Outline

1. History
2. Research Conducted
3. How does this affect you?
4. Moving Forward
Who and What is STI/SPFA?

• Association of 180 fabricating and affiliate companies of steel construction products – shop-fab tanks, field erect tanks, pipe, pressure vessels and other special fabricated products

• STI members build a significant majority of shop-fabricated underground and aboveground fuel storage tanks
What does Steel Tank Institute do?

• UST and AST tank technologies
• Industry standards, RP’s
• Quality control of tank fabricators who build tanks to STI specifications
• Information resource
  • TankTalk, Tank Mishaps
• Certification
History

• 2006 – ULSD
• 2007 – PEI forum
• 2008 – 2009 ASTM committees
• 2010 – Clean Diesel Fuel Alliance
History

• 2012 – Battelle Report
• 2015/2016 – EPA study and report
Problem exists!

STP column pipe inside FRP tank
In service less than one year
STP Column Pipe
Pump connection corroded thru
CDFA hires Battelle - 2012

- API
- Ford Motor Co.
- Railroads
- PEI
- NATSO
- PMAA and others
Battelle Investigation - 2012

• 6 FRP tanks
• Tank age: 4 - 14 years old
• Throughput: 6,500 gallons – 26,000 gallons
• Capacity: 6000 gallons to 17,265 gallons
Inspection Process
Vapor Sampling: SKC Tubes

• Tested for carboxylic acids and formic acid analysis by GC-MS (CAS Method 102)
Water Bottom Sampling

• ~1-2 Liters of water bottom sample/site
• Bottom sediment
• Consolidated from multiple risers
• Bacon Bomb triggered by bottom of tank
Inspection Process
Fuel Sampling

• 1 gallon of diesel sample/site
• Consolidated from multiple risers
• Bacon Bomb with string to trigger collection within fuel column
Inspection Process
Disassembled System

- Collected scrape, wipe, o-rings, and other corrosion samples
- Fouling investigation process by 2 labs
Site CA-3 (Feb 23)
Liquids and Vapor Summary

- Low biodiesel levels
- 3 fuels failing NACE ratings
- Sulfur content 5.9 – 7.7 ppm
- pH 3.5 to 5.3
  - 3 NACE failures had pH of 3.5 – 3.8
Liquids and Vapor Summary

- Trace amounts of ethanol at 4 sites
- Acetate (dominant acid) and formic acid detected in all water and vapor samples
- Glycolic and other acids found
- Acetobacter dominant organism found at 3 sites
Other elements found

• Significant levels of sodium and chlorides (4 of 6)
• Significant level of potassium (3 of 6)
• Significant level of magnesium (4 of 6)
• Others:
  • Methyl vinyl ketone, phthalate, glycol and dioxane
Conclusions of Battelle Report

Battelle hypothesize: Acetic acid was created by Acetobacter microorganisms and ethanol, thus causing the corrosion.
EPA Research - 2015

• Concern about possible releases
• Overfill limiters, automatic shut-offs and other
• Worked with CRC members to develop test plan
• Similar approach to first Battelle study
Changes from Battelle R&D

- 2007, RFS expanded
- EPA considered both in study, while not eliminating other possibilities
42 sites- 24 FRP, 18 STEEL
Diverse population

• AGE: 1 to 29 years
• CAPACITY: 5,000 – 20,000 gallons
• OWNERS: Gov’t, retail and fleet
• NUMBER SITES OWNED: One to multiple
Vapor Testing

- Acids, humidity
Fuel Testing

- Water content
- Acids
- Particulates
- Biofuel
- Conductivity
- Corrosion Rating
- Chromatography
Water Bottom Testing

- Water bottoms tested for:
  - ethanol,
  - methanol,
  - glycerin
  - acids,
  - cations
  - pH level
Equipment Analysis

• If equipment was removed, it was visually examined and photographed
• Pristine condition!
What did they find?

• EPA Report issued, June 2016
• Acids: formic, acetic, propionic and lactic
• Methanol, ethanol and glycerol
• Humidity levels relatively high – average 68%
• Failed NACE ratings on percentage of fuels
• Gasoline
What did they find?

- **Minimal** Corrosion Category:
  - Steel: 3
  - Fiberglass: 4

- **Moderate** Corrosion Category:
  - Steel: 8
  - Fiberglass: 9

- **Severe** Corrosion Category:
  - Steel: 7
  - Fiberglass: 11
What did they find?

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Fiberglass tank photos
How Does This Affect You?

• Documented cases have only occurred in USTs dispensing fuel
• Few stories of cases involving shop-fab ASTs
• A few concerns in terminal tanks
Heating Oil Tanks?

Biggest known problem in heating oil tanks is microbiologically influenced corrosion in tank bottoms, which is treatable.
Steps Forward

• CRC – Coordinating Research Council
• A research group composed mainly of major oils and automotive industry.
• Instead of more field tests, CRC is planning to conduct lab tests to help eliminate variables.
Lab Test – Isolate Variables

- Corrosion inhibitors
- Oxygen levels
- Humidity
- Water absorption

- Temperature
- Fungi
- Bacteria
- Biocides
Corrosion Continues...

2015 Photos
Preventive Maintenance Guide for Diesel Storage and Dispensing Systems

This guide provides practical tips for maintaining underground storage tanks (USTs), minimizing fuel contamination and maximizing fuel system cleanliness necessary for diesel equipment. Adopting these guidelines can help improve fuel quality, prolong equipment life, reduce corrosion and owner’s operating expenses. All suggestions below should be performed in a safe, legal and environmentally sensitive manner.

Good water management eliminates most fuel quality problems:

Keep water from entering tanks to minimize tank water bottoms:

No detectable water is desirable and if found should be removed as soon as possible. Test removed water for microbes. If detected, take appropriate corrective action. If biocide is used, expect more frequent filter changes for a brief period.
Inspection and Maintenance

STI R111, Storage Tank Maintenance & PEI RP 900

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