Underground Storage Tanks: New Fuels and Compatibility

Biomass 2014

Demand—Developing Biomarkets

Fostering Technology Adoption I: Building the Market for Renewables with High Octane Fuels

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Storing High Octane Fuels in Underground Storage Tanks (USTs)

- Mid range E20-E30 high octane fuels being considered as possible path forward
- Storing high octane ethanol blended fuels will require careful consideration of material compatibility issues with existing infrastructure
- Outline:
  - 1. Ethanol blended fuels and compatibility with USTs
  - 2. Operator implications for those who would want to store E20-E30

The Underground Storage Tank Universe

- EPA: Protect Human Health and the Environment
- OUST: Protect environment and groundwater from contamination by leaking underground storage tanks
- UST universe includes 578,000 tanks

  OUST – End of FY 2013 Report (http://www.epa.gov/oust/cat/ca-13-34.pdf)

  - Mostly traditional automotive fuels, but also a range of other hazardous substances – E10 most common
  - 2,392 E85 stations at end of 2012 (DOE, Alternative Fuels Data Center)
  - E15 – approximately 78 stations in 12 states (Renewable Fuels Association, Jan.9, 2014)

Evolution of Automotive Fuels and the Impact on UST Systems

Ethanol — Petroleum + lead — MTBE — Ethanol — ???

1910 1920 1970 2000 2030

Basic Fuel Dispensing System has many parts

Equipment Legend

1. MPD
2. MPD sump
3. Shear valves
4. Seal
5. Product pipe
6. D/W tank with brine interstice
7. STP manhole
8. Sump lid
9. Tank sump
10 Tank sump mounting collar
11. Line leak detector
12 STP pump head
13. Sump leak detector
14. Ball valve
15. Manway lid
16. Flexible connector
17. Pump and motor
18. Tank bottom protector plate
19. Tank deadman
20. ATG (VeederRoot/Emco) Console
21. Tank level gauge
22. Tank level water float
23. Spill bucket with fill adapters
24. Drop tube
25. Vapor manhole with adapter
26. Extractor valve
27. Ball float valve
28. Vent Pressure/vacuum valve
29. Vent riser
30. Brine level sensor
31. Tank brine reservoir
32. Tank anchor strap

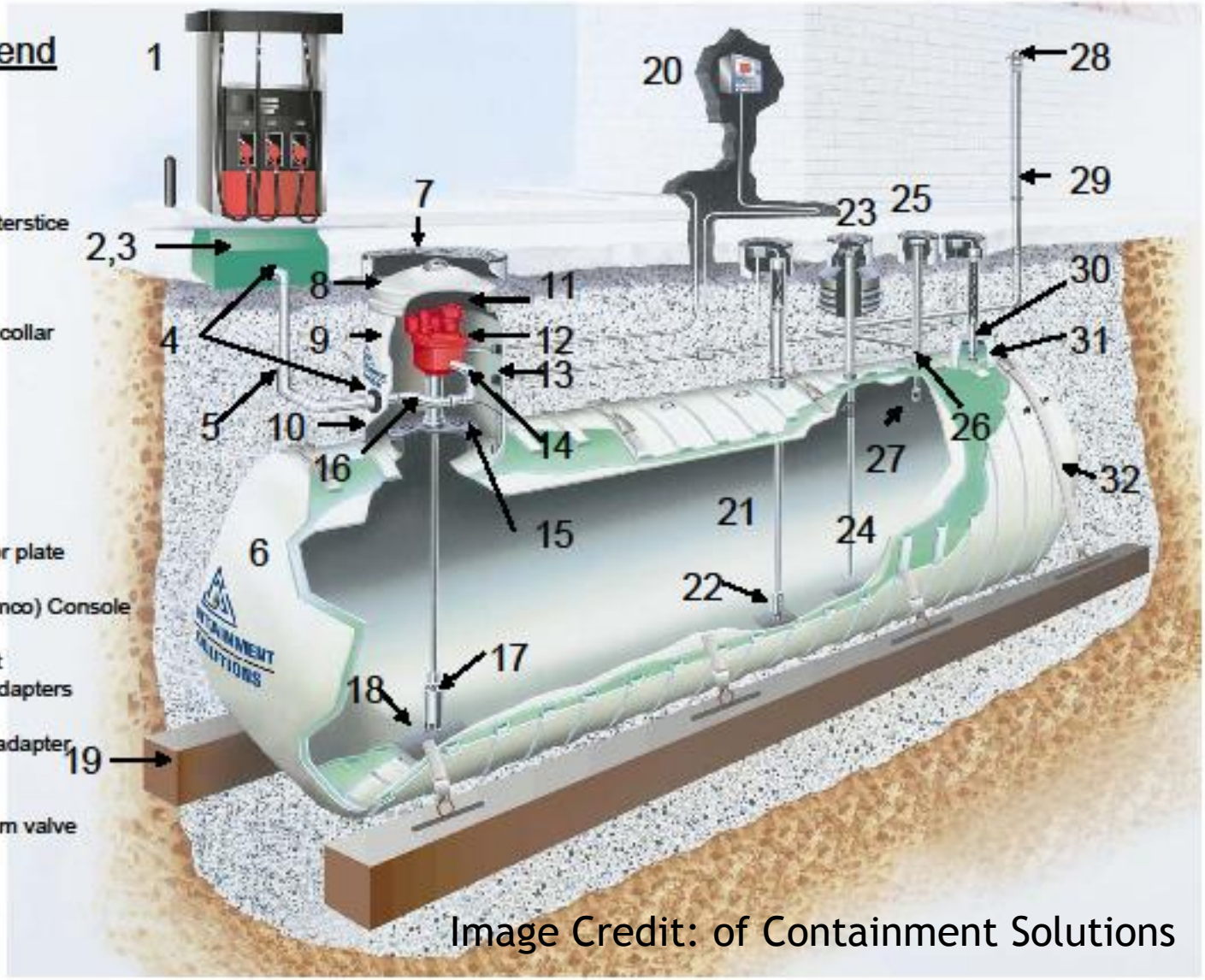


Image Credit: of Containment Solutions

1988 Regulatory Requirement

40 CFR §280.32 states,

"Owners and operators must use an UST system made of or lined with materials that are compatible with the substance stored in the UST system."

Key things to take note of:

- Our regs apply to the tank owner/operator
- Compatibility applies to the entire UST system
- It doesn't matter what the tank owner is storing – if it's a regulated UST, it has to be compatible with whatever is in the tank.

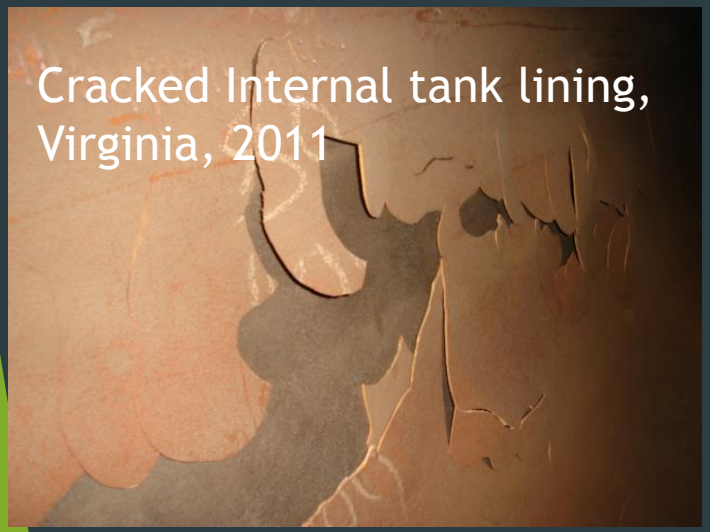
Are E20-E30 Blends Being Considered Going to be Compatible with USTs?

Ethanol blends in UST systems

- E10 is commonly stored nationwide
- Some materials used in UST systems can swell and soften in the presence of ethanol
- Ethanol blends in the E10 –E25 range may show most compatibility issues with non-metal materials

Oak Ridge study on Elastomers, Metals, and Sealants (March 2011)
Oak Ridge study on Plastic, Elastomeric, and Metallic Materials (May 2012)

Incompatibility Examples: Elongation, Delamination, Cracking



Corrosion in sumps of USTs containing ethanol blended fuels

- *www.epa.gov/nrmrl/gwerd/pubs/corrosion-in-stp-**sumps**.pdf*
- Known to be caused by ethanol vapors in the sump – not a compatibility problem, but owners should be aware of the issue
- No known leaks, but can become a servicing concern and possibly shorten the lifetime of metal materials
- Some coating treatments companies entering the market – not permanent, but results show slower corrosion

Corrosion on submersible pump head of an E10 tank in Florida

Challenge of Determining Compatibility with Existing UST Systems

- UST systems are a major investment
- Designed to last a long time underground– many tanks have 30 year warranties –
  - often put in before ethanol was commonly being used
- Majority of systems in the ground today are likely not 100% compatible with higher blends of ethanol

Example: Historical Timeline for Fiberglass Storage Tank Ethanol Compatibility

NOTE: Data reflects standard tank timelines—special tank products could at any time be requested by the customer and may have different warranty coverage.
Modified from Wisconsin Department of Commerce, Bureau of Storage Tank Regulation

Owens Corning (OC), Containment Solutions (CS) (formerly Fluid Containment)

Prior to Oct. 1980: No single or double wall tanks are warrantied for any alcohol or alcohol blended fuels.

Jul. 1984 to Jun. 1990: Single and double wall Owens Corning tanks are warrantied for alcohol blends up to 10% ethanol and up to 5% methanol.

Jan. 1995: Start of Containment Solutions. Both single and double wall tanks are warrantied for 100% alcohol.

1980 1983 1984 1987 1989 1990 1995 1996

† In 1995, CS purchased the assets of the OC Tank business. CS did not purchase the warranties or liabilities.

Oct. 1980 to Jun. 1984: Single wall Owens Corning tanks are warrantied for ethanol blends up to 10%.

May 1989 to Jan. 1995: Double wall Owens Corning tanks are warrantied for 100% alcohol.

Jul. 1983: UL 1316 1st edition 30-, 60-, 90-day immersion test @ 38C. No alcohol test fluids.

Jul. 1987: UL 1316 1st edition, revised 30-, 90-, 180-day test @ 38C, 3 options*:
* Petroleum only (no ethanol)
* Gasohol (up to 30% ethanol)
* Alcohol (up to 100% ethanol)

Apr 1996: UL 1316 2nd edition, revised
No change in ethanol test fluids

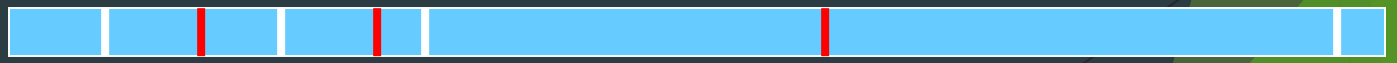
* Note: Manufacturer can choose one or more

Xerxes Corporation

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

Jul. 15 1985 to Jun. 1988: Single and double wall tanks are warrantied for alcohol blends up to 10% ethanol and up to 4.75% methanol.

After Jul. 2005: Both single and double wall tanks are warrantied for 100% alcohol.



1981 1983 1985 1987 1988 1996 2005

Feb. 1981 to Jul. 14, 1985: Single wall and double wall tanks are warrantied for ethanol blends up to 10%.

Jun. 1988 to Jul. 2005: Double wall tanks only are warrantied for 100% alcohol.

2011 Guidance

Guidance On Compatibility Of UST Systems
With Ethanol Blends Greater Than 10 Percent
And Biodiesel Blends Greater Than 20 Percent

Acceptable methods for owners and operators of UST systems to demonstrate compatibility under 40 CFR 280.32 are:

- Use components that are certified or listed by a nationally recognized, independent testing laboratory (for example, Underwriters Laboratories) for use with the fuel stored;
- Use components approved by the manufacturer to be compatible with the fuel stored. EPA considers acceptable forms of manufacturer approvals to:
    - Be in writing;
    - Indicate an affirmative statement of compatibility;
    - Specify the range of biofuel blends the component is compatible with; and
    - Be from the equipment manufacturer, not another entity (such as the installer or distributor); or
- Use another method determined by the implementing agency to sufficiently protect human health and the environment. EPA will work with states as they evaluate other acceptable methods.

Implications for Owners & Operators

- 2011 guidance incorporated into new rulemaking effort – proposed rule required owners to demonstrate compatibility for higher blend fuels
- May require targeted retrofits to upgrade some equipment to meet compatibility requirement in order to store ethanol blends greater than 10%

Conclusions

- Existing UST infrastructure currently not generally 100% compatible with higher ethanol blends
- Owners/operators will need to *demonstrate* systems storing greater than 10% ethanol are compatible in order to store them
- Research is ongoing – OUST is interested in solving compatibility challenges and working with stakeholders to make sure any fuels stored are done so safely

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For more information, please visit our webpage at:

http://epa.gov/oust/index.htm

Or our Biofuels Compendium at:

http://epa.gov/oust/altfuels/ethcompat.htm