UST Removal Time: A Look Inside Aging Tanks

Strategies for Inspecting, Managing, Upgrading, and Replacing UST's

Tanknology

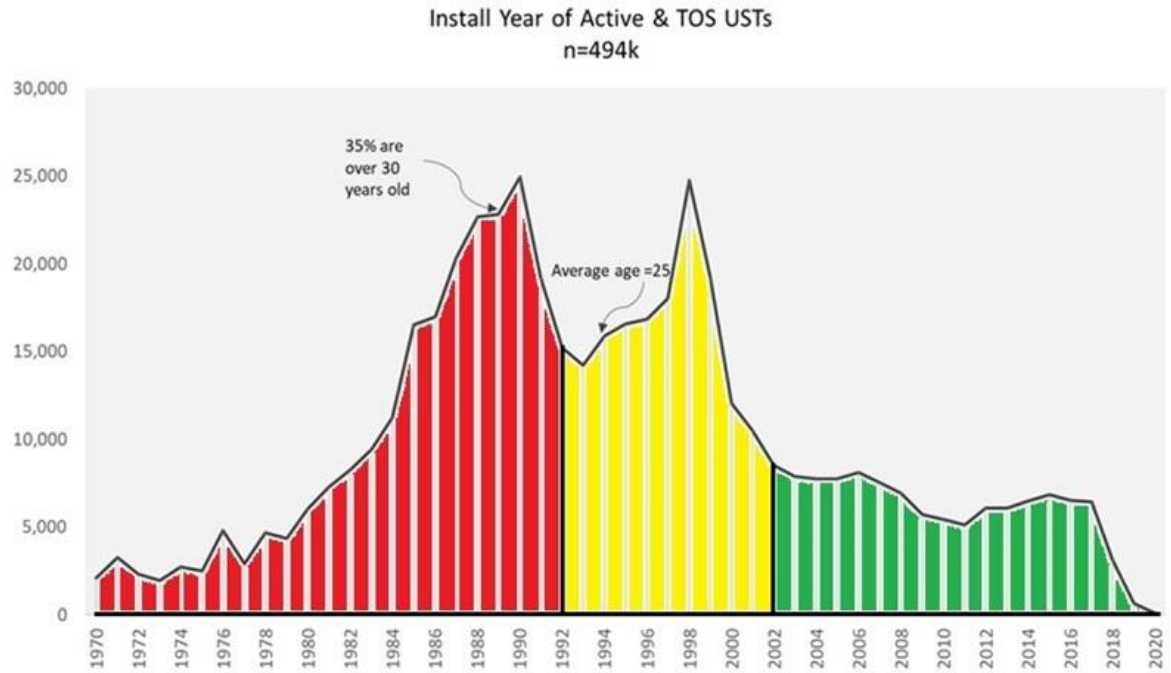
Brad Hoffman

Pittsburgh, PA
September 14, 2022

PUT THE INDUSTRY LEADER ON YOUR TEAM

Overview

- About 3/4 of UST's will be over 30 years old this decade
  - Not just the tanks, but related piping & equipment
- Risk Management – more than just compliance
- Internal Video Inspections will show problems & causes.



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Things to Consider…

- How long should a tank system last?
  - Until the warranty expires?
  - 30 years? Longer? Until it leaks?
- Why do some tanks fail and others seem unaffected?
- When to repair or replace a tank?
  - Before or after they fail?
- Supply chain issues: Are tanks & parts available?
  - Can’t replace everything right now
- Is ***Compliance*** good enough?
  - What about a Risk Management program?

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Risk Management of UST's

- Evaluate risk factors for specific installations
  - Site risk factors
  - Equipment risk factors
    - Piping, Sumps, UDC's, ATG's
    - Steel UST's
    - Fiberglass UST's
- Establish risk management practices
  - Frequency/Type of leak detection
  - Frequency/Type of inspections & maintenance
  - Removal/Replacement/Upgrading schedules

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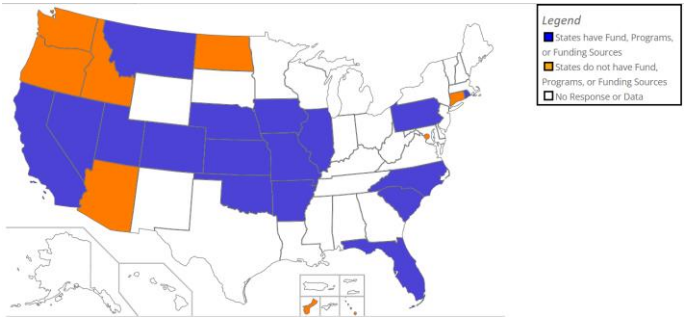
Site Risk Factors

- Sensitive Receptor Survey
- Construction activities at site
- Groundwater conditions (& flooding)
- Change in product storage and compatibility
- Throughput volume
- State Cleanup Fund



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Risk Assessment – Equipment: Not Just Tanks

- Piping: SW vs DW
- STP's: Inside sumps or "buried in the dirt"
- Dispensers: UDC's or no containment
- Overfill Prevention: Current technology?
- Leak Detection: Current technology?

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Risk Assessment - Tanks

Steel

- Make/Model/Age
- Type of Corrosion Protection
- C.P. systems records/history
- Tank Maintenance (STI R-111)
- Experience with similar UST’s

Fiberglass

- Make/Model/Age
- Installation Checklist
- Warranty (UL Listing)
- Product Compatibility
- Experience with similar UST’s

Possible Steel Tank Issues

- External corrosion
  - If C.P. systems not maintained
  - Or problem with coating/jacket
- Internal corrosion
  - Worse with ULSD but can happen with other fuels
  - Usually involves water issues (or high moisture/humidity)
  - Often with dirty tanks that haven't kept clean
- May form pinholes or cracks along welds
- Product in normally dry interstice
- Ingress of groundwater
- Leak of product

These issues impact a small percentage of tanks.
Many old tanks are still in good shape!

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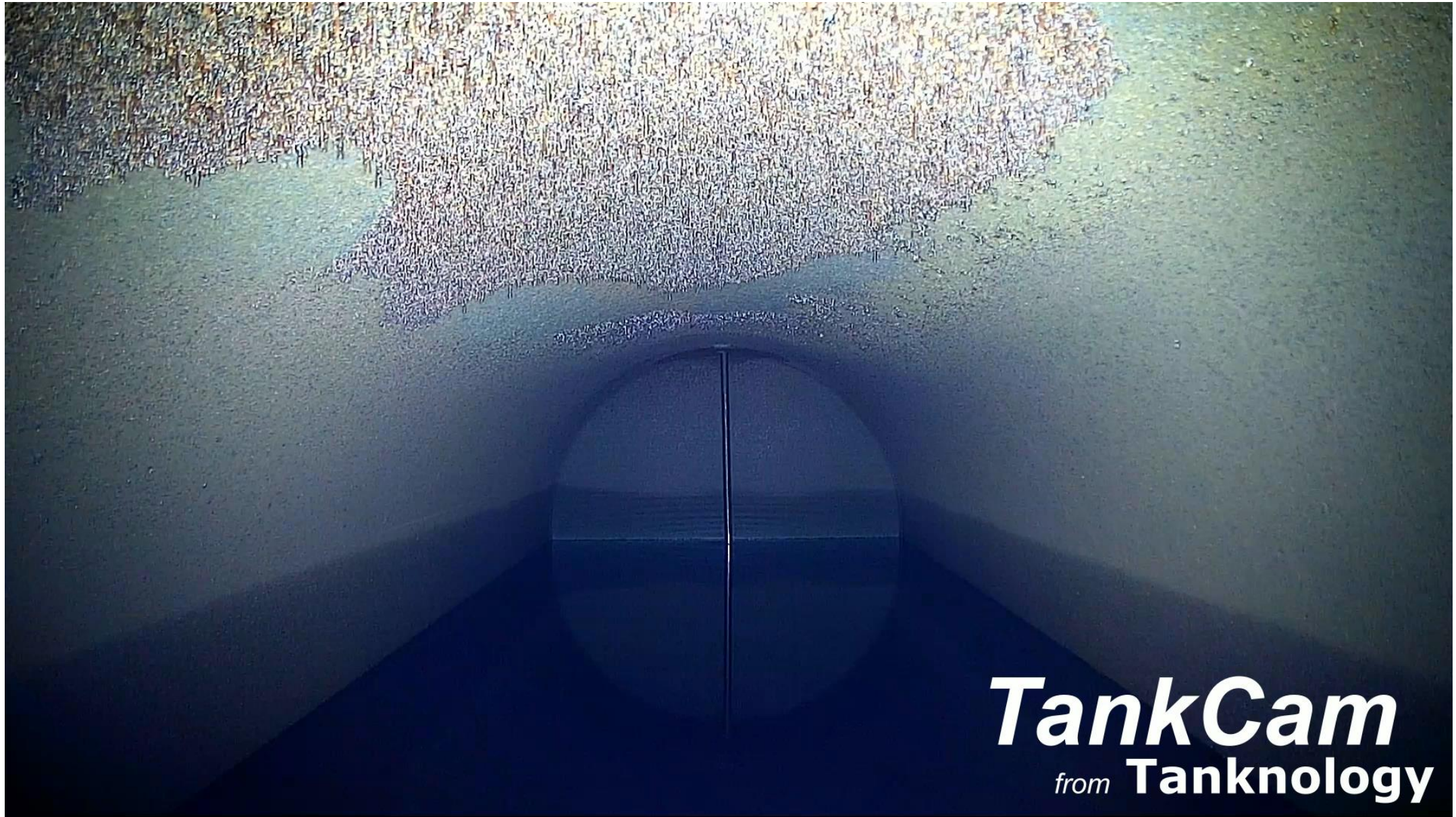
Water Ingress – Steel Tank - ULSD

Water Ingress – Steel Tank - Regular

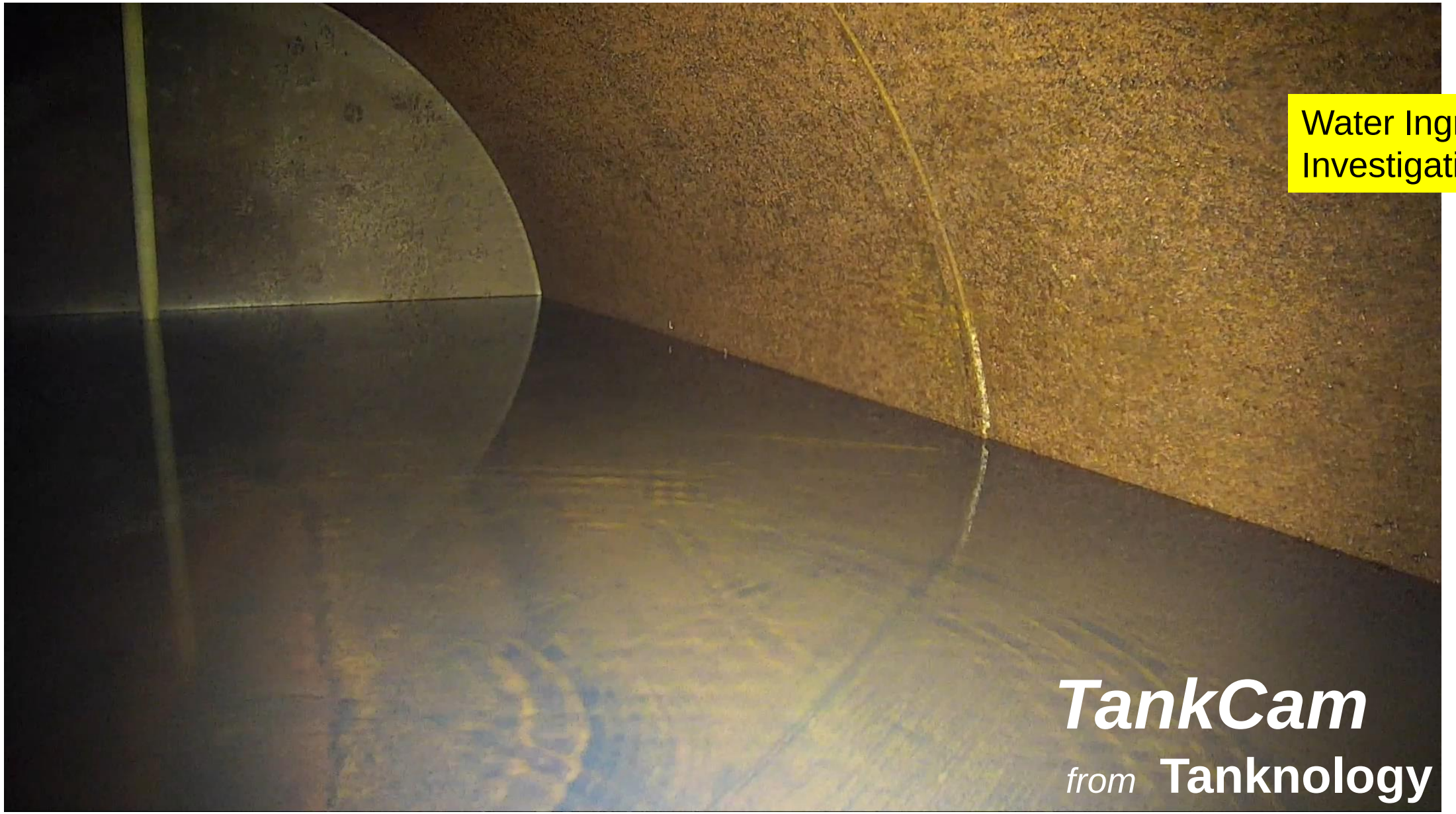
Corrosion Tubercles in Steel Tank



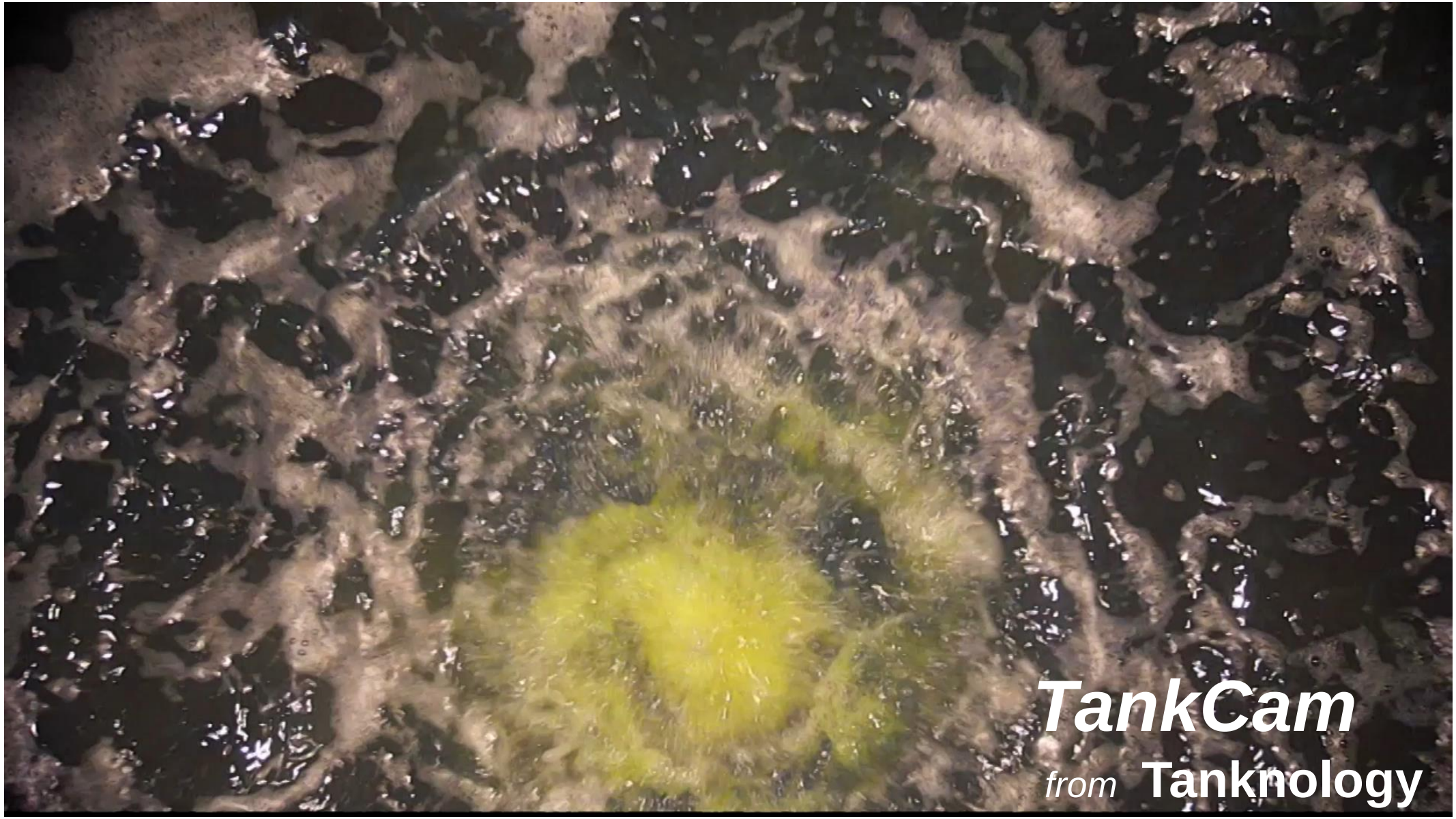
AZ

Water Ingress – Steel Tank – Diesel

Drips & Ingress – Steel Tank



Hole/Leak in Steel Tank – Tank Test & Video

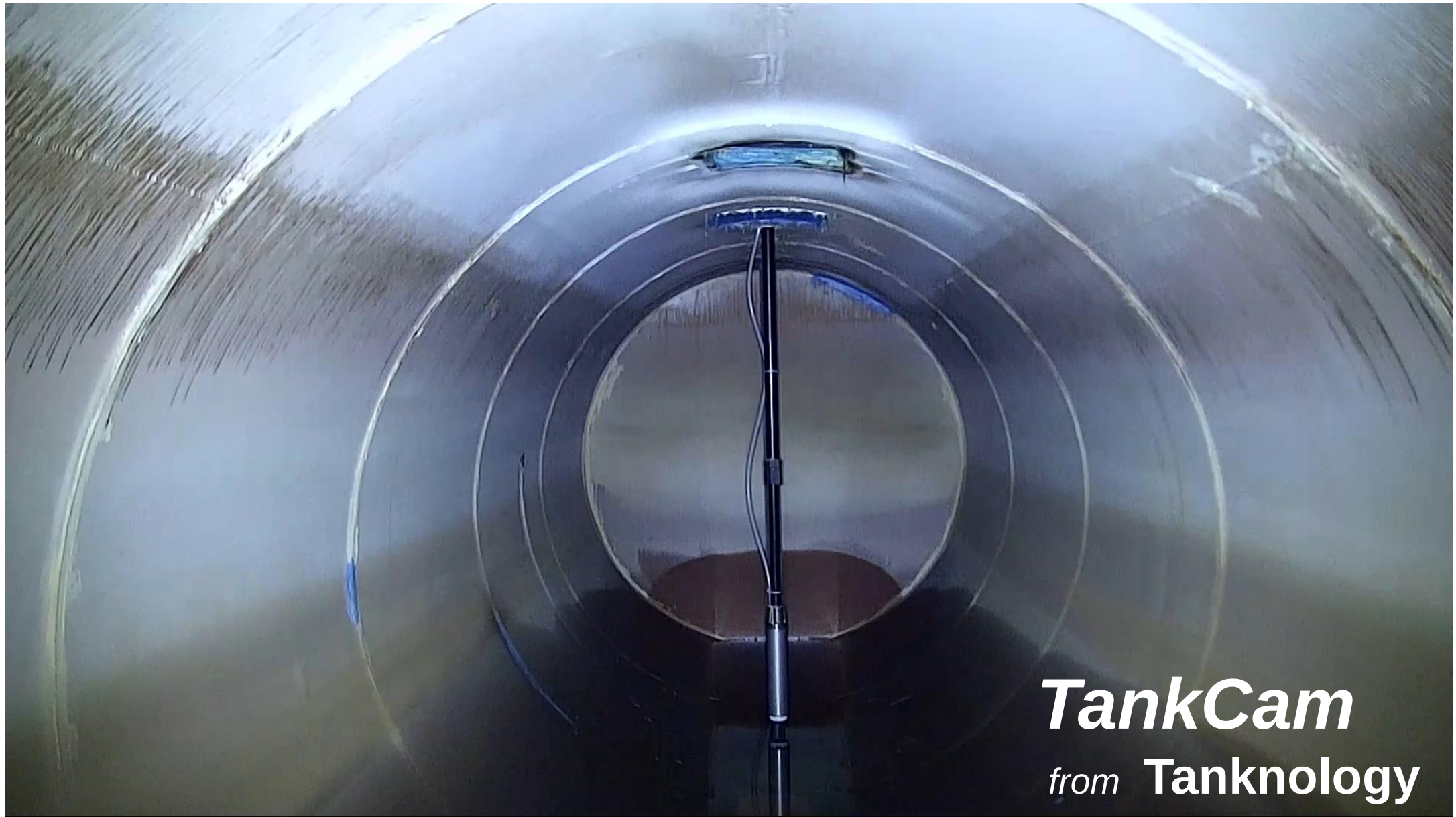


TX

Failed Lining in Steel Tank

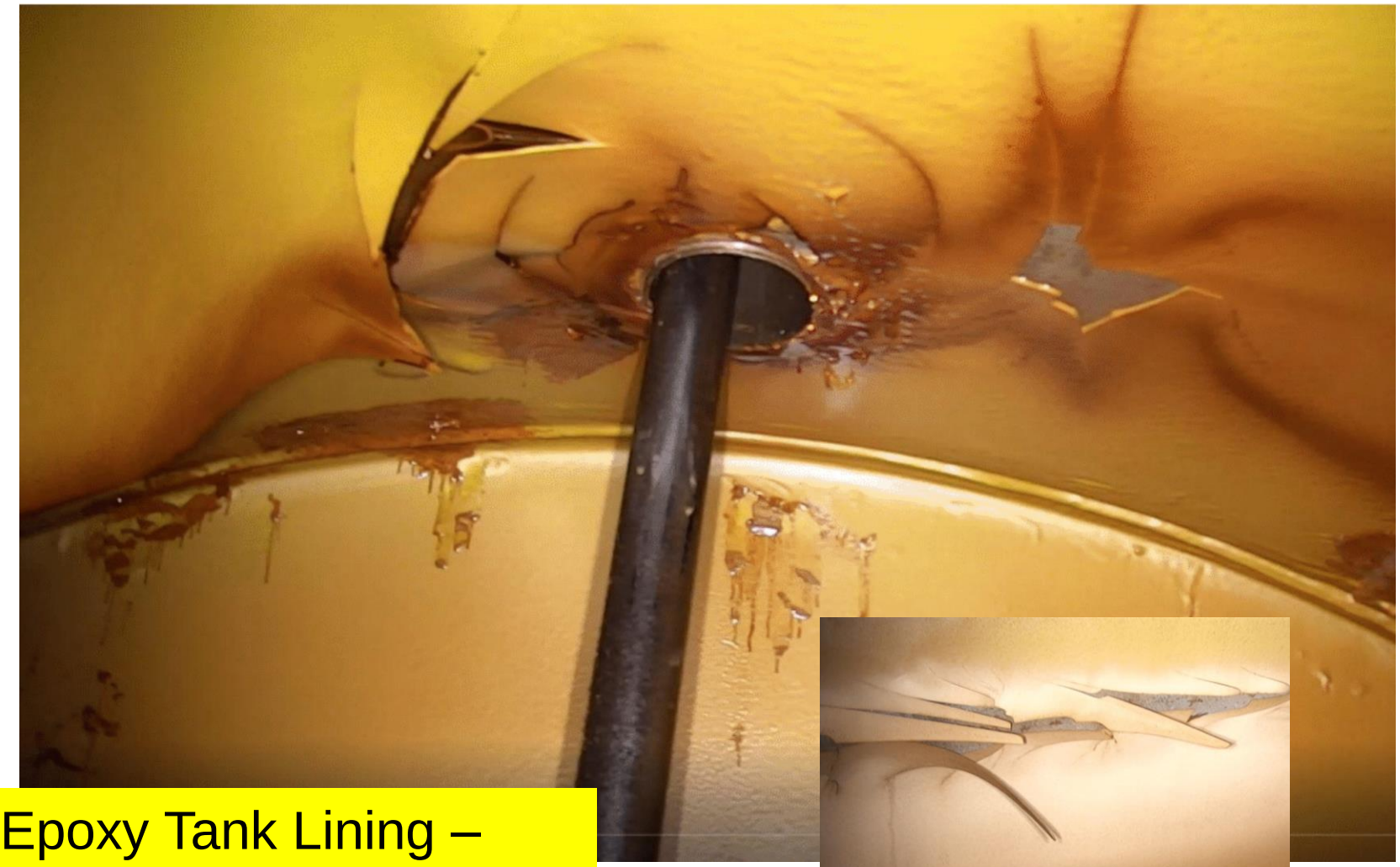
NC

Failed Lining in Steel Tank



IN

Failed Lining in Steel Tank



Epoxy Tank Lining –
Cracked and Peeled

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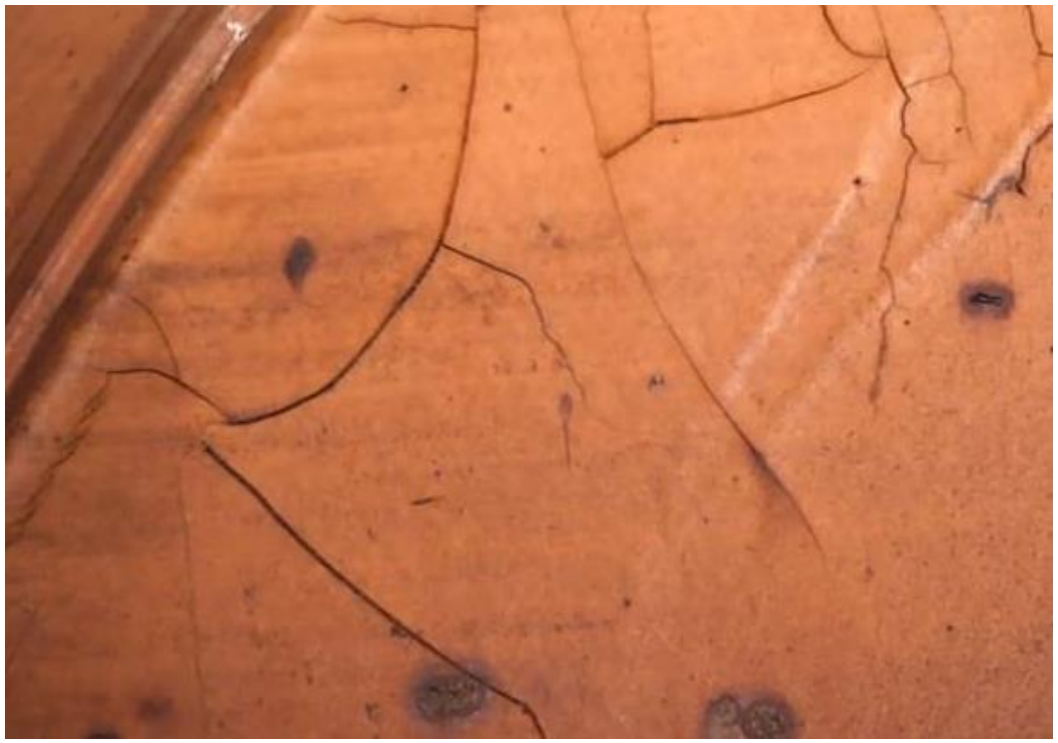
VA

Failed Lining in Steel Tank



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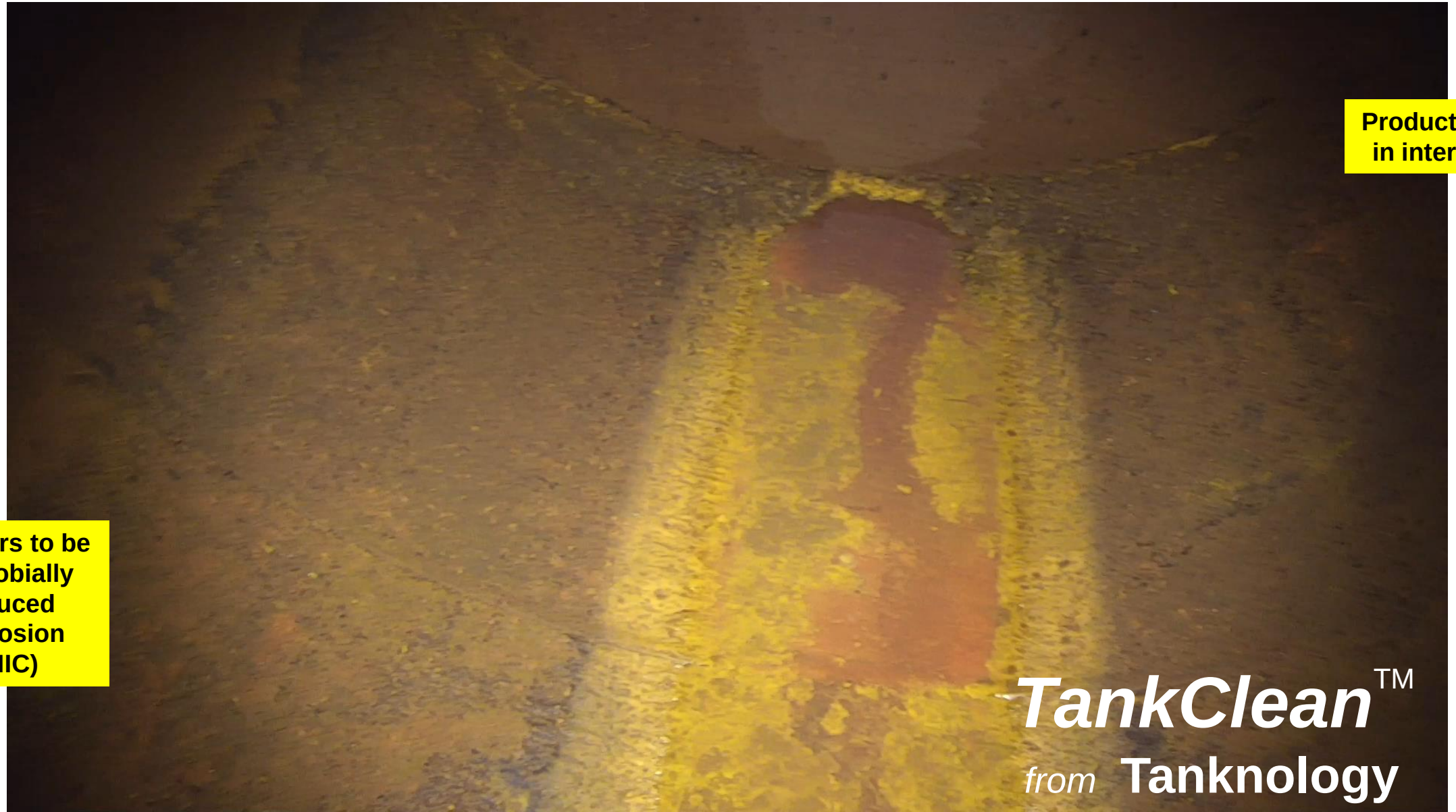
FL

Pitting Holes in DW Steel Tank - Diesel



DW Steel Tank – Interstitial Pipe

WI

DW Steel Tank – Diesel in Interstice

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NH

Epoxy Repair at Steel Tank Interstitial

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GA

DW Steel Tank Interstitial Riser – Clean/Dry

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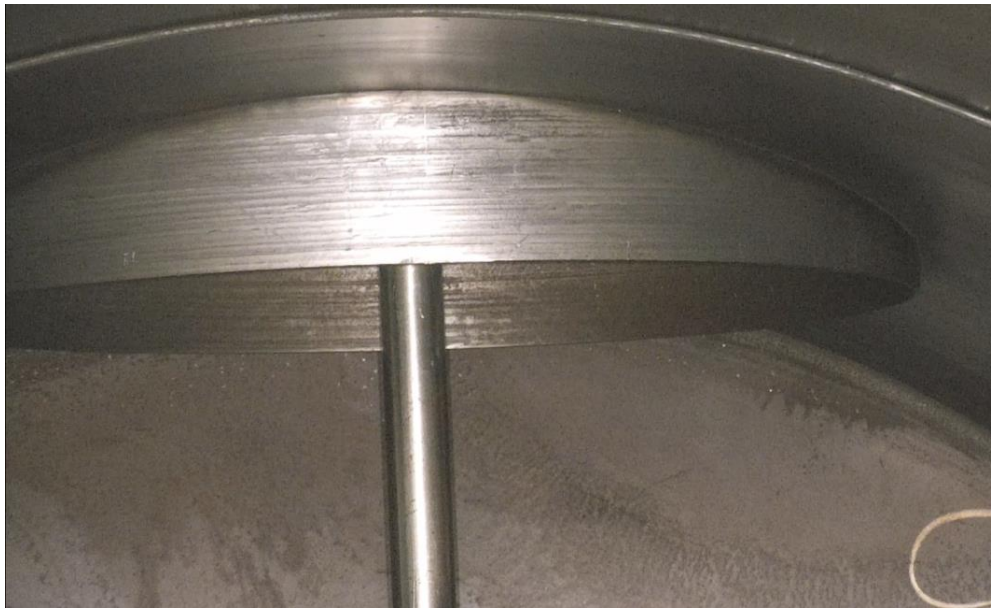
Steel Tank with ULSD & NO water

No Water

No Problems



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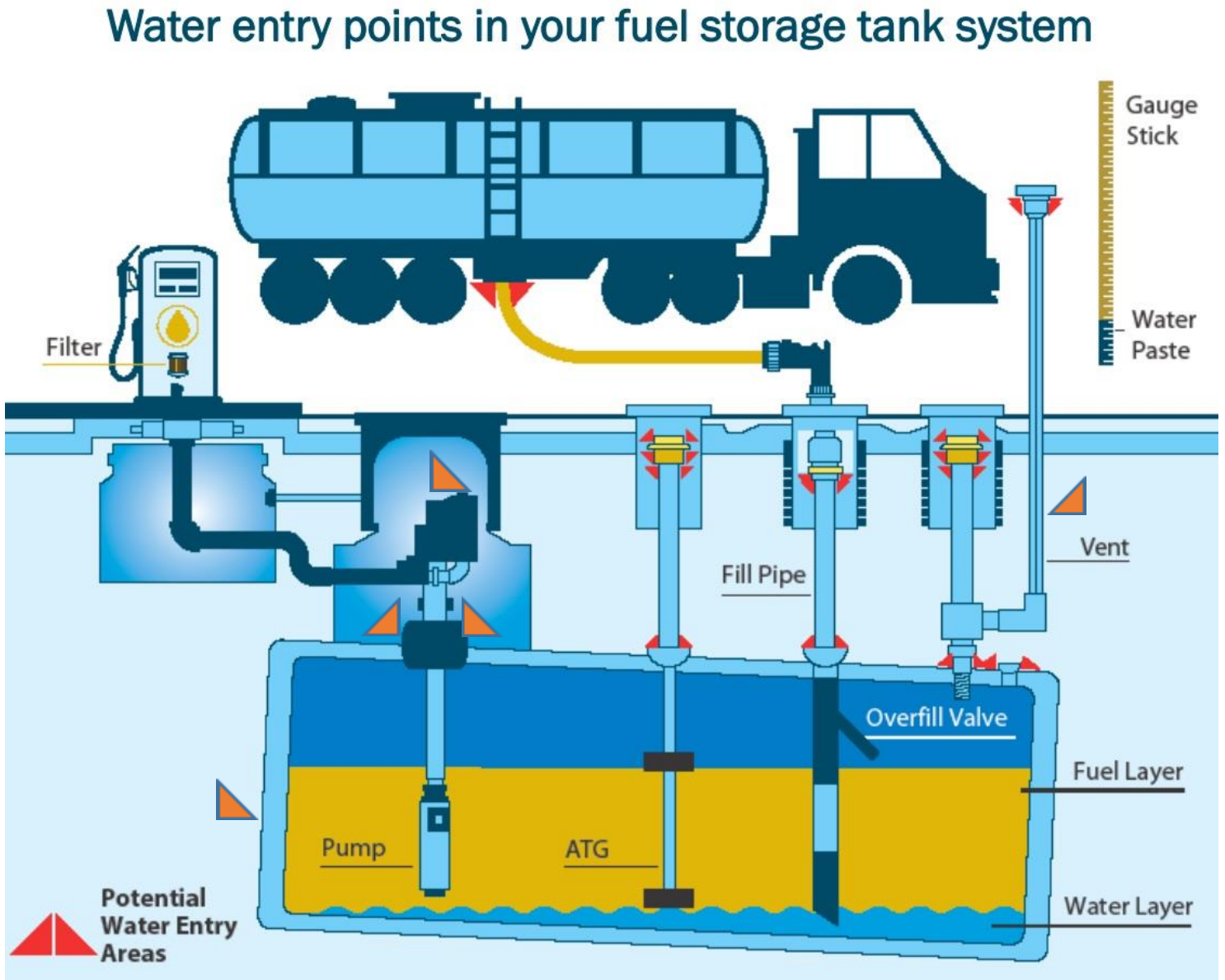
STI Guidance: Keeping Water Out of Tanks



Other Potential Water Entry Points

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Possible Fiberglass Tank Issues

- Deflection and/or flattening of tank bottom
- Degradation of tank interior and gel coat
- Crack formation – often along rib lines
  - Usually associated with “older” tanks and ethanol blends
- Leak of product into hollow rib space
- Product in normally dry interstice
- Loss of brine from interstice
- Ingress of groundwater
- Leak of product into ground

These issues impact a small percentage of tanks.
Many old tanks are still in good shape!

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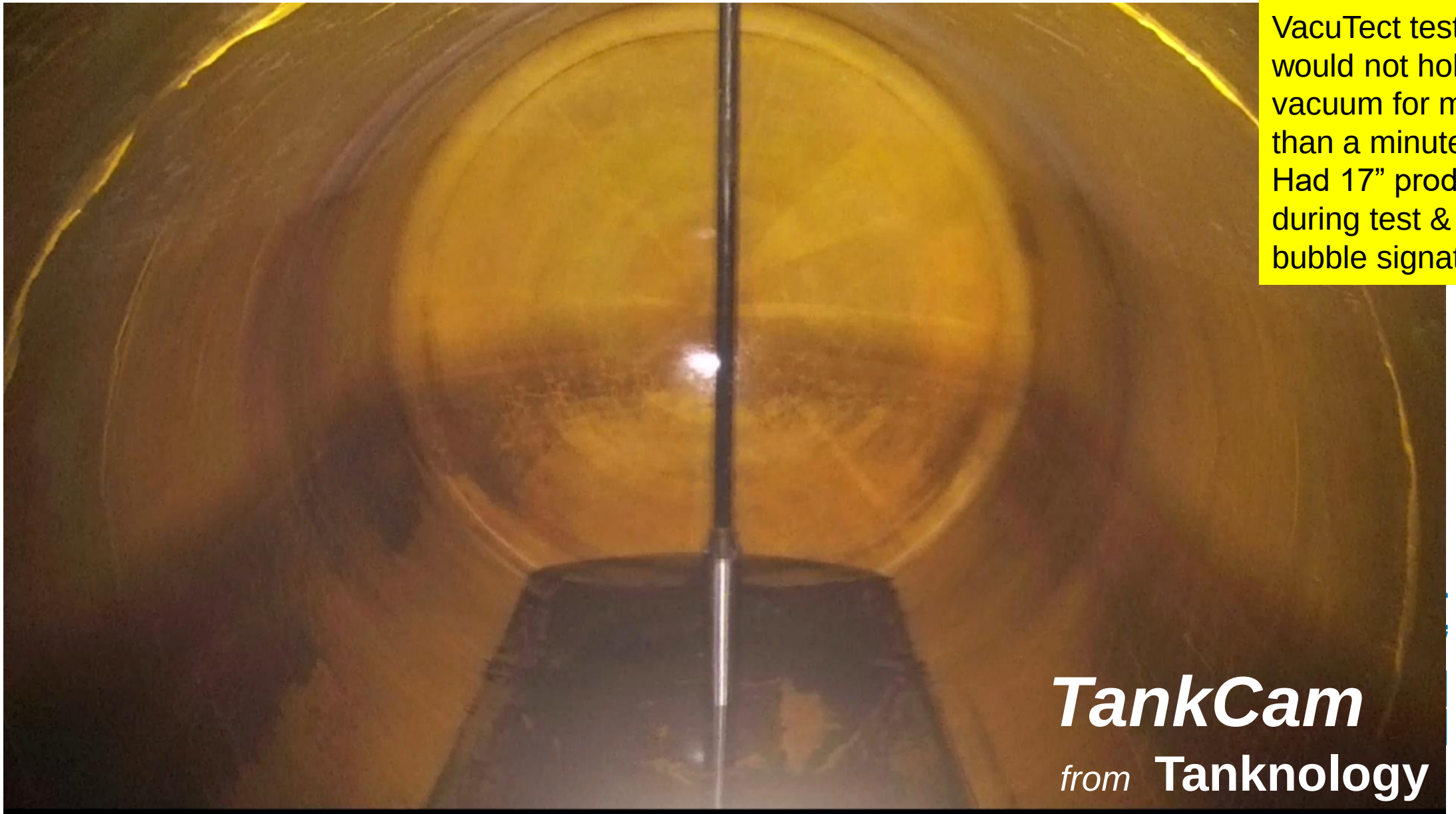
Wrinkle, Crack & Leak – FRP Tank

Premium Tank. VacuTect test would not hold vacuum for more than a minute. Had 17” product during test & loud bubble signature.



TX

Flaking in FRP Tank

NM

Blisters/Flaking in FRP

Flakes & chips floating on the cloudy yellow “liquid”

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MI

Crack at Bulkhead & Ingress – FRP Tank

IN

Multiple Cracks & Ingresses FRP Tank

LA

Crack, Blisters, & Leak – FRP Tank

IN

Cracks in Two FRP Tanks at same site

Crack & Water Ingress – FRP

Hole & Ingress – FRP Tank

Hole and water ingress.
No striker plate.
Diesel tank.

Tank Bottom covered with sludge prior to TankClean™

IL

Star Cracks in FRP Tank

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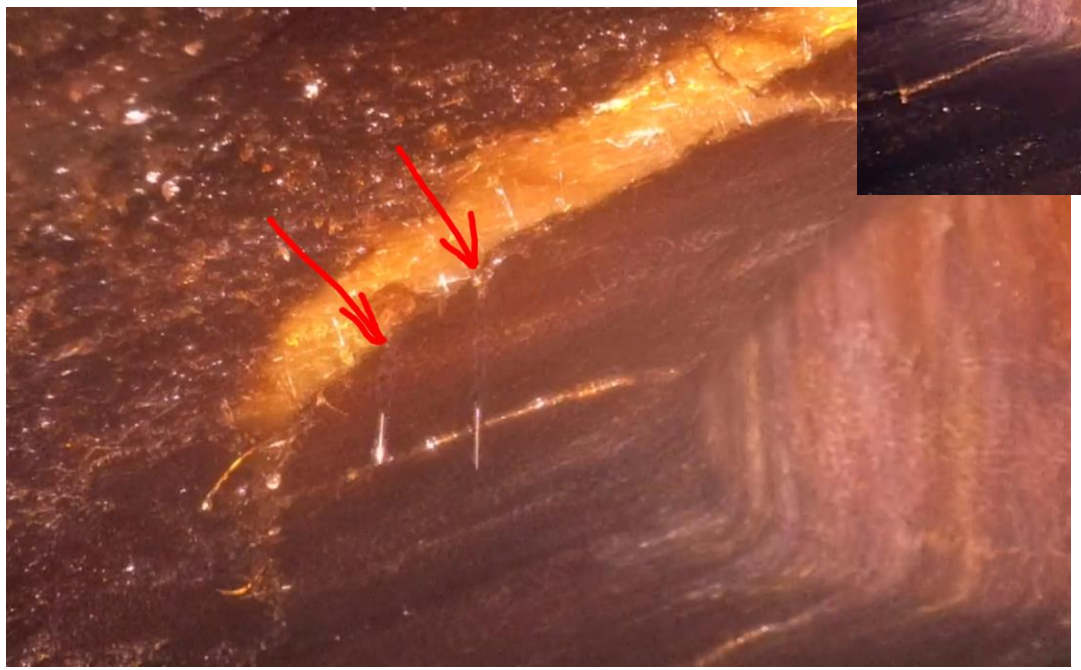
KY

Cracked Manway – FRP Tank

Drips from along the crack



May be excess loading from improper manhole installation

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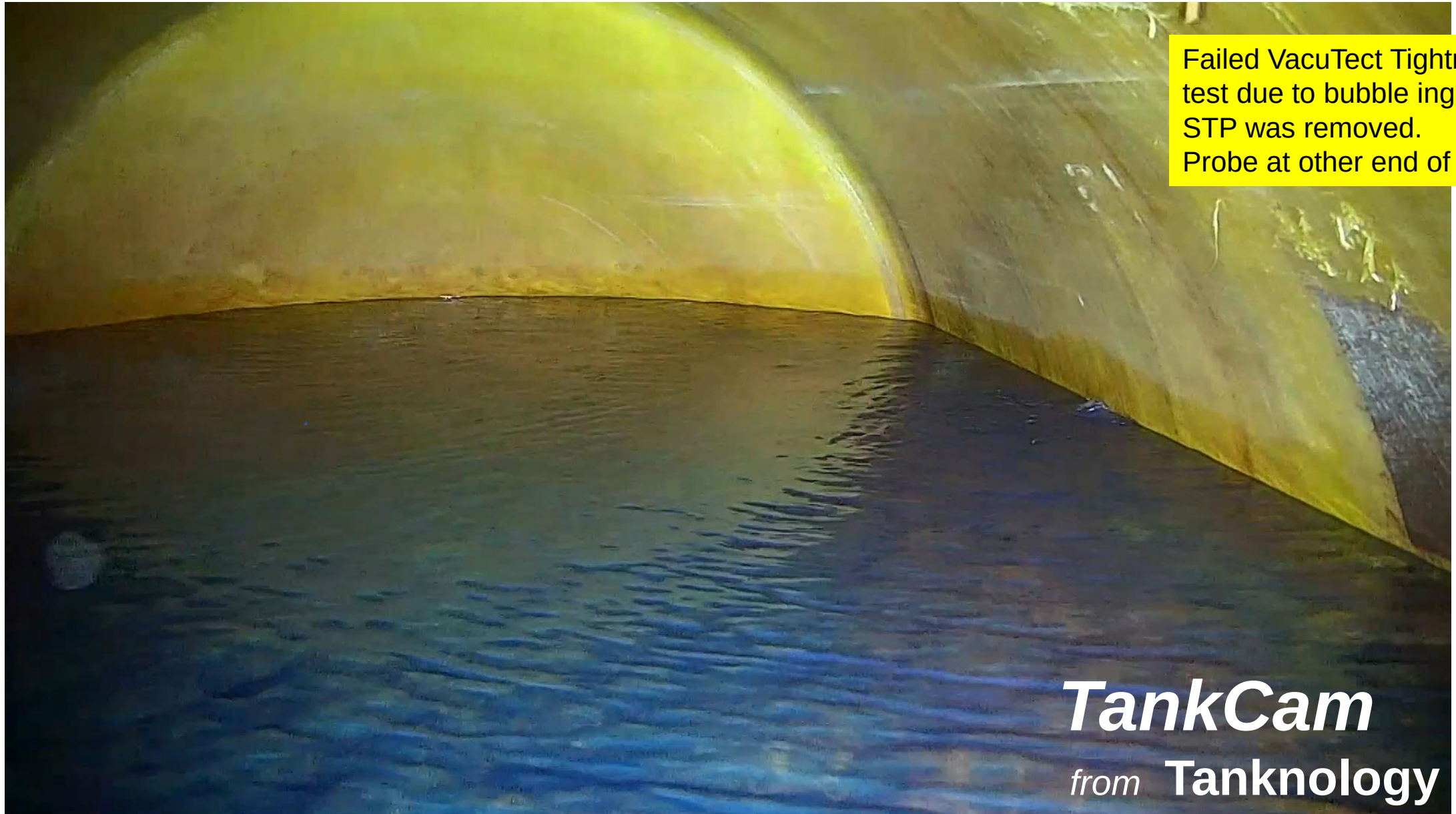
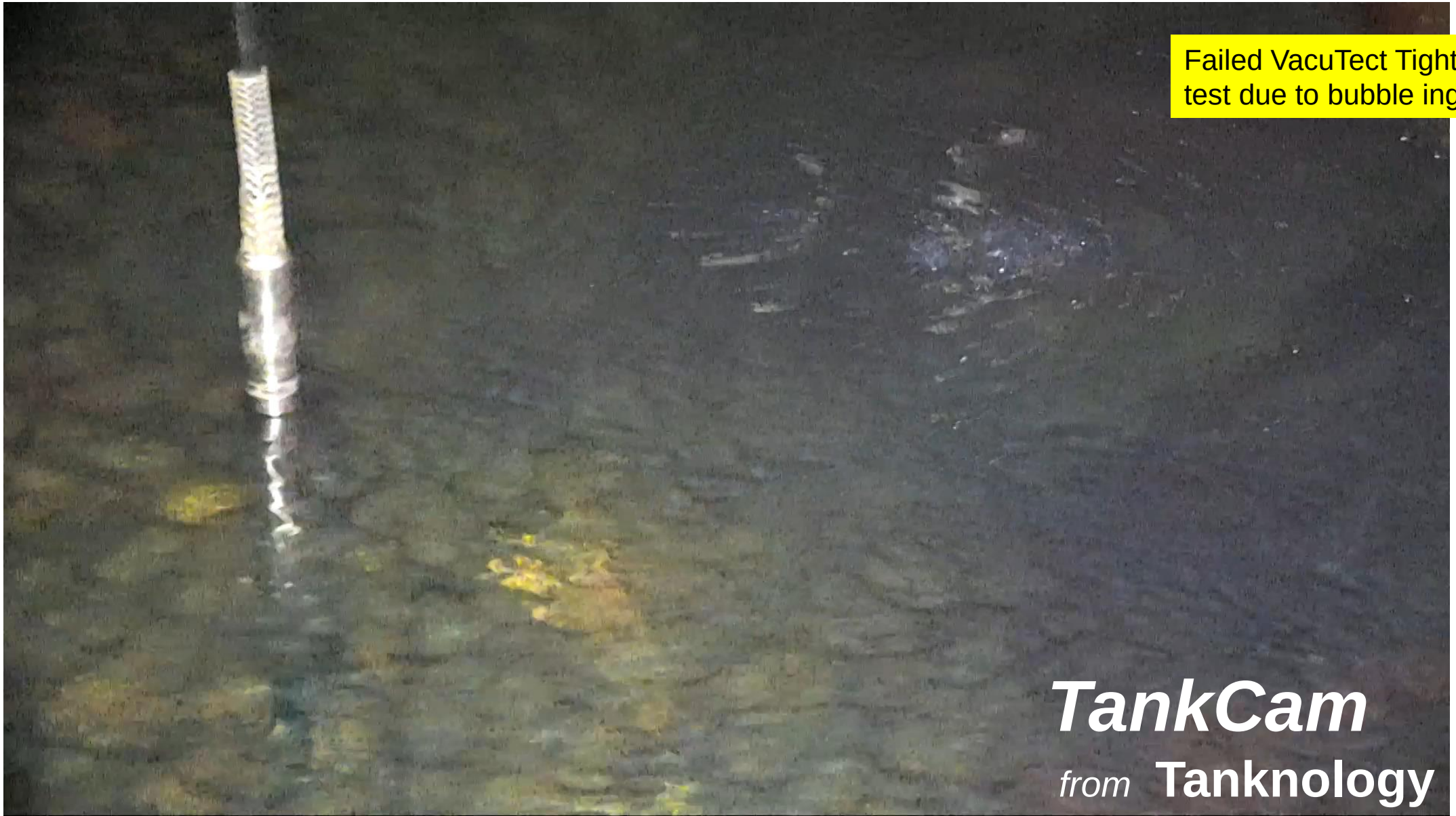
TX

Crack/Leak in FRP Tank – Tank Test & Video

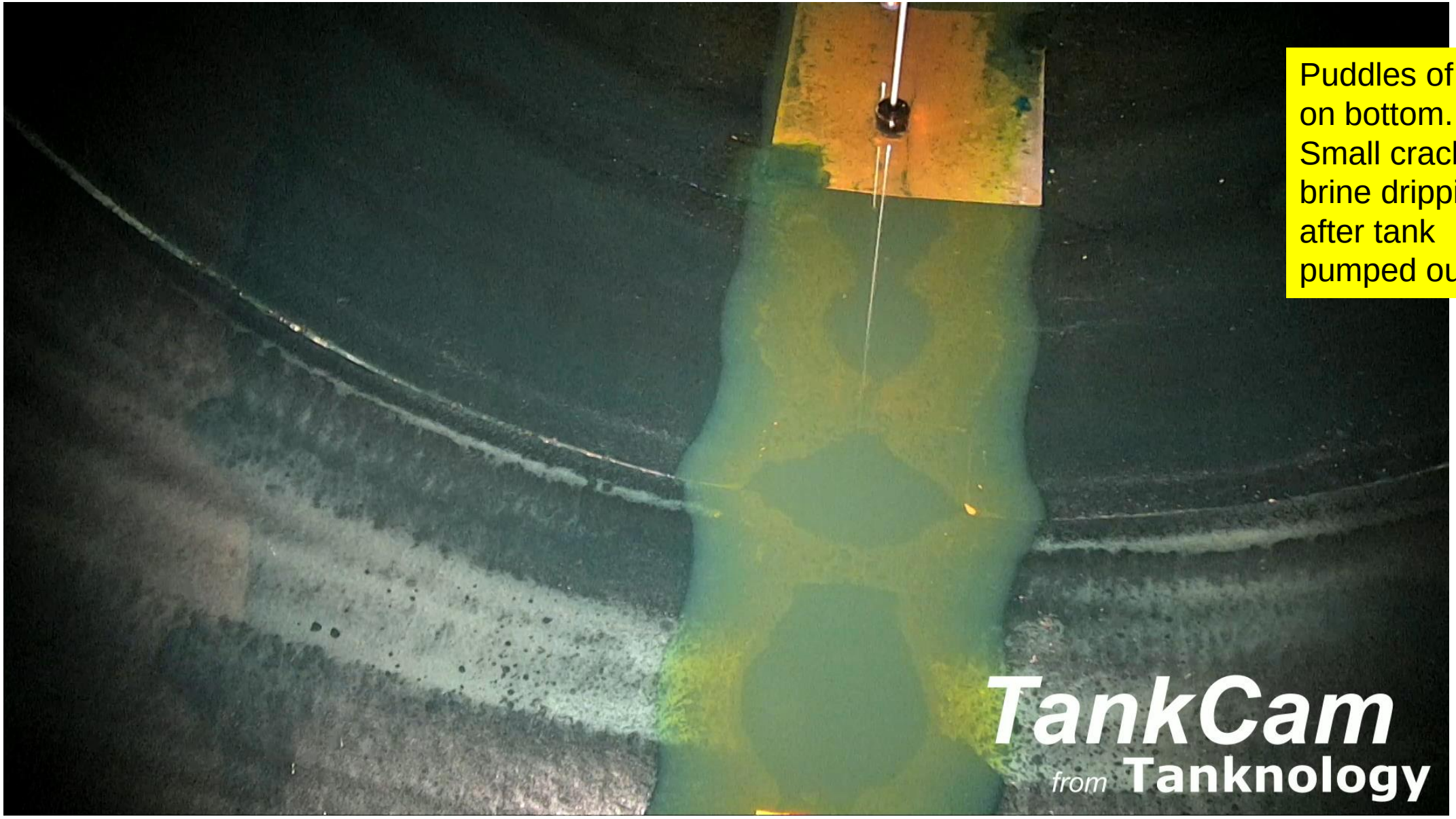


KY

Crack/Leak in FRP Tank – Tank Test & Video



Crack & Loss of Brine - DWF



Puddles of brine on bottom. Small crack and brine dripping – after tank pumped out.

IL

Aging FRP Tanks: Gas vs DSL; Same Site

Gasoline tank has flaking, blisters, and cracks.

Diesel tank has none, just minor residue.

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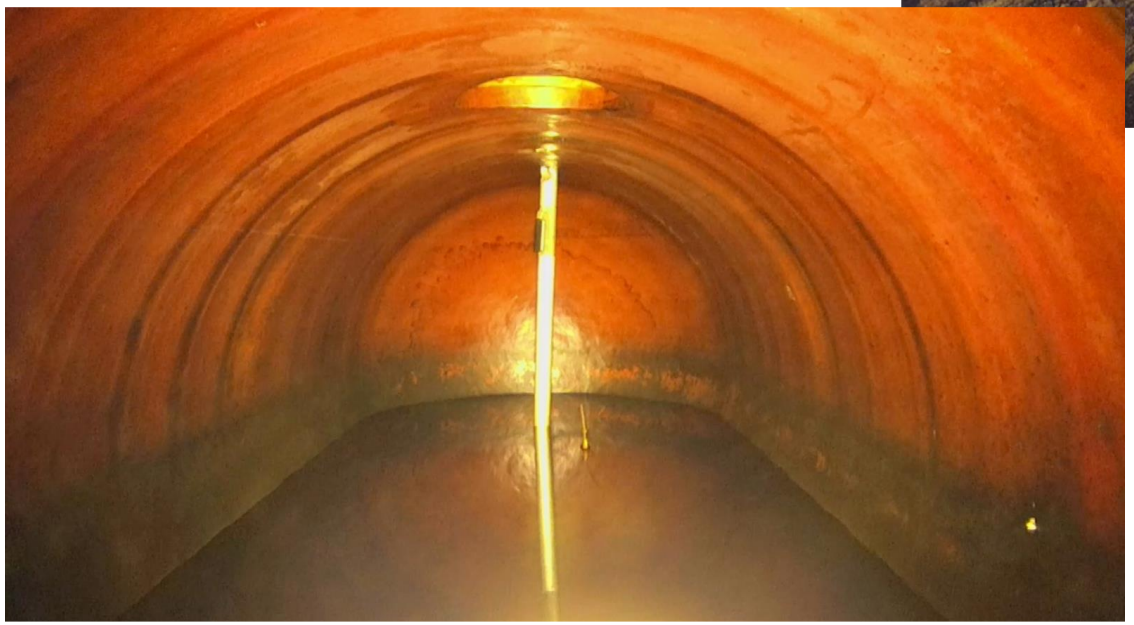
PA

Aging FRP Tanks: Gas vs DSL (2)

Gasoline tank (right) has flaking, blisters, and possible cracks.

Diesel tank (below) has none, just minor residue.



These were at the same location

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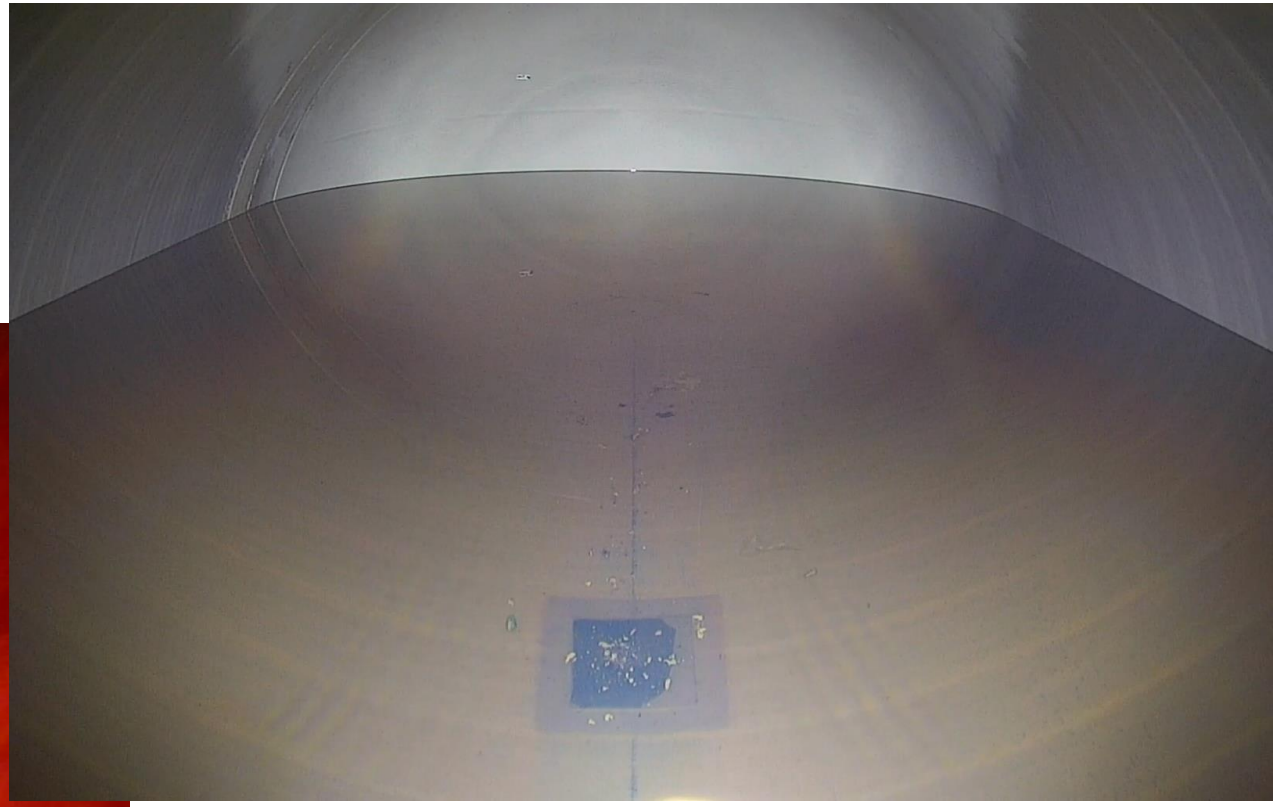
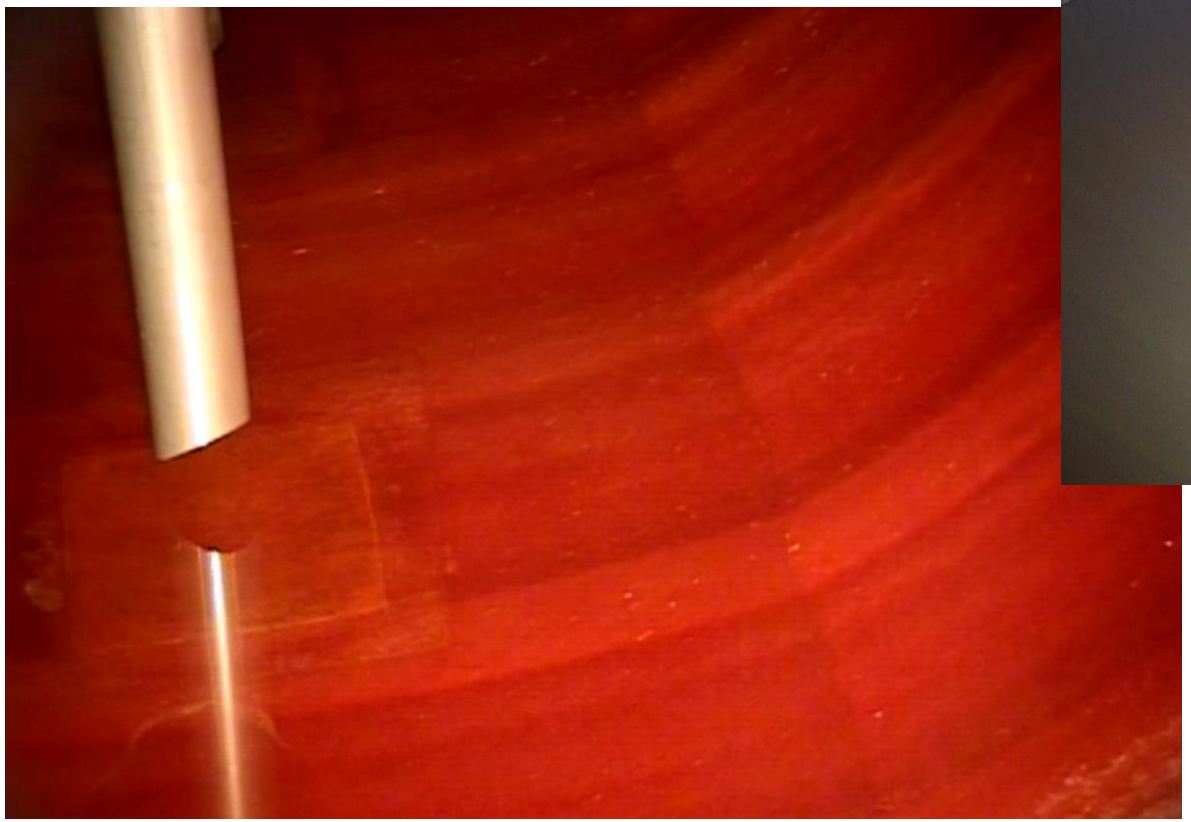
HI

Fiberglass Tanks – Good Condition

With good installation and storing compatible products, FRP tanks should last many years.





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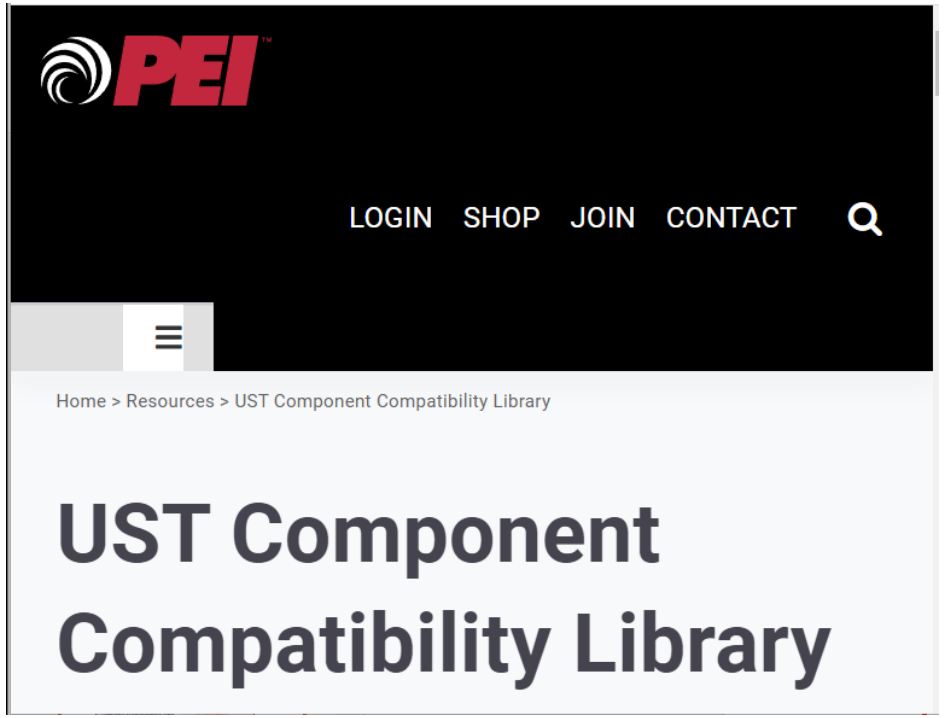
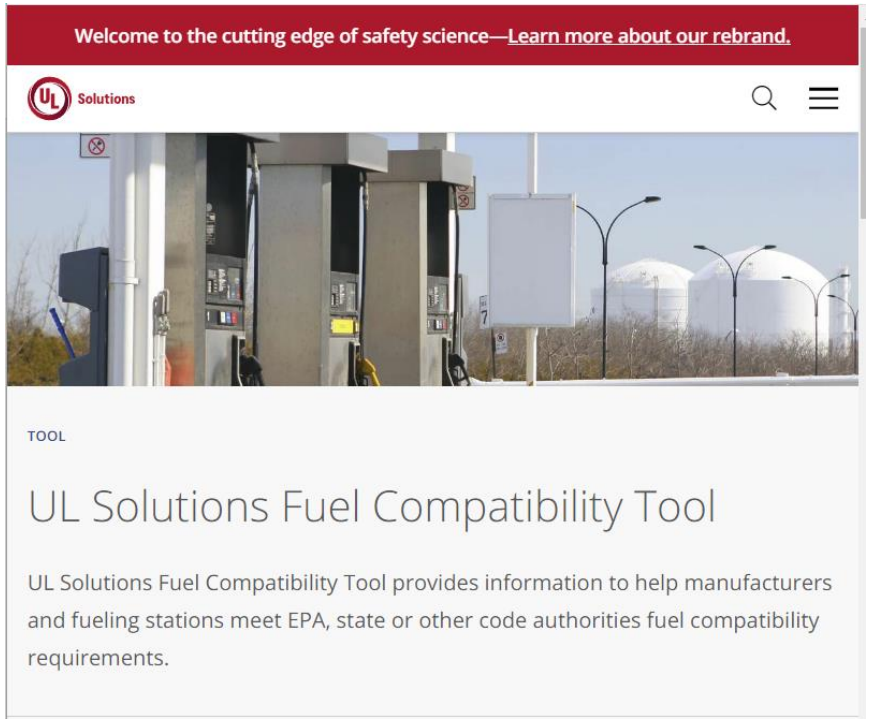
UST Equipment Compatibility Resources

- PEI and UL resources

Other components matter – not just tanks!





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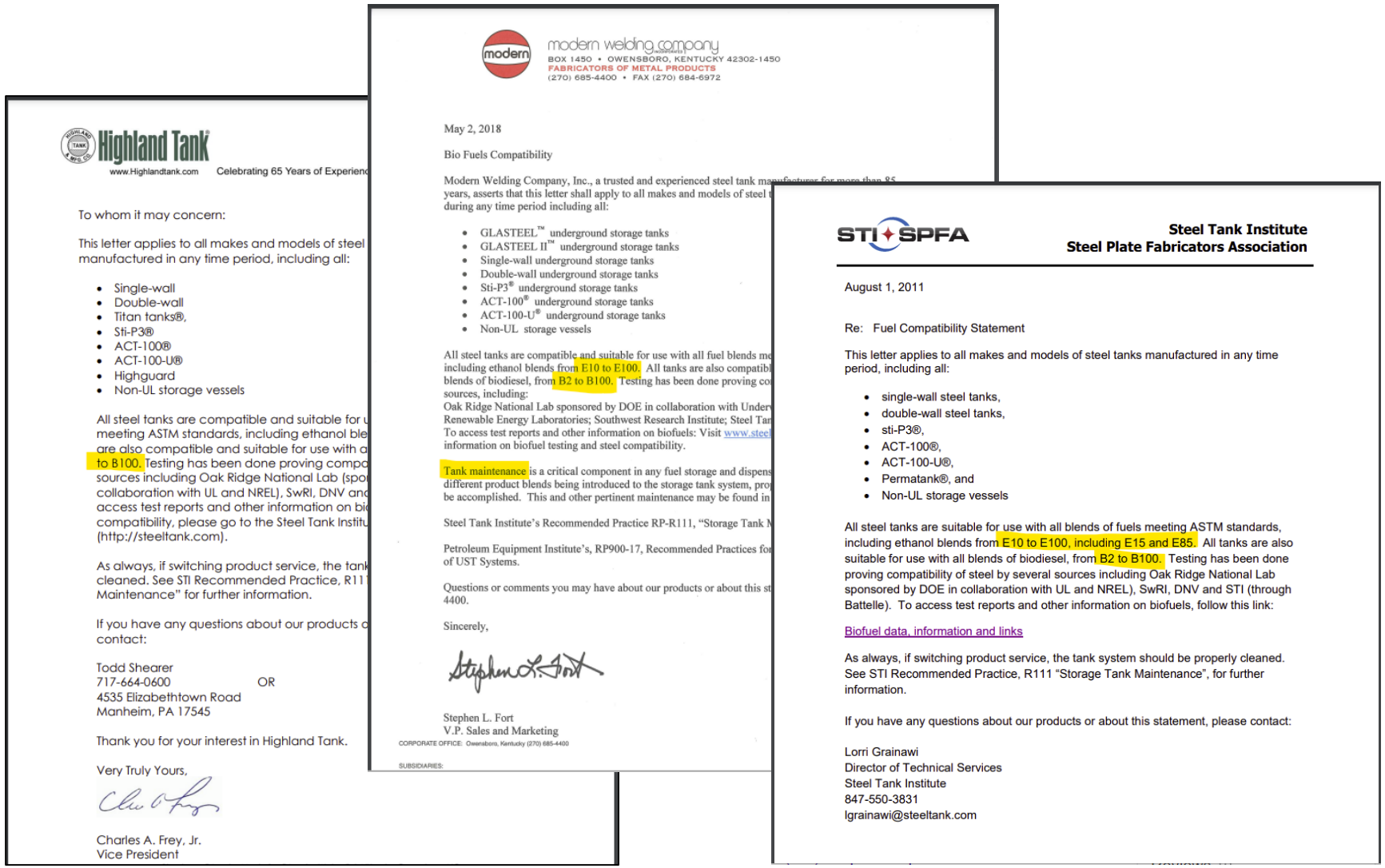
Steel Tank Institute - Compatibility

- All ASTM fuels
  - E10 – E100
  - B2 – B100
- Keep it clean
  - STI R111



Highland Tank
www.Highlandtank.com Celebrating 65 Years of Experienc

To whom it may concern:

This letter applies to all makes and models of steel manufactured in any time period, including all:

- Single-wall
- Double-wall
- Titan tanks®,
- Sti-P3®
- ACT-100®
- ACT-100-U®
- Highguard
- Non-UL storage vessels

All steel tanks are compatible and suitable for u meeting ASTM standards, including ethanol ble are also compatible and suitable for use with a to B100. Testing has been done proving compa sources including Oak Ridge National Lab (spo collaboration with UL and NREL), SwRI, DNV an access test reports and other information on bi compatibility, please go to the Steel Tank Instit (http://steeltank.com).

As always, if switching product service, the tank cleaned. See STI Recommended Practice, R11 Maintenance" for further information.

If you have any questions about our products o contact:

Todd Shearer
717-664-0600 OR
4535 Elizabethtown Road
Manheim, PA 17545

Thank you for your interest in Highland Tank.

Very Truly Yours,

Charles A. Frey, Jr.
Vice President

modern welding company
BOX 1450 • OWENSBORO, KENTUCKY 42302-1450
FABRICATORS OF METAL PRODUCTS
(270) 685-4400 • FAX (270) 684-6972

May 2, 2018

Bio Fuels Compatibility

Modern Welding Company, Inc., a trusted and experienced steel tank manufacturer for more than 85 years, asserts that this letter shall apply to all makes and models of steel t during any time period including all:

- GLASTEEL™ underground storage tanks
- GLASTEEL II™ underground storage tanks
- Single-wall underground storage tanks
- Double-wall underground storage tanks
- Sti-P3® underground storage tanks
- ACT-100® underground storage tanks
- ACT-100-U® underground storage tanks
- Non-UL storage vessels

All steel tanks are compatible and suitable for use with all fuel blends me including ethanol blends from E10 to E100. All tanks are also compatibl blends of biodiesel, from B2 to B100. Testing has been done proving co sources, including:
Oak Ridge National Lab sponsored by DOE in collaboration with Under Renewable Energy Laboratories; Southwest Research Institute; Steel Tan To access test reports and other information on biofuels: Visit www.steel information on biofuel testing and steel compatibility.

Tank maintenance is a critical component in any fuel storage and dispens different product blends being introduced to the storage tank system, pro be accomplished. This and other pertinent maintenance may be found in

Steel Tank Institute's Recommended Practice RP-R111, "Storage Tank M

Petroleum Equipment Institute's, RP900-17, Recommended Practices for of UST Systems.

Questions or comments you may have about our products or about this st 4400.

Sincerely,

Stephen L. Fort
V.P. Sales and Marketing

CORPORATE OFFICE: Owensboro, Kentucky (270) 685-4400

SUBSIDIARIES:

STI SPFA
Steel Tank Institute
Steel Plate Fabricators Association

August 1, 2011

Re: Fuel Compatibility Statement

This letter applies to all makes and models of steel tanks manufactured in any time period, including all:

- single-wall steel tanks,
- double-wall steel tanks,
- sti-P3®,
- ACT-100®,
- ACT-100-U®,
- Permatank®, and
- Non-UL storage vessels

All steel tanks are suitable for use with all blends of fuels meeting ASTM standards, including ethanol blends from E10 to E100, including E15 and E85. All tanks are also suitable for use with all blends of biodiesel, from B2 to B100. Testing has been done proving compatibility of steel by several sources including Oak Ridge National Lab sponsored by DOE in collaboration with UL and NREL), SwRI, DNV and STI (through Battelle). To access test reports and other information on biofuels, follow this link:

Biofuel data, information and links

As always, if switching product service, the tank system should be properly cleaned. See STI Recommended Practice, R111 "Storage Tank Maintenance", for further information.

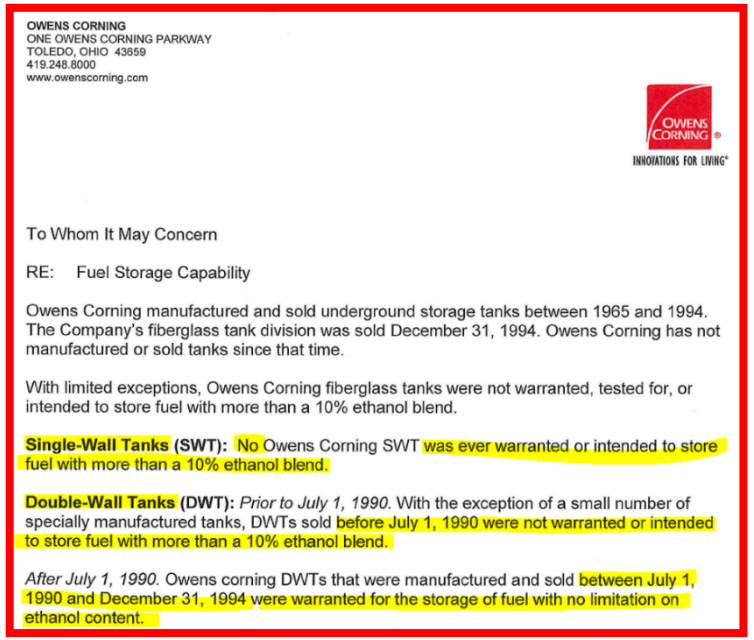
If you have any questions about our products or about this statement, please contact:

Lorri Grainawi
Director of Technical Services
Steel Tank Institute
847-550-3831
lgrainawi@steeltank.com

Fiberglass Tanks - Compatibility

Owens Corning

- SWF – E10 (up to 1994)
- DWF – E10 before July 1990
- DWF – E100 after July 1990



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

INNOVATIONS FOR LIVING

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.

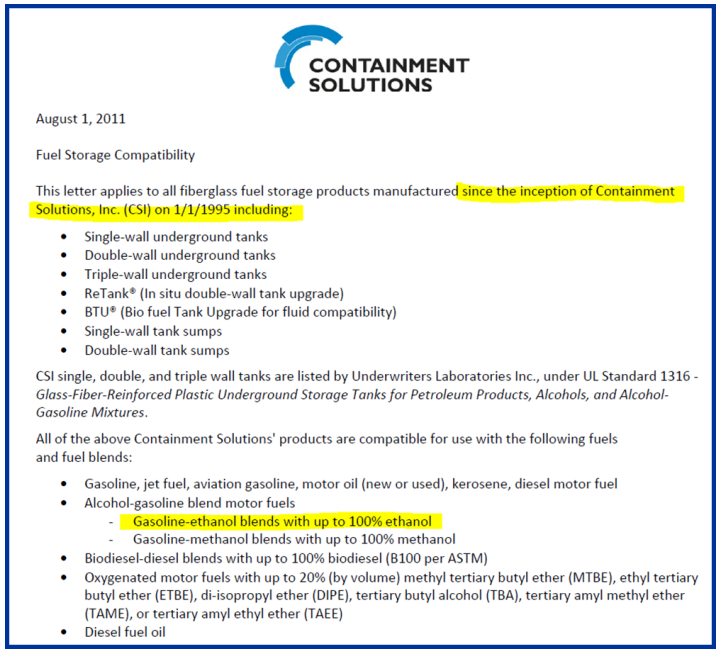
Single-Wall Tanks (SWT): No Owens Corning SWT was ever warranted or intended to store fuel with more than a 10% ethanol blend.

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.

Containment Solutions

- All tanks up to E100
- From 1995 onward



CONTAINMENT SOLUTIONS

August 1, 2011

Fuel Storage Compatibility

This letter applies to all fiberglass fuel storage products manufactured since the inception of Containment Solutions, Inc. (CSI) on 1/1/1995 including:

- Single-wall underground tanks
- Double-wall underground tanks
- Triple-wall underground tanks
- ReTank® (In situ double-wall tank upgrade)
- BTU® (Bio fuel Tank Upgrade for fluid compatibility)
- Single-wall tank sumps
- Double-wall tank sumps

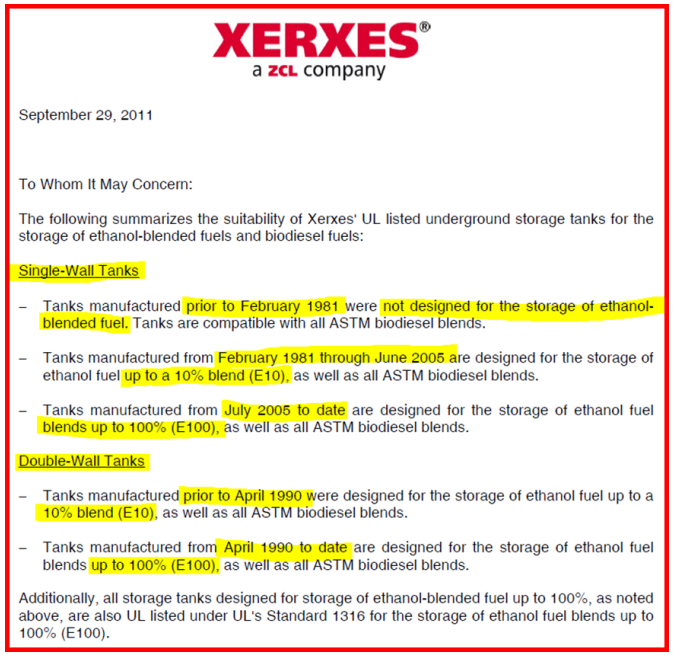
CSI single, double, and triple wall tanks are listed by Underwriters Laboratories Inc., under UL Standard 1316 - *Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures.*

All of the above Containment Solutions' products are compatible for use with the following fuels and fuel blends:

- Gasoline, jet fuel, aviation gasoline, motor oil (new or used), kerosene, diesel motor fuel
- Alcohol-gasoline blend motor fuels
  - Gasoline-ethanol blends with up to 100% ethanol
  - Gasoline-methanol blends with up to 100% methanol
- Biodiesel-diesel blends with up to 100% biodiesel (B100 per ASTM)
- Oxygenated motor fuels with up to 20% (by volume) methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), di-isopropyl ether (DIPE), tertiary butyl alcohol (TBA), tertiary amyl methyl ether (TAME), or tertiary amyl ethyl ether (TAEE)
- Diesel fuel oil

Xerxes

- SWF - Pre Feb. 1981: No ethanol
- SWF – Feb. 1981 – June 2005: E10
- SWF – After July 2005: E100
- DWF – Pre April 1990: E10
- DWF – After April 1990: E100



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).

Common Sense Tips for Maintaining Tanks

1. Store products that are compatible with UST materials.
2. Maintain and monitor leak detection and C.P. systems.
3. Inspect and verify overfill and spill prevention.
4. Cycle product through tank regularly (or keep tanks full).
5. Check equipment for signs of corrosion or degradation.
6. Keep out water, sediment, debris, sludge, microbes.
7. “Enhanced” water monitoring.
8. Use tank cleaning and biocides if/when necessary.
9. Consider other options for extreme humidity.
10. Inspections for “at-risk” tanks or planning purposes.

PUT THE INDUSTRY LEADER ON YOUR TEAM

Brad Hoffman

Bhoffman “At” Tanknology “Dot” com

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