ASTSWMO, Providing Pathways to Our
Nation's Environmental Stewardship Since 1974

An Analysis of UST System Infrastructure in Select States

Final Report

October 2015

Aging Tanks Workgroup
Tanks Subcommittee

ASTSWMO
1101 17th Street, NW, Suite 707
Washington, DC 20036
www.astswmo.org

ACKNOWLEDGEMENTS

The Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Tanks Subcommittee's Aging Tanks Workgroup prepared this document with assistance from the U.S. Environmental Protection Agency (EPA) Office of Underground Storage Tanks (OUST) under Cooperative Agreement US-83536501. This document does not necessarily reflect the policy or legal position of U.S. EPA or OUST. The views expressed in this document are those of the ASTSWMO Aging Tanks Workgroup and its members, and have not been formally endorsed by the ASTSWMO Board of Directors.

ASTSWMO is an organization supporting the environmental agencies of the States and Territories (States). ASTSWMO's mission is to enhance and promote effective State and Territorial programs and to affect relevant national policies for waste and materials management, environmentally sustainable practices, and environmental restoration.

ASTSWMO thanks the following Workgroup members for their participation in this study and in the development of this report:

Therron Blatter, Utah DEQ
Amy Cole, Colorado DLE
Katie Koelfgen, Minnesota PCA
Carol Eighmey, Missouri PSTIF
Jill Hall, Delaware DNREC
Cassandra Garcia, Washington PLIA
Russ Olsen, Washington PLIA
Lon Revall, Georgia DNR
Tara Rosie, Arizona DEQ
Mitch Scheel, Oregon DEQ
Richard Spiese, Vermont DEC
Perry Theriot, Louisiana DEQ

ASTSWMO and the Aging Tanks Workgroup also thank the States that provided information to ASTSWMO and the Workgroup; each State's information and data were vital to the Workgroup's efforts.

TABLE OF CONTENTS

I. INTRODUCTION 1
II. PROBLEM DEFINITION, DATA COLLECTION, DATA ANALYSIS 1
A. Background 1
B. What Do We Know About the Nation's UST Infrastructure? 2
C. Detailed Analysis of UST Data From Eight States 3
i. Age of Underground Tanks 3
ii. Age of UST Piping 4
iii. UST Material and Construction 5
iv. UST Piping Material and Construction 6
v. ULSD Storage 7
vi. Ethanol-Blended Fuels Storage 8
III. UST INFRASTRUCTURE AND RISK MANAGEMENT 9
A. Risk Factors 9
B. Source and Cause of Leaks 10
C. State Policy Choices and Initiatives 11
D. Private Market Forces as Drivers for UST Removal and Replacement 14
E. UST Owners' Initiatives 15
F. Actuaries' Opinions 16
IV. CONCLUSIONS 16
APPENDIX A: ADDITIONAL INFORMATION ON UST DATA FROM EIGHT STATES A-1
APPENDIX B: INDIVIDUAL STATE RESPONSES REGARDING EFFECT OF DOUBLE-WALL REQUIREMENT ON UST INFRASTRUCTURE CHANGES B-1
APPENDIX C: LETTERS FROM MANUFACTURERS REGARDING COMPATIBILITY OF FIBERGLASS TANKS WITH ALCOHOL-BLENDED FUELS: C-1
APPENDIX D: FEEDBACK FROM INSURERS, ACTUARIES, AND OTHER INDUSTRY REPRESENTATIVES D-1
APPENDIX E: SUGGESTED LIST OF DATA ELEMENTS FOR ANALYZING RISK OF LEAKS FROM USTS E-1

I. INTRODUCTION

In October 2014, at the request of the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Tanks Subcommittee, the ASTSWMO Board of Directors formed a Workgroup to examine issues related to aging underground storage tanks (USTs) and the potential impacts to owners, operators, and State UST programs. The Workgroup's objective was to analyze whether aging UST infrastructure poses a higher risk of leaks, thus creating higher risks for State tank funds and private insurers and, ultimately, higher costs for tank owners/operators.

States face very different challenges and the data available from the States varies considerably because each State has implemented its own unique UST program over the last 25 years. This report examines data provided to ASTSWMO by some States, reports on policy decisions made by States in response to concerns about aging USTs, and suggests issues for consideration as States consider similar policy choices.

II. PROBLEM DEFINITION, DATA COLLECTION, DATA ANALYSIS

A. Background

The December 22, 1998, U.S. Environmental Protection Agency (EPA) deadline for UST systems to meet new tank requirements in 40 CFR 280.20, be upgraded according to 40 CFR 280.21, or meet closure requirements in 40 CFR Part 280, Subpart G, had a significant impact on the composition of the nation's UST infrastructure. As a result, USTs across the nation that did not meet new requirements were upgraded, replaced, or permanently closed. Since that time, there have been no additional nationwide requirements for upgrading or closure, and UST replacement and upgrade policies have been State-specific and diverse across the nation. The precise age distribution and characteristics of the nation's current UST population is unknown.

The questions initially addressed by the Workgroup were:

- Is the nation's UST infrastructure getting older?
- If so, to what extent does this affect the risks shouldered by insurers and State tank funds that serve as the predominant financial responsibility mechanisms for owners/operators?

As the Workgroup collected data, additional questions arose:

- Are States collecting data in a way that informs risk management decisions needed in the future?
- How do a State's policies impact owners' and operators' decisions related to upgrading, replacing, or closing their USTs?

B. What Do We Know About the Nation's UST Infrastructure?

As a first step, the Workgroup sought to better understand what UST data are maintained and available from the States. ASTSWMO sent a request to State UST programs asking for information about what UST demographic data they collect and maintain. Twenty-seven States responded, most indicating their UST data sets include sufficient detail for analyzing various risk factors

The chart below summarizes the 27 State responses:

For sites where at least one UST is in operation, do you record the following data?:	***Yes***	***No***
The date the tank was installed?	27	0
The material the tank is made of?	27	0
Whether the tank is single or double-walled?	27	0
The date piping was installed?	21	6
The material the piping is made of?	27	0
Whether piping is single or double-walled?	27	0
Which leak detection method is used to monitor the UST?	26	1
Whether tank is lined?	25	2
If yes, the date lining was installed?	16	11
Whether tank has cathodic protection (CP)?	27	0
If so, if it is impressed current or sac anode?	27	0
The date CP was installed?	17	10
Whether there is under-dispenser containment?	17	10
Whether there has been a confirmed release at the tank site?	26	1
If so, date of the release?	26	1
If so, the source/cause of the release?	25	2
If so, how the release was discovered?	22	5
What financial responsibility mechanism the owner/operator is currently using?	27	0
	Yes	***No***
Does your State inspect new UST installations?	19	8

During the Workgroup's analysis it became apparent that the level of detail and means of collecting and maintaining data on UST system infrastructure vary significantly among the States. Questions also arose about data quality. In some States certain information is maintained in their databases, such as the age of piping, but analysis indicated the data are inconsistent or incomplete. Some States require owners and operators to update their UST data regularly as part of an annual registration, permitting, or financial responsibility process. Others rely on inspectors to note whether tanks, piping, leak detection methods, and other infrastructure or operations

have changed. A few States have no organized method of updating UST data and acknowledge much of the information in their databases may be obsolete. It is not reflected in the chart above, but several States qualified their responses with phrases such as "usually" and "yes, but not always", which may indicate they have concerns about their data quality.

C. Detailed Analysis of UST Data From Eight States

To better understand the UST infrastructure data and to evaluate how those data might be used to assess risks, the Workgroup conducted an in-depth analysis of data on in-use USTs from eight Workgroup member States. As noted in subsequent sections, some of the States' data sets do not include sufficient detail to be included in all the analyses.

The Workgroup analyzed the following factors: age of the USTs, age of the piping connected to those tanks, and the material and construction of the USTs and piping. The Workgroup also analyzed data on USTs storing ultra-low sulfur diesel (ULSD) and ethanol-blended fuels due concerns about accelerated corrosion in systems storing these fuels. See Appendix A for more information on data and sources.

i. Age of Underground Tanks

Figure 1 presents information on the average ages of the underground tanks in eight States illustrating that 59% of the tanks in these States are more than 20 years old. Seventy-nine percent of the tanks in these States are less than 30 years old, and less than 1% are older than 50 years.

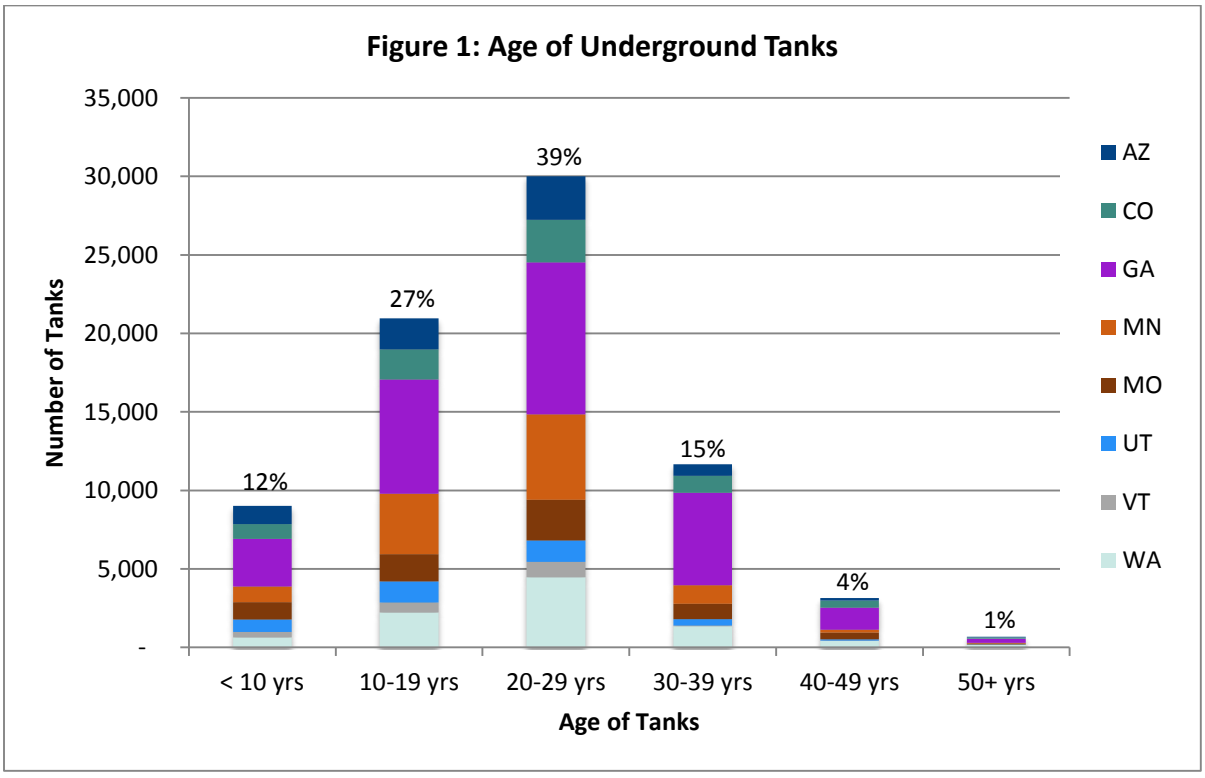
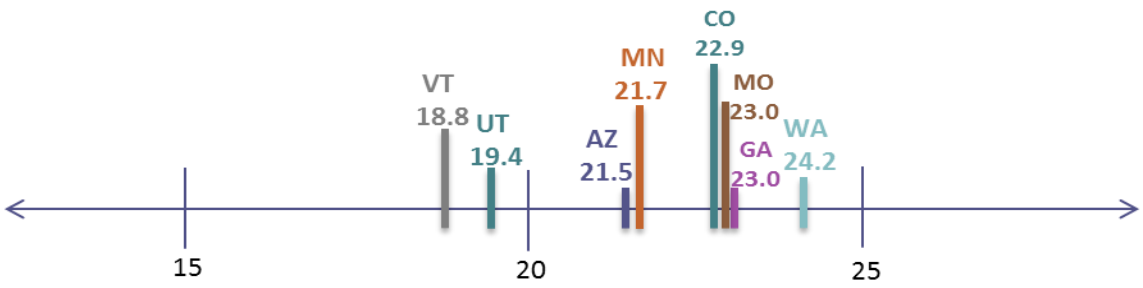


Figure 2 shows the average tank age ranges from 18.8 years in Vermont to 24.2 years in Washington, with an average among the eight States of 22.6 years. These results compare reasonably well to a recent analysis made by ASTSWMO's Emerging Fuels Task Force; the average tank age in the 26 States responding to that Task Force's inquiry was 21.4 years.

Figure 2: Average Age of Underground Tanks



ii. Age of UST Piping

The Workgroup also evaluated age of piping for the four States from which these data are available. In each State the piping is newer than the tanks and 33% of piping is more than 20 years old. As indicated in Figures 3 and 4, about 90% of piping in these four States is less than 30 years old and the average age among the four is approximately 17.7 years. Missouri, tied with Georgia for having the second oldest tanks of the eight States analyzed, has the second newest piping, with an average age of 16.5 years. Vermont has the newest piping at 15.4 years.

Figure 3: Age of Piping

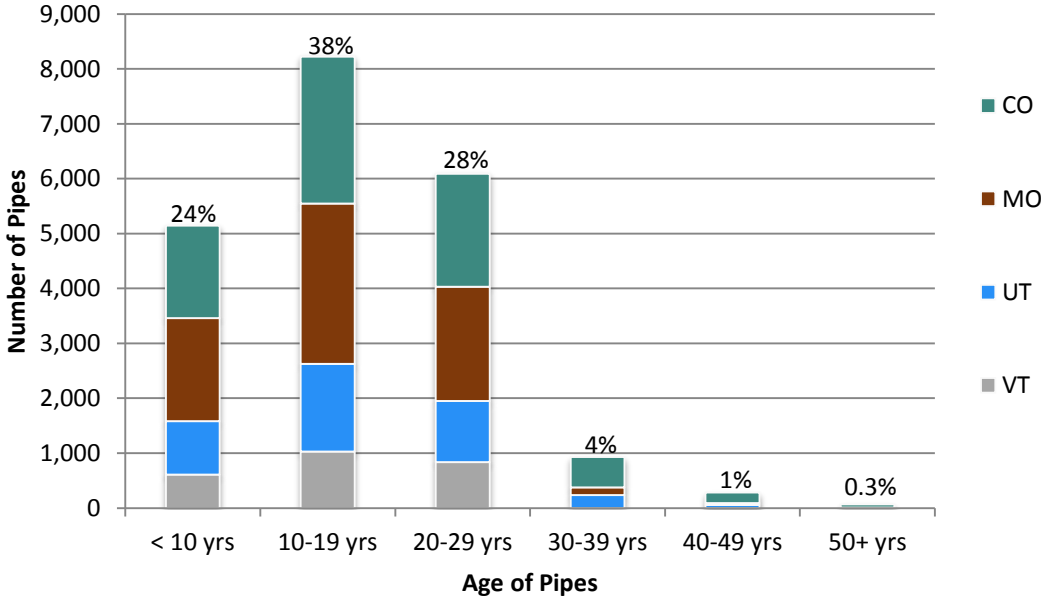
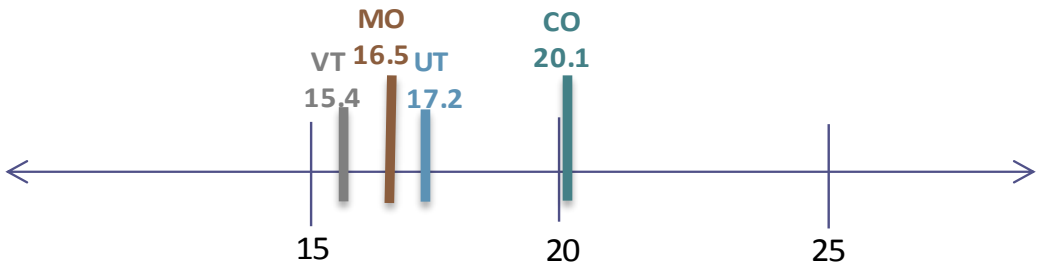


Figure 4: Average Age of Piping



iii. UST Material and Construction

Figures 5 and 6 provide information on UST construction for six of the eight States. The States' data diverged noticeably. For example, 61% of Minnesota's tanks are steel with cathodic protection, compared to only 20% of Utah's tanks. The lowest percentage of double-walled fiberglass tanks is in Missouri, which was the last State in the country to impose a deadline by which new USTs must be double-walled. Forty-five percent of Vermont's tanks are steel composite with an outer shell. In a separate analysis conducted by the ASTSWMO Emerging Fuels Task Force, the reported percentages of steel tanks ranged from 4% in Hawaii to 61% in South Dakota.

Figure 5: Tank Material & Construction
AZ, CO, MN, MO, UT, VT - Combined

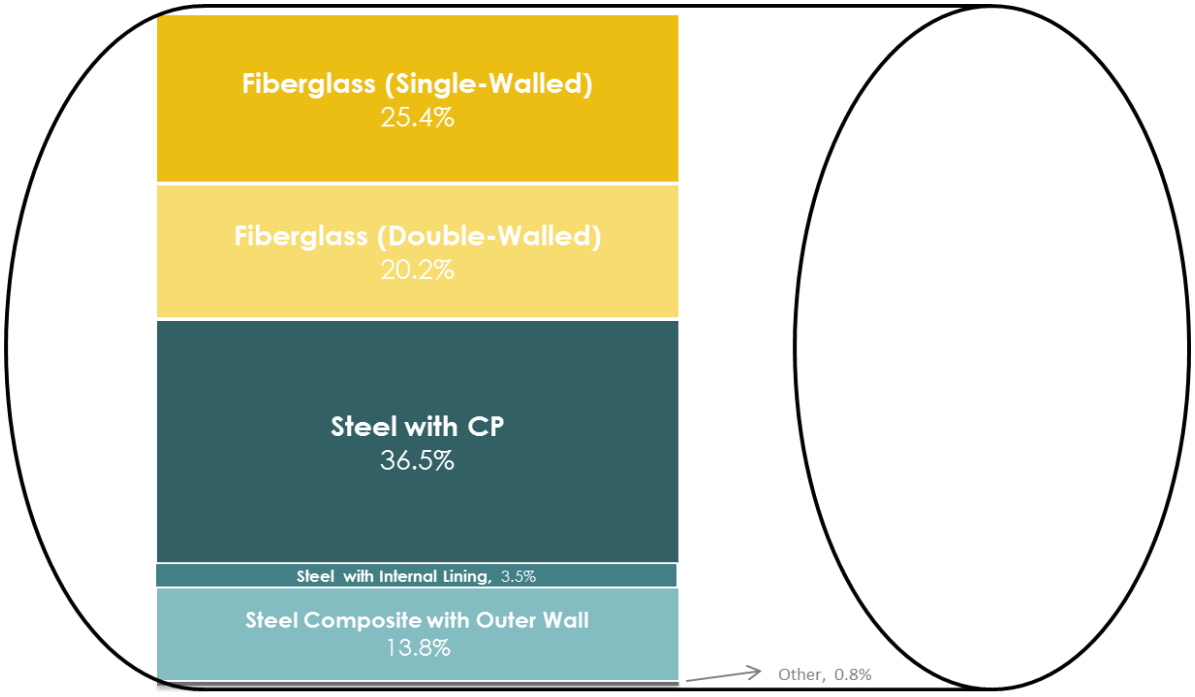
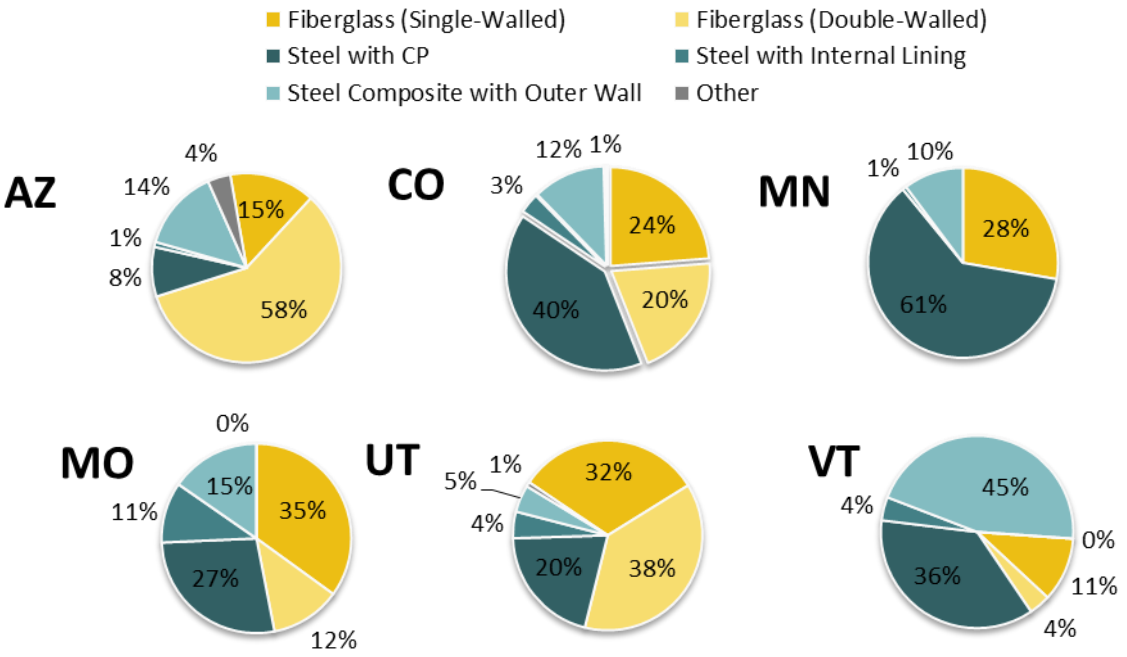


Figure 6: Tank Material & Construction - By State*



*Note: Minnesota was unable to distinguish between single-walled and double-walled tanks so the total percentages for the Fiberglass categories may be skewed.

iv. UST Piping Material and Construction

Figures 7 and 8 show similar information for piping. As with tanks, the States' data differ significantly. A substantial percentage of the piping in Colorado and Missouri is single-wall fiberglass. Minnesota has the highest percentage of cathodically-protected steel piping.

Figure 7: Pipe Material & Construction
AZ, CO, MN, MO, UT, VT - Combined

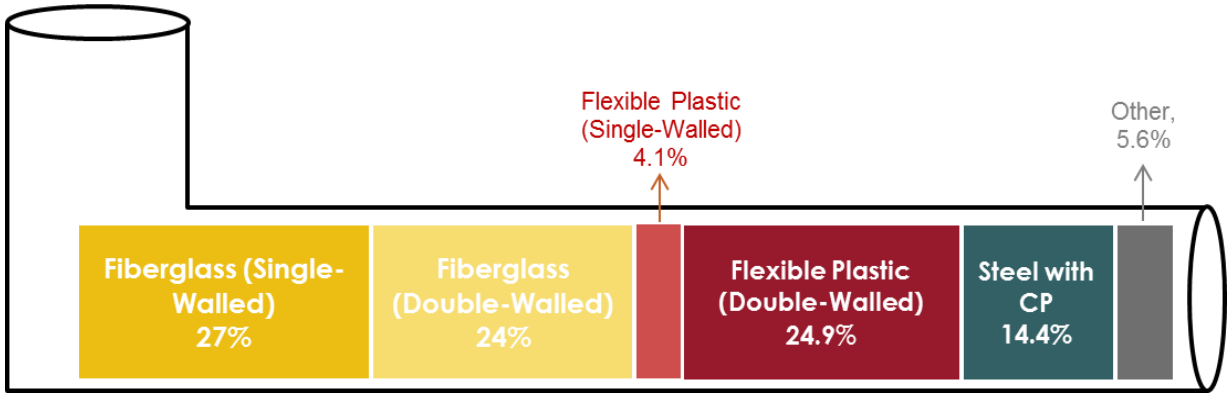
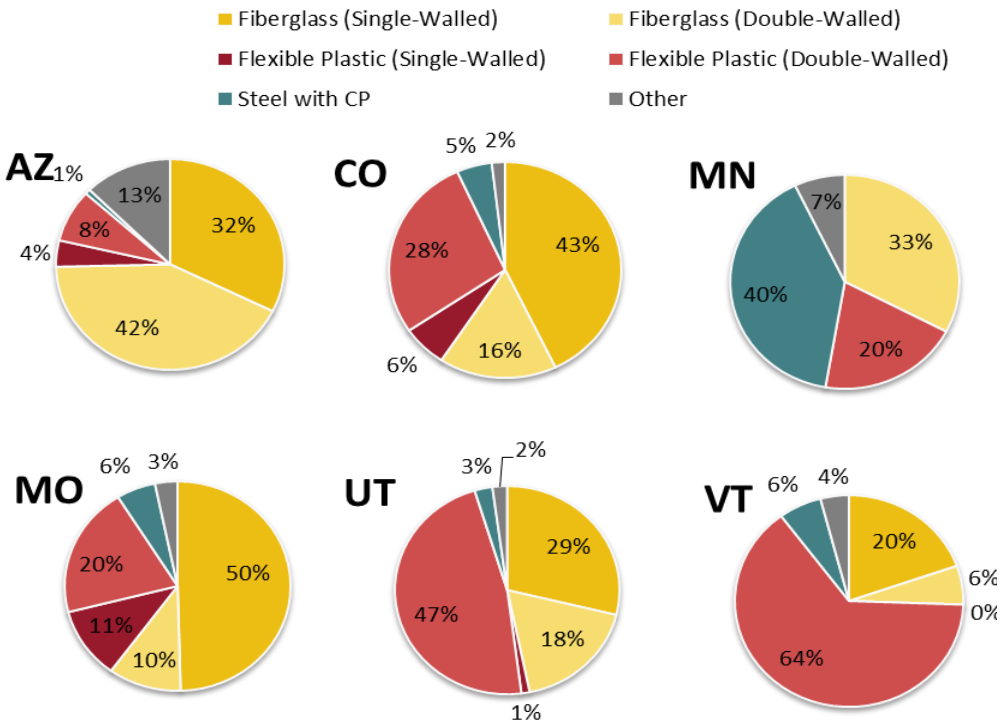


Figure 8: Pipe Material & Construction – by State



*Note: Minnesota was unable to distinguish between single-walled and double-walled tanks so the total percentages for the Fiberglass categories may be skewed.

v. ULSD Storage

Multiple efforts are underway across the country to better understand the extent to which a lack of compatibility between the equipment and the products stored and dispensed is increasing the risk of leaks or contributing to a higher loss frequency. Other parties and other ASTSWMO Tanks Subcommittee Task Forces are actively working to collect and analyze data regarding the interaction between emerging fuels and existing fuel infrastructure.

The Workgroup analyzed data from five States on their UST infrastructure and storage of ULSD and ethanol blends to perhaps aid these groups in their studies. In two of the five, (Arizona and Utah), more than 70% of ULSD storage tanks are fiberglass. In another, (Vermont), nearly all ULSD is being stored in steel tanks. Missouri's and Colorado's tanks are about 50/50 fiberglass and steel. A summary of this data is provided in Figures 9 and 10.

Figure 9: Tanks with ULSD Product

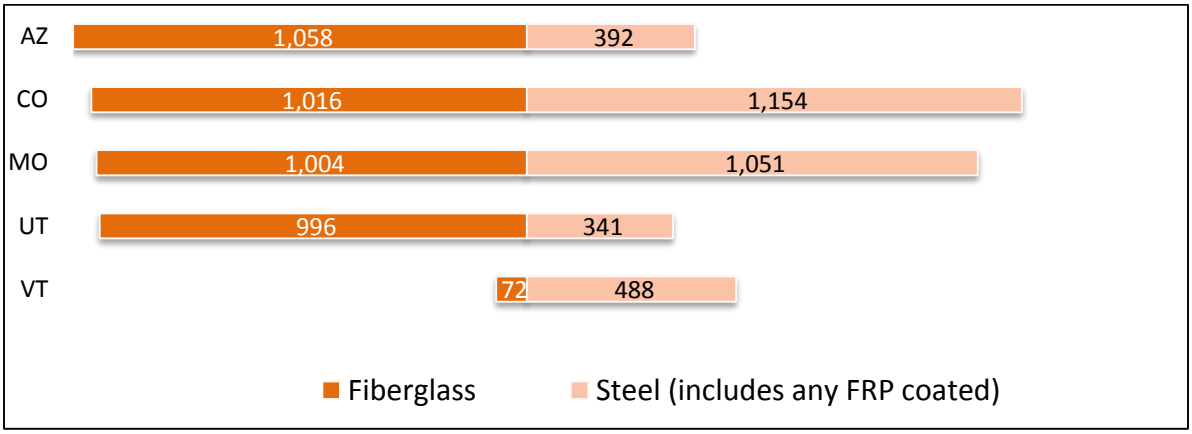
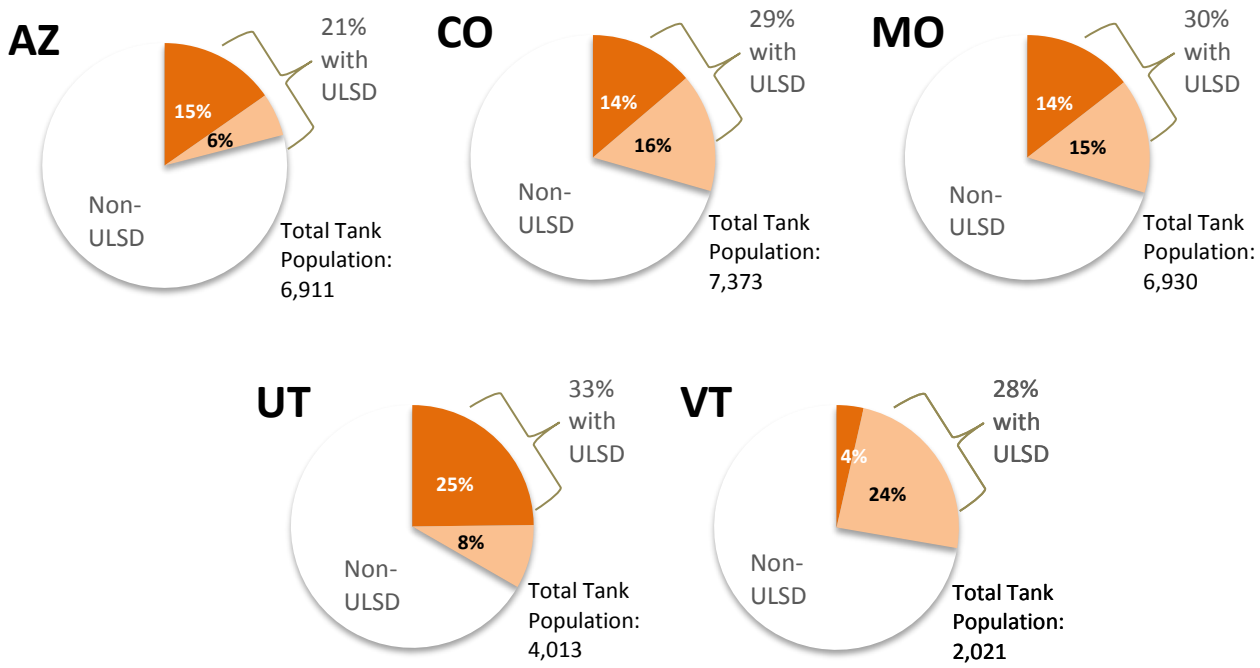


Figure 10: Tanks with ULSD Product – by State

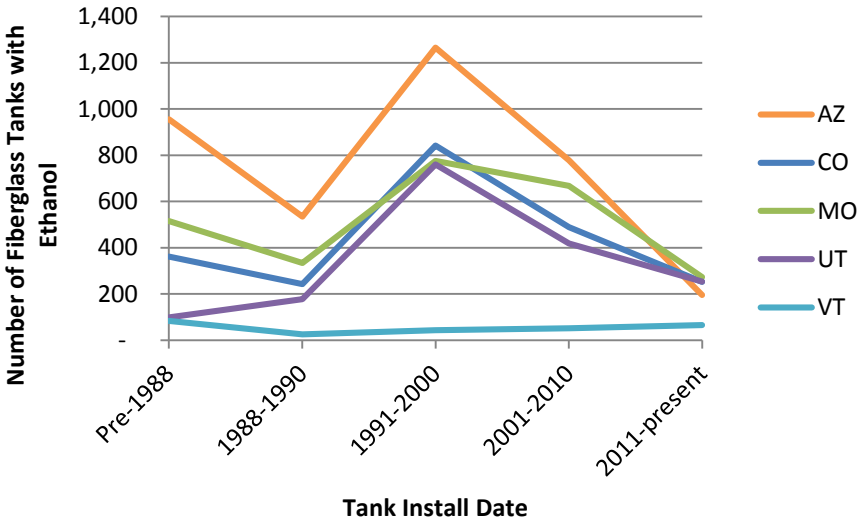


vi. Ethanol-Blended Fuels Storage

Given that nearly all of the nation's gasoline contains some ethanol (typically up to 10%) and certain fiberglass tank manufacturers have indicated tanks manufactured prior to certain dates are not suitable for ethanol-blended fuel, the Workgroup also analyzed the ages of fiberglass tanks containing ethanol-blended fuel. Information on compatibility of various fiberglass tanks is contained in Appendix C.

It should be noted that many of the older fiberglass tanks currently being used to store ethanol-blended fuel have been lined; the Workgroup's analysis did not distinguish between lined and unlined tanks.

Figure 11: Fiberglass Tanks that Contain Ethanol-Blended Fuel (Including 10% Ethanol)



	AZ	CO	MO	UT	VT
Pre-1988	955	362	515	98	83
1988-1990	535	243	334	177	25
1991-2000	1,265	842	775	760	43
2001-2010	778	489	668	419	52
2011-present	196	252	273	253	65
Unknown	8	29	2	-	-
Total	3,737	2,217	2,567	1,707	268

III. UST INFRASTRUCTURE AND RISK MANAGEMENT

A. Risk Factors

Mitigating the risk of fuel leaks into the environment was the driving factor behind the 1998 U.S. EPA upgrade requirements and continues to be a primary concern driving States' policy decisions.

Many factors affect the risk of leaks from a State's population of UST systems. A critical part of risk analysis requires deciding which system features are most relevant – i.e., What factors

indicate a higher risk of a release? The Workgroup found there is no uniform set of criteria for evaluating risk of release.

The following list of factors may affect the likelihood of a release from an operating UST system, *listed in no particular order*.

- Level of diligence by the owner/operator in leak prevention and leak detection efforts;
- Effectiveness of the owner's/operator's ongoing maintenance program;
- Effectiveness of regulatory agency's training, inspection, compliance, and enforcement programs;
- Number of dispensers and presence or absence of under-dispenser containment;
- Compatibility of substance stored with tank, piping, and ancillary components;
- Type of leak detection method used;
- Age and construction of piping;
- Age and construction of tank;
- Length of time site has been a fuel storage facility; and
- Whether "legacy pollution" has already been identified and cleaned up.

B. Source and Cause of Leaks

The source and cause of leaks in the nation's population of in-use USTs are is an important consideration. The Workgroup queried States on whether such information is being collected, and most States reported they do record this information. However, many acknowledged their current data collection efforts are inadequate and/or their information is incomplete and less accurate than they would like. No comprehensive source of this vital information is known to exist.

This project did not include analysis of the "source and cause" data that States are required to report publicly as a result of the 2005 Energy Policy Act. Some States, including California and Florida, have published supplemental reports on source and cause information, but it has been limited in scope. Private insurance companies may have such data for their insured USTs, but it is not readily available to other parties.

Source and cause investigations are time-consuming and resource-intensive, often requiring specialized expertise or laboratory analyses. In addition, the investigation must be initiated immediately after the release is discovered, and few regulatory agencies have personnel who can be deployed quickly when a release is reported.

The few published studies available on this subject all have concluded that components other than the tank itself – i.e., piping, joints, connectors, gaskets, dispensers, etc. – are the source of

most UST leaks.[1,2] Those desiring to learn more about how to properly investigate and document the source and cause of a release may refer to ASTM E2733-10(2015), "Standard Guide for Investigation of Equipment Problems and Releases for Petroleum Underground Storage Tank Systems."

C. State Policy Choices and Initiatives

In an effort to understand what policy decisions States have made to mitigate the risk of leaks and trigger replacement of aging USTs, the Workgroup also asked States the following three questions.

1. Does your State have a legal requirement in statute or regulation requiring replacement of old USTs or UST equipment?

2. Describe your State's requirements regarding replacement of the UST system with double-wall tanks and/or double-walled piping under the secondary containment provisions of the 2005 Energy Policy Act. In your opinion, has this requirement encouraged, discouraged, or had no effect on the upgrade and/or replacement of older UST systems and equipment?

3. Does your State have any incentives to encourage owners/operators to replace aging USTs and UST equipment? Please explain or provide a link describing the program.

Eight of the 38 States responding to the first question said they require replacement of old USTs or UST equipment and reported the following specifics:

CT: 30 years from date of installation system must be replaced.
FL: All single-walled USTs had to be upgraded to double-walled by 12/31/09.
IL: USTs with failed lining inspection must be upgraded.
NH: Single-walled USTs and piping must be closed by 12/22/15. All new tanks must be double-walled.
RI: Mandatory deadline for permanent closure of single-walled tanks.
SC: Single-walled systems must be closed by 12/22/18 if within 100' of a water supply or surface waters.
VT: Single-walled systems must be closed by 1/1/16, lined tanks removed 10 years after lining date.

[1] For example, see http://www.aces.edu/pubs/docs/A/ANR-0790/WQ4.8.1.pdf, which states, "Four out of five leaks in UST systems occur in the piping, not the tank itself."
[2] See also http://www.neiwpcc.org/neiwpcc_docs/ustlust_shows/mott_smith.pdf

WY: USTs with throughput >500,000 gal/month must be replaced when over 30 years old.

Thirty-nine States responded to the second question, describing requirements for double-wall tanks and/or double-walled piping enacted under the secondary containment provisions of the Energy Policy Act and offering opinions on the impact of the requirements. It should be noted that most States have already implemented the Energy Act requirement for new USTs to have secondary containment, but most did not mandate a deadline for replacement of old systems.

Twenty of the 39 respondents opined their requirements had no effect on replacement of old systems. Ten believed their requirements did have an effect; some said the effect was to delay equipment replacements, while others thought it had a positive effect on replacing old single-walled systems with new ones. Four respondents expressed uncertainty whether their requirements had any effect. Four expressed no opinion. Individual State responses are included in Appendix B.

In response to the third question about incentives to replace USTs, 32 States responded that they have no such incentives and six indicated their States have implemented an incentive or plan to do so:

AL: Will waive the closure site assessment requirement if owners want to proactively replace old flexible piping (must pass piping leak detection requirements). There is no equivalent policy for tanks.

CO: A bill will be introduced this legislative session [2015] which would allow incentives.

IA: Iowa offers up to $15,000 per site for the removal of USTs. This provides some relief when replacing UST systems.

TN: Offers a reduced deductible for coverage from State fund, based on various upgrades to the UST system.

UT: Zero interest loan program to upgrade, replace, or remove USTs. Rebate program offering up to 40% of the per gallon fuel surcharge back for UST systems with a low risk of release.

VT: Zero-interest (for small mom & pop operations) and low-interest (for chains) loan program. A higher deductible if the release is from a single wall system.

In addition to the responses received from 38 States, the Workgroup learned of the following State initiatives:

DE: Has a low-interest loan program to assist UST owners in replacing old USTs; few owners have utilized the program since its creation in 1996.

IA: At the urging of the Petroleum Marketers and Convenience Stores of Iowa (PMCI), the Iowa legislature enacted a bill in 2015 that would have offered grants to UST

owners to replace aging underground gasoline and diesel storage tanks. However, Iowa's governor vetoed the bill.

KS: Legislation enacted and signed by the Governor in 2015 authorizes the Kansas Department of Health and Environment (KDHE) to offer $50,000 grants to UST owners to replace single-wall USTs with double-wall USTS and, if a release is confirmed during the upgrade, to waive the deductible for the Kansas UST cleanup fund. KDHE estimates that 90% of existing Kansas retail UST facilities are older single-wall systems and reports the majority are owned by small businesses. The program is "retroactive" to August 8, 2005 – meaning small businesses who already did so can apply for grants to offset costs already incurred – and will expire on June 30, 2020. Owners must be in substantial compliance with KDHE UST rules and if contamination is found, must apply to the UST Petroleum Release Trust Fund. The State cannot disburse more than $3 million per year for this program.

ME: Legislation was enacted requiring underground tanks to be removed and/or replaced at the end of their warranty period.

NM: New Mexico has developed a geospatial software tool that incorporates over 50 different risk factors to assess risks and prioritize inspections, including:

- Facility details (history, maintenance, and equipment at a facility);
- Landscape (physical surroundings); and
- Community (socio-economic factors).[3]

UT: Utah has implemented a "risk based" fee for its State tank fund. Beginning on January 1, 2015 the surcharge that finances the tank fund was increased from 0.5 to 0.65 cents per gallon. All facilities will pay the full rate but facilities deemed to have a lower risk of leaks will be eligible for a rebate of a portion of their fees, based on a four-tiered risk profile created for each facility by the State UST regulator. Rebates may be requested when fuel taxes are paid to the State tax commission. Owners of the highest risk USTs get no rebate, somewhat lower risk UST owners can apply for a rebate of 10% of their fees, even lower-risk UST owners can get 25%, and the lowest-risk UST owners can apply for 40%. The lowest-risk USTs are ones that meet the secondary containment requirements of the Energy Policy Act and have tested their secondary containment.

[3] Information on New Mexico's approach was presented at the 2013 National Tanks Conference and that presentation can be viewed at: https://www.neiwpcc.org/tanksconference/presentations/tuesday/Whirlwind%20Tour%20Compliance/Whirlwind%20Compliance_Arfman_2013_Tuesday.pdf]

WA: As part of the State's 2015-2017 capital budget, Washington appropriated $1,800,000 to design a capital finance program to provide underground storage tank owners and operators with financial resources to remove, replace or upgrade underground storage tank fuel systems, retrofit existing systems to dispense renewable or alternative fuels, and clean up contamination caused by legacy petroleum releases. The design must assess options for program structure and administration, develop a recommended program design, financial management and staffing model; include data and legal analysis of statewide need, availability of existing fund sources for grants and loans, assessment of owner and operator willingness to participate, and potential environmental and economic impacts of the loan program. A final report of program design, as well as any associated legislative and budget recommendations, is due to the governor and legislature by October 1, 2015.

D. Private Market Forces as Drivers for UST Removal and Replacement

In States where private insurance is the dominant financial responsibility mechanism, insurance underwriting criteria – which include profitability and risk considerations – may become a trigger for removal or replacement of high-risk UST systems. Specifically, increased premiums or cancellation notices may trigger UST closure or replacement.

These States have observed the following factors as significant in insurers' underwriting decisions:

- Install dates
- Tank and piping construction
- Retro dates
- Presence of historical contamination
- Bulk rating and credits when more than one tank or site is underwritten

Anecdotal information and opinions expressed by insurance companies and other risk management experts are quite diverse as to whether the age of the tank is a significant or decisive factor in assessing the risk of leaks. Some of the opinions expressed by these experts to Workgroup members appear in Appendix D.

The State of Washington reported the following specific examples of underwriting decisions by private insurers:

Example 1:

- Three underground tanks installed in 1962.
- Retroactive date of current insurance coverage: 1994.
- Annual premium: $4,437 with a $10,000 deductible.
- Insured is in compliance and performs all required equipment tests.

- The insurer has indicated the tanks need to be replaced but banks are not willing to loan money for the project and no other insurer is inclined to underwrite the risk.

Example 2:

- Two underground tanks installed in 1962.
- Retroactive date of current insurance coverage: 1993.
- Annual premium: $1092, includes tank repair & business interruption options with a $2500 deductible.
- Contamination was found when older tanks were removed in the mid-1990's; cleanup of this contamination is not covered by the current policy due to the 1993 retro date.
- Two additional claims (totaling several thousands of dollars) have been made since then; one in 2008 due to line leaks, one in 2012 due to spill bucket and turbine sump leaks.
- Insurance company sent out non-renewal notice due to site conditions; indicated USTs need to be replaced, but the tank owner/operator does not have the funds to do so and cannot get financing.
- No other insurer is likely to underwrite this risk because of the site conditions and loss history.

Example 3:

- Tanks installed in the 1960's.
- Tank owner provided recent tank tightness testing.
- Insurance company did not provide an estimated premium because they wanted to verify the owner could support such a high deductible before spending the time to develop an insurance quote.

Example 4:

- Two tanks installed in 1949 and one tank installed in 1955.
- Insurer requiring a $250,000 deductible (or higher).
- Applicant required to provide tightness tests and financial statements.

E. UST Owners' Initiatives

In addition to mandatory upgrade or replacement requirements imposed by the regulatory agency, incentives offered by the State and business-related considerations also drive UST owners' decisions about infrastructure upgrade and replacement.

Some convenience store owners rank their equipment for inspection and maintenance resources or replacement; those ranking systems typically include many of the risk factors discussed in this report. For example, 7-Eleven, Inc. uses a ranking system that includes the following criteria:[4]

- UST material
- Tank age and warranty
- System component type
- Property ownership (owned or leased)
- Ability to accomplish multiple remediation goals simultaneously
- Long term marketplace strategic plans
- Store's financial performance
- Regulatory future
- Investment rate of return

F. Actuaries' Opinions

The Workgroup invited three actuaries who have experience analyzing UST risks for input regarding what risk factors are most significant. Two responded; their opinions are contained in Appendix D.

IV. CONCLUSIONS

- The average age of in-use tanks has not been routinely calculated by most States, making it impossible to discern trends over time. The average tank age appears to vary considerably among the States. The age of a UST does not appear to be a major concern in most States. A few States have implemented policy decisions to compel removal of tanks after they reach a certain age; some States have offered incentives for removal and/or replacement of older UST systems.

- Some owners lack the financial resources to replace aging tank systems; in States where private insurance is the dominant financial responsibility mechanism, high premiums and/or insurance cancellation notices may prompt closure of these sites. Regulators should consider how best to assure financial resources are available for cleanup of such sites.

- The source of most UST releases from operating tank systems is widely perceived to be dispensers, piping, and ancillary equipment, not the tank itself. However, States do not have accurate information on the source and cause of leaks from operating UST systems. Without these data, analyzing risks is more difficult. The parties most likely to initiate

[4] Information on 7-Eleven's ranking system was presented at the 2013 National Tanks Conference: http://www.neiwpcc.org/tanks2013/presentations/wednesday/Out%20of%20Sight/Out%20of%20Sight_Johnson_2013_Wednesday.pdf

improvements in the current methods of capturing information on the source and cause of leaks are the entities paying for cleanups, i.e., State tank funds and private insurers.

- The quality of data about operating UST systems varies substantially among the States, and some States do not have an effective method of regularly updating such data. This makes risk analysis more difficult in those States. A suggested list of data elements useful for analyzing risks is presented in Appendix E; some States may wish to consider making improvements in their record keeping practices.

- Whether a lack of compatibility between the product being stored and the UST system equipment is a significant risk factor remains an unanswered question. States should monitor steel tanks and piping where diesel fuel is stored and fiberglass tanks and piping in which ethanol-blended gasoline is stored, and should be alert for risks of leaks at those locations.

APPENDIX A: ADDITIONAL INFORMATION ON UST DATA FROM EIGHT STATES

Data was compiled from the databases in eight States to conduct this analysis. More details about the database, date accessed, and contact information for each State are listed below.

- Arizona: AZURITE, accessed 4/6/2015. Contact: Tiffany Yee, tiy@azdeq.gov.
- Colorado: COSTIS, http://costis.cdle.state.co.us/home.asp, accessed 2/6/2015. Contact: Amy Cole, amy.cole@state.co.us.
- Georgia: Accessed 4/21/2015. Contact: Lon Revall, Lon.Revall@dnr.state.ga.us.
- Minnesota: TALES, http://www.pca.state.mn.us/, accessed 2/1/2015. Contact: Nate Blasing, Nathan.blasing@state.mn.us.
- Missouri: PSTIF Database, accessed 3/12/2015. Contact: Carol Eighmey, pstif@sprintmail.com.
- Utah: UST Information Management System, http://equstdb.deq.utah.gov/Default.aspx, accessed 3/2/2015. Contact: Therron Blatter, tblatter@utah.gov.
- Vermont: VTUST Database, accessed 3/20/2015. Contact: June Reilly, june.reilly@state.vt.us.
- Washington: Database not publically available, accessed 12/4/2015. Contact: Kris Grinnell, krgr461@ecy.wa.gov.

The data used for this analysis varied among the States. Data from in-use tanks was requested; some States also may have included data from temporarily-closed tanks. For more information on definitions and the data criteria, see the table below. State data is provided in the two figures after the table.

Definitions and Criteria:		
Tank Type	Underground Storage Tanks Only	
Status	Active and Temporary Closed	
Definition of Age	>10	Install Date from 2005 to present
	10-19	Install Date from 1995 to 2004
	20-29	Install Date from 1985 to 1994
	30-39	Install Date from 1975 to 1984
	40-49	Install Date from 1965 to 1974
	50+	Install Date before 1965
	Unknown	Unknown age includes any tank or piping system whose age is not known and could not be verified or estimated with a high level of confidence.

Data Table for "Figure 1: Age of Underground Tanks"

	< 10	10-19	20-29	30-39	40-49	50+	Unknown	Total
AZ	1,153	1,976	2,770	730	179	43	60	6,911
	17%	*29%*	*40%*	*11%*	*3%*	*1%*	*1%*	
CO	943	1,919	2,719	1,075	447	79	191	7,373
	13%	*26%*	*37%*	*15%*	*6%*	*1%*	*3%*	
GA	3,046	7,287	9,669	5,899	1,396	259	555	28,111
	11%	*26%*	*34%*	*21%*	*5%*	*1%*	*2%*	
MN	997	3,842	5,451	1,179	185	48	0	11,702
	9%	*33%*	*47%*	*10%*	*2%*	*0%*	*0%*	
MO	1,091	1,743	2,590	982	434	52	38	6,930
	16%	*25%*	*37%*	*14%*	*6%*	*1%*	*1%*	
UT	794	1,338	1,358	406	88	10	19	4,013
	20%	*33%*	*34%*	*10%*	*2%*	*0%*	*0%*	
VT	344	627	994	49	7	0	0	2,021
	17%	*31%*	*49%*	*2%*	*0%*	*0%*	*0%*	
WA	642	2,228	4,458	1,339	414	184	2	9,267
	7%	*24%*	*48%*	*14%*	*4%*	*2%*	*0%*	
Total	*9,010*	*20,960*	*30,009*	*11,659*	*3,150*	*675*	*865*	*76,328*
	12%	*27%*	*39%*	*15%*	*4%*	*1%*	*1%*	

Data Table for "Figure 3: Age of Underground Pipes"

	< 10	10-19	20-29	30-39	40-49	50+	Unknown	Total
CO	1,685	2,678	2,058	556	195	57	144	7,373
	23%	*36%*	*28%*	*8%*	*3%*	*1%*	*2%*	
MO	1,878	2,916	2,083	141	34	1	676	7,729
	24%	*38%*	*27%*	*2%*	*0%*	*0%*	*9%*	
UT	976	1,600	1,117	236	55	10	19	4,013
	24%	*40%*	*28%*	*6%*	*1%*	*0%*	*0%*	
VT	608	1,029	834	0	0	0	73	2,544
	24%	*40%*	*33%*	*0%*	*0%*	*0%*	*3%*	
Total	*5,147*	*8,223*	*6,092*	*933*	*284*	*68*	*912*	*21,659*
	24%	*38%*	*28%*	*4%*	*1%*	*0%*	*4%*	

APPENDIX B: INDIVIDUAL STATE RESPONSES REGARDING EFFECT OF DOUBLE-WALL REQUIREMENT ON UST INFRASTRUCTURE CHANGES

AL: Alabama does not believe that the changes in the Energy Act have had any effect on upgrade decisions by tank owners. Alabama does require new installations be double walled with interstitial monitoring.

AZ: Arizona is unsure of whether the requirement for upgrade has had any impact on replacement of old systems. Since 2009, Arizona has required new installations for tanks and piping (over 25%) to be upgraded to double wall and interstitial monitoring. It is unsure whether the owners/operators are weighing costs of new installations against re-lining old tanks.

CNMI: The Northern Marianna Islands believe the new requirements have no effect.

CO: Colorado has not adopted a requirement to replace single wall tanks/piping with double wall. It does require new installations to be double walled and have interstitial monitoring. It has not answered part two of the question.

CT: Connecticut believes that higher costs have contributed to decision to close rather than replace the older tanks. It does have requirements for double wall on new installations after October 2003.

DC: The District of Columbia believes that the upgrade requirements did not have a significant impact on tank upgrades and replacements. DC already had double wall requirements in 1999. Energy Act impacts were limited to operator training, interstitial monitoring, and UDC's for dispensers.

DE: Delaware allows single wall tanks and lines to remain in use indefinitely. All replacements must meet Energy Act upgrades. Delaware does not believe that the requirements have had any effect until such time as a problem arises. Larger retailers have upgraded to mitigate risk.

FL: Florida adopted upgrade requirements before the Energy Act, and therefore does not believe the upgrade requirement is having any impact.

GA: Georgia believes that the requirements have had little effect on decisions involving replacement of existing systems. Georgia has adopted upgrade requirements for new installations and replacements of more than 20% of lines. It also requires upgrades of dispensers to have containment. It does not require automatic upgrades of existing systems.

HI: Hawaii does not believe the new requirements have had any effect on the replacement of existing systems as owners/operators were already installing tanks and piping with secondary containment.

IA: Iowa does not believe the requirements have any effect. The new regulations do require replacement of lines with double wall if more than 10 feet of line is replaced.

ID: Idaho does not believe the new requirements have had any effect on replacement or old systems. It requires all tanks and piping installed after 2/23/2007 be double walled.

IL: Illinois seems to believe that the new requirements have forced replacement of old systems with new double walled and interstitial monitoring.

IN: Indiana believes that the new requirements have encouraged replacement of old systems with new double walled systems. Indiana also adopted a prohibition against re-lining old tanks that had been lined once before.

KS: Kansas did not express an opinion on whether the new requirements had any effect.

KY: Kentucky is unsure whether the new requirements have had any effect, but believes it makes enforcing the new requirements easier. Kentucky requires replacement to all double walled if 100% of a line is replaced or when the tank is replaced. New installations must meet requirements.

LA: Louisiana believes the new requirements have delayed replacement of old single walled systems with double walled. It has done so by encouraging repair over replacement. Costs of new systems has risen over 50% since secondary containment requirements were adopted. Louisiana has adopted the upgrade requirements but does not require upgrade unless 25% of the piping system is replaced. Old systems can remain.

MI: Michigan believes the requirements have had a neutral effect, believing that some will replace and some will not.

MN: Minnesota believes the new requirements have resulted in more replacements of single wall systems with upgraded systems. It adopted the new standards in 2010 which require new installations to be double walled and interstitial monitored.

MO: Missouri has not expressed an opinion on whether the new requirements have had any effect. It has not adopted the new Energy Act requirements. It does believe that active enforcement of existing regulations has resulted in upgrades.

MS: Mississippi believes the new requirements have had no effect. It has adopted the new double walled requirements as of 2008, but does not classify replacement of lines as a new installation.

MT: Montana does not believe that the new requirements have had any effect on replacement of old systems with new double walled systems. It does not require replacement of old systems which may continue to operate.

ND: North Dakota believes that the new requirements are delaying installation of new systems due to the cost of double walled systems. It did not say whether it had adopted the new requirements.

NH: New Hampshire already required double walled systems before the Energy Act and therefore believes its adoption had no effect on replacement of systems in New Hampshire.

NM: New Mexico believes the adoption of the new standards has resulted in replacement of old systems with new systems. It adopted the new requirements in 2008.

NV: Nevada did not express an opinion on the effect of the new requirements. Nevada did adopt requirements for upgrades in 2008, but provided exemptions for existing systems.

NY: New York does not believe the Energy Act requirements have impacted replacement of existing systems. It believes so as a result of NY requiring any tank system installed after 1986 to have double walled tanks (not lines).

OH: Ohio is unclear whether the new requirements have had any effect on replacement of old systems. It does require upgrades for any replacement of single walled tanks and whenever more than a certain percentage of the system is repaired.

OK: Oklahoma has not adopted a double wall requirement. It therefore has not opinion on the effect of such a requirement.

OR: Oregon did not express an opinion on whether the new requirements had any effect. It does require double walled systems when an old system is replace or when a new system is installed.

RI: Rhode Island did not express an opinion on the effect of the new requirements on the systems. It does require all single walled systems to be closed are upgraded by a date certain. Therefore, its requirement has a mandatory effect.

SC: South Carolina does not know whether the new requirements have had any effect. It has adopted requirements for upgrade.

TN: Tennessee believes that the adoption of the new regulations have had little or no effect on replacing old systems with new systems. It has adopted the new requirements.

UT: Utah did not express an opinion on the effect of the adopting of the new requirements. It has adopted the requirements should the existing system be replaced. It did not adopt a requirement that old systems be replaced.

VA: Virginia does not believe the adoption of the requirements has had any effect on replacement of old systems. It has adopted the new requirements for new installations.

VT: Vermont believes its requirements will result in replacement of old systems. From the contents of the response, it appears Vermont adopted a deadline for replacing/upgrading old systems.

WA: Washington does not believe that the new requirements have had any effect on replacement of existing systems. It did adopt the requirement that new installations meet the new standard, but did not provide any information on what is required of the old systems.

WV: West Virginia appears to believe that the new requirements have had little effect. It has adopted the new requirements since 2008.

WY: Wyoming did not adopt the new requirements and has expressed no opinion on their effect. It does require replacement of systems pumping more than 500,000 gallons a month to replace tanks when they get over 30 years old.

APPENDIX C: LETTERS FROM MANUFACTURERS REGARDING COMPATIBILITY OF FIBERGLASS TANKS WITH ALCOHOL-BLENDED FUELS:

XERXES®
a ZCL company

September 29, 2011

To Whom It May Concern:

The following summarizes the suitability of Xerxes' UL listed underground storage tanks for the storage of ethanol-blended fuels and biodiesel fuels:

Single-Wall Tanks

- Tanks manufactured prior to February 1981 were not designed for the storage of ethanol-blended fuel. Tanks are compatible with all ASTM biodiesel blends.
- Tanks manufactured from February 1981 through June 2005 are designed for the storage of ethanol fuel up to a 10% blend (E10), as well as all ASTM biodiesel blends.
- Tanks manufactured from July 2005 to date are designed for the storage of ethanol fuel blends up to 100% (E100), as well as all ASTM biodiesel blends.

Double-Wall Tanks

- Tanks manufactured prior to April 1990 were designed for the storage of ethanol fuel up to a 10% blend (E10), as well as all ASTM biodiesel blends.
- Tanks manufactured from April 1990 to date are designed for the storage of ethanol fuel blends up to 100% (E100), as well as all ASTM biodiesel blends.

Additionally, all storage tanks designed for storage of ethanol-blended fuel up to 100%, as noted above, are also UL listed under UL's Standard 1316 for the storage of ethanol fuel blends up to 100% (E100).

This summary is intended to address standard production tanks. Different tank models with an appropriate UL listing and designed for higher levels of ethanol storage were available throughout this period of time. Ethanol blend compatibility for such tanks is based on the design specifics of each tank.

Further information regarding product compatibility can be found in the applicable Xerxes limited warranty.

Sincerely,

Thomas Tietjen
Vice President
Sales & Marketing

making a lasting difference™
7901 Xerxes Avenue South • Minneapolis • Minnesota • United States • 55431-1288
Ph: 952-887-1890 • **Fax:** 952-887-1870 • **Web:** www.xerxes.com

OWENS CORNING
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO 43659
419.248.8000
www.owenscorning.com

To Whom It May Concern

RE: Fuel Storage Capability

Owens Corning manufactured and sold underground storage tanks between 1965 and 1994. The Company's fiberglass tank division was sold December 31, 1994. Owens Corning has not manufactured or sold tanks since that time.

With limited exceptions, Owens Corning fiberglass tanks were not warranted, tested for, or intended to store fuel with more than a 10% ethanol blend.

Single-Wall Tanks (SWT): No Owens Corning SWT was ever warranted or intended to store fuel with more than a 10% ethanol blend.

Double-Wall Tanks (DWT): *Prior to July 1, 1990.* With the exception of a small number of specially manufactured tanks, DWTs sold before July 1, 1990 were not warranted or intended to store fuel with more than a 10% ethanol blend.

After July 1, 1990. Owens corning DWTs that were manufactured and sold between July 1, 1990 and December 31, 1994 were warranted for the storage of fuel with no limitation on ethanol content.

For additional details, please refer to the attached letter from Owens Corning to customers from April 1995. Please also note that in addition to these compatibility limitations, in 2006 Owens Corning completed reorganization under Chapter 11 of the Bankruptcy Code. Under the confirmed plan of reorganization, all past and future claims against Owens Corning for alleged breach of warranty were discharged in bankruptcy.

Sincerely,

Brian McPeak
Vice President, External Affairs

OWENS-CORNING WORLD HEADQUARTERS
FIBERGLAS TOWER
TOLEDO, OHIO 43659
419.248 8000

April 14, 1995

To Owens-Corning Tank Customers:

The purpose of this letter is to clarify the use of fiberglass underground storage tanks produced by Owens-Corning for the storage of ether and alcohol fuel blends. All percentages are by volume.

FUELS BLENDED WITH ETHER:

Owens-Corning has extensively tested fuels containing up to 20% MTBE, ETBE, and TAME. The results show very little effect on the laminate, and hence storage of these ether blends in underground storage tanks produced by Owens-Corning from 1964 through 1994 would not void the manufacturer's warranty.

ALCOHOL FUELS:

TANKS MADE PRIOR TO JANUARY 1981:
Tanks produced prior to January 1981 were not warranted for any alcohol or alcohol blend fuels. In addition, these tanks were not tested and listed by Underwriter's Laboratory (UL) for such fuels. The use of alcohol or alcohol blends in tanks produced and sold prior to January 1981 would void both the manufacturer's warranty and the UL listing for the tank.

TANKS MADE BETWEEN JANUARY 1981 AND JUNE 1984:
In December 1981, Owens-Corning completed UL testing and introduced a 30-year warranty on the standard fiberglass tank for 10% ethanol blended fuel. For these tanks, the use of ethanol blends over 10% or any methanol blends in the standard fiberglass tank would void both the manufacturer's warranty and the UL listing for the tank.

For methanol blends or blends of ethanol exceeding 10%, an optional vinylester resin system was UL listed and available as an option from Owens-Corning.

TANKS MADE BETWEEN JULY 1984 AND JUNE 1990:
In July 1984, Owens-Corning completed additional UL testing and introduced a 30-year warranty on the standard fiberglass tank for low levels of methanol such as 90.5% gasoline and 9.5% Oxinol-50 (4.75/4.75 methanol/GTBA). For these tanks, the use of ethanol blends over 10% and methanol blends over 4.75% would void the manufacturer's warranty and the UL listing for the tank.

April 14, 1995
Page Two

TANKS MADE SINCE 1990:
In July of 1990, Owens-Corning issued a 30-year warranty for all levels of alcohol (ethanol or methanol) on standard double wall tanks. These tanks were UL listed for this service.

It is our belief that the prudent tank owner will want to secondarily contain any high level alcohol blends (over 10%), as higher levels could be considered hazardous material as defined in the underground tank regulations published by the federal Environmental Protection Agency. It is our recommendation that double wall fiberglass tanks be used to achieve that secondary containment.

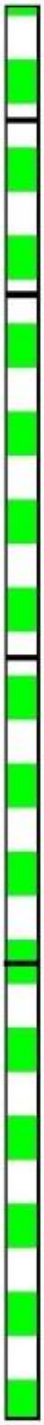
The above should clarify the issue of fuel compatibility warranty coverage and UL listings for ether and alcohol blended fuels stored in tanks manufactured by Owens-Corning between 1964 and December 31, 1994.

Sincerely,

David Bartlow
Manager, Tanks
Owens-Corning Fiberglas Corporation

Historical Timeline for Storage Tank Ethanol Compatibility

Containment Solutions:
(Formerly Owens Corning/Fluid Containment)



Prior to Jan 1981: No single or double wall tanks are warranted for any alcohol or alcohol blended fuels.

Jan. 1981 to June 1984: Single and double wall tanks are warranted for ethanol blends up to 10%.

July 1984 to June 1990: Single and double wall tanks are warranted for ethanol blends up to 10% and methanol blends up to 4.75%.

July 1990 to Jan. 1995: Double wall tanks only are warranted for all concentrations of ethanol or methanol.

After Jan. 1995: Both single and double wall tanks are warranted for all concentrations of ethanol or methanol.

Xerxes Corporation:

Prior to Feb. 1981: No single or double wall tanks are warranted for any alcohol or alcohol blended fuels.

Feb, 1981 to July 14, 1985: Single wall tanks are warranted for ethanol blends up to 10%. No mention of double wall tanks.

July 15, 1985 to June 1988: Single and double wall tanks are warranted for ethanol blends up to 10% and methanol blends up to 4.75%.

June 1988 to July 2005: Double wall tanks only are warranted for all concentrations of ethanol or methanol. Single wall tanks are only warranted for ethanol blends up to 10% unless premium resin used and documented in Xerxes records database.

After July 2005: Both single and double wall tanks are warranted for all concentrations of ethanol or methanol.

Wisconsin Department of Commerce **Bureau of Storage Tank Regulation**

H:\Program letters\Tank compatibility for e85.doc

APPENDIX D: FEEDBACK FROM INSURERS, ACTUARIES, AND OTHER INDUSTRY REPRESENTATIVES

Below are a variety of views expressed by insurers, actuaries, and other industry representatives with whom Workgroup members consulted during this study:

- "Older tanks are costly to insure, it would be in the insured's best interest if they were able to remove and replace the older tanks with new ones."

- "Tanks are only going to get older and companies will not offer coverage on those sites any longer."

- "We have been limiting our exposure…on older tanks for the past six or seven years…[Most of our claims] come from piping related incidents, but some…from tank failures where there is a slow leak that gets bigger over time, or a total failure…The problem with many older tanks from an underwriting perspective is that they are usually undesirable risks [in other ways]…run down, not profitable…they change hands every year or two…where we have good owners taking care of their tank systems, [we] will continue to insure…"

- "Insurance has not proved to be unavailable or too expensive for small businesses to survive in [my State]. We have required FR since 1996 and 80% of our facilities utilize private insurance. We have a large percentage of "mom and pops" still serving up gas, and most of those are in the rural areas of the State."

- "Underwriting older tank systems becomes more difficult in jurisdictions where compliance has been loosely enforced…"

- "Arbitrary age limits are a bad idea. We have not seen an age [at which] tanks are likely to fail…Data indicates fiberglass tanks should last over 100 years…Steel tanks may have a similar lifespan, although anodes need to be replaced periodically…tanks [should be replaced] not because of their age, but because of the fuels to which they are exposed. If fiberglass tanks [contain] diesel there is no need to replace them. If they are going to see 15% or greater alcohol, they should be removed or replaced…"

- "It has been demonstrated in numerous industries that preventive maintenance programs lead to great cost savings and more predictable operations. There is nothing worse for a business than an unplanned six-week outage, a large bill for new equipment, and a large cleanup bill. State tank funds have distorted the economics by making owners believe their cleanup costs are limited to the deductible…"

- "Requiring replacement of tanks at the end of their warranty period is a crazy idea. Many components of tank systems have warranties of only 1 year or a few years…Owners are

not required to replace those components at the end of a warranty period. Would you require cars to be replaced at the end of their warranties?"

Below are opinions offered by two actuaries and printed here with permission.

From Daniel Lupton, Consulting Actuary, Taylor & Mulder, Potomac, Maryland – June 11, 2015 – dlupton@taylorandmulder.com – Phone: 301-956-9199:

Introduction

Taylor & Mulder have been asked to answer what are essentially two questions:

1. What factors most greatly impact the risk that a site will suffer a leak, and what factors most greatly impact the severity of leaks that do occur?

2. What factors most greatly impact the cost to an owner/operator of insuring underground storage tanks?

Although the questions may seem identical, in fact they are not. By way of a simple example, assume that an insurer rates exposures based on depth to groundwater at a site, but the insurer ignores any question as to the proximity of the tank to city wells. Both of these factors could greatly impact the potential severity of losses caused by a leak at the site, but in this example only one factor, the depth to ground water, will influence the cost of insurance. Depending on the goals of the tank owner / operator, it may make more sense to prioritize improvement in risk factors that directly impact insurance cost than to prioritize based on actual leak risk. However, the factors that directly impact the cost of insurance will vary from insurer to insurer.

Risk Factors for UST Sites

The risk factors for UST sites consists of the dual risks of frequency and severity. It should be noted at the outset that the risk factors associated with the *frequency* of leaks at a site (i.e., the likelihood that any given tank/pipe/dispenser will leak) are not necessarily the same factors as the risk factors associated with the *severity* of leaks (i.e., the cost to remediate a site) when they do occur. For instance, certain combinations of risk characteristics of a site/tank/piping/dispenser could lead to relatively frequent, low-severity leaks or infrequent, high-severity leaks.

Some common factors (not an exhaustive list) assumed to have an impact on claim frequency or severity include:

a. Tank age
b. Piping age

c. Age of dispenser
d. Tank material
e. Tank construction (e.g., single-walled or double)
f. Piping construction
g. Piping type (E.g., pressure, suction, gravity-fed)
h. Matching of piping and tank
i. Substance stored in tank (gasoline, diesel, low sulfur products, etc.)
j. Presence of gasoline additives (e.g., lead, MTBE, ethanol, etc.)
k. Leak detection / prevention technology (e.g., auto monitors / enhanced leak detection / cathodic protection, overfill protection)
l. Tank lining / relining
m. Tank capacity
n. Tank maintenance history
o. Soil acidity
p. Depth to groundwater
q. Proximity to surface water
r. Proximity to other water pathways (e.g. wells, sanitary sewers, etc.)
s. Soil density

Note that these risk factors are not always included in the rating factors used by private insurance carriers. However, they are factors that should be taken into account when evaluating the probability of a leak, and the expected cost of cleaning up a leak.

The two risk factors that are typically given the greatest consideration in terms of risks that insurance companies use to determine rates for underground storage tanks are the tank age and the tank's construction. By contrast, pipe age and pipe construction may not be used by all insurers to determine the risk to a site, despite the fact that they may be significant factors affecting a site's risk. Pipe age and construction may be particularly important risks for states that target old tanks but ignore the problem of aging piping with less durable or mismatched construction (i.e., where the pipe may be an old single-walled pipe matched with a new double-walled tank).

Some risk factors, such as proximity to water pathways and soil density/type seem to have a greater impact on leak severity than on frequency. Data reviewed by Taylor & Mulder shows that groundwater-impact releases tend to be much more severe than soil-only releases, potentially by a factor of 6.0 or more. As a result, sites that have low risk of impacting water pathways often have significantly lower risk of *large* losses than sites nearer to water, even though the relative frequency of leaks may be similar.

Perhaps most significant about this list of risk factors, however, is how little is known about the exact amount that each factor contributes to risk of overall losses (i.e., frequency and severity combined). Based on current data available to us, an exact ranking of each factor would be very difficult. In Taylor & Mulder's experience, data collection efforts often fall short, having relatively low-quality/ incomplete data and/or having a low

quantity of data. Efforts to study LUST risk factors would benefit greatly from agreed to minimum data requirements (or best practices) for data collection efforts, as well as subsequent pooling of anonymized data. Obviously, establishing minimum data requirements and agreeing to the frequency of data reporting would require significant cooperation among the various agencies overseeing USTs and the insurance carriers providing coverage.

The Impact of Better Data

If a given risk factor is used as an underwriting criterion in the private insurance market in a state, improving that risk in a state (for instance, by installing new tanks or piping) will tend to lower insurance premiums in that state. However, if a risk factor is not used as an underwriting criterion then improving that risk factor will only have an indirect effect on insurance rates that will take several years to be fully realized. For instance, if age of piping is a large source of risk for UST systems but is not used as an underwriting criterion by insurers in the state, then installing new piping at sites across the state will eventually lead to a drop in insurance rates in the state, but it will typically take three to five for that drop to impact insurance rates, depending on the level of competition among insurers in the state.

The mechanism for this indirect benefit is as follows. As covered claims drop (concomitant with the less risky exposures), insurers will see improved profitability. Over a long time, this may (but will not necessarily), lead to decreases in insurance rates across the board. The speed with which this adjustment takes place will depend on the elasticity of demand for owner/operators of USTs as well as the level of competition in the private insurance market in a state. It should be noted, for instance, that if there is not adequate competition among insurers in the state then improved profitability may not lead to lower insurance rates.

As data collection efforts improve, however, and studies can be done to more accurately predict the risk posed by various facets of a UST system, private insurers may include more of those risk factors in their underwriting equations (to the extent that they are significant sources of risk). The effect of such a change would be to bring riskiness of UST systems more closely in line with prices charged by private insurers. Such a change would also help improve incentives for owner/operators to use best practices for minimizing risk.

The conclusion of this line of reasoning is that improving data collection for underground storage tank insurance programs could ultimately lead to greater coordination between private insurance, state cleanup efforts, and owner/operator incentives, and ultimately to lower costs for UST owners and operators.

From Lee Bowron, Kerper and Bowron LLC, Birmingham, Alabama – June 26, 2015 – lee@kerper-bowron.com – Phone: 205-870-0595:

In my opinion, the data about claims is much more important than the data about tanks.

Here is how I have ranked the factors:

1	Whether there has been a confirmed release at the tank site?
2	If so, date of the release?
3	If so, how the release was discovered?
4	If so, the source/cause of the release?
5	Whether there is under-dispenser containment?
7	What FR mechanism the owner/operator is currently using?
8	The date the tank was installed?
9	Whether the tank is single or double-walled?
10	The date piping was installed?
11	The material the tank is made of?
11	Which leak detection method is used to monitor the UST?
12	Whether tank is lined?
13	Whether tank has CP?
14	If yes, the date lining was installed?
15	Whether piping is single or double-walled?
16	The material the piping is made of?
17	If so, if it is impressed current or sac anode?
18	The date CP was installed?

APPENDIX E: SUGGESTED LIST OF DATA ELEMENTS FOR ANALYZING RISK OF LEAKS FROM USTS

Suggested Data Elements	*More Robust Data Elements*
Date each tank was installed	Date each tank was installed
Tank material • Steel • Fiberglass • Other	Tank material • Steel – lined • Steel – w/ impressed cathodic protection • Steel – w/ sacrificial cathodic protection • Steel – w/ lining and cathodic protection • Fiberglass – unlined • Fiberglass - lined
	Type of lining • Armor Shield CG1000 • Armor Shield TL300M • Armor Shield TL400 • Glass Armor GA27G • Glass Armor GA65 • Glass Armor GA2000 • Glass Armor GA27P • Enviroline EC125 • Sherwin Williams Fast Clad ER • VersaFlex FSS-50DM • VersaFlex FFS-50DM, VT40 & LC25 • DynaKote Lining • Phoenix • Devoe Dev-Mat 110/111 • AOC F764 • Resin Tech Corp STL21 • OME F105 • PR • Thermoset Plastics Inc EP89
	Date(s) lining and/or cathodic protection were installed (by tank)
Tank construction • single-wall • double-wall	Tank construction • single-wall • double-wall

Suggested Data Elements	***More Robust Data Elements***
Product stored • Gasoline • Diesel • Kerosene • Waste Oil • Heating Oil • Lube Oil • Aviation Fuel • Other	Product stored • Premium gasoline • Midgrade gasoline • Regular unleaded gasoline • Ethanol blended gasoline (with blend amount) • Diesel • Biodiesel (with blend amount) • Kerosene • Waste Oil • Heating Oil • Lube Oil • Aviation Fuel • Other
Date the oldest piping at the site was installed	Date each piping run was installed – by tank
Piping material (by tank or piping run) • Steel w/ cathodic protection • Fiberglass • Thermoplastic • Copper • Combination	Piping material (by tank or piping run) • Steel w/ impressed current cathodic protection • Steel w/ sacrificial anode cathodic protection • Fiberglass • Thermoplastic • Copper • Combination
Piping construction • Single-wall • Double-wall	Piping construction • Single-wall • Double-wall
	Piping fuel delivery type • Pressurized • Suction • Gravity

Suggested Data Elements	***More Robust Data Elements***
Leak Detection Method Used (by tank) • Automatic tank gauge • Interstitial monitoring • SIR • Groundwater monitoring • Vapor monitoring • Daily inventory control	Leak Detection Method Used (by tank) • Automatic tank gauge - by manufacturer and model – monthly • Automatic tank gauge – by manufacturer and model - CSLD • Interstitial monitoring – brine • Interstitial monitoring – vacuum • Interstitial monitoring – sensor • Interstitial monitoring – manual log • SIR and name of service provider • Groundwater monitoring • Vapor monitoring and name of service provider or monitoring device • Other
Line leak detector (by tank) – yes/no	Line leak detector (by tank) • Mechanical • Electronic
	Number of Dispensers
	Under-dispenser containment – yes/no for each
Overfill Prevention (by tank) – yes/no	Type of Overfill Prevention (by tank) • Ball float valve • Flapper valve
Spill Prevention (by tank) – yes/no	Type of Spill Prevention (by tank) • Single-walled spill bucket • Double-walled spill bucket • Double-walled spill bucket w/ sensor • Spill bucket w/ replaceable liner • None

Suggested Data Elements	***More Robust Data Elements***

Confirmed Release at Site – yes/no
• Date of Release
• Cleanup complete – yes/no
	Confirmed Release at Site – yes/no
	• Date of Release
	• How Release was discovered
	  ○ Detected by leak detection equipment or method
	  ○ Discovered during site assessment
	  ○ Discovered during closure
	  ○ Fumes in sewer
	  ○ Impact in drinking water
	  ○ Other environmental impact observed
	  ○ Other
	• Source of Release
	  ○ Spill
	  ○ Overfill
	  ○ Dispenser
	  ○ Flex connector
	  ○ Piping
	  ○ Piping Joint
	  ○ Tank
	  ○ Unknown
	• Cleanup complete – yes/no
	• Date Cleanup completed