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L.U.S.T.LINE

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

Exit Strategy Toolkit for Optimization and Termination of Active Remediation Systems

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Active remediation systems at petroleum underground storage tank (UST) sites often remain in operation even after they no longer effectively reduce risk or result in net environmental benefit. This happens for a variety of reasons, including the following:

- Lack of clear, established, and agreed-on remedial concerns, goals, and performance criteria.
- Little use of published and readily available tools to inform remedial decision-making.
- Uncertainty about the natural capacity of aquifer systems to attenuate key constituents of concern (COCs) below regulatory clean-up levels within reasonable time periods.

The Exit Strategy Toolkit was developed for Shell by ARIS Environmental and Hers Environmental Consulting, Inc. to address these and other issues in UST remediation planning and implementation. The Toolkit offers a structured framework for selecting active remediation systems, optimizing their performance, and transitioning from active to passive remediation and ultimately to site closure (no further action) more confidently and sustainably in a manner protective of human and ecological receptors. This framework is intended to be integrated into an existing federal or state regulatory corrective action plan that ensures no adverse effects on human health and the environment. Certain elements of the Toolkit will require upfront stakeholder alignment on methods, tools, data needs, and criteria to support remedial decision-making.

The Motivation

It is a predicament practitioners find themselves

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in all too often at UST sites where there has been a release of light non-aqueous phase liquid (LNAPL) to the subsurface. Active remediation is initiated, and then continued, without sufficiently understanding three main questions:

- Will remedial goals and objectives ever be met?
- Is there more that can be done to optimize remedial performance to get to closure?
- Is it time to exit?

Practitioners are left in a state of uncertainty, lacking confidence in how or when to transition to a less energy-intensive form of remediation or terminate active remediation altogether. This often results in remediation systems that are no longer effective, sustainable, or providing net environmental benefits. Net environmental benefit can be evaluated in context of the ISO 18504:2017 definition for sustainable remediation: elimination and/or control of unacceptable risks in a safe and timely manner while optimizing the environmental, social, and economic value of the work. Moreover, their continued operation may delay brownfield redevelopment and squander clean-up (trust) funds and resources that could otherwise be put to better use. In such instances, the onus falls on the practitioner community to revisit cleanup objectives and determine whether the proper remedy was selected, appropriate data was collected to assess remedy performance and transitioning, and whether the remedy could be terminated confidently without a negative impact on human health and the environment. Written guidance is also needed to help avoid issues like this from arising in the future.

Over the years, numerous tools and guidance have been developed and published to help in remedial decision-making and navigating the remedial paradigm (API 2018; ITRC 2018). The focus has largely been on improving the understanding of source-pathway-receptor linkages (site risk), honing conceptual site model (CSM) development, and selecting and implementing remediation measures that are fit for purpose. This guidance has been complemented by advancements in several areas. High-resolution site characterization tools have been instrumental in improving source identification, characterization, and remediation. Innovative approaches have been developed for measuring rates of physical migration (such as LNAPL transmissivity and mass flux/discharge) and natural attenuation of petroleum hydrocarbons in source areas (natural source zone depletion, or NSZD) and along groundwater and vapor migration pathways. Despite these advanced methods, there is still uncertainty about whether and when to terminate active remediation. The reasons for this can include:

- An absence of key data and/or a focus on data that have little to do with actual risk (such as hydrocarbon mass removal rates).
- An "old-school" mentality reluctant to try or embrace new tools and guidance.
- Inexperience in integrating the latest science, such as NSZD, into remedial frameworks.
- Absence of a practical framework that collectively addresses relevant issues and helps stakeholders make informed, confident remedial decisions.

Because a practical framework is something tangible that can be addressed, we developed and published this Exit Strategy Toolkit incorporating recent science and tools on remediation performance. The Toolkit is intended for application at sites with on-going as well as proposed remediation.

What Exactly is the Exit Strategy Toolkit?

The Exit Strategy Toolkit is a series of factsheets that provide a systematic framework to initiating, evaluating, implementing, and terminating active remediation systems. The Toolkit is a web-based tool available at https://naplansr.com/tools/exit-strategy-toolkit/. Use of the Toolkit is expected to increase stakeholder confidence in remedial decision-making, minimize unnecessary active remediation, and ultimately achieve more successful, sustainable remedial outcomes. The Toolkit reinforces good practice by emphasizing the importance of establishing and agreeing on critical elements of the remedial approach.

L.U.S.T.Line

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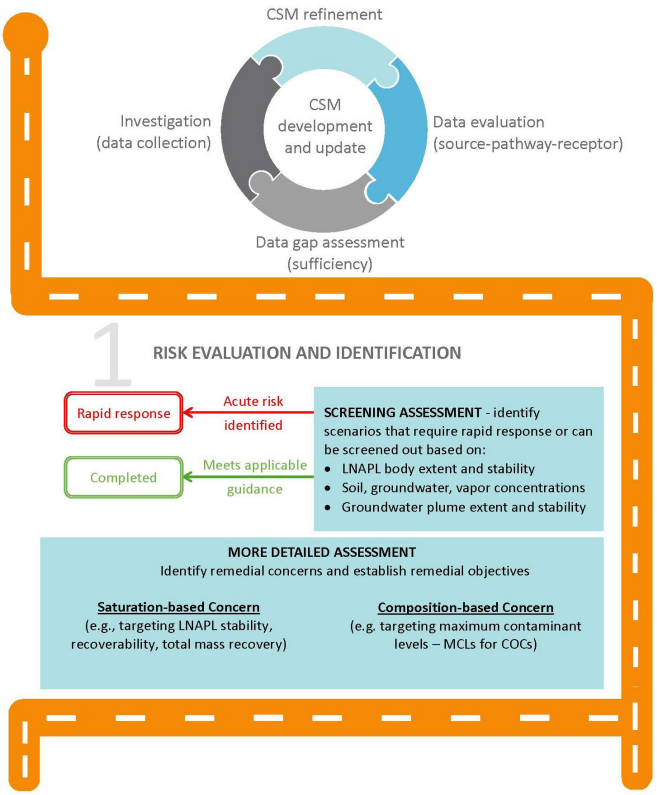

Figure 1a. Four-stage Process and Roadmap for Remedial Decision-Making (from Toolkit).

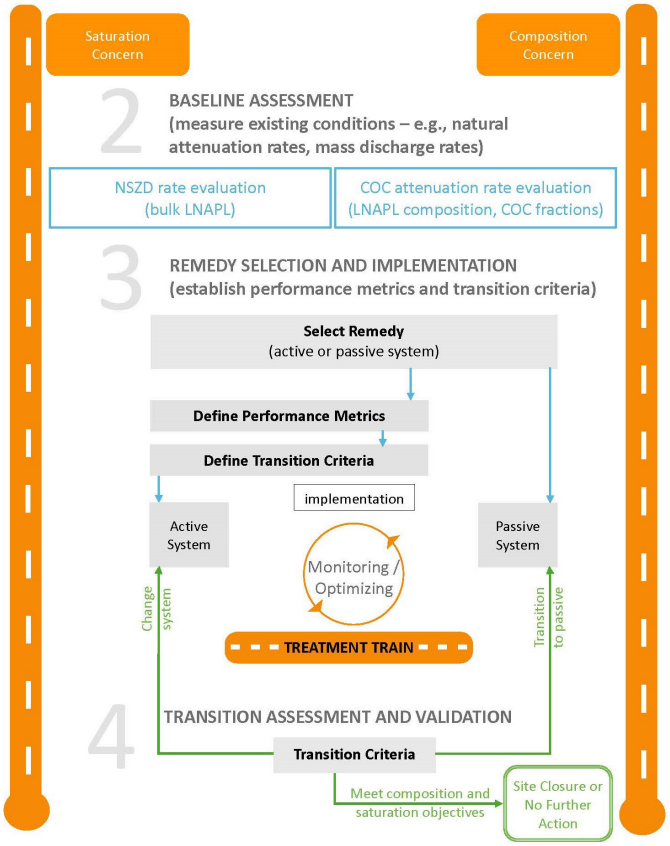

Figure 1b. Four-stage Process and Roadmap for Remedial Decision-Making (Part 2 from Toolkit).

The Toolkit consists of a Compendium that serves as an overarching framework and roadmap for a series of technology-specific factsheets on hydraulic recovery, soil-vapor extraction (SVE), air (and bio) sparging, bioventing, and natural attenuation. The Toolkit is user-friendly and easy to follow, yet sufficiently detailed, with best practices, tools, and methods in appendices or referenced through links. The Toolkit can be applied at sites where remediation is being planned or is ongoing. It is designed for use by key stakeholders involved in remedial decision-making, including consultants, industry representatives, and environmental regulators who oversee the management of individual sites or portfolios of sites impacted by LNAPL.

The Toolkit focuses on active remediation, not CSM development, although the CSM is inherently fundamental to optimizing remediation and efficiently meeting remedial goals. References to guidance on developing petroleum-related CSMs are provided in the Toolkit. The CSM is thus assumed to be firmly established and updated or refined, as necessary, throughout the site investigation and remedial process. The CSM should be reviewed to identify potential deficiencies or gaps, especially at sites where remediation is ongoing and remedial goals are not being met.

The Four-Stage Remedial Paradigm

The remedial framework presented in the Compendium is based on a four-stage process (Figure 1a and 1b), listed below. These stages are often missing from guidance or are not meaningfully incorporated into remedial frameworks at the outset or considered when re-evaluating or re-defining objectives during the remedial process.

Stage 1: Risk Evaluation and Identification: identify remedial concerns and goals.
Stage 2: Baseline Assessment: conduct natural attenuation rate assessment.
Stage 3: Remedy Selection and Implementation: establish performance metrics for system monitoring and optimization.
Stage 4: Transition Assessment and Validation: apply pre-defined thresholds for transitioning and terminating active remediation.

Stage 1 - Risk Evaluation and Identification

The Toolkit in Stage 1 emphasizes the importance of upfront concurrence on remedial concerns and goals (or objectives) among all stakeholders (Table 1). It is also critical in Stage 1 to identify acute safety or other risks that warrant rapid response. The CSM must be sufficiently developed to assess whether the LNAPL concern (and associated remedial goal) is saturation (mass)- or composition-based. A saturation-based concern commonly involves LNAPL recovery to remove and control LNAPL that is migrating or spreading (migrating LNAPL), or to reduce LNAPL that is present in monitoring wells (mobile LNAPL, but not migrating). A composition-

based concern targets LNAPL that acts as a source for key COCs that exceed regulatory cleanup values or risk-based guidelines for various media-specific exposure pathways. Risk-based guidelines may be derived following an exposure evaluation (source-receptor-pathway) or quantitative risk assessment approach in accordance with applicable regulatory requirements.

The remedial goal ties directly to the identified remedial risk or concern: whether to abate LNAPL migration or decrease LNAPL mass (saturation) or reduce COC concentrations below a regulatory level (composition). The remedial goal drives the choice of remedial technology (e.g., hydraulic recovery, SVE, bioventing), the type of baseline assessment (Stage 2), the metrics and thresholds used to gauge remediation performance and transition criteria (Stages 3 and 4), and associated data needs. The remedial goal should also factor in a reasonable time frame and the ultimate transition to a passive system (monitored natural attenuation, or MNA) and/or site closure.

Stage 2 - Baseline Assessment

Stage 2 encompasses the measurement and analysis of natural attenuation rates prior to the initiation of remediation (ideally) or potentially during remediation while the system is turned off (planned as part of the transition process). This information is used as a baseline in remedial decision-making. The natural attenuation rate can be estimated using existing data, for example, by applying simple screening models such as U.S. EPA BioScreen model (U.S. EPA 1996) or applying tools described in Strasert et al. (2022) or from new data (ASTM 2022) that are not routinely collected during site investigation, such as NSZD rate measurements. For a saturation-based concern, natural attenuation rates are typically estimated from bulk LNAPL attenuation. For a composition-based concern, natural attenuation rates are typically estimated for key COCs in relation to concentration or mass discharge.

Table 1. Stage 1: Examples of Remedial Concerns and Goals.

Identified Risk or Concern	Primary Remedy	Remedial Goal
Saturation: Presence of migrating or mobile LNAPL	Mass removal or recovery	Abate LNAPL migration or reduce mobile LNAPL
Composition: Concentrations or mass discharge/ loading exceeding health-based criteria (human or ecological)	Phase change and mass reduction	Reduce concentrations or mass discharge/ loading

The baseline attenuation rates can be used for the following purposes:

- As a baseline for monitoring hydrocarbon mass loss rates (bulk LNAPL depletion or COC attenuation) and plume migration and attenuation.
- Inform remedy selection in Stage 3, including evaluation of whether an active or passive remediation system is warranted.
- Support termination of active remediation in Stage 4.

The Exit Strategy Toolkit Natural Attenuation Factsheet details guidance, methodologies, tools, analyses, and data needs to support MNA, groundwater plume attenuation rate estimates, and NSZD, and directs the user to associated references (several key references are ITRC 2009; ITRC 2018; CRC Care 2018; CL:AIRE 2019; ASTM 2022).

Stage 3 — Remedy Selection and Implementation

Stage 3 focuses on selection and implementation of the remedy, which should be consistent with the remedial concerns and goals identified in Stage 1 and the baseline attenuation rates estimated in Stage 2. The Toolkit provides key guidance and resources to aid in remedy selection and monitoring performance. Remedies that target bulk hydrocarbon removal, such as excavation and hydraulic recovery, should be selected if the concern is LNAPL saturation. Remedies that target physical phase changes and enhance biodegradation and abiotic reactions should be applied at sites with composition-based concerns. These include multi-phase extraction (MPE), SVE, air sparging, bioventing, biosparging, and in-situ chemical oxidation. Many sites require a treatment train approach, with sequential implementation of various active remedies to address both saturation- and composition-based concerns; or use of technologies, such as MPE, that may simultaneously address both concerns.

The first step is identifying and agreeing on the appropriate remediation technology. Performance metrics and transition thresholds are established with stakeholders prior to the onset of remediation.

Once the system is implemented, it is critical to monitor and confirm that the remedy performance is acceptable, optimized, and sustainable. Performance assessment is conducted during the life cycle of remediation to determine if progress aligns with the remedial concern. The performance assessment typically involves a review of the CSM to identify deficiencies and gaps, application of performance metrics and transition thresholds, and benchmarking hydrocarbon plume migration or mass loss rates against baseline rates of natural attenuation assessed in Stage 2.

The performance metrics and transition thresholds presented in Table 2 provide the basis for optimization and transition. Performance metrics for a given remediation technology are both subsurface- and system-related. Those related to the subsurface are applied and evaluated before, during, and after remediation system operation, and can include monitoring of potential rebound in COC concentrations when, for example, a pumping or SVE system is provisionally turned off.

Each Toolkit technology factsheet addresses potential system optimization measures, such as changes in well location and design, pulsed versus continuous operation, and use of amendments. The technology factsheets also include system monitoring and performance assessment tools. For examples, new tools such as remote sensing and telemetry are designed to enhance system performance and sustainability through improved data collection (e.g., data on greenhouse gas, or GHG, emissions and energy use), reduced exposure hours, and lowered costs of operation. Collection of targeted and timely data can lead to more optimal remediation performance.

Key guidance and resources to support remedy selection include the ITRC LNAPL Guidance (ITRC 2018) and the Remediation Technologies Screening Matrix (Federal Remediation Technologies Roundtable, FRTR). Guidance on the greening of remediation and environmental footprint analysis includes U.S. EPA (2012) and U.S. EPA (2019). The Golder (2016 and 2021) Remediation Toolkits address sustainability principles and indicators, remedy transition, and footprint analysis. The Concawe LNAPL Toolbox makes available multiple tools and models to characterize LNAPL fate and transport (Strasert et al. 2022). Several other tools and aids are referenced in the Exit Strategy Toolkit.

Stage 4 – Transition Assessment (Active Systems) and Validation

The final step in the process is to compare remedy performance to the transition thresholds, and validate transitions from active to passive remediation or ultimately site closure. Effective and confident transitions should invoke multiple lines of evidence based on key metrics (such as hydrocarbon mass reduction or COC concentrations) to conclude that the system no longer produces a benefit (see Table 2). The Toolkit graphically illustrates and describes various transition thresholds that can be used as lines of evidence, such as assessment of LNAPL transmissivity change over time, comparison of remediation mass removal rates to baseline assessment natural attenuation rates, and evaluation of metrics such as GHG emissions, with examples provided in Figure 2. Detailed information on metrics, thresholds, and optimization for the transition thresholds are provided in the Toolkit's technology-specific factsheets.

Table 2a. Example Performance Metrics.

Example Performance Metrics S = Saturation C = Composition	
Subsurface related	**System related (measurements at header or individual extraction wells)**
LNAPL stable footprint based on absence in sentinel wells (S).	LNAPL recovery vs. time, cost, or GHG emissions (S).
LNAPL transmissivity (S).	LNAPL decline curve analysis (S).
LNAPL velocity (S).	LNAPL/vapor or LNAPL/water ratio (S).
LNAPL fraction remaining is below threshold of concern, i.e., primarily residual LNAPL (S).	TPH/COC mass recovery vs. time, cost, or GHG emissions (C).
NSZD rate (bulk TPH or COC) (S and C).	TPH/COC concentration attenuation (C).
Concentration or mass flux/discharge of COC in soil gas or groundwater (C).	COC rations in water or vapor (C).
Distribution of geochemical parameters or electron acceptors (S and C).	Pressures, flow rates (S and C).
N/A.	Soil-gas temperatures (C).

Table 2b. Example Transition Thresholds and Performance Metrics

Example Transition Thresholds S = Saturation C = Composition
Recovery of sufficiently high fraction of LNAPL (90-95%) quantified through decline curve analysis (S).
LNAPL transmissivity below ITRC (2018) threshold of 0.1-0.8 ft^2/day (S).
Concentrations or mass discharge at or approaching criteria within accepted statistical certainty (C).
Active remediation mass recovery rates similar to or less than NSZD (bulk) rates (S).
Active remediation concentration attenuation rates similar to or less than natural attenuation rates (C).
Cumulative mass removal or concentration attenuation by active recovery approaching asymptotic levels while ratio of GHG emissions or cost per unit reduction or concentration is rapidly increasing (S and C).

Example Performance Metrics	
System Related	**Subsurface Related**
• LNAPL recovery vs. time, cost or greenhouse gas (GHG) emissions (S). • LNAPL/vapor ratio or LNAPL/water ratio (S). • TPH/COC mass recovery vs. time, cost or GHG emissions (C). • TPH/COC concentration attenuation (C). • COC rations in water or vapor (C.) • Pressures, flow rates (S and C). • Soil-gas temperatures (C).	• LNAPL stable footprint based on absence in sentinel wells (S). • LNAPL transmissivity (S). • LNAPL fraction remaining is below threshold of concern, for example, primarily residual LNAPL (S). • LNAPL velocity (S). • NSZD (bulk TPH or COC) rate (S and C). • Concentration of mass flux/ discharge of COCs in soil, gas, or groundwater (C). • Distribution of geochemical parameters or electron acceptors (S and C).

Notes: TPH = total petroleum hydrocarbon; COC = constituent of concern ; GHG = greenhouse gas; NSZD = natural source zone depletion; ITRC = Interstate Technology and Regulatory Council.

Transition thresholds, like performance metrics, should be agreed on with stakeholders prior to the onset of active remediation, since the thresholds will dictate the type and timing of data collection before and during active remediation. The transition threshold may also shift over time at sites where remediation treatment trains are implemented. For example, early in remediation a transition threshold may be LNAPL transmissivity declining below a practical limit of hydraulic recovery. Later in remediation, the transition metric may shift to threshold COC concentrations (maximum contaminant levels, or MCLs) and/ or threshold mass discharge or mass loading limits.

Conclusion

The Exit Strategy Toolkit has been created to help improve remedial decision making and remediation operation while ensuring that there is no risk to human health and the environment. The primary motivation of the Toolkit is to address active UST LNAPL remediation systems that remain in operation even though they no longer effectively reduce the threat of an exposure or provide a net environmental benefit. The Toolkit serves as a framework for systematically optimizing the performance of active remediation systems and transitioning to site closure more confidently and sustainably. The four-stage strategy involves risk evaluation and identification; baseline assessment; remedy selection and implementation; and transition assessment and validation. The Toolkit contains a Compendium and a series of factsheets on natural attenuation and active remediation technologies. The approach in the Toolkit can be adapted for use in other guidance with similar objectives. For example, much of the information contained in the Toolkit is being incorporated into draft ASTM Standard Guidance designed to support petroleum UST site closures. We encourage those interested in the Toolkit to view or download it at https://naplansr.com/tools/exit-strategy-toolkit/.

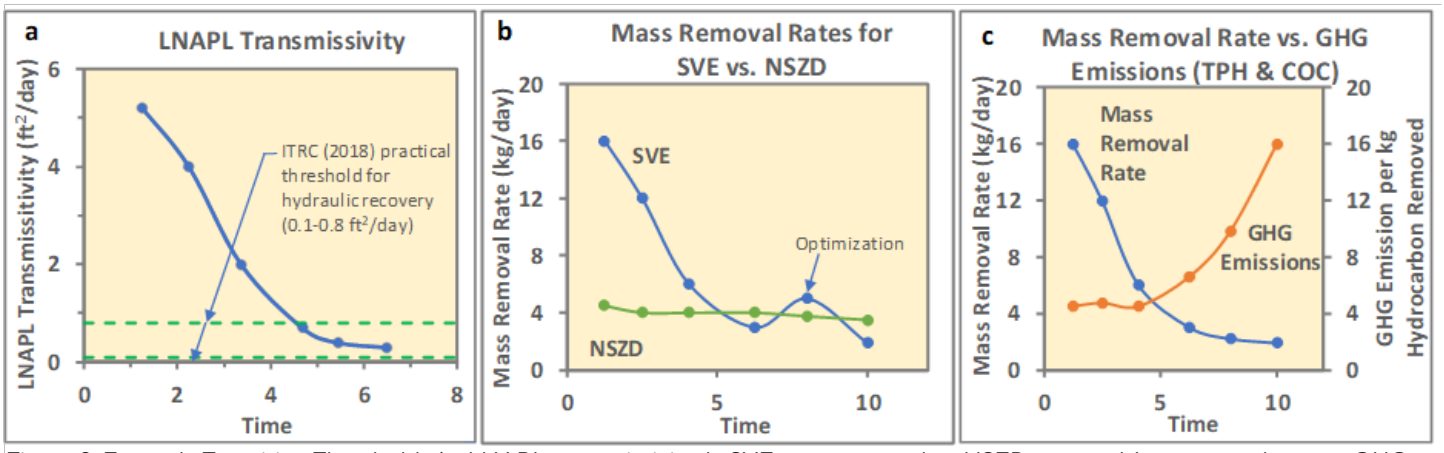

Figure 2. Example Transition Thresholds (a: LNAPL transmissivity; b: SVE mass removal vs. NSZD rates; c: Mass removal rate vs. GHG emissions).

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A Message From Mark Barolo

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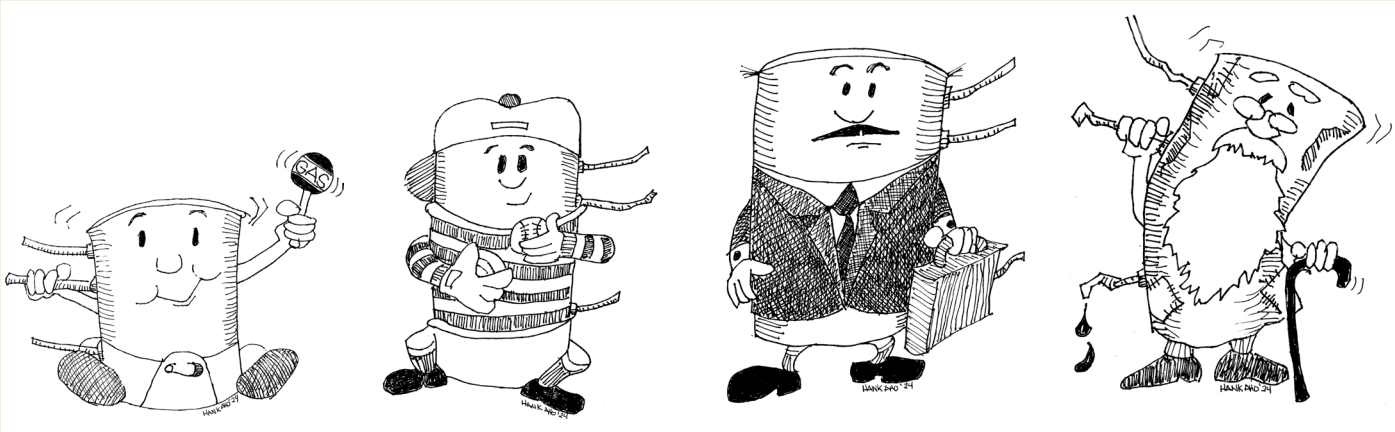


Tanks Program — Past, Present, and Future

Past — Foundations of a National Tanks Program

What were you up to in 1984? Catching "Ghostbusters" and "Beverly Hills Cop" in theaters? Listening to "Footloose" and "Purple Rain" on repeat?

In 1984, Congress was laying the groundwork for the national tanks program. Congress amended the Solid Waste Disposal Act, adding Subtitle I, among other things, to protect the public from underground storage tank petroleum releases. Subtitle I directed the U.S. EPA to develop a regulatory program for USTs storing petroleum and certain hazardous substances.

The negative impacts of gasoline leaking from underground storage tanks were a growing concern for the U.S. population. One year before, in 1983, CBS's "60 Minutes" aired the segment "Check the Water" that brought national attention to families in Canob Park, Rhode Island that were suffering from the effects of gasoline leaking from underground storage tanks. The local gas station had a leaking UST and gasoline had spread to soil and groundwater that was used as a drinking water source. Health, safety, and environmental concerns from petroleum and hazardous substance releases were in the spotlight.

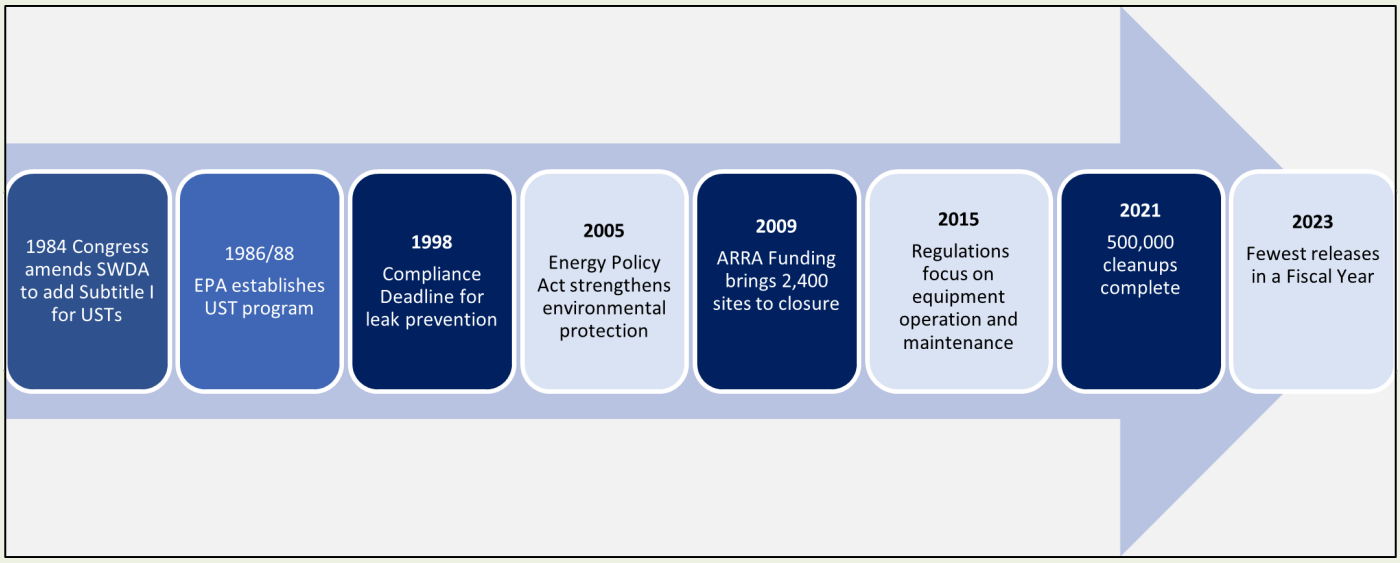
In 1984, Congress took action and passed legislation that set forth definitions and exemptions, notification requirements, and instructed the EPA to develop UST regulations.

The Way We Were — The UST Universe in the 1980s

Faced with the mandate of Subtitle I, EPA recognized several unusual aspects of the regulated universe that have created special problems in developing an effective regulatory approach. First, the regulated universe is immense, including over 2 million UST systems estimated to be located at more than 700,000 facilities nationwide. Second, more than 75 percent of the existing systems are made of unprotected steel, a type of tank system proven to be the most likely to leak and thus create the greatest potential for health and environmental damage. Third, most of the facilities to be regulated are owned and operated by very small businesses, essentially mom and pop enterprises not accustomed to dealing with complex regulatory requirements. Fourth, numerous technological innovations and changes are now underway in various sectors of the UST system service community. – Preamble to 40 CFR Part 280, pg. 8. September 1988.

A Message From Mark Barolo... continued

UST Program Progress and Milestones



EPA had a lot of work to do in a short period of time to create a national program. It was quite an undertaking — from understanding the universe of tanks across the country, to working with owners and operators, states, Tribes, industry, and others to promote safety and environmental protection while providing flexibility for innovation and varying circumstances. Indeed, the immensity and complexity of the tanks universe at the time is summarized in the preamble to the 1988 regulations (see sidebar).

Building a program from the ground up included several rounds of public comment and public hearings, surveys and studies from the EPA and industry, and a series of draft regulations and guidance that covered prevention and cleanup requirements, state program approvals, and federal enforcement provisions.

In 1988, the EPA issued a broad set of regulations that set the structure for our modern-day tanks program. The regulations included technical requirements for leak detection, leak prevention, and corrective action. They also included financial responsibility requirements for UST owners and operators to demonstrate financial responsibility for taking corrective action, as well as compensating third parties for damage from releases from tanks containing petroleum.

The EPA set various deadlines for regulated UST owners and operators to comply with the 1988 regulatory requirements. Perhaps the most significant deadline was December of 1998. The EPA provided tank owners and operators 10 years to come into compliance with spill protection, overfill protection, and corrosion protection requirements, or to close their tanks. The catchy UST program slogan of "Don't Wait Until 1998" served as a reminder and a warning. Upgrading, closing, or replacing tanks can be a costly and time-consuming effort. Missing the deadline could lead to violations, fines, and loss of insurance coverage.

The 1998 compliance deadline ushered in a new era of tank management. For the EPA's UST prevention program, it was a very busy time for owners, operators, contractors, and regulators alike. Tanks had to be upgraded or safely closed. There was a palpable feeling that, despite the challenges, we were collectively making significant progress and tackling one of the nation's most significant environmental challenges. Owners and operators that upgraded or replaced their tanks helped protect against petroleum releases into the environment. Thousands of old, sub-standard UST systems were permanently and properly closed. At the same time, thousands of contaminated properties were discovered and needed to be cleaned up. In fiscal year 1998 alone, 30,000 releases were reported. This flurry of activity ushered in a new era of UST system management that prioritized the safe storage of fuel underground. The following decades saw continued innovation in UST system management and an unwavering commitment to protecting human health and the environment from UST releases.

Present – We Have Come a Long Way

The UST program has continued to evolve and mature to the present day, tackling new challenges and formulating new solutions along the way. We have seen meaningful improvements in UST systems through the Energy Policy Act, the EPA's 2015 regulations (and associated state regulations) and

A Message From Mark Barolo... continued

continued technical improvements and adaptations. This included navigating the migration to biofuels and the associated compatibility issues. The cleanup program continues to grow and evolve as we master the nuances of subsurface petroleum migration, assessment, and remediation.

Collectively, we have achieved tremendous results. The prevention program requirements continue to protect communities and groundwater, and each year we have tens of thousands of inspections completed. The UST cleanup program has addressed 90% of releases, with well over 500,000 cleanups completed and nearly 57,000 to go. As evidence of this great work with our many partners over the decades, there were fewer confirmed releases during fiscal year 2023 than during any other year in the program's history, and we are on track to confirm even fewer releases this year.

Future – Who Knows What Tomorrow Will Bring?

As we turn our attention to the future, we must continue with our prevention and cleanup efforts. Aging tank infrastructure, natural disasters, and climate change add more layers of complexity for program planning and tank operations and maintenance. Meanwhile, we are seeing changes to the transportation sector, such as the emergence of electric vehicles and advances in fuel blends that will surely affect our program and UST owners and operators. It is hard to predict the UST landscape of the future. We must continue to work with our numerous partners, monitor trends, and develop new solutions as challenges evolve and emerge.

Conclusion

The tanks program has come a long way since 1984. Forty years later, we can look back in gratitude to our many partners who made the program a success and look forward to the challenges ahead. So many people have worked with the EPA to achieve our shared mission to protect human health and the environment. As long as fuel is stored underground, the regulatory and industry professionals in the UST industry will play a vital role in keeping our communities safe.

Were you involved in the tanks program in the '80s?

We would love to hear your UST and LUST stories from that time period. Please contact James Plummer at jplummer@neiwpcc.org or Mark Barolo at barolo.mark@epa.gov.

Become a L.U.S.T.Line Author

LUSTLine is a national bulletin that promotes the exchange of information among UST and LUST stakeholders.

NEIWPCC has published LUSTLine since 1985, and it has become the publication of record for UST matters nationwide.

Do you have an idea for an article? NEIWPCC is currently seeking authors to provide content on a variety of pertinent topics related to release prevention, corrective action, and financial responsibility.

To learn how to become a contributer, please contact James Plummer (jplummer@neiwpcc.org).

Enhanced Version of the EPA's EJScreen Tool Now Available

By Sara Miller

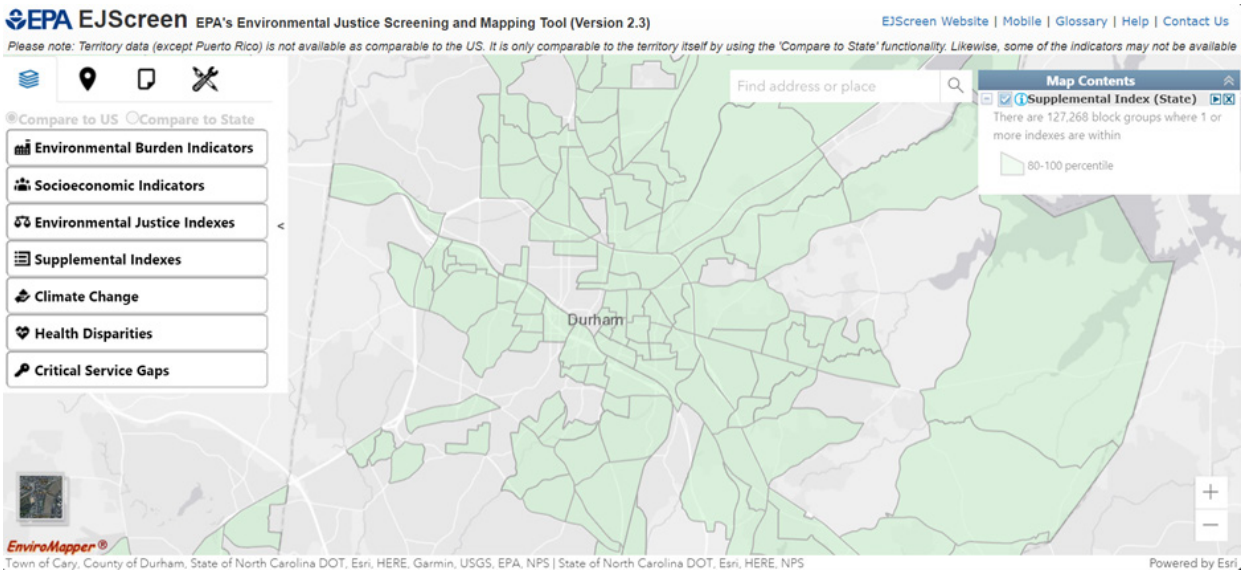


Figure 1. EJScreen featuring Supplemental Index Threshold Map for user-defined area.

In accordance with the EPA's responsibilities to protect human health and the environment, the Office of Underground Storage Tanks has been working with the EPA regions, states, and Tribes to integrate environmental justice (EJ) into the national tanks program. The EPA appreciates the work that programs are doing across the country to advance EJ and to address cumulative burdens that communities face. Some states have developed their own mapping tools and databases to help clarify program priorities, identify focus areas, and advance state and federal program objectives.

The data that states and Tribes provide helps develop comprehensive national applications such as EJScreen and UST Finder that can assist in meeting program and EJ goals. EJScreen, the EPA's EJ mapping and screening tool, aids efforts to ensure programs, policies, and resources consider the needs of communities most burdened by pollution. The EPA recently updated EJScreen to version 2.3, which includes several enhancements to the application. UST Finder is a state-sourced mapping application that provides the attributes and locations of active and closed USTs, UST facilities, and UST releases in a Geographic Information System platform. The platform also includes layers of other environmental and socioeconomic data, providing a detailed snapshot of communities that have USTs. Both tools are available online and have updates underway.

EJScreen provides a nationally consistent dataset and approach for combining environmental and socioeconomic indicators. The application is a useful tool that screens for disproportionate impacts on communities. This can support tanks programs in their efforts to integrate EJ considerations and address cumulative burdens across the country. For example, some states use EJScreen criteria to identify sites in areas with one or more EJ indexes at the 80th percentile to prioritize cleanup decisions and actions. Where all site risks are equal, EJ criteria are prioritized.

EJScreen 2.3 features 13 **environmental indicators**. The environmental indicators vary widely in what they indicate, and it is important to understand the caveats and limitations. For example, some quantify proximity to potential sources of exposure to environmental pollutants, while others are estimates of ambient levels of air pollutants.

EJ indexes combine a single environmental indicator with socioeconomic information. EJScreen 2.3 features two types of EJ indexes: standard and supplemental. Each has a different calculation of socioeconomic data. There are 13 standard EJ indexes and 13 supplemental EJ indexes reflecting the 13 environmental indicators.

Read more information about environmental indicators and indexes in the EJScreen Technical Documentation.

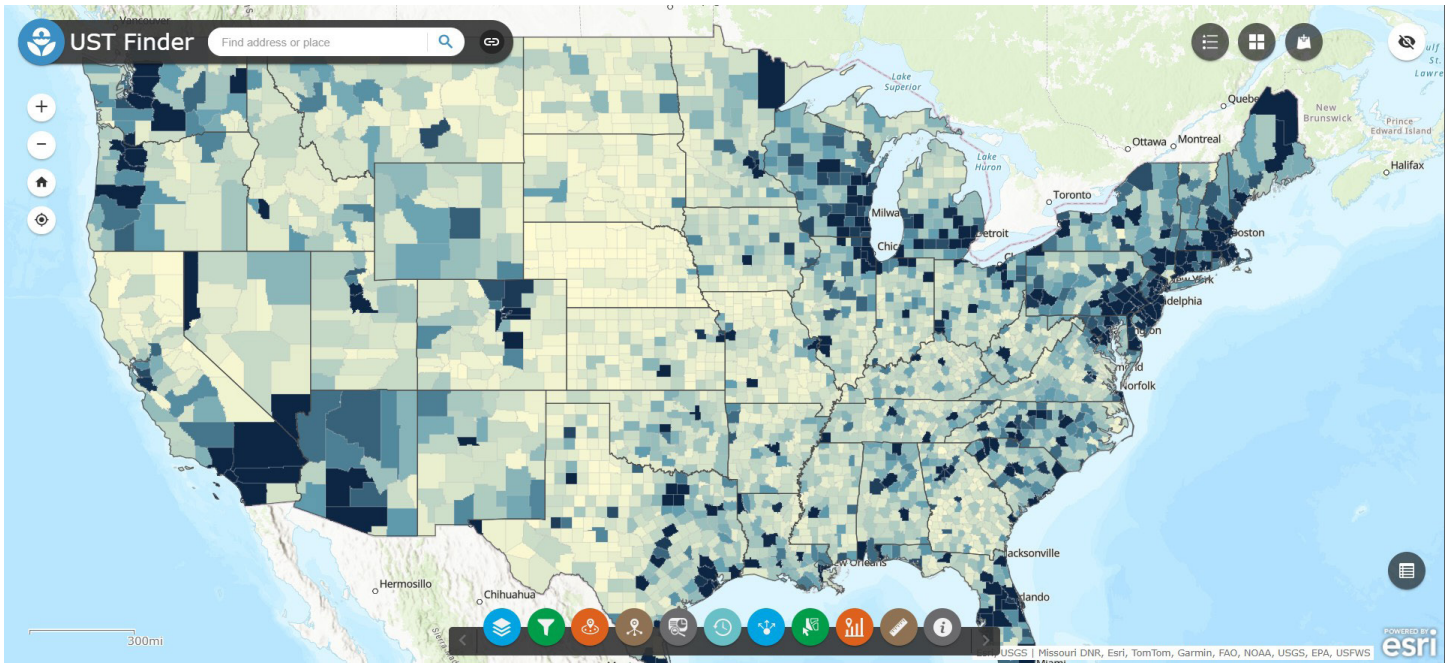


Figure 2. UST Finder application.

EJScreen includes an Underground Storage Tank environmental indicator derived from UST Finder data. The UST indicator is calculated as a weighted sum of active UST releases and active and temporarily out-of-service USTs within a certain distance from a block group. Like all environmental indicators in EJScreen, the UST indicator can be combined with socioeconomic information to create corresponding standing and supplemental indexes.

Just as EJScreen uses UST data, the UST Finder application also features EJScreen data. The EJScreen data in UST Finder allows users to screen for disproportionate impacts on communities directly within the tool. The EPA expects to update UST Finder with EJScreen 2.3 data in the process of updating UST Finder to version 2.0.

As of July 2024, EJScreen version 2.3 features several enhancements, updated datasets, and new map layers, including:

- Interface changes.
- New environmental indicators: nitrogen dioxide and drinking water non-compliance.
- New map layers: extreme heat, private drinking wells, drinking water area boundaries, air toxics cancer risk, and environmental justice grants.
- Methodological changes: the supplemental index was reformulated to include disabilities data and exclude unemployment data.

You can check out all the newly added EJScreen 2.3 features and data in the EJScreen Change Log.

The EPA provides trainings and office hours to help guide users through EJScreen and become familiar with the updates. Office hours provide an opportunity to talk with the EPA EJScreen experts about many topics including how to use and apply the tool.

Sara Miller is an environmental protection specialist with the U.S. Environmental Protection Agency. Miller can be reached at miller.sara@epa.gov.

Want more L.U.S.T.Line?

All previous issues, dating back to 1985, are available for viewing in the LUSTLine Archive.

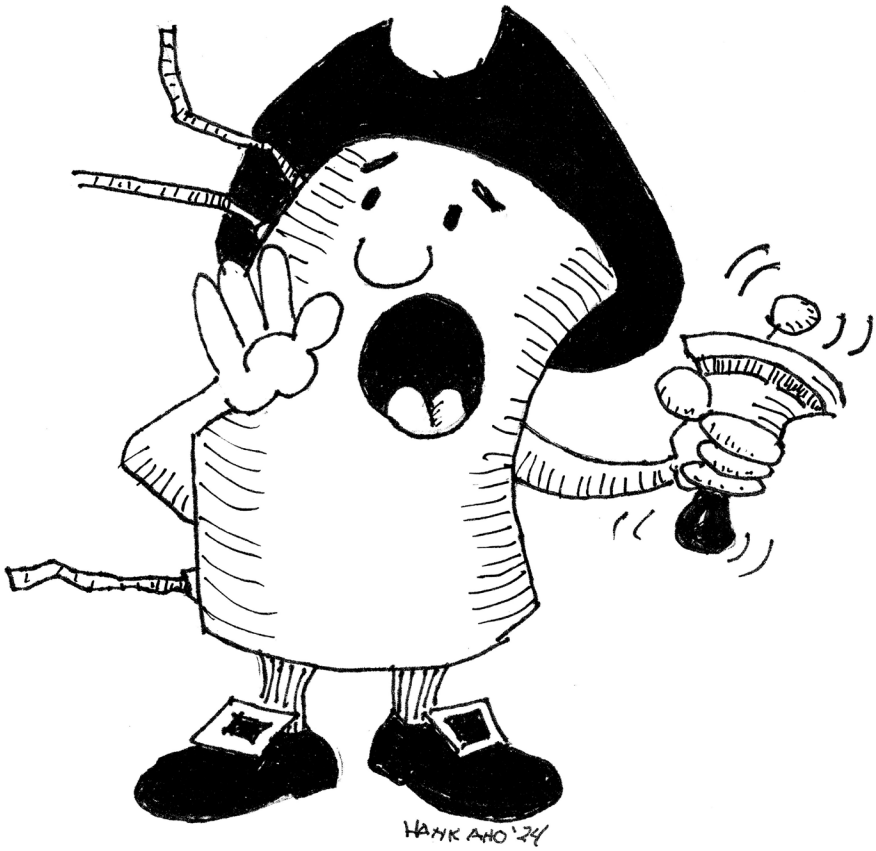
A categorized list of articles is also available in the LUSTLine index. This resource allows you to see each article written about a topic and provides a link to the PDF where the piece was published.

How Email Marketing is Transforming Tennessee's Division of Underground Storage Tanks

By Sara Kenney

The mission of the Tennessee Department of Environment and Conservation (TDEC) Division of Underground Storage Tanks is to protect human health and the environment by preventing future petroleum underground storage tank (UST) releases and remediating existing petroleum UST contamination.

When you think about email marketing, you probably think about the private sector, but utilizing it in government agencies is a great way to encourage civic engagement and guide readers towards beneficial resources. Abdul Kayum outlines the benefits of email marketing in an article written for LinkedIn: "The main purpose of marketing is to provide value to the audience. So that the audience is attracted and connected, email marketing can be said to be the best way to do all this because you can easily deliver emails to all your audience through email and attract their attention by constantly offering mind-blowing emails to them."



TDEC created a small team whose primary focus is creating helpful information and providing outreach to the UST community. The team decided a better way to educate our owners and operators about their USTs and preventing releases was through email marketing. For example, we used email marketing to promote a training webinar series about our new UST rules and regulations. Our newsletter "Tennessee Tank Talk" was first released in August 2020. The monthly newsletter contains Division updates, information on UST rule changes, and general helpful information about improving UST compliance rates. Newsletters are emailed to 17,000 UST stakeholders inside and outside of Tennessee each month. Each edition of our newsletter focuses on specific topics like state fund eligibility, new overfill testing requirements, yearly violation recaps, and tips and tricks for compliance inspections. The newsletter also includes information and links to current rules and regulations, form letters, and other valuable information on our Division's website. Readers can also reply to the newsletter and direct their questions or concerns to a specific contact. The emails ensure that owners and operators have all the necessary and relevant information at their fingertips.

Since its inception more than three and a half years ago, TDEC has sent out 28 editions of Tennessee Tank Talk. A recent Tank Talk focused on the top UST violations of 2023. It also included information on UST testing requirements, record-keeping requirements, and fines associated with these violations. Doing this provided tank owners and operators with more information to help them obtain and maintain compliance.

The email marketing software that TDEC uses provides metrics for email open and click rates. This data helps refine communication strategies for greater marketing effectiveness. Tank Talk has been popular, exceeding expected government email marketing metrics in nearly every issue since inception. The table below shows the 28th edition's open and click rates email analytics for within and outside of Tennessee:

	Opened	Clicked
Inside Tennessee	34.3%	4.2%
Outside Tennessee	31.5%	3.5%

Since starting the newsletter, TDEC has had fantastic feedback from our owners and operators. They love the simplicity of getting Division updates and information relevant to their UST systems. From the beginning, I have always said that this newsletter is valuable — even if only one person takes something from it, we have achieved a goal.

Utilizing email marketing allows for quick distribution of information to a large audience at a nominal expense. It can also help motivate readers to react and better respond to the latest news and updates. I highly recommend and encourage other agencies to start their own outreach program, as it is an efficient way to get information to the public. By highlighting proper UST management, you will hopefully inspire the readers to take the necessary steps to protect the environment and public health.

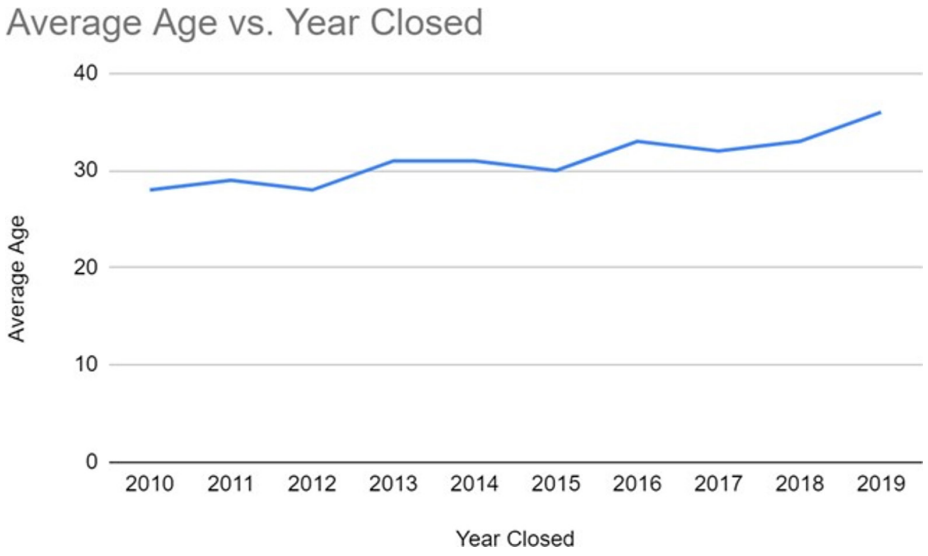
To read more about all of our Tank Talk editions and Division updates, visit our Division's website.

> "Utilizing email marketing in government agencies is a great way to encourage civic engagement and guide readers towards beneficial resources."

Sara Kenney is an environmental consultant with the Tennessee Department of Environment and Conservation's Underground Storage Tanks Division. Kenney can be reached at sara.kenney@tn.gov.

Are We There Yet? 1998 and Our Journey in Release Prevention

By Mahesh Albuquerque



The year 1998 was filled with interesting events, such as the Denver Broncos winning back-to-back Super Bowls. Most underground storage tank (UST) owner/operators and many regulators remember December 22, 1998, as the deadline for compliance with the U.S. Environmental Protection Agency (EPA) regulations. In late December 1998, I remember driving a U-Haul truck through a blizzard as we moved from Duluth, Minnesota to Denver and the following year, I began working in the tanks program with the state of Colorado.

It is hard to believe it has been 26 years, and while we have seen a lot of improvements and changes in the tanks world, some things have stayed the same. In 1998 we were dealing with aging tanks, and now in 2024, many of the tanks installed to meet the 1998 deadline are approaching or have passed their 30-year mark. In fact, a recent EPA study indicated that tanks are staying in the ground longer with an average age of around 30 years. Like any other mechanical devices, as tank system components age, their risk of failure increases, which in turn increases the risk of a release of fuel products into the environment.

Thankfully, the UST provisions in the 2005 federal Energy Policy Act (EPAct) required significant changes to state and federal UST programs aimed at preventing releases. The UST provisions, among other things, included inspections, operator training, delivery prohibition, secondary containment and financial responsibility, and cleanup of releases that contain oxygenated fuel additives. Like many other states across the country, Colorado welcomed these changes as they strengthened our programs, ensuring new tank systems were more protective, operators were more knowledgeable about their systems, and delivery prohibition provided an effective means to ensure and maintain significant operational compliance.

This was followed by the 2015 revisions to EPA's UST regulations. The new tank standards and operational requirements to comply with these 2015 revisions continue to reduce the impact of releases from operating USTs across the country. Thanks to these revised regulations and updated publications such as the Petroleum Equipment Institutes RP1200 (Testing of UST Spill, Overfill, Leak Detection, and Secondary Containment), the annual functionality testing of release detection equipment and the three-year testing of spill buckets, containment sumps, and overfill prevention devices have not only ensured more protective systems, but have also enabled earlier detection of releases.

As of this year, more than half a million, or 90%, of UST release sites in the United States have been cleaned up and closed. However, around 62,000 releases nationwide are still in the cleanup pipeline. Even though this number is high, the good news is that many of the newer releases are being detected earlier and are often cleaned up more quickly and therefore cost less. These significant achievements of the national tanks program are the result of great partnership and collaboration between the EPA, the states, industry partners, and most importantly UST owner/operators, working together toward a common goal.

In line with the national regulatory changes over the past two decades, Colorado tried to be innovative as we expanded our efforts on release prevention. We preached, "an ounce of prevention is worth a pound of cure," and we wanted to make sure we put our money where our mouth was. We began doing this in 2007 when we adopted the 2005 EPAct requirements and enabled our Petroleum Storage Tank Fund (PSTF) monies to be used to provide small incentives to owner/operators for significant operational compliance. This was only possible through legislation and strong collaboration with our Colorado Wyoming Petroleum Marketers Association (CWPMA). The incentives were in the form of a waiver of a $10,000 clean-up deductible if the owner had voluntarily

installed under-dispenser containment, double-walled spill buckets, and tank removals.

Later, through additional legislation, we were able to expand the scope of incentives to upgrades and early testing of equipment to comply with EPA's 2015 regulatory requirements. Our PSTF also began offering owner/operators up to $30,000 per facility for tank removal costs by reimbursing a dollar per gallon of tank volume removed. Because of the effectiveness of this incentive which resulted in the removal of several hundred tank systems, we are now upping the ante to $60,000 per facility, by offering two dollars per gallon of tank volume removed for tank systems installed prior to 2008 (before our double-walled requirements). Our hope is that this will motivate owner/operators to remove many of the older tank systems without a mandate and also lower the average age of tanks in the ground, which we equate to reduced risk of releases.

This past year, through continued collaboration with our CWPMA partners, legislation has given us the authority to be creative and use a percentage deductible in lieu of our standard $10,000 deductible on PSTF cleanup reimbursements. As I write this, we are considering adopting a 10% deduction from the first dollar spent through $100,000 and an additional 1% thereafter up to our fund's maximum liability of $2 million. While having a $10,000 standard deductible is great, it does not benefit those owner/operators who were diligent with operational compliance and therefore had small releases that were detected early and cleaned up for less than our deductible. Queries of our database indicated that 61% of owner/operators with confirmed releases do not even apply for reimbursement from our PSTF, and we suspect many do not because their cleanup costs were below our deductible. Our data also indicated that 79% of the NFAs (No Further Actions) or cleanups closed between 2004 through 2023 cost less than $100,000, and only 1.8% cost more than $1 million. We hope this new percent deductible will be a further incentive to find and address releases quickly, reward efficient cleanups, and make more releases eligible for reimbursement, while imposing a small disincentive for ineffective, costly cleanups.

> "As of this year, more than half a million, or 90%, of UST release sites in the United States have been cleaned up and closed."

Looking back over the last 25 years, I think we all have reason to be proud of the national accomplishments of the tanks program in protecting soil and groundwater. There will continue to be development and innovative improvements in tank equipment construction, installation, and operation focused on release prevention. I suspect we will continue to see significant changes in policies related to the use of transportation fuels over the next few decades, driven by climate change and other concerns. How will this affect our tanks programs? I am currently working on legislation related to our program's oversight of electric vehicle charging stations. Will gas stations become obsolete by 2050, as we will all be driving around in electric vehicles, or better yet, teleported? I do not know; some things change, and some stay the same as in our tanks programs today. As Yogi Berra says, "It is tough to make predictions, especially about the future."

Mahesh Albuquerque is the director of the Colorado Division of Soil and Public Safety. Albuquerque can be reached at mahesh.albuquerque@state.co.us.

News and Resources

A Message From NEIWPCC's New UST/LUST Program Coordinator: James Plummer

Words I use to describe myself: goofy, helpful, creative, wicked cool, wicked smart, wicked good-looking, and super humble.

Things I am interested in: live music, the natural world and society's relationship with it, birds, learning, fermentation, water, and most anything at a surficial level.

I started at NEIWPCC as an intern in 2016 with the Youth and the Environment program, coordinating a six-week curriculum for a summer work-based learning program for disadvantaged youth in Lowell, Massachusetts. We went on educational field trips and worked at the local wastewater treatment facility, where I may have spilled primary wastewater on myself, but that was a formative time in my career in the environmental/public health field.

After graduating from the University of Tampa in Florida with a bachelor's degree in biology, I thought I would be playing with birds in the woods or teaching high school classes. Instead, I found myself back home in New Hampshire, appreciating a comfy office gig at NEIWPCC, and embracing the opportunity to learn about all things water, environmental policy, and project and people management.

Over the last half dozen years, I have been granted foundational opportunities to host national and regional conferences, and coordinate countless workgroup meetings, and essentially achieve what I consider to be a Ph.D. in NEIWPCC'ing. In tandem with being the point person for all things related to nonpoint source management, stormwater, workforce development, and infrastructure finance, I have had the opportunity to spread my wings and build confidence in my project management skills.

A lot of NEIWPCC's programs gravitate around networking and information sharing. The COVID-19 pandemic presented a unique occasion to experiment with new styles of conducting meetings. Engagement in any setting, but especially virtual, requires establishing an atmosphere of friendly collaboration, making people feel comfortable and welcome to take a seat at the table. This new opportunity to work with the UST/LUST community has, in just a few short months, fueled new friendships that I am sure will last.

Here are a few things that have inspired me to learn more and things I am excited for coming up:

- Hosted two Tribal UST/LUST workgroup meetings.
- Attended the Tribal Lands and Environment Forum.
- I will be joining Matthew Jones, NHDES, for a tank closure near me very soon.
- ASTSWMO's Annual Meeting in Washington, DC.

I expect that NEIWPCC's portfolio of UST/LUST projects will allow me to usher in a new era of engagement for the UST/LUST community. I strive

News and Resources

Message From James Plummer (continued)

to continue grounding NEIWPCC as a reliable focal point for professionals seeking answers. I aim to serve you all with courtesy and kindness by providing platforms that enable introverts, extroverts, and ambiverts, people of all backgrounds, identities, and convictions to feel safe to express concerns, ideas, and questions in a variety of contexts.

Although I could keep talking about myself, I should probably touch on upcoming work products of interest and where we are taking them.

LUSTLine

There are many tools at our disposal to make LUSTLine more accessible, engaging, and useful. I aim to explore these over the next couple issues while adhering to the traditions established by those folks responsible for creating such a broadly educational and recognizable asset to geographically diverse UST/LUST programs. As always, please let us know if you are:

- Interested in writing an article for LUSTLine.
- Involved in a program that you think folks should be aware of.
- Participating in the execution of a noteworthy project.
- Interested in seeing videos and other resources linked within future issues.
- Interested in an interview with a specific individual.
- Aware of any upcoming or recent events worthy of reporting.

National Tanks Conference

Internal planning is underway for the 2025 National Tanks Conference. Keep an eye out for a Save-the-Date and if you are not on our mailing list, sign up on the National Tanks Conference webpage.

Tribal Activities

NEIWPCC has been coordinating with U.S. EPA and Victoria Flower with Oneida Engineering Solutions to develop a self-paced, online Class A and Class B Operator Training for Indian Country. If you are interested in learning more, please reach out.

NEIWPCC's Tribal UST/LUST Workgroup brings together Tribal staff to discuss challenges and opportunities they are experiencing. If you are new to your program or have wisdom to share, the participants are a great mix of new and seasoned staff. It is lowkey and I can genuinely call some of the folks I have met in the group friends. It is more of an office hours than a formal workgroup.

NEIWPCC is also working with MobileWright Solutions, Inc. to develop an UST compliance assistance tool capable of providing facility-specific regulatory compliance plans for owners/operators within Indian country. The web-based application will produce a plan that outlines compliance requirements based on facility-specific equipment, highlight actions a facility must complete, and note release response measures and best practices.

In conclusion, there is even more happening behind the screen that we are excited to share with you. I appreciate the enthusiasm of the folks I have met so far, and I am eager to get nerdy about tanks. Please reach out if you have ideas, questions, concerns, or want to just chat about the work that you do. The more folks I meet, the more I learn about the history of these programs and the more stoked I get to gather momentum behind this work.

James Plummer can be reached at jplummer@neiwpcc.org or 978-349-2520.

Tell us what you think!

We are looking for feedback about the current format of LUSTLine and what you wish to see. Let us know your ideas by filling out this quick survey.

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NTC