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

Sources and Causes of UST Releases

ASTSWMO Tanks Subcommittee
April 23, 2020

Logistics

- All attendees are muted throughout the webinar.
- **Questions:** Use the Questions Pane in the control panel to send questions to the speakers throughout the webinar.
  - **Note who the question is directed to in your submittal.**
- The webinar is being recorded and will be made available on the ASTSWMO website.

Presentations & Speakers

- National Trends in Underground Storage Tank Infrastructure: Alex Hall (EPA ORD)
- Source and Cause of Utah Petroleum Storage Tank Fund Releases: Therron Blatter (UT DEQ)
- Internal Corrosion and UST Releases – Lessons Learned in Arizona: Chris Marks (AZ DEQ)
- Florida's Process for Determining Source and Cause: Zach Barrett (FL DEP)

EPA
United States
Environmental Protection
Agency

National Trends in Underground Storage Tank Infrastructure

Alex Hall, US EPA Office of Research and Development—Cincinnati, OH
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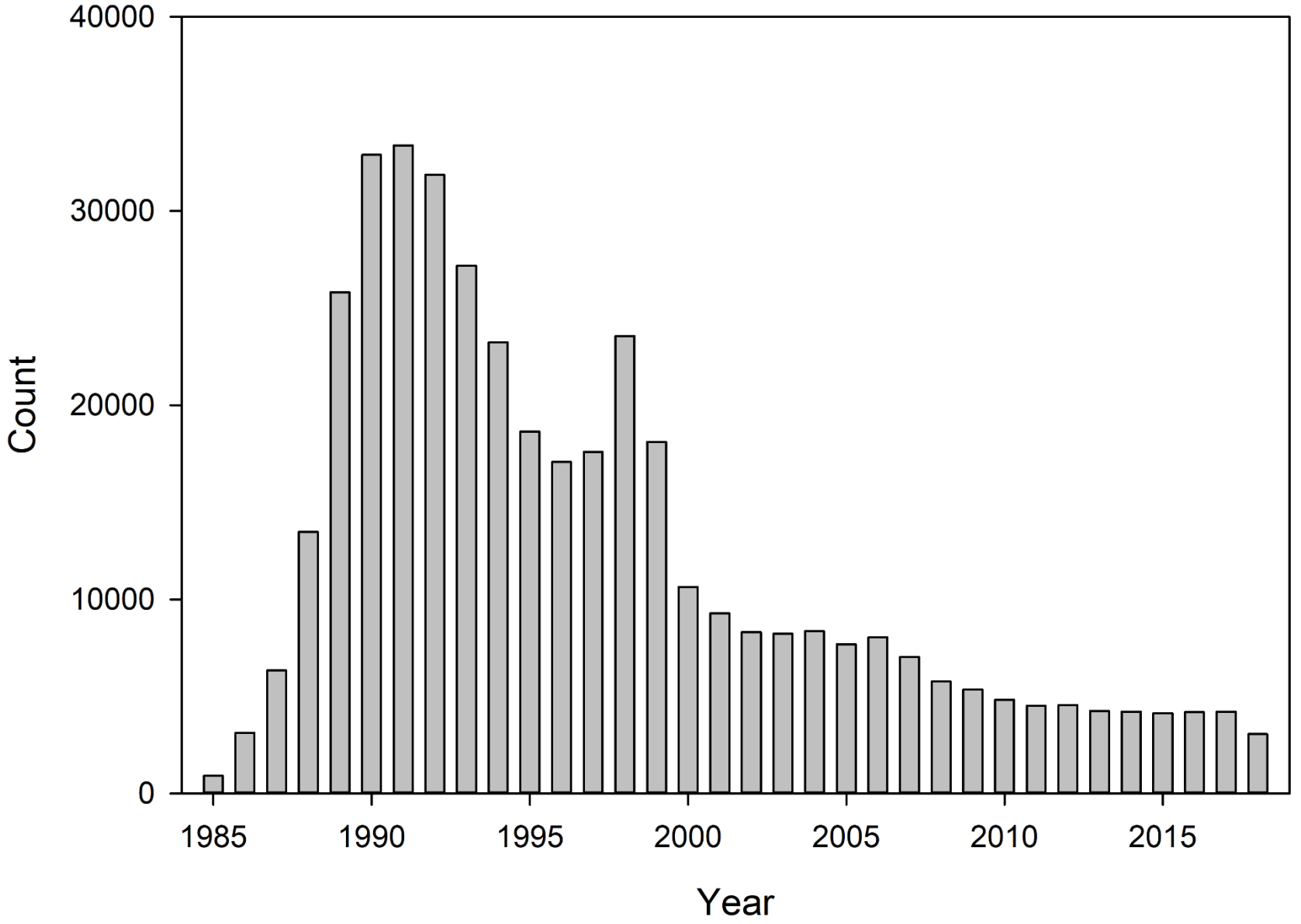
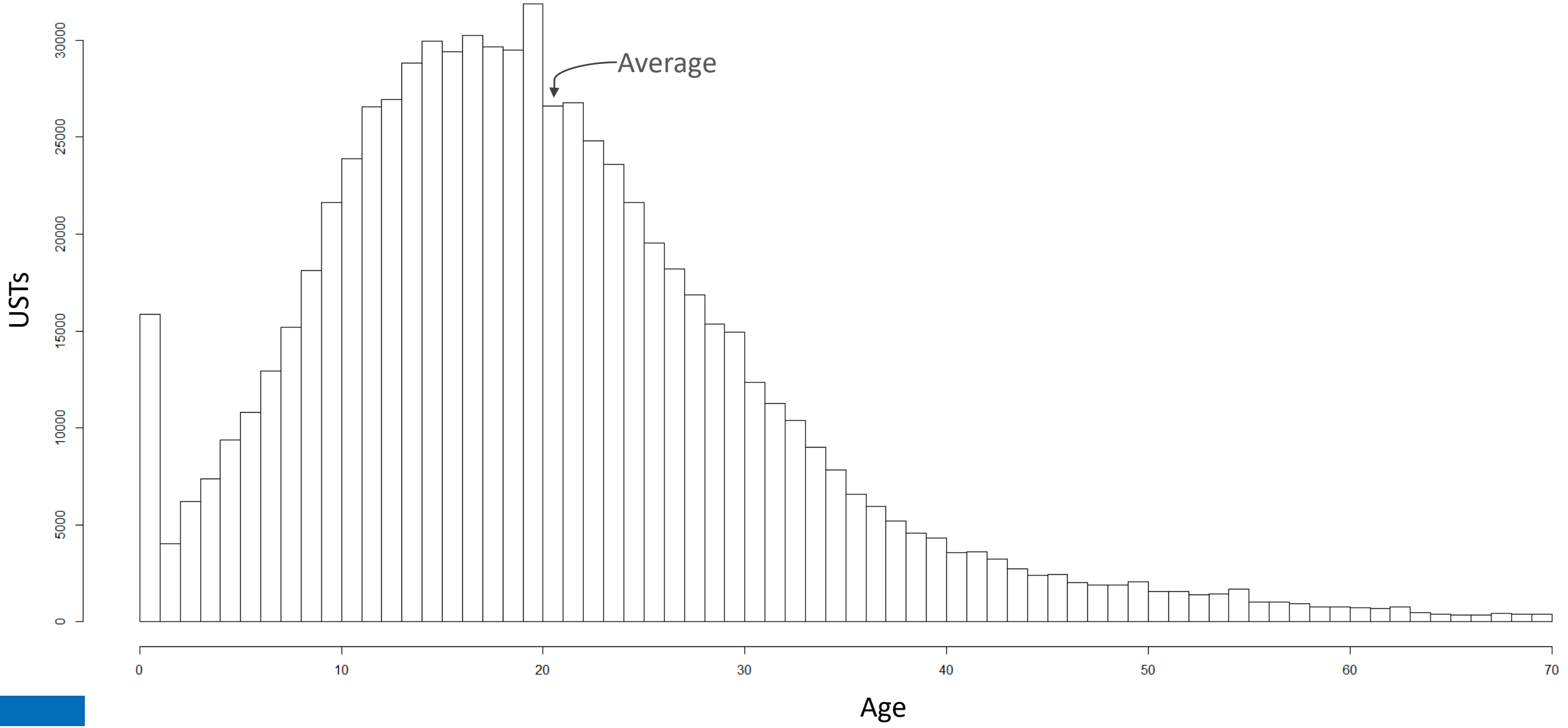
The views expressed in this presentation are those of the author and do not necessarily represent the views of policies of the U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

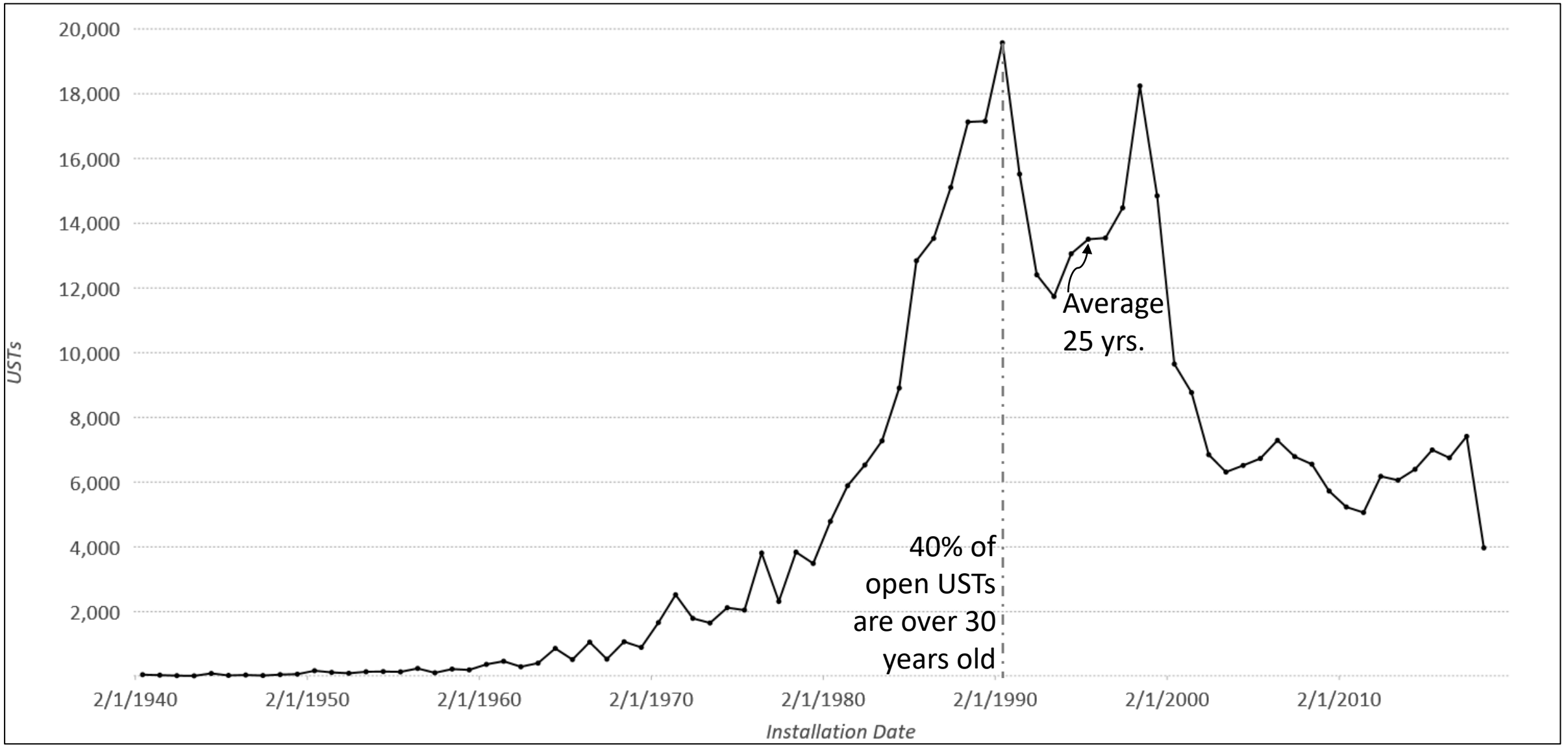
Underground Storage Tank Releases, by Year



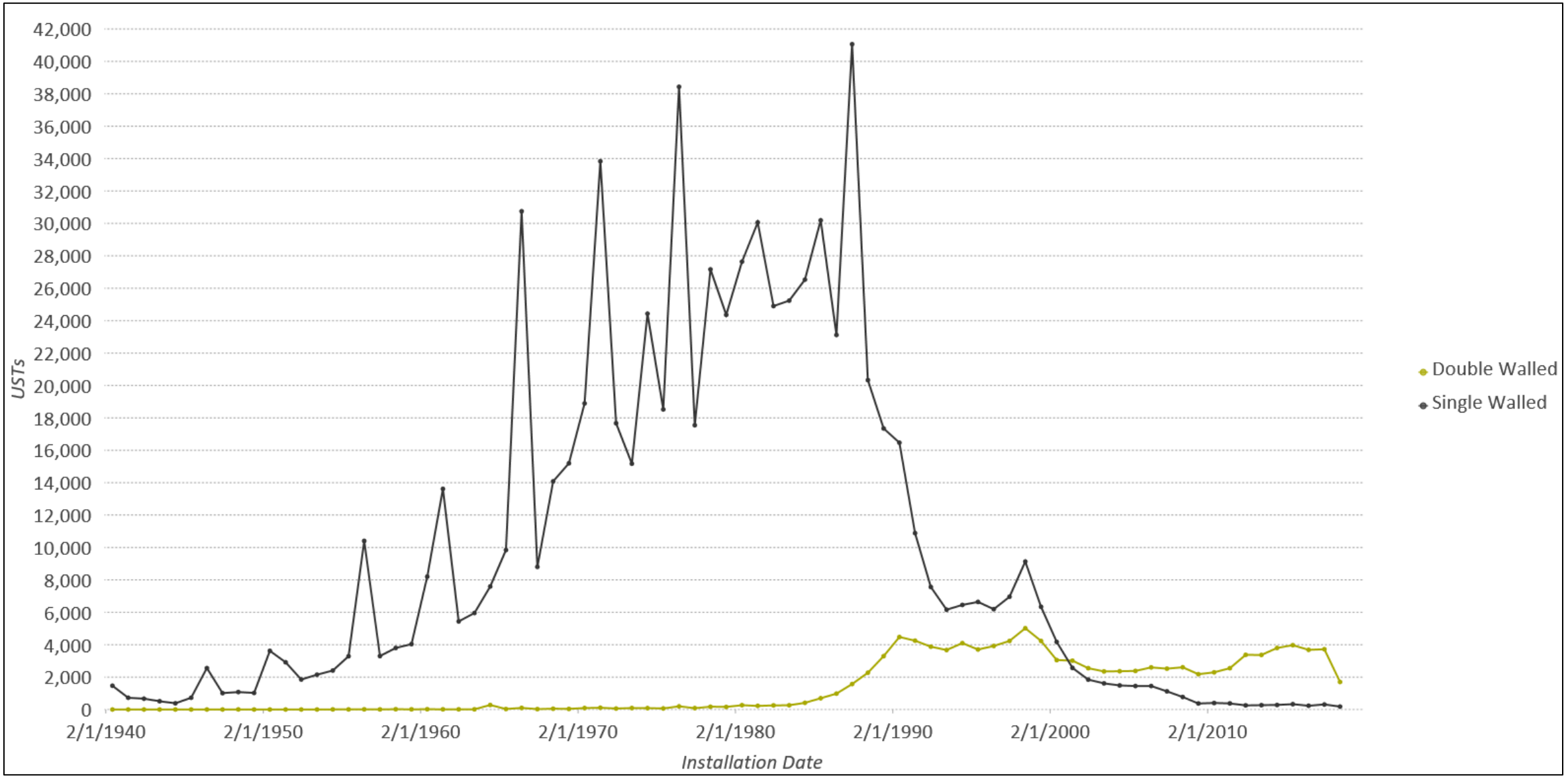
Historical UST Lifespan | Removal Date – Installation Date (n=736,757)



Installation Date of Currently Open USTs (n=415k)

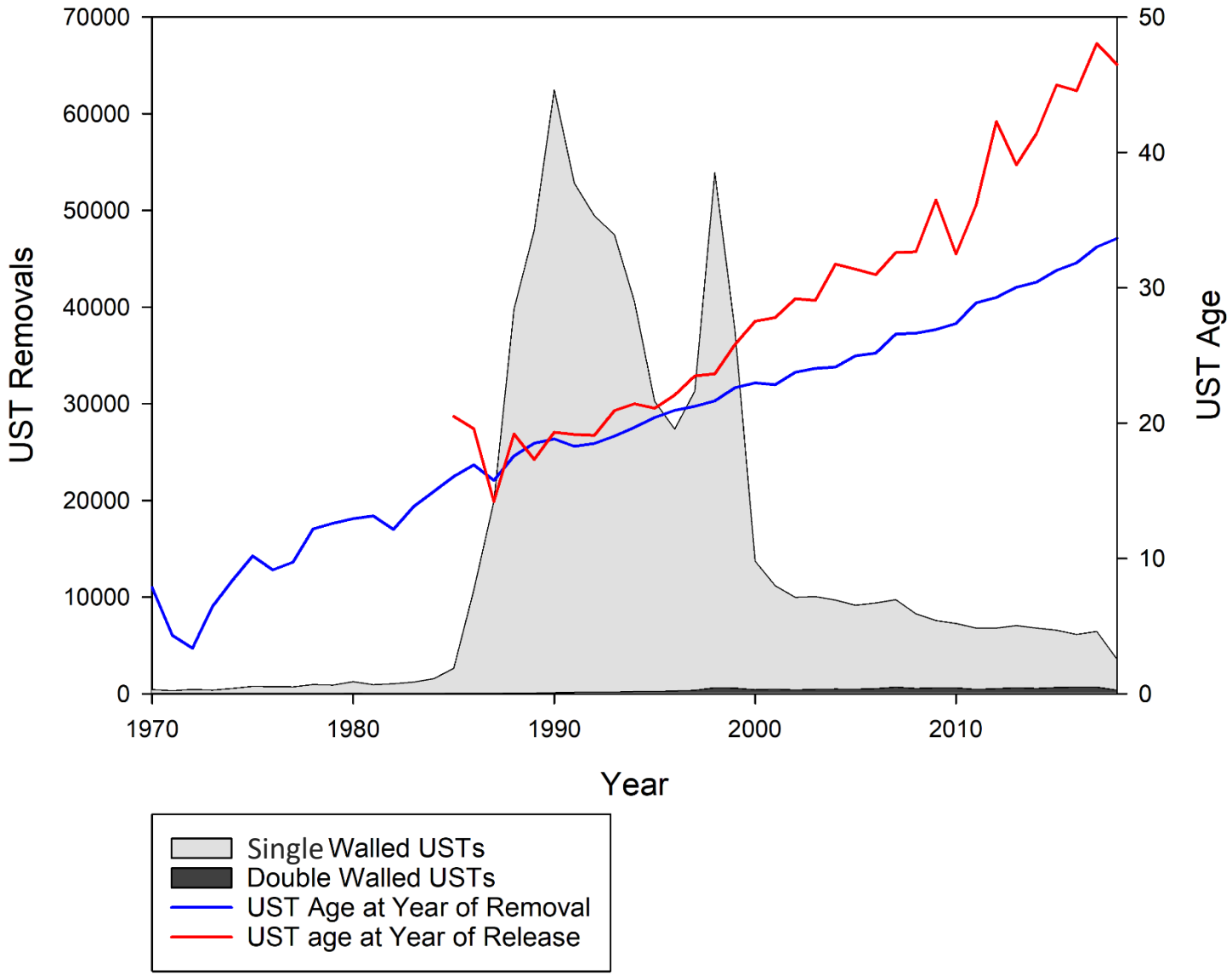


Single Wall and Double Wall Installations, by Year



EPA United States Environmental Protection Agency

Average Underground Storage Tank Age at Removal (n=725,259) & Release Date (n=9,817)



Fuel Type: Diesel and non-Diesel Gasoline UST Release Rates for Twelve States

- Is the rate of diesel releases in diesel tank infrastructure higher than the rate of non-diesel releases in non-diesel gasoline tank infrastructure?
- For every 1 diesel UST installed what is the probability it will be associated with a reported release?
- For every 1 non-Diesel gasoline UST installed what is the probability it will be associated with a reported release?

UST Universe: All USTs installed after 1970
LUST Universe: All LUSTs after 1988

$$Rate = LUST\ Universe^{substance} / UST\ Universe^{substance}$$

Fuel Type: Diesel and non-Diesel Gasoline UST Release Rates

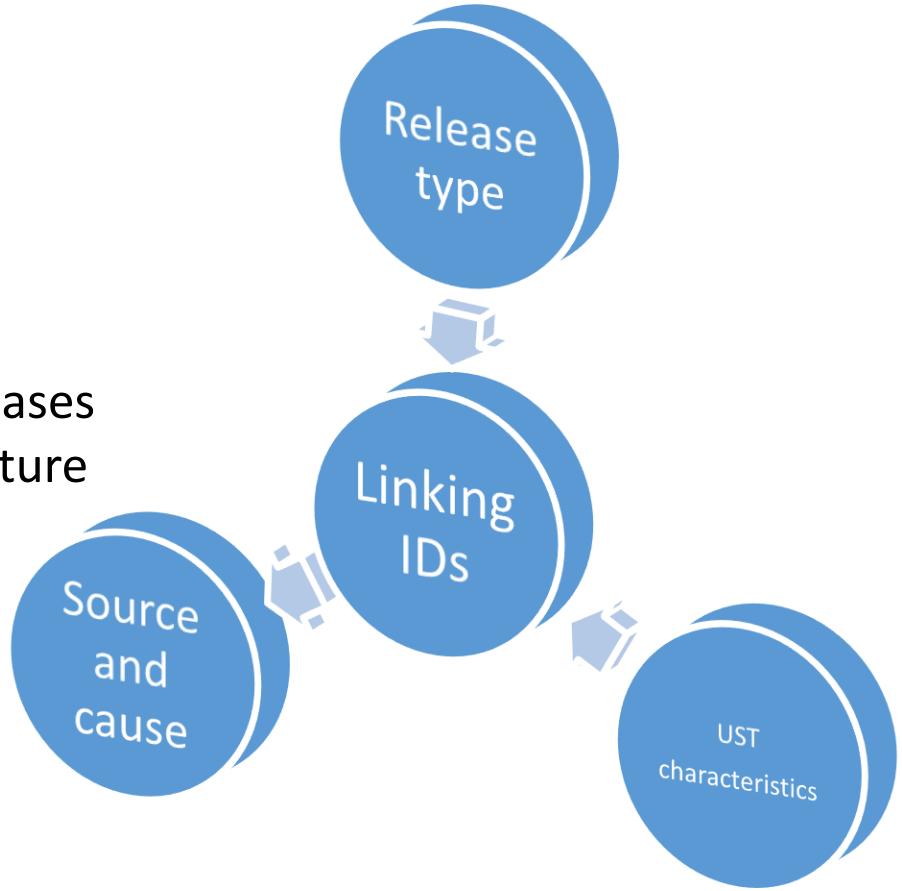
State	Substance	UST Count	LUST Count	: of Gas USTs to Diesel USTs	: of Gas LUSTs to Diesel LUSTs	: of Diesel USTs to Diesel LUSTs	: of Gas USTs to Gas LUSTs	% LUST Rate	% Likelihood a Diesel UST will become a Diesel LUST over a Gas UST becoming a Gas LUST
A	Diesel	5360	169	3:1	3:1	32:1	33:1	3.2%	0.10%
	Gasoline	15964	487					3.1%	
B	Diesel	3223	396	5:1	3:1	8:1	11:1	12.3%	3.74%
	Gasoline	15486	1323					8.5%	
C	Diesel	539	120	2:1	3:1	4:1	2:1	22.3%	-21.94%
	Gasoline	941	416					44.2%	
D	Diesel	10015	3223	2:1	4:1	3:1	7:1	32.2%	-25.19%
	Gasoline	21308	12224					57.4%	
E	Diesel	5142	969	2:1	3:1	5:1	3:1	18.8%	-9.82%
	Gasoline	10744	3080					28.7%	
F	Diesel	3243	456	3:1	4:1	7:1	5:1	14.1%	-7.53%
	Gasoline	8383	1810					21.6%	
G	Diesel	11878	1698	3:1	3:1	7:1	7:1	14.3%	-3.32%
	Gasoline	30368	5348					17.6%	
H	Diesel	2504	282	2:1	2:1	9:1	8:1	11.3%	-0.66%
	Gasoline	5746	685					11.9%	
I	Diesel	7445	604	3:1	5:1	12:1	7:1	8.1%	-6.15%
	Gasoline	20431	2914					14.3%	
J	Diesel	16940	1455	2:1	2:1	12:1	13:1	11.64%	-1.25%
	Gasoline	40237	3122					12.89%	
K	Diesel	2016	312	2:1	3:1	6:1	4:1	15.5%	-7.10%
	Gasoline	4358	984					22.6%	
L	Diesel	2179	432	3:1	3:1	6:1	7:1	19.8%	2.27%
	Gasoline	7110	1248					17.6%	

Looking to the Future

- Framing the complex relationship between UST infrastructure and the cause of a release should be data driven

- Linking individual USTs IDs (and associated piping and stored substances) with a release is fundamental to understanding the source and cause of a release. Without this information we are feeling around in the dark.

- A large database of USTs characteristics and their associated releases will allow analysis on current vulnerabilities in the UST infrastructure and provide predictive insights to prevent leaks.



Source and Cause of Utah Petroleum Storage Tank Fund Releases

Therron Blatter, UST Branch Manager
Division of Environmental Response and Remediation

UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
ENVIRONMENTAL RESPONSE
& REMEDIATION

Why Do I Care About “Source” and “Cause” of UST Releases

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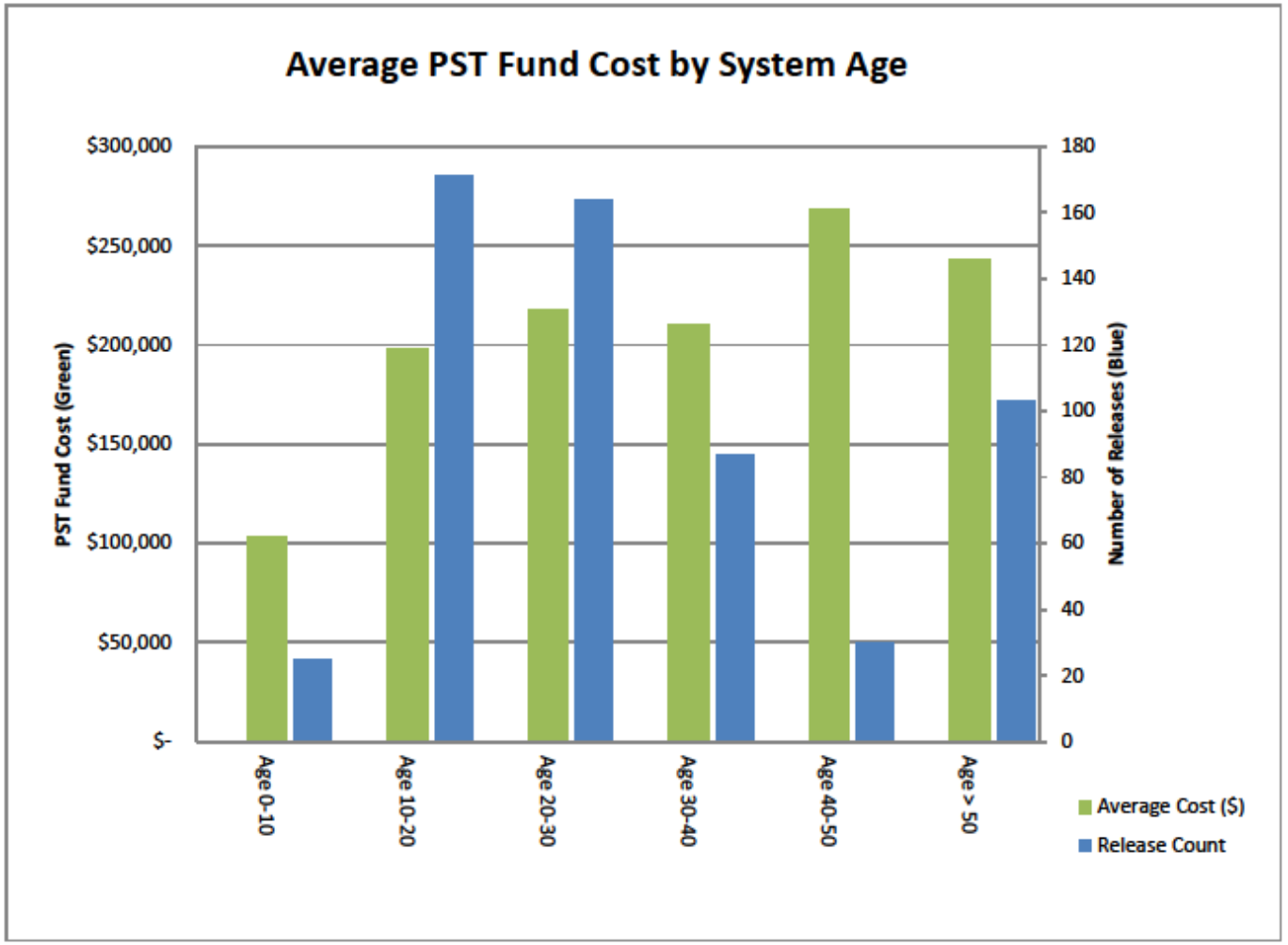
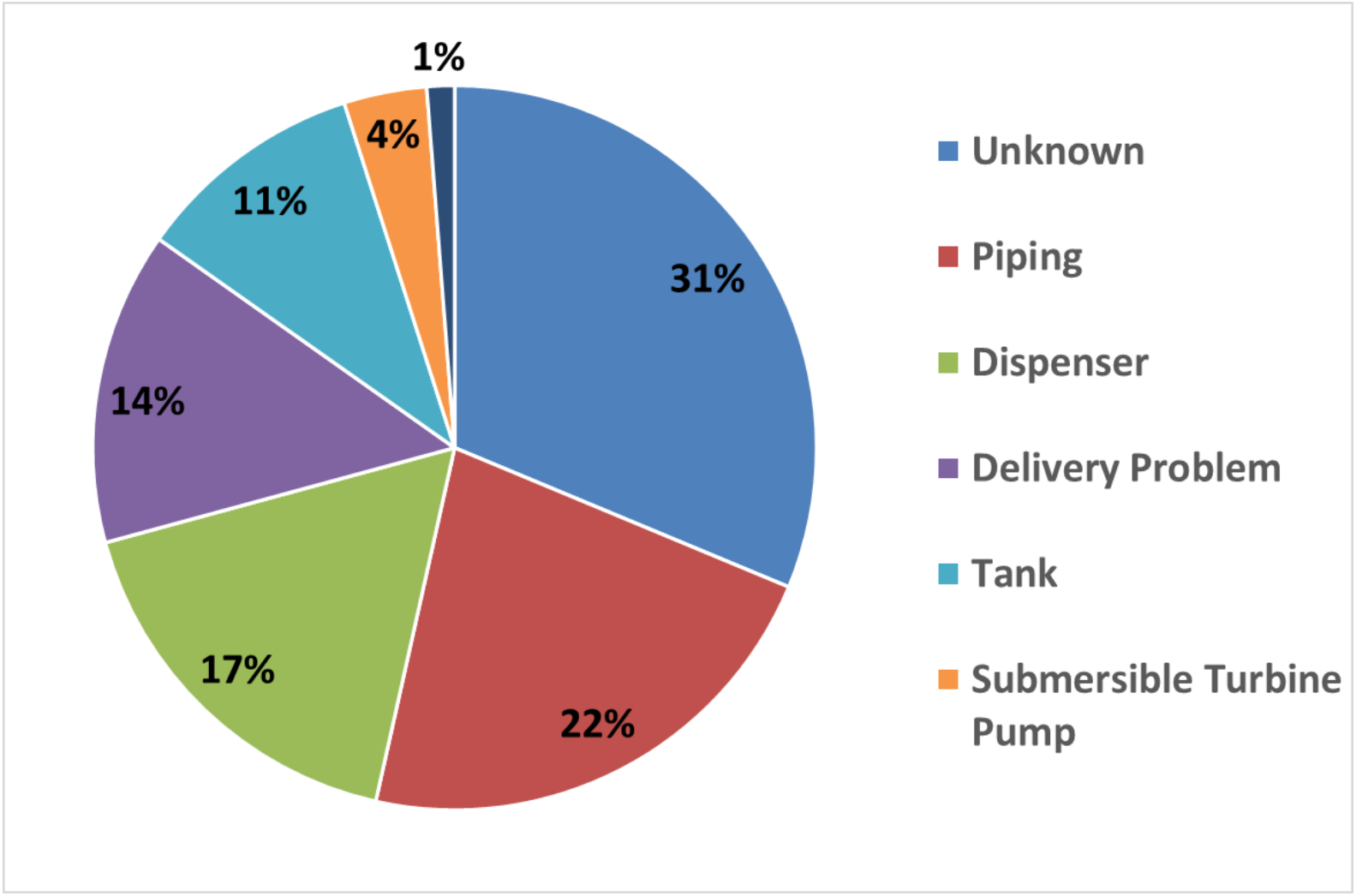

Average PST Fund Cost by System Age
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$-
PST Fund Cost (Green)
180
160
140
120
100
80
60
40
20
0
Number of Releases (Blue)
Age 0-10
Age 10-20
Age 20-30
Age 30-40
Age 40-50
Age > 50
Average Cost ($)
Release Count

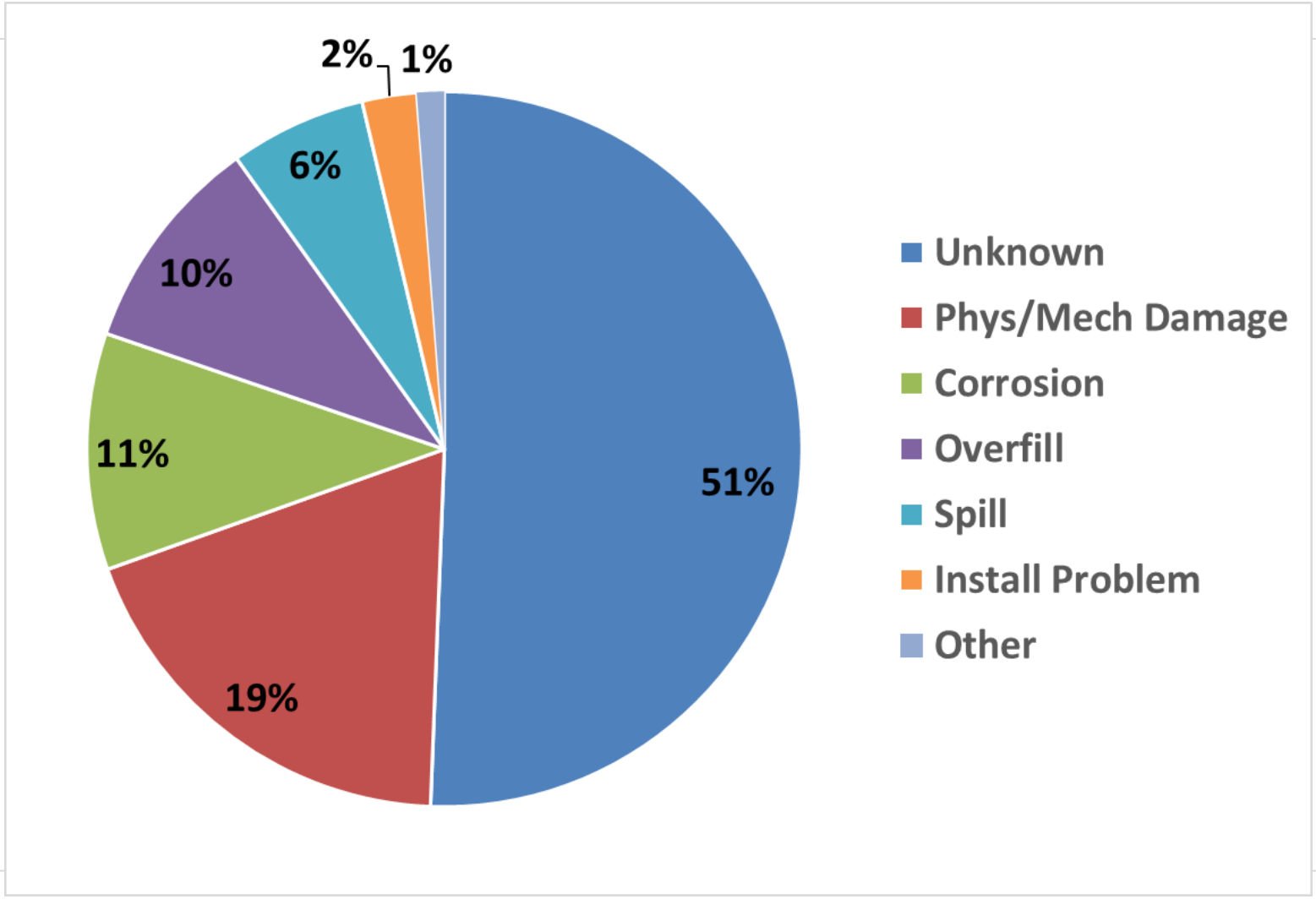
Selected Data Set

- Releases reported after January 1, 2000
- Releases for which Utah's Petroleum Storage Tank Fund has made payment.
- Source and Cause data have been reviewed and verified
- Source and Cause data were matched with the options set forth in the Grant Guidelines for Implementing the Public Record Provision Of The Energy Policy Act Of 2005
- 244 releases: Average cleanup cost $175K

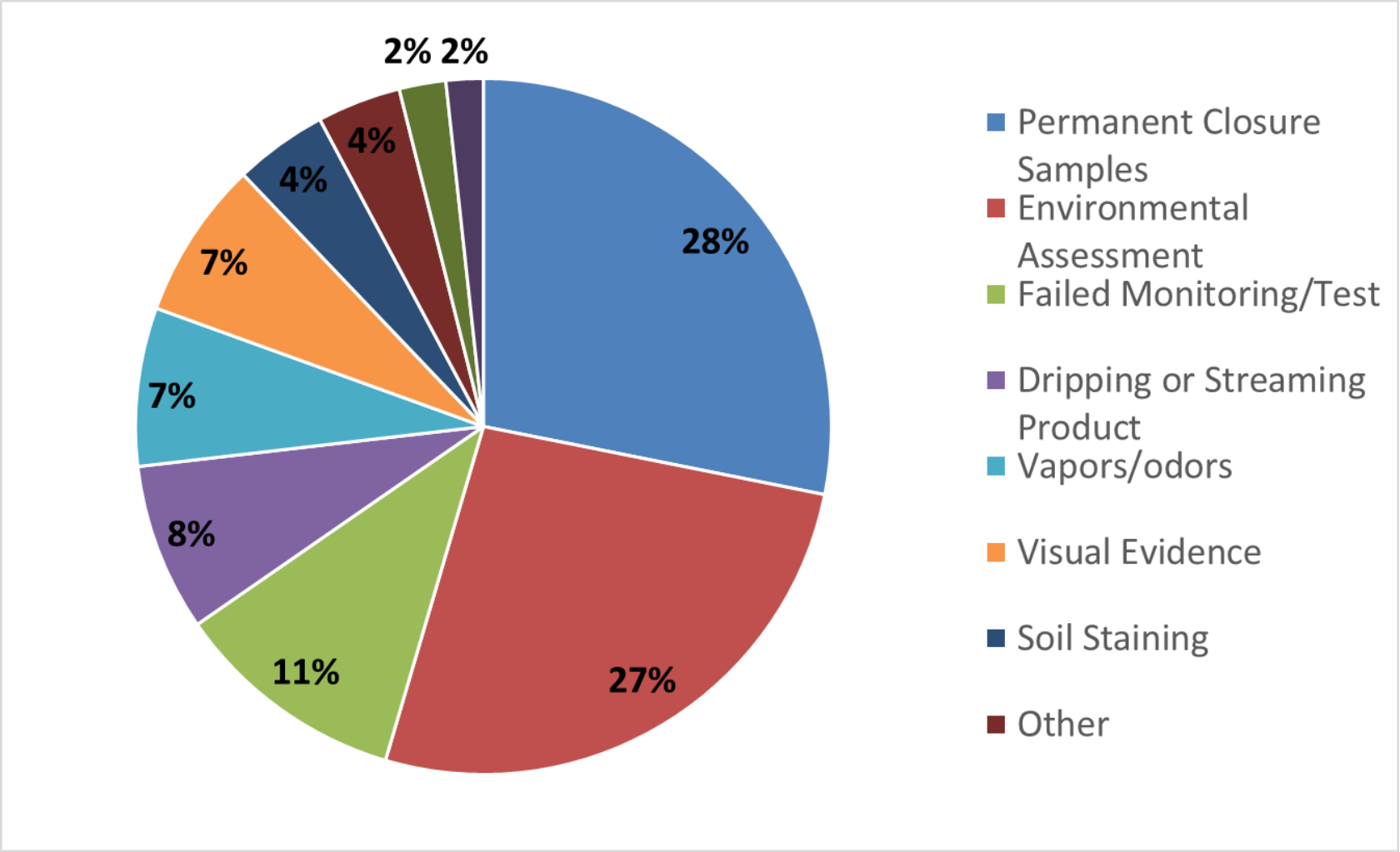
Source of Release



Cause of Release



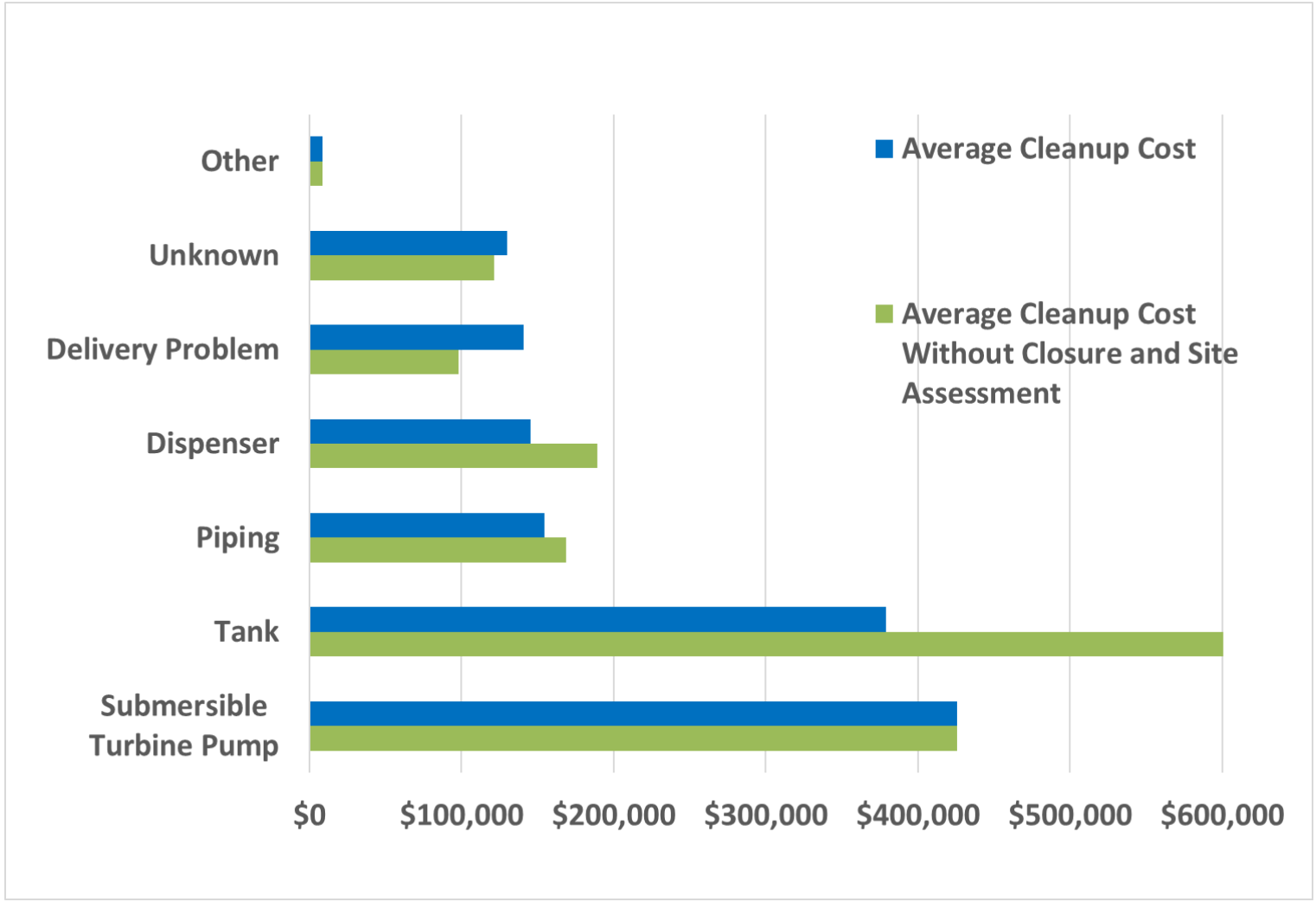
Method the Release was Discovered



What We Know About “Unknown”

- 76 sites had an “Unknown” source of release: 74% of these unknown sources were discovered by either a site assessment or permanent closure samples.
- 123 sites had an “Unknown” cause of release: 72% of these unknown causes were discovered by either a site assessment or permanent closure samples.
- Assumptions typically must be made when classifying Source and particularly Cause for releases discovered via site assessments or permanent closure samples.
- I consider source and cause data for releases discovered via closure and site assessment significantly less reliable than for other methods of determination.

Average Cost of Cleanup By Source



Average Cost of Cleanup By Cause

Lessons Learned and What is Next

- Determining the Source and Cause of a release is difficult for existing contamination.
- Releases from tanks and submersible turbine pump are significantly more expensive to clean up. Anything that encourages removal of old UST systems, especially impressed current CP steel tanks, is worthwhile.
- What would this look like with multiple states data sets?
- Have trends gotten better with newer releases?

Contact Information:

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Internal Corrosion and UST Releases – Lessons Learned in Arizona

Chris Marks Ph.D.
Arizona Dept. of Environmental Quality
ASTSWMO Tanks Subcommittee – Sources and Causes of UST Releases
April 23, 2020

Internal Tank Inspection Project

ADEQ Study:

- Evaluate the existence and extent of internal corrosion (and degradation) on UST surfaces for representative systems, including:
  - UST storing diesel and gasoline
  - USTs constructed of steel and fiberglass reinforced plastic (FRP)

- Data Collected
  - Internal video (visual) inspection
  - Ullage temperature and % relative humidity
  - Water presence testing
  - Laboratory analyses of water bottoms and fuel samples
  - Visual inspection of sumps and spill buckets for signs of corrosion

Can this information be used to identify USTs more likely to have a release?

Rating System and Summary of Results

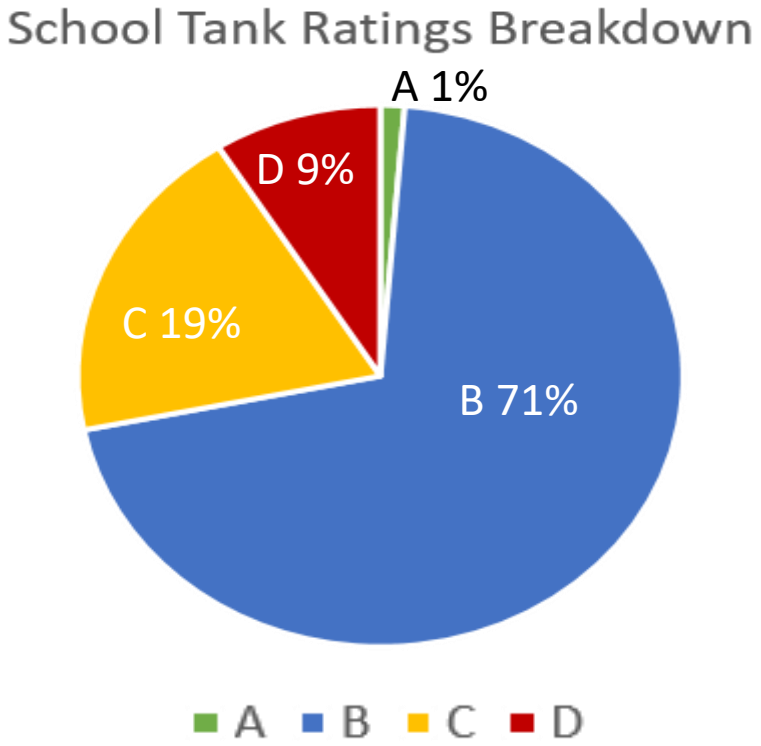
CRC Rating (STP shaft)	Corrosion Coverage Area	ADEQ Rating (Internal Surfaces)
Minimal	Less than 5%	A or B
Moderate	5 – 50%	C
Severe	Greater than 50%	D

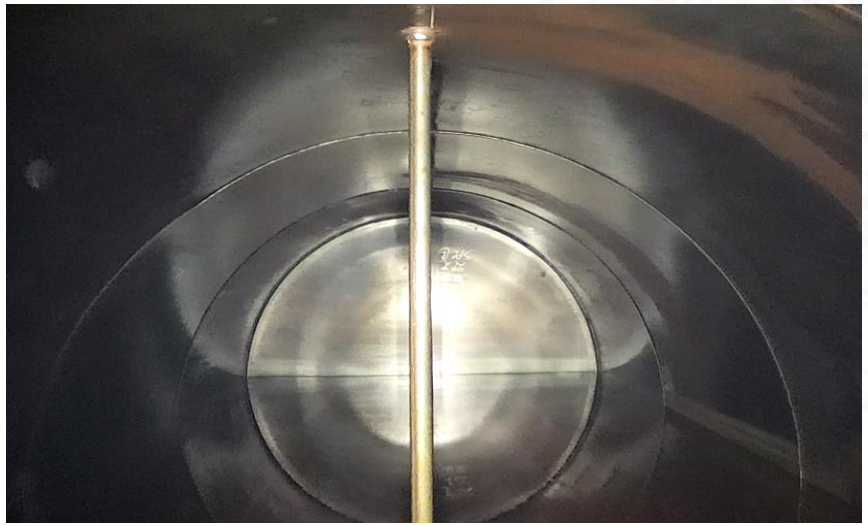
AZ Results:

- Moderate – Severe issues found in ~30% of surveyed tanks (n = 78)
  - Including both diesel and gasoline storing systems
  - Including both steel tanks and FRP

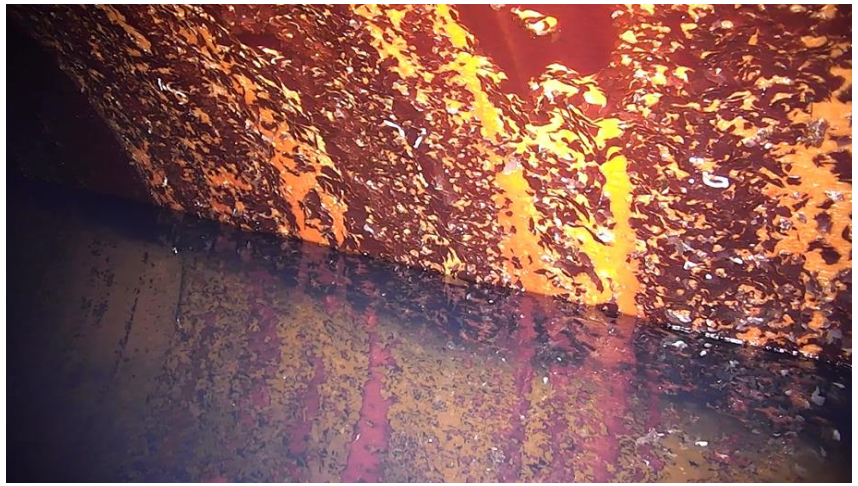
- Tank age is not predictive of corrosion rating

Rating Results





Corrosion Rating: B



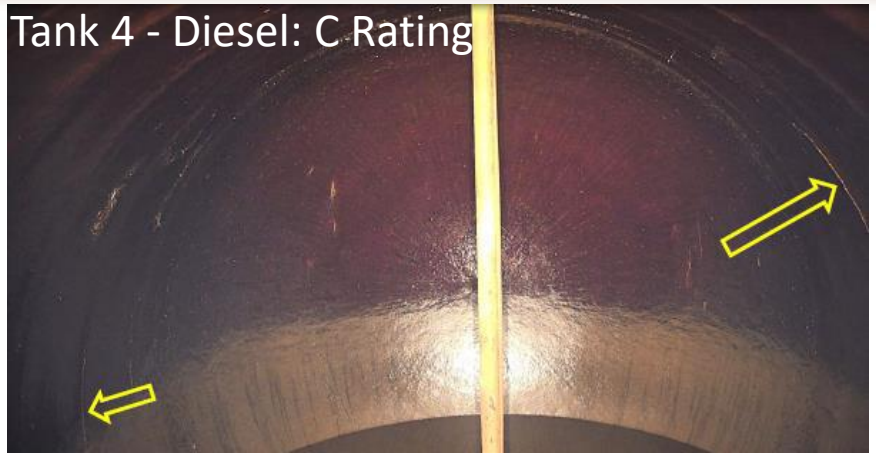
Corrosion Rating: D

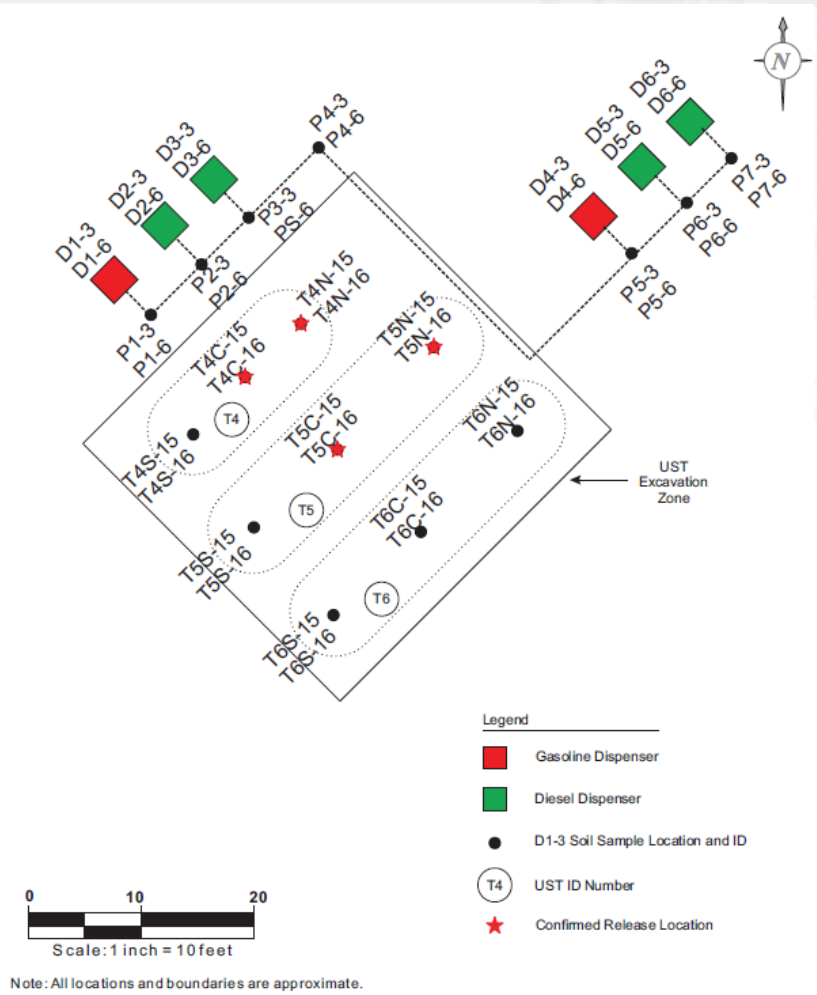
Linking Internal Inspections to Assessment Results

Facility #	Tank No.	Tank Description	Product	Tank Age (Yrs)	ADEQ Corrosion Rating	EPA Corrosion Rating	Release Location
1	1	10k DW FRP	Gasoline	31	D	Minimal	**Piping**
	3	10k FRP	Diesel	14	B	Minimal	
2	2	5k SW Steel	Gasoline	45	B	Minimal	**UST #2**
3	4	6k SW FRP	Diesel	35	C	Moderate	**USTs #4 & 5**
	5	10k SW FRP	Gasoline	35	D	Moderate	
	6	10k SW FRP	Diesel	35	B	Minimal	
4	6	20k DW FRP	Gasoline	21	C	Minimal	**Dispenser**
	7	20k DW FRP	Red Diesel	21	B	Minimal	
	8	20k DW FRP	Red Diesel	21	B	Minimal	
5	5	10k DW FRP	Red Diesel	22	B	Minimal	None Confirmed
	6	10k DW FRP	Gasoline	22	D	Minimal	
	7	10k DW FRP	Red Diesel	22	B	Minimal	
	8	10k DW FRP	Red Diesel	22	B	Minimal	
6	1	10k SW FRP	Red Diesel	32	B	Minimal	None Confirmed
	2	10k SW FRP	Red Diesel	32	B	Minimal	
	3	2.5k SW FRP	Gasoline	32	C	Minimal	
7	4A	Compartment 2k SW Steel	Gasoline	27	B	Minimal	None Confirmed
	4B	Compartment 2k SW Steel	Red Diesel	27	B	Minimal	
8	1	10k SW Steel	Diesel	34	B	Moderate	None Confirmed
9	2	3k SW FRP	Gasoline	28	D	Minimal	**Dispenser**
	3	3k SW FRP	Diesel	28	B	Minimal	
10	2	4k DW FRP	Gasoline	28	D	Minimal	None Confirmed
	3	10k DW FRP	Diesel	28	B	Minimal	
	4	10k DW FRP	Diesel	28	B	Minimal	
11	1	10k DW FRP	Diesel	32	B	Minimal	**Dispenser**
	2	10k DW FRP	Gasoline	32	B	Minimal	
	3	10k DW FRP	Red Diesel	32	B	Minimal	

Facilities with USTs removed after internal visual inspection study.
All USTs removed less than 3 years after visual inspection.

Example: Release Confirmed from USTs Rated C and D

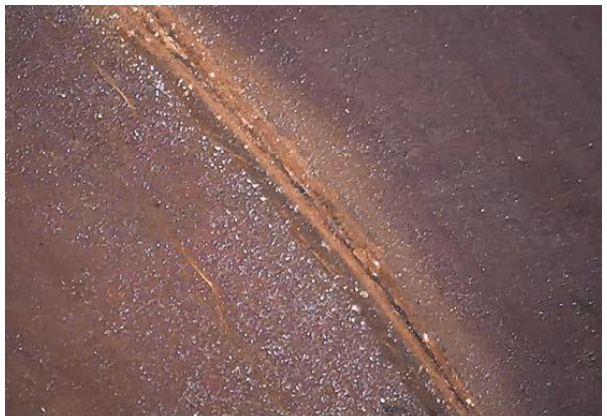


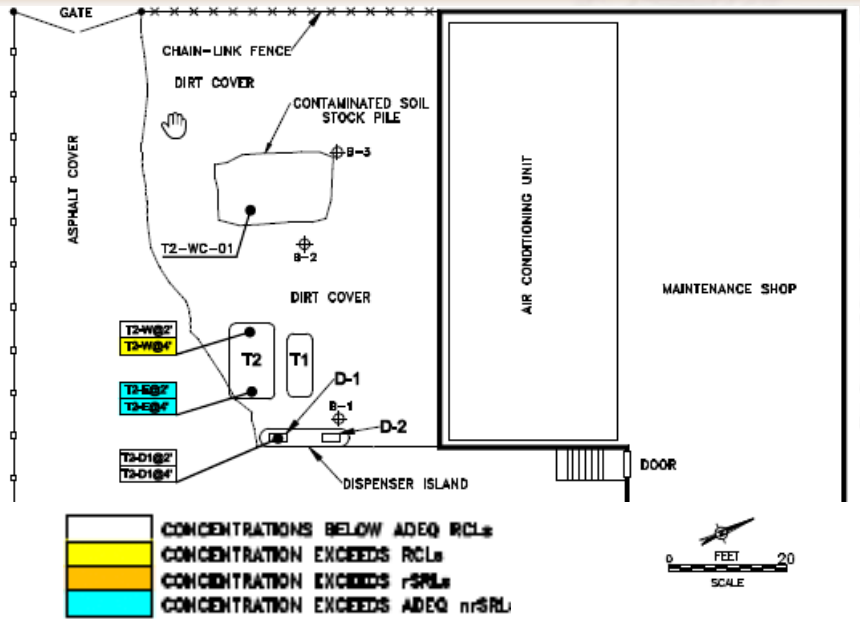


<u>Tank Inspection Details:</u>

- Cracks noted in Tank 4 (yellow arrows) and generalized oxidation of STP shaft
- Tank 5 had extensive wall degradation/flaking and STP shaft oxidation, sediment/debris buildup in tank bottom

Release Confirmed from UST with B Rating





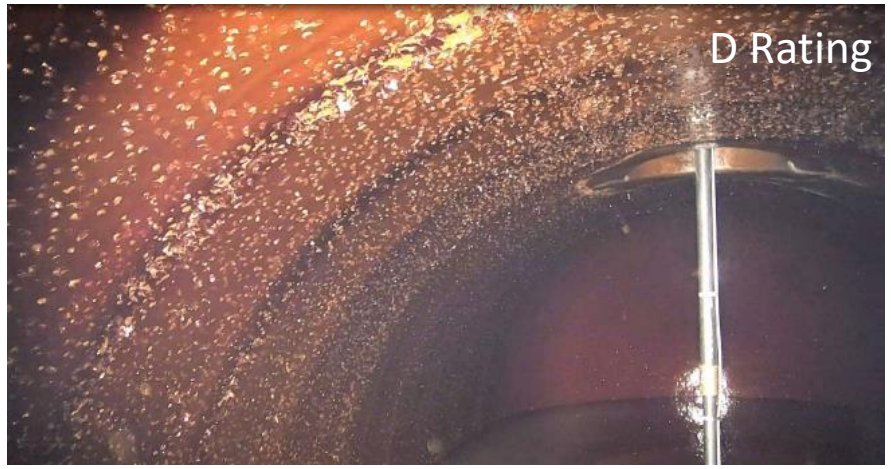
Tank Inspection Details:

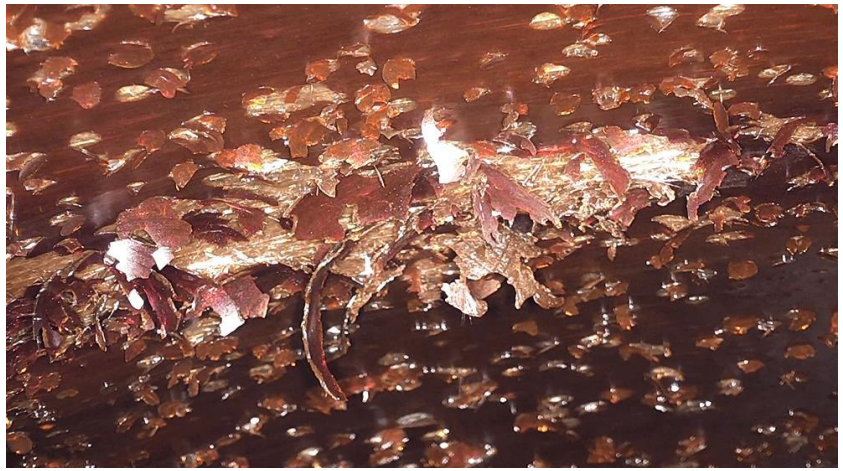
- Oxidation on tank seams and sediment/debris buildup

Release Details:

- A split weld near tank bottom discovered during removal

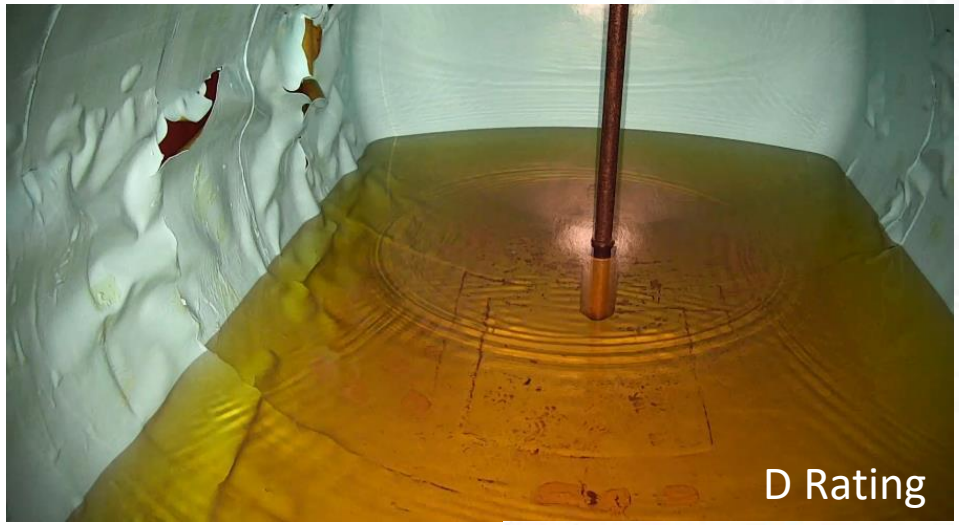
D Rated USTs – No Documented Release

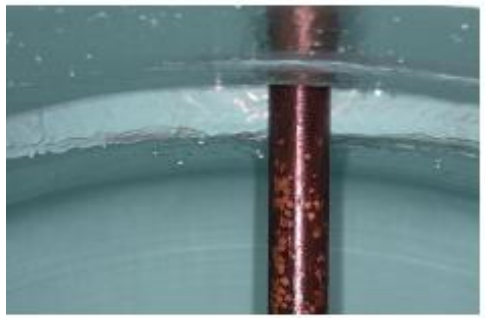




Tank Inspection Details:

- Widespread wall deterioration/flaking
- Buildup of sediment on tank bottom





Tank Inspection Details:

- Complete failure of tank lining
- Extensive generalized oxidation of STP shaft

Lessons Learned: the call for nation-wide data

We need to know more about our UST systems, the fuel products stored, and how releases occur

We need to analyze available data at a local and national level to search for trends and to identify where we have data gaps

Sometimes, evidence of internal corrosion and degradation issues can help identify potential leaks.

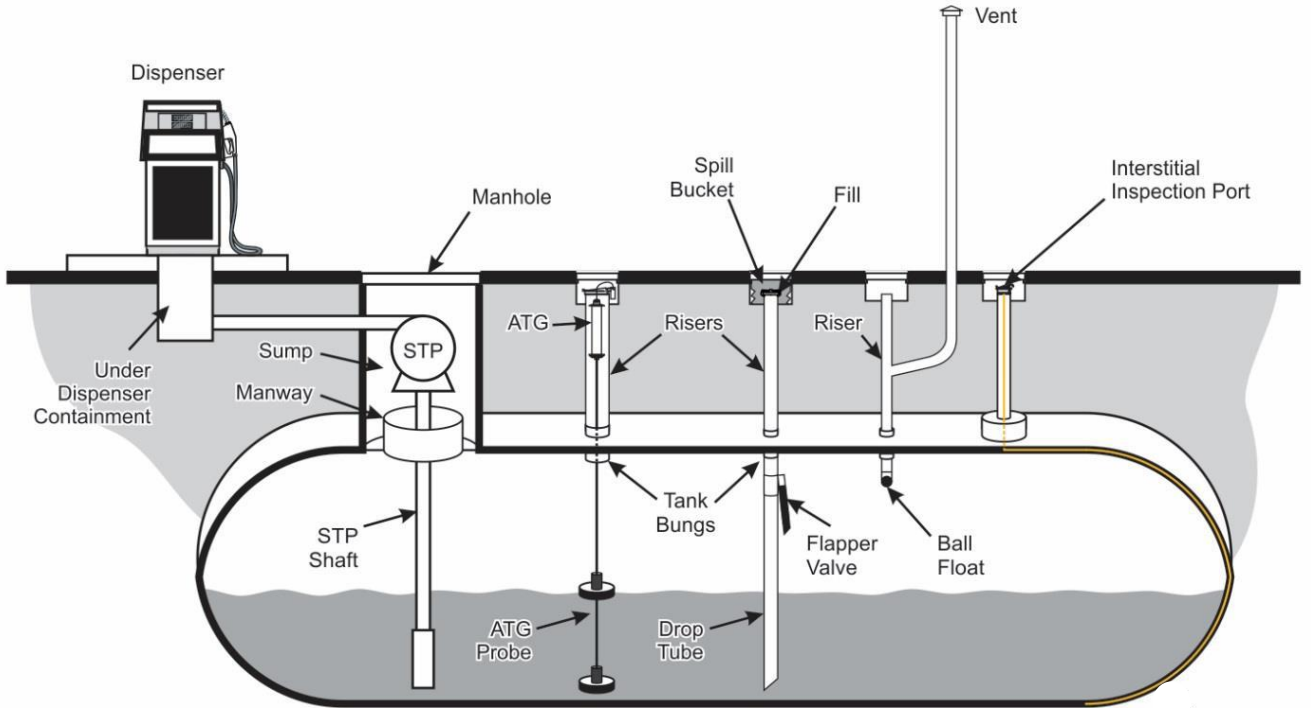
- Current ADEQ & EPA rating scheme limitation:
  - Provides useful info to customers/stakeholders related to fuel quality and system operations; *however, the limited data reviewed so far does not suggest that internal corrosion ratings may be used to predict a release to the environment*

Lessons Learned: the need for new paradigms

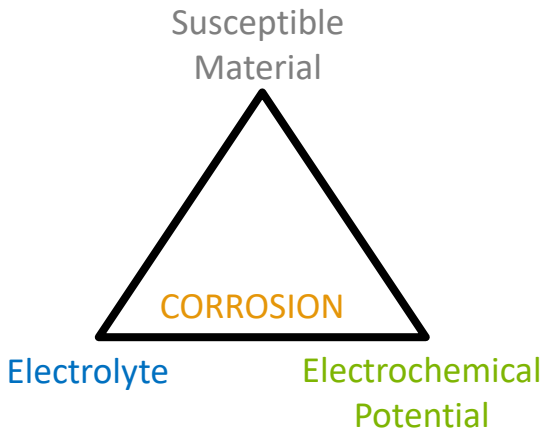
In addition to the need for improved understanding of the source and cause for releases from UST systems, the following observations suggest that we need to improve our understanding of the existing UST infrastructure:

- Corrosion of UST internal infrastructure is widespread and common
- Microbiologically-influenced Corrosion (MIC) is a complex process
- Assessments of potential infrastructure deterioration need go beyond the native fuel chemistries to account for conditions to be expected from fuel storage (e.g. acidification, biofouling)
- A new UST infrastructure deterioration paradigm is needed to encompass them as dynamic ecosystems and to include non-metallic components

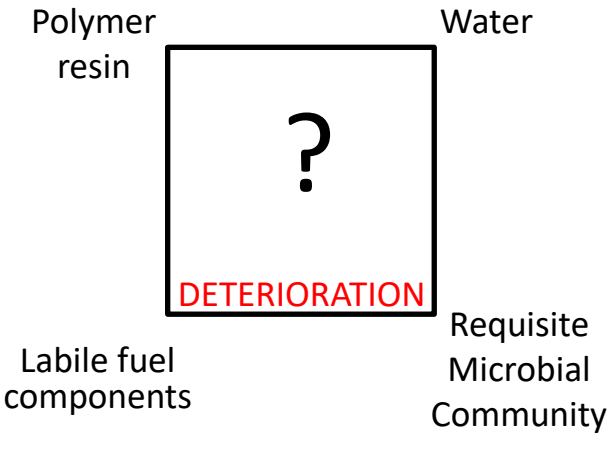
Lessons Learned: the need for new paradigms



Steel Components



Fiberglass Components



Contact Info and References

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(602) 771-0561

https://azdeq.gov/USTProgram

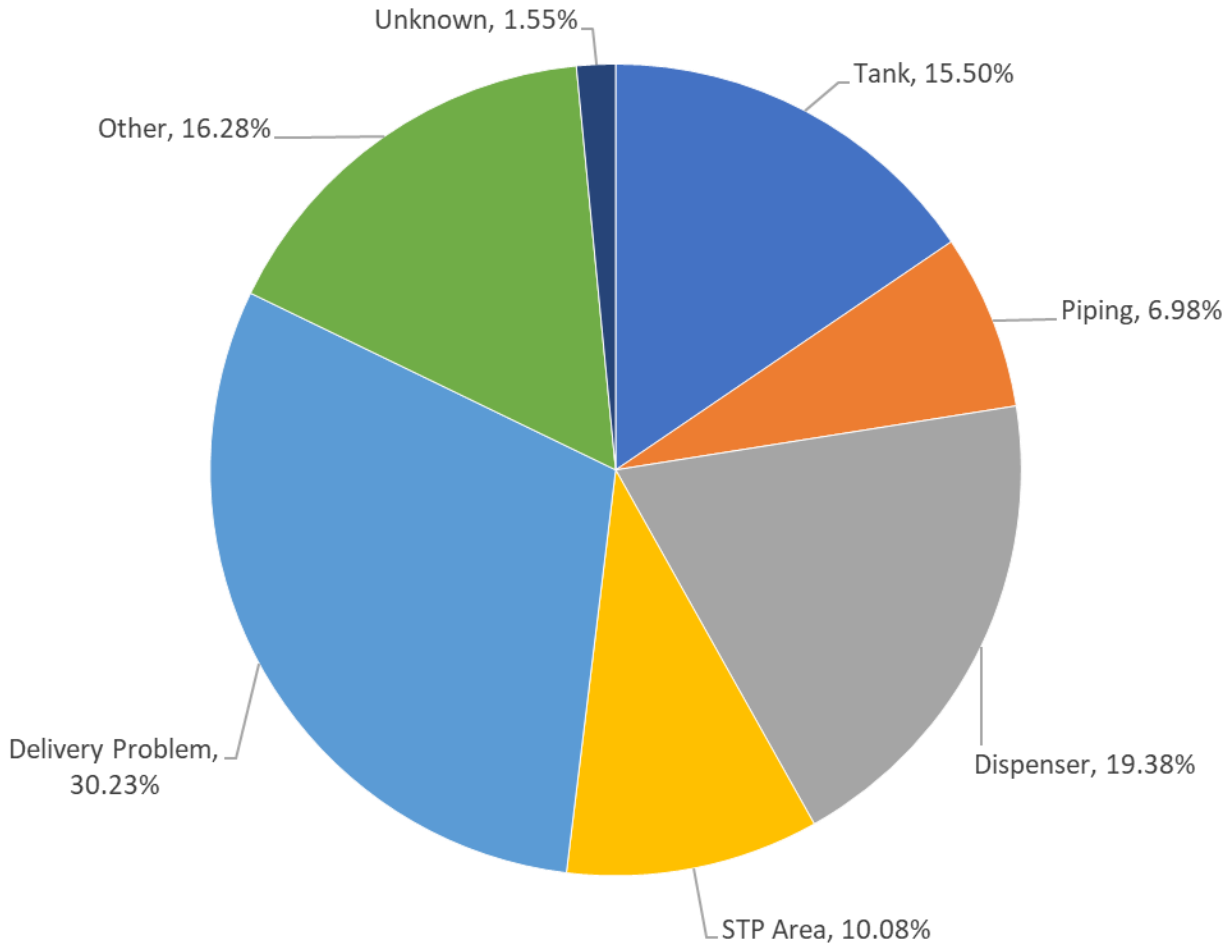
References:

- "An Inside View of Arizona's USTs". National Tanks Conference 2018. (http://neiwpcc.org/wp-content/uploads/2018/10/Yee.pdf)
- NEIWPCC UST Inspector Training Webinar Series: Emerging Fuels. 8/26/2019. (https://neiwpcc.org/our-programs/underground-storage-tanks/ust-training-resources-inspection-leak-prevention/webinar-archive-inspector-training/)
- USEPA. Investigation of Corrosion-Influencing Factors in Underground Storage Tanks with Diesel Service. EPA 510-R-16-001. 2016.

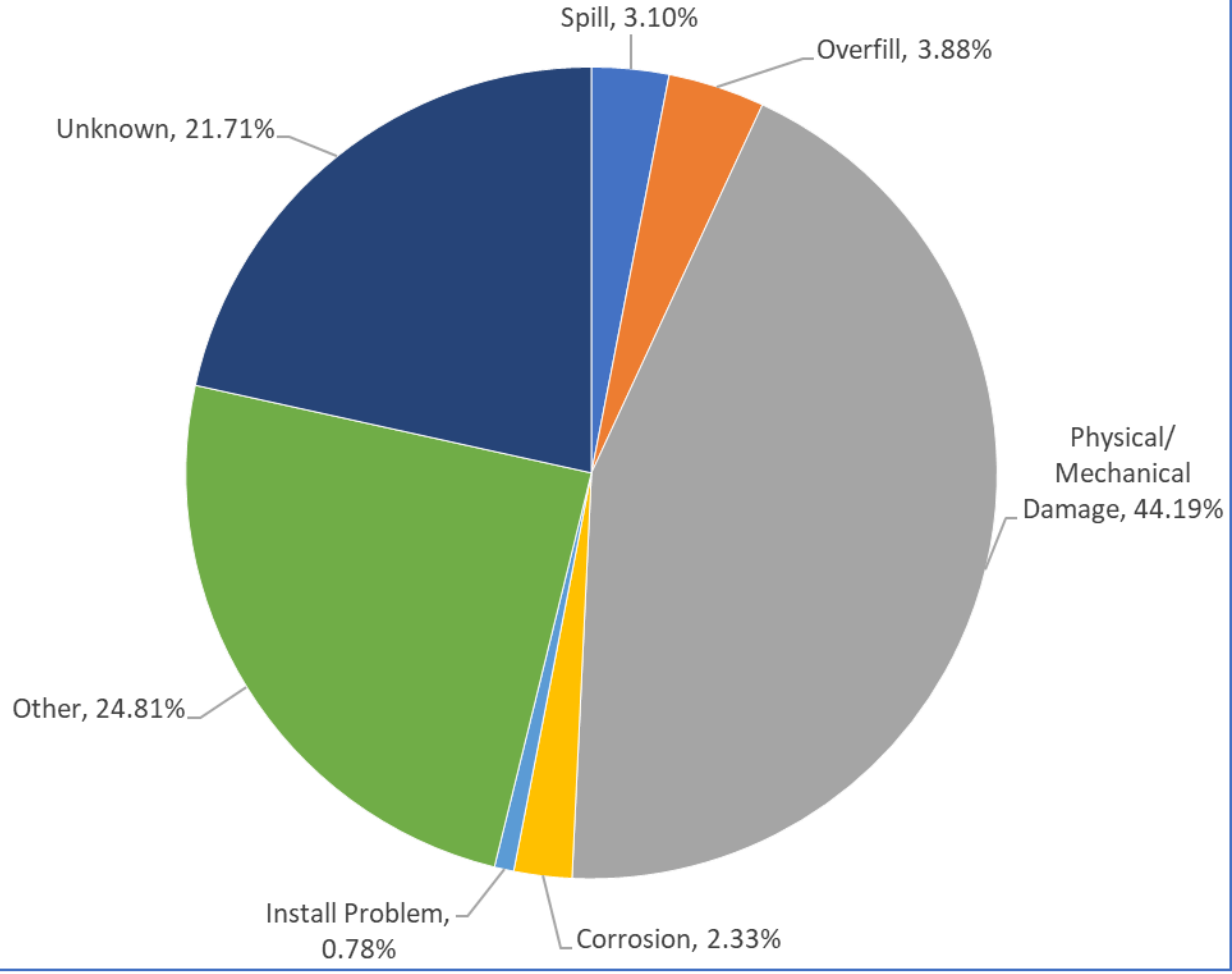
Florida's Process for Determining Source and Cause

Florida's Source and Cause Data

SOURCE



CAUSE



Determining Source and Cause

Discharge Reporting Form (DRF)

- Many options
- Simple terminology
- Comments field

Discharge Inspections

- Required inspection by DEP
- Training on identification
- Proper data entry

Our Discharge Reporting Form

Discharge originated from a: (Check all that apply)

- ☐ Tank
- ☐ Piping
- ☐ Spill bucket
- ☐ Dispenser
- ☐ Piping sump
- ☐ Dispenser sump
- ☐ Other secondary containment
- ☐ Fitting or pipe connection
- ☐ Valve
- ☐ Tank truck
- ☐ Vehicle or customer vehicle
- ☐ Aircraft
- ☐ Railroad tankcar
- ☐ Barge, tanker ship or other vessel
- ☐ Pipeline
- ☐ Drum
- ☐ Unknown
- ☐ Other (specify)_____

Cause of the discharge: (Check all that apply)

- ☐ Spill
- ☐ Overfill
- ☐ Corrosion
- ☐ Puncture
- ☐ Material failure (crack, split, etc.)
- ☐ Material incompatibility
- ☐ Improper installation
- ☐ Loose connection
- ☐ Collision
- ☐ Vehicle accident
- ☐ Fire/explosion
- ☐ Vandalism
- ☐ Weather
- ☐ Human error
- ☐ Unknown
- ☐ Other (specify)_____

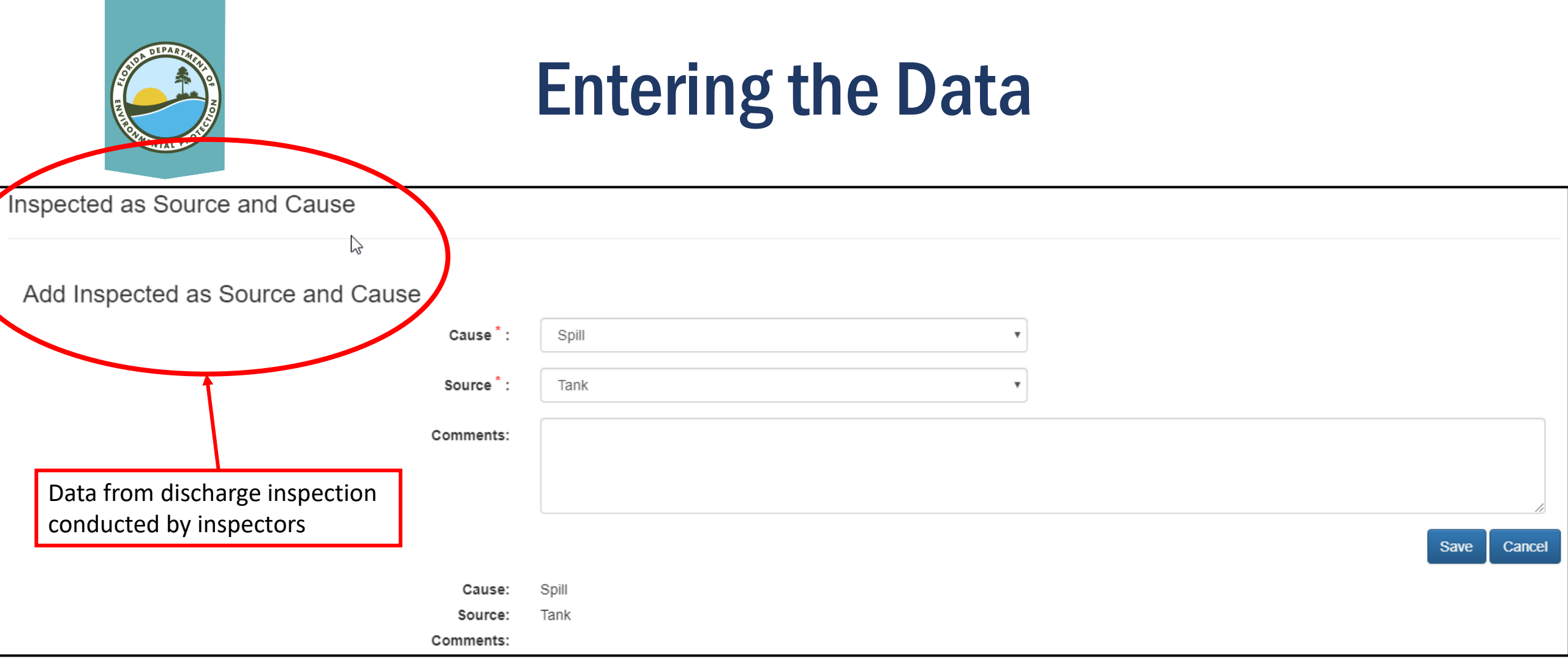
Actions taken in response to the discharge:

Comments:

Agencies notified (as applicable):

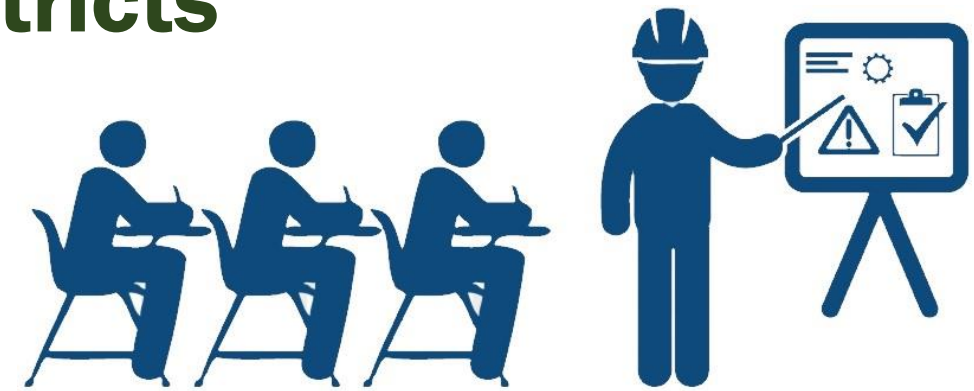
- ☐ Fire Department
- ☐ County Program _____
- ☐ District Office _____
- ☐ State Watch Office 800-320-0519
- ☐ National Response Center 800-424-8802

Entering the Data



Types of Inspector Training

- Routine Inspector Webinar Trainings
- Monthly teleconference with Districts
- Quarterly teleconferences with contracted counties
- Annual conference for District and County Inspectors



Closures & Other Unclear Discharges

- Use evidence for identification
- Look at location of contamination
- Look for visible damage
- Review system monitoring data
- Review incident reports
- Some are just unknown

THANK YOU!

- National Trends in Underground Storage Tank Infrastructure: Alex Hall (EPA ORD)
  - Hall.Alexander@epa.gov
- Source and Cause of Utah Petroleum Storage Tank Fund Releases: Therron Blatter (UT DEQ)
  - TBlatter@utah.gov
- Internal Corrosion and UST Releases – Lessons Learned in Arizona: Chris Marks (AZ DEQ)
  - Marks.Christopher@azdeq.gov
- Florida's Process for Determining Source and Cause: Zach Barrett (FL DEP)
  - Zachary.Barrett@floridadep.gov
- ASTSWMO Contact:
  - Charles Reyes charlesr@astswmo.org