanks are kept aware of their responsibilities, they are likely to make the decision to either permanently close their out-of-service tanks or put them back into service—after a few years, regulatory requirements become a cost burden with no financial return. Owner/operators are therefore likely to make the decision to close their tanks. However, many states are considering making rule changes to require the owner to close these tanks permanently. If a tank has been closed for more than five years—maintained or not—chances are that it won't ever be going back into service. And the environment has no need to have it in the ground.

Vermont, like most other states, is still dealing with abandoned tanks that were never notified to the state. The Vermont Department of Environmental Conservation uses Sanborn Fire Insurance maps as a supporting historical source for validating the suspected location of old buried tanks discovered during property transfers, redevelopment of property, and installation of sewer or water lines. To avoid another generation of abandoned tanks, tracking TOS tanks until their permanent closure is a must. And there is no excuse, because by the notification of tanks states know where they are. ■

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Field Notes ✍

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

Equipment Compatibility and the New Fuels

We have known for some time that many alternative fuels do not have the same compatibility characteristics as conventional fuels when they are transported, stored, metered, and dispensed. We know, for instance, that certain metals are not compatible with some ethanol blends. We are also aware that some nonmetallic materials may degrade when placed in contact with ethanol.

Biodiesel fuels also require special storage and handling requirements. While biodiesel is commonly mixed with ordinary petroleum diesel to make bio blends like B5 or B20, straight, nonmixed biodiesel (B100 or "neat" biodiesel) can also be burned as fuel in diesel engines. Some studies suggest that compatibility problems increase as the percentage of biodiesel in the diesel increases.

The problem until now has been finding a reliable source for which everyone involved with these alternative fuels (owners/operators, regulators, installers and equipment providers) can obtain the latest and most accurate information on equipment compatibility.

The Petroleum Equipment Institute (PEI) has recently begun an ambitious project to provide an online database of ethanol- and biodiesel-compatible equipment. The information, available under the Alternative Fuels section of PEI's website, *www.pei.org*, is searchable by manufacturer and general item description. Manufacturers are responsible for providing the list of equipment and the particular fuel(s) with which the component is compatible (B5, B20, B100, E10, E20, E85, and E100). The manufacturer also identifies the verification process used to prove that the equipment is indeed compatible with those fuels.

We anticipate that, in time, the following equipment, components and materials will be identified as ethanol and/or biodiesel compatible:

- Automatic shutoff and overfill valves
- Tanks
- Submersible pumps
- Line-leak detectors
- Leak detection equipment
- Spill containment and sumps
- Piping
- Sealants/adhesives
- O-rings and gaskets
- Flex connectors
- Filters
- Dispensers and internal components
- Hanging hardware

We anticipate that this equipment matrix will be a dynamic reference document, with changes constantly being made as manufacturers confirm compatibility and list their products. Questions and/or comments about the PEI alternative fuels website in general or the equipment compatibility guide in particular should be directed to Allison Monroe (amonroe@pei.org) of the PEI staff at (918) 494-9696. ■

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**

Beware the Unintended Consequences of Manifolding

It used to be that connecting tanks containing the same product together to increase storage capacity was a simple matter. A pipe was run from the bottom of one tank, out the top of the tank, over to the second tank, and back down through the top to the bottom of the second tank. In the days of suction-pumping systems, this was the only practical way to connect two tanks. The piping was called a siphon, or sometimes a siphon bar, and the arrangement was called "tank manifolding."

The advent of submersible pumps did little to change the basic siphon arrangement, although other alternatives also became feasible. For example, it was now possible to install submersible pumps in each tank and connect the product piping coming out of the pumps together using a "T" fitting, so two tanks could be used to feed a single product line out to the dispenser islands. This arrangement is called a "piping manifold" to distinguish it from a tank manifold. With a piping manifold, a siphon connection between the tanks is no longer needed.

With the advent of tank gauges, we have entered an era when the electronic intelligence of the tank gauge can be used to control the operation of the submersible pump. The option of having the ATG control the pump now offers other possibilities for managing product in multiple tanks. Two pumps can be installed into two tanks storing the same product as before, but now the pumps can be controlled individually and automatically via the tank gauge. This offers multiple possibilities.

Instead of having the two pumps connected to a piping manifold operating together all the time, the two pumps can be used in an alternating fashion. For example, pump #1 might operate to supply product to a customer, and pump #2 can be used for the next customer, pump #1 for the third, and so forth. This allows both tanks to be drawn down more or less at the same rate.

Another way to use the ATG with the pipe manifold is to have one pump be the primary pump and the second pump the backup. In this mode, one pump is used continuously until the product level in the tank is low, then the tank gauge shuts down the first pump and transfers the pumping activity to the second pump. When the first tank is refilled, the pumping activity switches back to the first pump. In this type of arrangement, the second tank serves as a reserve or backup supply of product.

What Effect Has Manifolding Had on Leak Detection?

The traditional tank siphon connection increases the difficulty of tank leak detection because of the greater fluctuation in liquid level when small amounts of product flow between tanks through the siphon during test periods. This complicates the issue of determining whether the liquid level is changing due to a leak. Also, the leak rate in each tank of a two-tank manifold is half the actual leak rate, making it necessary for the leak-detection system to find smaller leaks. For example, in a two-tank manifold, if one tank is leaking at 0.2 gph, the leak rate measured in each tank is 0.1 gph, requiring an increased sensitivity on the part of the leak detection equipment.

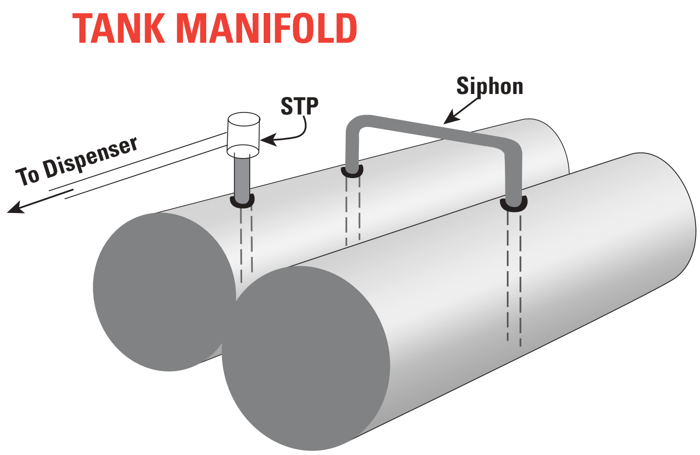
Piping manifold systems in which both pumps operate simultaneously cause problems with mechanical line-leak detectors because the simultaneous operation of the two pumps means that the detectable leak rate is doubled. (See *LUSTLine* Bulletin #29, "Of Blabbermouths and Tattletales, The Life and Times of Automatic Line-Leak Detectors," for a description of the operation of MLLDs and the NWGLDE article on page 33 of this issue.)

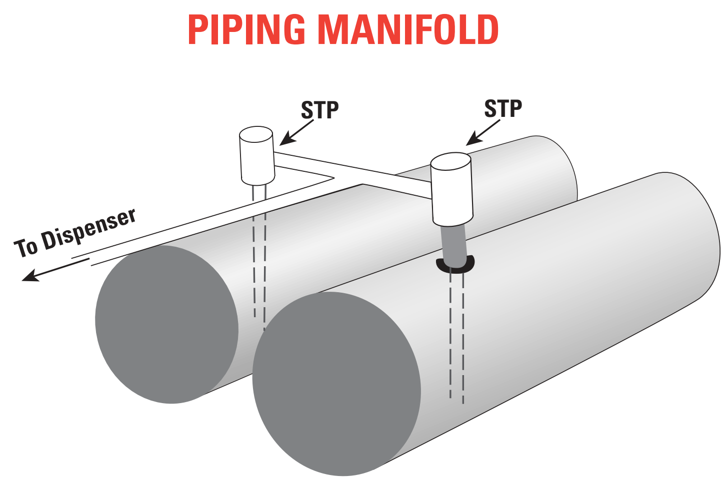
Piping manifold systems in which pumps are operated individually do not have the issue of line-leak detectors not detecting the required size leak. However, these systems have another potential environmental hazard that must be addressed.

The Potential Hazard

One of the features common to all submersible pumps is a check valve that is present in the pump head (also known as the pump manifold) whose function is to open when product is flowing and close when product is not flowing, thus keeping the piping full of product between customers. This is why fuel should start flowing immediately when you squeeze the nozzle handle. Otherwise the product would drain out of the piping back to the tank and the piping would need to be refilled every time there was a time lag between customers.

Because the check valve creates a length of piping that is closed at both ends (at the check valve and at the dispenser), there is the risk of thermal expansion of the product in the pipe, producing very high pressures in the piping. To prevent this, the check-





valve mechanism also includes a pressure-relief valve that allows product to flow back to the tank if the pressure is too great.

The problem arises when the operating pressure of the pump is greater than the closing pressure of the pressure-relief valve. These days, pressure-relief valves can have a variety of settings, but in many cases the valve will open at pressures in the range of 10 to 15 pounds. Now a typical pump operating pressure is in the range of 25 to 30 pounds…and higher horsepower pumps have even higher operating pressures than this.

It is obvious from this that if two submersible pumps are connected in a piping manifold configuration, but only one pump operates at a time, the operating pump will in many cases have sufficient pressure to open the pressure-relief valve. This means that when one pump is operating, product will flow not only to the customer, but also past the pressure-relief valve of the nonoperating pump and into the other tank.

This might seem relatively harmless as the fuel is still contained in a storage tank. However, if the facility is operated so that the master tank is refilled frequently and the secondary tank is kept full as a reserve, the continual addition of product to the secondary tank could produce an overfill situation.

Only an overfill alarm type of system would be able to detect this condition, as neither drop-tube shutoff devices nor ball-float valves would be effective in preventing the flow of product into the secondary tank through the pressure-relief valve. If the overfill alarm is silenced, it can conveniently be ignored for quite some time. Of course, inventory control recordkeeping would also reveal the unintentional transfer of product to the second tank—if anyone were paying attention.

If two submersible pumps are connected in a piping manifold configuration, but only one pump operates at a time, the operating pump will in many cases have sufficient pressure to open the pressure-relief valve. This means that when one pump is operating, product will flow not only to the customer, but also past the pressure relief valve of the nonoperating pump and into the other tank.

The situation could be made even worse if the check valve on the secondary pump did not seat properly (not an uncommon problem) and the amount of fuel that flowed into the secondary tank increased greatly.

If all the tank-top fittings are liquid tight, this could eventually result in fuel coming out of the vent pipe. The more likely scenario, however, is one where the tank top is not liquid tight and fuel escapes via the ATG probe cap, the stage I vapor recovery fitting, the fill cap, or some other connection that is not liquid tight.

I am aware of one instance where this scenario unfolded and the copper vent tube of a mechanical leak detector was not properly connected. Over a period of several months, a substantial amount of fuel was released to the environment via the vent-tube opening.

The Solution?

To determine whether this type of situation is present, the installer must determine the holding pressure of the pressure-relief valve relative to the operating pressure of the pump. If the operating pressure of the pump is higher than the opening pressure of the pressure-relief valve, there are two solutions. One pump manufacturer recommends the installation of a check valve in each leg of the piping manifold with a pressure-relief setting that exceeds the operating pressure of the submersible pumps. As long as this auxiliary check valve operates properly, the product will flow only to the customer and not into the second tank.

Another pump manufacturer provides pressure-relief valves with different settings, so the installer need only purchase and install the appropriate pressure-relief valve in the submersible pump. Not all tank installers, however, are aware of the need to take the pressure-relief valve setting into consideration when installing a piping manifold where both pumps do not operate simultaneously.

The Moral?

As technology makes pumping systems more sophisticated, it is wise to keep our old friend Murphy in mind and consider the possibility that our actions could have unintended consequences. ■

From Our Readers

Thoughts from Louisiana on "Operator Training: Boon or Bust"

In regard to your article, "Operator Training: Boon or Bust" (*LUSTLine* #52, Marcel Moreau), I have some input on the issue. As a regulator in Louisiana, I can see that the requirement for all owner/operators to be trained is a goal that will be difficult to meet. At the present time, Louisiana DEQ has a system in place that gives the option for UST owner/operator first-time violators to take a training class and pay a reduced fine for violation(s) of the UST regulations.

The class covers the basics of UST system types, release-detection methods/requirements, corrosion-protection requirements, recordkeeping, etc. The class is thorough but basic (it is a five-hour class). I think with a little tweaking here and there, the class could include the other points in your "short list." The class is offered to whoever wants to come to it (violators and nonviolators), is free of charge, and the training dates/locations are posted on the LDEQ public website. We offer resources for the individual owner/operator after the class for site-specific questions.

My thought is, instead of trying to get everyone trained at once, the regulatory agency could, as sites are inspected, require the violators to attend the class, all the while offering it to any one who would like to attend. A deadline could be set for all owner/operators to have attended the training by [a certain date]. Presently, we are offering the class [approximately] 12 times a year. The class is offered in different regions each time 2–3 times a year. Attendance is typically between 30 and 60 people (in the capital region) and is based on the size of the region and the number of UST facilities in the region.

So far we have received excellent feedback from the attendees; many of them ask us why we didn't offer the class sooner. I agree with your solution that one or two people from each facility/company should be required to attend and be certified as the "professional UST operator" for that facility/company. Then the certified person(s) would have the responsibility to train site personnel. We do that already for our stage II vapor-recovery sites. We require that there be at least one person on site who is trained to do the daily equipment inspections and that individual can train others [on site] as the need arises.

Here is the link to the LDEQ UST training calendar for the rest of 2006: *http://www.deq.louisiana.gov/portal/tabid/2501/Default.aspx* ■

These thoughts come from Terry Dedon, Staff Scientist, Louisiana Department of Environmental Quality Capital Region
e-mail: terry.dedon@la.gov

■ **Tribal Lands** *from page 13*

elevated for landscape, then the user could access the landscape category and see all the criteria for that particular category and the scores.

The benefits of this type of system of collecting, analyzing, and viewing data are tremendous. The ITEC UST staff are able to prioritize UST facilities for inspection, maximize the staff time, and inspect high-risk sites more frequently. Not only does this tool give us the ability to determine the impact of a leak to the environment and natural resources in the area, it may also give us the ability to predict where future leaks may occur based on the data obtained from an UST inspection.

There is still work to be completed and improved upon. Another goal for this project is to develop a planning tool for siting future UST installations using only the community and topography/geology categories. This tool is a valuable asset that could be used by any tribal department for a number of programs beyond the UST program.

We hope to make everything Internet accessible, where the user can enter a latitude and longitude and have the results delivered over the Internet. As work continues, the CRUST GIS tool will adopt additional changes to increase the overall effectiveness of this application to the UST inspection process. ■

Frank Harjo is an Environmental Specialist with ITEC. He can be reached at fharjo@cherokee.org. Special thanks to the EPA Region 6 UST Tribal Program and U.S. EPA Region 6 staff Dr. Gerald Carney and Jeff Danielson, who have been instrumental in providing support and input to our project.

FAQs from the NWGLDE

...All you ever wanted to know about leak detection, but were afraid to ask.

Questions about Automatic Mechanical Line Leak Detectors (MLLDs) — Part II

In this issue's FAQs from the National Work Group on Leak Detection Evaluations (NWGLDE), we discuss the effects of the type of piping and the location of the MLLD in the line on the MLLD itself. This article does NOT apply to electronic line-leak detectors (ELLD). (Please Note: the views expressed in this column represent those of the work group and not necessarily those of any implementing agency.)

Q. ***Can an MLLD evaluated in a rigid pipeline system be used in a flexible pipeline system?***

A. Due to the difference in bulk modulus (amount of stretching under pressure) between rigid piping and flexible piping, MLLDs designed for use in rigid pipelines may not be satisfactory for use in flexible-pipeline applications. MLLDs are likely to see the stretching as a leak and erroneously respond by restricting the flow (false alarm). NWGLDE believes that MLLDs used in flexible-pipeline systems must be evaluated in flexible-pipeline systems to ensure that they are able to detect leaks in accordance with U.S. EPA performance standards. However, the decision as to whether or not to restrict MLLD use on specific pipeline systems is up to each state.

Evaluations of MLLDs tested for use in flexible pipelines show that the affect of stretch (bulk modulus) limits the capacity (and therefore the length) of flexible-pipeline systems that can be successfully monitored by an MLLD when compared with the capacity (also length) of rigid-pipeline systems that can be successfully monitored with the same MLLD. It is also necessary to evaluate MLLDs in a combination of both rigid and flexible pipelines if they are to be used in that type of system. Again, the decision on whether or not to restrict MLLD use on this type of pipeline system is up to each state.

Q. ***Is it important where MLLDs are placed in the system?***

A. Since MLLDs are designed to detect leaks downstream from their installation point (from the MLLD toward the dispenser), the normal installation point is in the submersible turbine pump (STP). In some applications, MLLDs must be placed in a special pipe fitting adjacent to the STP. In these cases, the MLLD should be installed as close to the STP as possible. However, in this situation, the piping that is between the STP and the MLLD is not being monitored for leaks.

Installations involving manifolded tank systems appear to have the most MLLD placement errors. In cases where two or more STP systems are piped to one common discharge line, and each STP has its own MLLD, the leak rate that will be monitored is equal to the total amount of product being metered into the line by the MLLDs. For example, a two-tank system, each with its own STP and MLLD, will trip when a leak greater than 6 gph is detected. The leak rate for a three-tank system would be 9 gph. On the other hand, if a single MLLD is placed on the common discharge line, that MLLD will check the piping downstream for a 3 gph leak.

Manufacturers of MLLDs have suggested configurations that installers can use to achieve the required 3 gph leak-detection rate when connecting to one common discharge line. For example, if the STPs are on a delay relay, when the first pump comes on, the MLLD associated with that pump will check all the piping for a 3-gallon-per hour leak before the other STPs come on. This information can be found by visiting MLLD manufacturers' websites. ■

About NWGLDE

The NWGLDE is an independent work group comprising 10 members including 9 state and 1 U.S. EPA members. This column provides answers to frequently asked questions (FAQs) the NWGLDE receives from regulators and people in the industry on leak detection. If you have questions for the group, please contact them at questions@nwglde.org

NWGLDE's mission:

- Review leak-detection system evaluations to determine if each evaluation was performed in accordance with an acceptable leak-detection test method protocol and ensure that the leak-detection system meets U.S. EPA and/or other applicable regulatory performance standards
- Review only draft and final leak-detection test method protocols submitted to the work group by a peer review committee to ensure they meet equivalency standards stated in the U.S. EPA standard test procedures
- Make the results of such reviews available to interested parties

SNAPSHOTS FROM THE FIELD

SHELTER FROM THE STORM

Mr. J. L. Faircloth of Pensacola, Florida constructed this storm shelter from a salvaged steel UST anchored to the earth by log chains, site-built concrete deadmen, and partially bermed. The tank was originally reported to the local UST program as an unregistered storage tank, the subject of a complaint investigation.

Photos courtesy of John Stevenson of the Escambia County (Florida) Dept. of Health.

The outside is painted silver, the interior a pastel green. Internal stanchions are welded in place, supporting shelves along the sides, which serve as storage for food, water, candles and first aid supplies, tools, and as a place to spread sleeping bags. Ventilation is provided by a port low at one end, and several four-inch PVC risers from bungs at the top with return bends at the top of each to exclude rain. A step-through door at the south end of the tank provides access. A steel door constructed with a removable sheet metal panel for emergency egress opens inward.

Mr. Faircloth and his dog occupied this shelter during Hurricane Dennis. He reports it was both quiet and comfortable during the stay. Intended for only a few hours tenancy, at the height of a storm, he says the rain cooled the interior quickly, and the wind effectively vented it. Also, convection stratification removed the warmed air at the top. Chocked, anchored, and bermed, the shelter was very stable while the wind tore at its surroundings.

A TANK CAR UNEARTHED...WITH PRODUCT!

What appears to be a single-dome railroad tank car was unearthed recently near a roundhouse (a circular building for housing, repairing, and switching locomotives) in Keene, New Hampshire. The car, which had no undercarriage, was probably used to fuel trains that approached the round house. It is riveted, which means that it was manufactured prior to 1920. The car contained some product and a very old broken baseball bat. There was some contamination around one end of the car and some petroleum in the groundwater. The area where the car was found is part of Keene's rails-to-trails project, which will connect two fairly long segments of existing bicycle trails. The New Hampshire Department of Environmental Services (NHDES) also determined that two nearby above-ground storage tanks were probably the tanks shown on the 1924 Sanborn map of the area.

There is a good entry in wikipedia.org on tank cars at *http://en.wikipedia.org/wiki/Tank_car*. This story and photos were provided by Gary Lynn, NHDES.

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

■ **L.A. Oversight Program** *from page 11*

Dr. Yue Rong (a.k.a. "Y.R.") is the program manager for the Underground Storage Tank Program at the California Regional Water Quality Control Board, Los Angeles Region. He has worked with cleanup of chlorinated solvents in the San Fernando Valley and is a senior staff member of the multidisciplinary MtBE groundwater contamination team. He can be reached at YRONG@waterboards.ca.gov

Dr. Matthew Small is a hydrogeologist for U.S. EPA Office of Underground Storage Tanks - Region 9 in San Francisco, California, and a licensed professional geologist. He provides technical support and training to state UST/LUST programs and direct program implementation on Native American lands, and is active in creation of national standards and guidelines. He can be reached at small.matthew@epa.gov

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How Much Bioenergy Can Europe Produce Without Harming the Environment?

In its new report, *How Much Bioenergy Can Europe Produce Without Harming the Environment?*, the European Environment Agency assesses how much biomass could technically be available for energy production without increasing pressures on the environment. The study concludes that "significant amounts of biomass can technically be available to support ambitious renewable energy targets, even if strict environmental constraints are applied." The report, which did not analyse costs and logistics, finds that Europe could actually produce 190 Mtoe (million tons of oil equivalent) of bioenergy in an environmentally viable fashion, by 2010. This could reach almost 300 Mtoe by 2030. Seems such a study would be useful here in the United States. Read more at *http://reports.eea.europa.eu/eea_report_2006_7/en.* ■

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