UST Inspector Training Webinar Series

Emerging Fuels
8/26/2019

Moderated by James Plummer
Environmental Analyst, NEIWPCC
jplummer@neiwpcc.org
Today’s Speakers

Ryan Haerer
Program Analyst, U.S. EPA, Office of Underground Storage Tanks

Doug Hansen
UST Compliance Manager, Utah Department of Environmental Quality

Ted Unkles
UST Program Coordinator, Vermont Department of Environmental Conservation

Chris Marks, Ph.D.
Associate Environmental Scientist, Arizona Department of Environmental Quality - UST Program

Tara Rosie
Principal Scientist, Arizona Department of Environmental Quality - UST Program
Emerging Fuels

UST Inspector Training Webinar
Presented by:
The New England Water Pollution Control Commission, and
The ASTSWMO Emerging Fuels Task Force
Renewable Fuel Standard

- Signed into law by president Bush as part of the Energy Act of 2005
- Required 4 billion gallons of renewable fuel be added to our fuel supply in 2006, ramping up to 9 billion gallons in 2008, and 36 billion gallons in 2022.
What’s an “Emerging Fuel”? 

• Any conventional fuel that has been blended with a renewable fuel (e.g. gasoline-ethanol mixtures & biodiesel blends) 

• Any conventional fuel that has had its formulation significantly changed recently (e.g. ultra-low sulfur diesel).
Problems with new fuel formulations

- Ethanol reacts with oxygen to form acetic acid (same reaction that turns wine into vinegar)
- ULSD – severe corrosion in the ullage portion of tanks
- Biodiesel – oxidizes readily creating aldehydes, alcohols, and organic acids.
- MIC – Microbially-induced corrosion
Diesel – corrosion

- Impacts UST functionality of equipment
- Could lead to releases through direct corrosion
- Impact engine functionality (vehicles and emergency generators)
Ethanol corrosion

- sump corrosion in E-10 gasoline
EPA and state UST Regs require that all UST components be compatible with the fuels they store.

But they do not require compatibility with the decomposition products.

- Organic acids are causing severe corrosion with steel and brass components
- Filters in dispensers have been clogged with glass fibers from FRP tanks – what is causing the fiberglass resins to break down?
What’s next with emerging fuels?

- As yet, we have not seen major releases stemming from corrosion and system failure caused by these new fuel formulations.

- BUT – the tsunami might be coming, just over the horizon.

- UST regulators, cleanup professionals, tank owners & operators, and UST contractors need to understand how new fuel formulations affect components that were not designed to come in contact with decomposition products from these new fuels.
What’s being done?

- We need more and better data on what’s going on with these new fuel formulations. The ASTSWMO Emerging Fuels Task Force has constructed some tools for reporting findings, as well as tracking compatibility.
  - Corrosion Observations Tool
  - Compatibility Tool
Thank You

- Ted Unkles
- Vermont Dep’t of Environmental Conservation
- UST Program
- ted.unkles@vermont.gov
- 802-522-0488
Federal Regulations on Corrosion and Compatibility
The Changing Fuel Chemistry Landscape

Renewable Fuel Standard (2005, 2007) mandates increasing annual minimum volumes to attain 36 billion gallons of biofuel annually by 2022.1,2

**Gasoline**
- Ethanol replacement of MTBE as fuel oxygenate (2002)
- Increasing fuel ethanol use
- E10 ethanol blend wall
- E15 allowed for year-round sale by recent EPA regulatory changes

**Diesel**
- Ultra-low Sulfur Diesel (15 ppm S) mandated by EPA beginning 20063
- Increased biodiesel blending
- B5 Biodiesel blend wall

**Slide credit goes to Tara Rosie, Chris Marks of AZ DEQ and the good people of Arizona.**

Incompatibility in UST Systems

- Delamination
- Discoloration
- Softening
- Swelling
- Elongation ("creep")
- Fiberglass Tank Walls
Federal Compatibility Requirements

UST system must be compatible with substance stored. (1988)

Biofuels (2015)
- Notify
- Demonstrate
- Keep Records
Compatibility and Biofuels –
When do I need to follow the additional federal regulations?

• **Notification** - Owners and operators must notify the implementing agency at least 30 days before switching to a regulated substance containing greater than 10 percent ethanol, 20 percent biodiesel, or any other regulated substance identified by the implementing agency

• **Demonstration of compatibility** – Owners and operators must
  • demonstrate compatibility of the UST system through a nationally recognized testing lab listing or manufacturer approval of UST equipment or components, or
  • use an alternative option identified by the implementing agency that is no less protective than demonstrating compatibility of the UST system

• **Recordkeeping** - Owners and operators must maintain records for as long as the biofuel blend is stored to demonstrate compliance
Biofuels: Demonstrate Compatibility For:

- Tanks
- Piping
- Containment sumps
- Pumping equipment
- Release detection equipment
- Spill equipment
- Overfill equipment
Examples for Demonstrating Compatibility

Independent Laboratory Certification or Listing for Use with the Substance

Affirmative Statement of Compatibility from Manufacturer
## Demonstrating Compatibility

### Sample Checklist for Determining and Documenting UST System Compatibility

**Instructions:** Complete all sections. This will help ensure you have the required information to demonstrate compatibility of an UST system with biofuels containing more than 10 percent ethanol or more than 20 percent biodiesel.

<table>
<thead>
<tr>
<th>Facility Owner:</th>
<th>Facility Name:</th>
<th>Facility's Street Address, City, State, Zip Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Number:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UST System Identifier:</th>
<th>Type and Blend Of Regulated Substance:</th>
<th>UST Capacity In Gallons:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the checklist below, listing compatibility determination, method*, and description. All answers must be Yes and supported with a sufficient description and documentation for your system to be demonstrated compatible with the biofuel.

<table>
<thead>
<tr>
<th>UST System Components</th>
<th>Documentation Demonstrating Compatibility With The Substance Listed Above?</th>
<th>Method A Or B*</th>
<th>Description Of Component Type, Model Number, And National Laboratory Certification, Listing Or Manufacturer Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Piping</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Containment Sumps</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Pumping Equipment</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

### 1. Determine component:
- manufacturer
- model number

### 2. Find certification, listing, or manufacturer statement of approval for use with the fuel you wish to store
Demonstrating Compatibility with Biofuels

BE
All Components, All Fuels

SHOW
Biofuels containing more than 10% ethanol, more than 20% biodiesel

A list of components.
Pipe Dope and Sealants

- Must be compatible
- Multiple versions available
- High ethanol compatible first came out around 2007
- Many pipe dope connections underground
Pipe dope, thread sealant is used with threaded ends to make threaded joints leak proof and pressure tight.

Diagram courtesy of Jeff Dzierzanowki, SOURCE Fueling Equipment Solutions
ASTSMWO Degradation Reporting Tool

http://astswmo.org/astswmo-corrosion-observations-tool/

Our Mission: 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.
Thank you!

Ryan Haerer
Release Prevention Division

202-564-0762
Haerer.ryan@epa.gov

EPA Office of Underground Storage Tanks
https://www.epa.gov/ust/emerging-fuels-and-underground-storage-tanks-usts
Arizona UST Infrastructure Assessment: Preliminary Findings & Ongoing Studies

Chris Marks Ph.D., Tiffany Yee, and Tara Rosie
Arizona Dept. of Environmental Quality
NEIWPCC UST Inspector Training Webinar Series
August 26, 2019
Increasing Awareness of UST Internal Corrosion Issues

- 2010: PEI survey documented 42% respondents reporting increased equipment issues relating to ULSD\(^1\)
- 2012: CDFA study identified microbiologically-influenced corrosion (MIC) as primary corrosion mechanism\(^2\)
- 2016: EPA study identified widespread internal corrosion issues in diesel USTs using the CRC corrosion rating system\(^3\)

Figure reproduced and photos from EPA 510-R-16-001
**ADEQ Study:**

- Evaluating internal corrosion on UST surfaces and internal infrastructure across:
  - Diesel and gasoline storing systems
  - Steel and FRP tanks
- Data Collected
  - Internal visual inspection by video
  - Ullage temperature and % relative humidity
  - Water presence testing
  - Laboratory analyses of water bottoms and fuel samples
- Currently 5,736 open USTs in AZ
- 78 school tanks studied/rated to date
- Geographically distributed across the state
Tank Rating: A  (CRC Rating: Minimal)

**No Issues:** no visual cracking, degradation, deformation, or discoloration.
**Tank Rating: B (CRC Rating: Minimal)**

**Minimal - Moderate Issues:** minor flaking/blistering, deformation, discoloration, or oxidation. Ideally <5% of the tank surfaces exhibit signs of degradation.

Tank Age: 26 yrs

Tank Age: 30 yrs
Tank Rating: C  (CRC Rating: Moderate)

**Moderate - Major Issues:** heavy flaking, blistering, corrosion, deformation, or minor cracks. Signs of degradation, stress and/or structural integrity has been affected. Ideally <50% of the tank surfaces exhibit signs of degradation. Investigation is warranted.
Tank Rating: D  (CRC Rating: Severe)

**Severe Issues:** severe cracks or evidence of fuel egress/water ingress, heavy degradation observed >50% of tank surfaces. Timely investigation is warranted.
Results:

- ~71% agreement between ADEQ and CRC Corrosion Rating Systems
- Moderate – Severe issues found in ~30% of surveyed tanks (n = 78)
- Tank age is not predictive of corrosion rating
**Preliminary Results**

**Results:**
- Moderate – Severe issues in both diesel and gasoline storing USTs.
- Internal corrosion issues observed in both of the major tank material categories.
- Study ongoing to increase sample size within categories. Currently data density insufficient to draw definitive trend distinctions between tank ratings and fuel type or UST material categories.

![ADEQ Corrosion Rating Proportions by Fuel Type](chart1)

![ADEQ Corrosion Rating Proportions by Tank Material](chart2)
Preliminary Results

Results:
- Ambient relative humidity has a strong influence on tank uillage relative humidity. EPA study surveyed geographically-diverse sites across US.
- Relative humidity in the tank uillage shows no or only a weak positive correlation with tank corrosion rating (Spearman’s Rho: ADEQ -0.07, EPA 0.13).
- Tank relative humidity cannot be used as predictive for internal tank corrosion status.
Key Preliminary Findings

- **Corrosion of UST internal infrastructure is widespread and common:**
  - 99% of tanks studied exhibited some evidence of degradation with ~30% classified as moderate to severe
  - Observed in both diesel and gasoline systems
  - Steel and fiberglass tanks are susceptible to severe deterioration.
  - Expands upon EPA & CDFA findings to show corrosion/degradation on tank walls in addition to internal infrastructure (e.g. floats, bungs, risers, etc.)

- **Microbiologically-influenced Corrosion (MIC) is a complex process**
  - Median tank age is not significantly different between corrosion ratings, but within group sample sizes are still too small for definitive statement.
  - No single variable has been identified as statistically predictive of tank corrosion status, in agreement with EPA study of 28 potential predictor variables.

- **ADEQ study is ongoing and similar investigations are recommended for other tank community members**
Christopher Marks, Ph.D.
Marks.Christopher@azdeq.gov
(602) 771-0561
https://azdeq.gov/USTProgram

References:
ASTSWMO Emerging Fuels Tools

Doug Hansen, Utah DEQ
Emerging Fuels Task Force

- Tanks Subcommittee
- Makeup
  - State and Territory representatives from each EPA Region
- Purpose
  - “assist the States’ and Territories’ UST programs by providing resources and information related to managing the storage and releases of new fuels that are in use or in development.”
Available Tools

- ASTSWMO Corrosion Observations Tool
- ASTSWMO Compatibility Tool
- http://astswmo.org/emerging-fuels-resources/
Emerging Fuels Resources

This webpage provides resources developed by the ASTSWMO Emerging Fuels Task Force and others to assist State underground storage tank programs.

**ASTSWMO Corrosion Observations Tool**
ASTSWMO's Emerging Fuels Task Force created this tool for the purpose of submitting information on UST system corrosion observed during inspections and removals in the field. We hope UST regulators, inspectors, contractors, and owners will use this Corrosion Tool to report incidences of corrosion. Our goal is that assembling all this data will help identify trends, and especially we hope this tool will help identify potential problems before they become widespread.

**ASTSWMO Compatibility Tool**
ASTSWMO's Emerging Fuels Task Force created this tool to assist users in identifying UST system components that are compatible with specific motor fuels and biofuel blends containing greater than 10 percent ethanol and diesel containing greater than 20 percent biodiesel. The majority of the information included comes directly from equipment manufacturers and ASTSWMO is not responsible for the accuracy or completeness of any information provided by other parties.
Corrosion Observations Tool

• Purpose and Uses
  • Reporting corrosion incidents observed during inspections
  • Providing data to highlight trends and identify possible research opportunities
  • Creating a repository of information that can be used for training
  • Preventing corrosion related releases from UST systems
http://astswmo.org/astswmo-corrosion-observations-tool/

ASTSWMO Corrosion Observations Tool

ASTSWMO’s Emerging Fuels Task Force created this tool for the purpose of submitting information on UST system corrosion observed during inspections and removals in the field. It is well known that some new fuel formulations are associated with accelerated corrosion, clogged filters, and other side effects. As yet however, we do not have a complete understanding of how widespread these issues are, nor do we know if these issues are leading to increases in releases from UST systems.

We hope UST regulators, inspectors, contractors, and owners will use this Corrosion Toolkit to report incidences of corrosion. Our goal is that assembling all this data will help identify trends, and especially we hope this toolkit will help identify potential problems before they become widespread.

The tool kit has been designed to be intuitive. Please enter all relevant data in the appropriate spaces. If you find a question to be unclear or confusing, please let us know. The Emerging Fuels Task Force will continue to refine this tool kit to be as useful and user-friendly as possible.

Please be aware that all information submitted may be shared on the ASTSWMO website and will be accessible to the public.

Your Information

Your Name*

Agency/Organization*
Sharing Observations

- Your information
  - Name
  - Agency
  - Email
• Facility/System Information
  • Location
    • City and State only
  • Affected component and degree of corrosion
    • Tank or tank lining
    • Submersible turbine pump area
    • Drop tube or overfill prevention device
    • Automatic tank gauge components
    • Flex connectors
    • Other connection points
What equipment was corroded and how severe? Use the example photos below to help with your response.

Low to Moderate

Significant

Severe

Tank or tank lining

Submersible turbine pump area

Drop tube or overfill prevention device

Automatic tank gauge components

Flexible connectors

Other connection Points
• Facility/System Information (cont.)
  • Estimated age of component
    • < 5 years, 5-10 years, 11-20 years, 21-30 years, > 30 years, or unknown
  • Was there a release from the component
    • Yes/No
  • Fuel being stored
    • Gasoline up to 10% ethanol (E0 to E10)
    • Gasoline with greater than 10% (eg E15+)
    • Ultra Low Sulfur Diesel (ULSD)
    • Biodiesel or ULSD with more than 5% biodiesel
    • Other (with comment field)
• Facility/System Information (cont.)
  • Identify any corrosion protection in place prior to observation
  • How was corrosion discovered?
    • Visual Observation
    • Clogged fuel filters
    • Inoperable equipment
    • Other (with comment)
Photo (or Document) Upload

Additional Information

Narrative Description of Issue, including any findings and resolutions:

Upload any pictures or public file information you would like to share with ASTSWMO. Accepts pdf, jpg, png, and gif formats.

Choose File

[No file chosen]

[captcha]

SEND
ASTSWMO Corrosion Observations

ASTSWMO's Emerging Fuels Task Force created the Corrosion Observations Tool for the purpose of submitting information on UST system corrosion observed during inspections and removals in the field. It is well known that some new fuel formulations are associated with accelerated corrosion, clogged filters, and other side effects; however, we do not have a complete understanding of how widespread these issues are, nor do we know if these issues are leading to increases in releases from UST systems.

We encourage UST regulators, inspectors, contractors, and owners to use the Corrosion Observations Tool to report incidences of corrosion. Our goal is that assembling all this data will help identify trends; and especially we hope this toolkit will help identify potential problems before they become widespread.

Click here to access the Corrosion Observations Tool.

The map below provides corrosion observation reports that have been submitted to ASTSWMO using the tool.

How to use

Simply click any blue state to read corrosion observation reports that have been submitted to ASTSWMO. Red states have no reports available yet. If you'd like to contribute to this tool please click on the link to the Tool above or contact the ASTSWMO staff.
ASTSWMO Corrosion Observations

ASTSWMO’s Emerging Fuels Task Force created the Corrosion Observations Tool for the purpose of submitting information on UST system corrosion observed during inspections and removals in the field. It is well known that some new fuel formulations are associated with accelerated corrosion, clogged filters, and other side effects; however, we do not have a complete understanding of how widespread these issues are, nor do we know if these issues are leading to increases in releases from UST systems.

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Click here to access the Corrosion Observations Tool

The map below provides corrosion observation reports that have been submitted to ASTSWMO using the tool.
From: Michael Hollis
Organization: NJDEP

Corrosion Location: Holmdel, NJ

Corroded Equipment:
Tank or tank lining:
Submersible turbine pump area: Severe Corrosion
Drop tube or overfill prevention device:
Automatic tank gage components:
Flexible connectors:
Other connection points:

Component age: 21-30 years
Was there a release: No

Fuel Type: Gasoline with up to 10% ethanol (E0 to E10)
Fuel Type Other:

Corrosion Protection: No
Protection Description:

Corrosion Discussed By: Visual Observation
Other Method:

Additional Information:

PHOTO:
• Compatibility Requirements
  • 40CFR 280.32 (b): notify when switching to a “regulated substance containing greater than 10 percent ethanol, greater than 20 percent biodiesel, or any other regulated substance identified by the implementing agency.”
  • 40CFR 280.32 (b)(1): Demonstrate compatibility
    • Certification or listing by independent test lab
    • Written manufacturer approval
    • Implementing agency approval
Purpose of Tool

- Provide access to compatibility documentation to meet requirements
  - UST operators
  - Inspectors
- Provide manufacturers an avenue to share information
Searching by Fuel Type

- Select Diesel blends >B20 or Ethanol blends >E10

- Select component
  - UST or lining
  - Piping
  - Flex connectors
  - Line leak detectors
  - STPs and components
  - Containment
  - Spill/Overfill prevention

- Drop tubes
  - Fill and riser caps
  - Floats, sensors, probes
  - Sealants
  - Shear Valves
  - Hanging hardware
  - Dispensers
Kungsör, Sweden 2011-09-28

Bio-fuel compatibility statement

This letter is to confirm the compatibility of KPS Petrol Pipe System™ products with alternative fuels such as Alcohol Blended Fuels and Biodiesel.

KPS Petrol Pipe System™ manufactures the following products:
- Double wall conductive plastic pipes
- Single wall conductive plastic pipes
- Flexible connectors
- Fuel storage, genital, couplings and entry boots
- Containerment supra
- Leak detection units for lifting and refueling

All of the above products are suitable for use with all fuel blends meeting ASTM standards, including alcohol-blended from E3 to E100, methanol blends from M5 to M100 and biodiesel blends from B2 to B100. Testing has been done proving compatibility of materials by ERA Technology Ltd and Underwriters Laboratories Inc., as well as by our own in-house testing facility.

Please visit www.kpsystem.com for all information on bio-fuels, testing, training and production of a fully bio-fuel compatible system.

For all questions and information please contact:

Mr Mats Sundberg
KPS Petrol Pipe System™
Kungsör AB
Box 70, Färingsgatan 3
SE-756 36 Kungsör
Sweden
Tel: +46 (0)227 422 00

Mats Sundberg
Technical Director
Search by Manufacturer

- Select manufacturer from the dropdown and submit

Review Compatible UST System Components by Manufacturer (Under Construction)

Manufacturer (Select 1)

Bravo Systems  Submit

Results:

- Bravo Systems: Fittings
- Bravo Systems: Sumps
RE: Bravo Fiberglass Entry Fittings and Alternative fuels

This letter is to certify the compatibility of Bravo (S. Bravo Systems, Inc.) Single and Double Wall Fiberglass Sump Entry Fittings with Alternative Fuels such as Biodiesel and Ethanol Blended fuels. It also addresses compatibility with DEF Diesel Exhaust Fluid.

Bravo Fiberglass Fittings are engineered with the same UL Listed materials used in the manufacture and certification of fiberglass Tanks, matching the UL Standard 1316. Since our Fiberglass Fittings are Built like a Tank, they can withstand continuous fuel exposure to, or submersion in Biodiesel, Ethanol and Alcohol Blends without failure.

All Fiberglass Fittings designed for DoubleWall Sumps are engineered to be fully compliant with the California State Water Resource Control Board Assembly Bill AB-2481 for DoubleWall Sumps and Continuous Monitoring Systems.

The following Single and Double Wall Fiberglass Fittings manufactured by Bravo in Commerce, California are compatible with Biodiesel and Ethanol fuel blends up to B100 and E100, respectively.

- F-Series “Full Body” Fiberglass Fittings.
- FF-Series “Flange” Fiberglass Fittings.
- FPE-Series Fiberglass Fittings for Flexible pipe.
- FLX-Series Fiberglass Split Retrofit Fittings for Flexible tube.
- FR-Series Fiberglass Split Test Reducers.
- F-Series Retrofit-3 & 3-QTAB Fiberglass Split Retrofit Fittings.
- F-Series D-BLR-8 & D-NNR-8 Fiberglass Split Retrofit Fittings.
- TBF-Series Fiberglass Tank Bung Fittings.

Bravo also certifies that these products are compatible with and approved for use in secondary containing NFPA (National Fire Protection Association) requirements.

Each respective Series may be UL Listed in addition to being manufactured of UL recognized materials approved for use in the manufacture of fiberglass UST tanks. Any other relevant documentation will be located in the documents area of each product’s respective webpage.

Please feel free to contact us with any questions you may have at 1-800-AT-BRAVO.

Additionally, you may find further information at www.sbravo.com.

Sincerely,

Jonathan E. Smith
Director of Brand Management
S. Bravo Systems, Inc.
Submit New or Updated Data

<table>
<thead>
<tr>
<th>Submit New or Update Current Data in Tool.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the form below to provide new documentation for inclusion into this tool, update current information, or if you observed errors.</td>
</tr>
<tr>
<td>Your Name</td>
</tr>
<tr>
<td>Agency Organization</td>
</tr>
<tr>
<td>Email</td>
</tr>
<tr>
<td>Description of your submission (if new documentation provide manufacturer, UST system component(s), and fuel type(s))</td>
</tr>
<tr>
<td>Upload Document (PDF only)</td>
</tr>
<tr>
<td>Choose File</td>
</tr>
</tbody>
</table>
ASTSWMO State Compatibility Compendium

The ASTSWMO Emerging Fuels Task Force developed a survey in 2014 to understand existing UST infrastructure, develop a compendium for State policies and activities specific to biofuels and other emerging fuel types and to help provide a framework for identifying similarities and differences between State programs. If your State has updates to the data in the compendium, please send them to ASTSWMO staff or the Emerging Fuels Task Force representative for your region.

Click here for a full screen version of the Compendium

As would be expected the number of UST facilities correlate well with population density. UST infrastructure across the country is aging. Based on the 26 states at provided UST age information, the average UST age is around 21 years and in some states the average UST age is approaching 30 years.

Average Age
- Average Year
  - > 24
  - > 20 to 24
  - < 20
  - No Answer
Final Thoughts

- Update Compatibility Compendium
- Please submit corrosion observations
- Share the Compatibility Tool with stakeholders
- Provide feedback to ASTSWMO on both tools
- Be part of the dialogue
Thank You, Speakers!

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