National Tanks Conference 2018

UST Corrosion

Problems and Solutions

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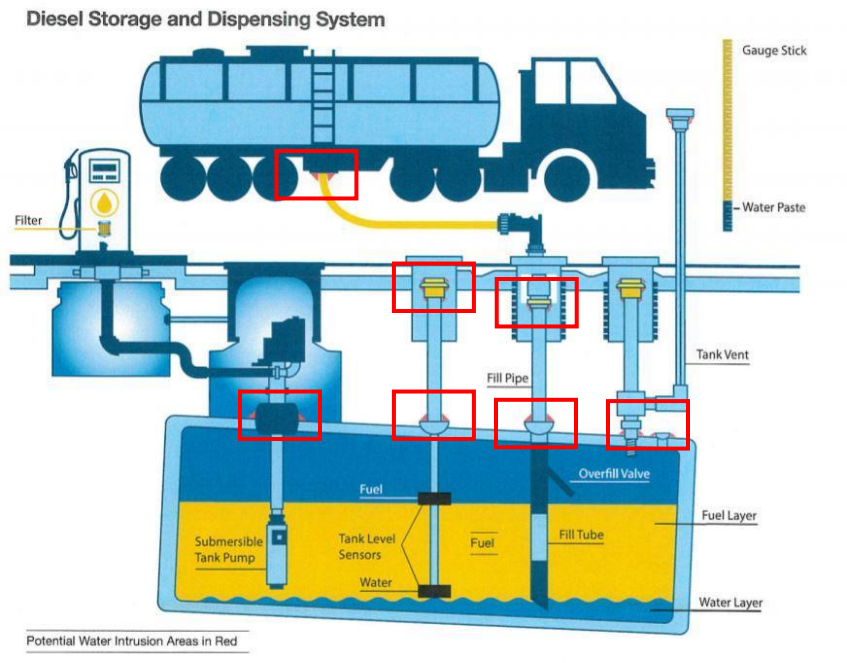
chemistry matters

Underground Storage Tank Corrosion
- Root Cause: Water Ingress



- Water Contamination Points
  - Tank Vent
  - Fill Pipe
  - Access Points
  - Truck Transport
  - Man Entry Cover
  - Tank Breathing
- Preventive Measures
  - Check seals and gaskets
  - Ensure caps are properly sealed
  - Install desiccant vents caps

https://www.cdfa.ca.gov/dms/programs/petroleum/CRC_DieselStorageSystem.pdf

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Underground Storage Tank Corrosion
- Root Cause: Microbial Contamination

- Microbial Contamination
  - Presence of water is required, diesel fuel is food source
  - Microbes can produce mild to strong acids that can lead to corrosion and degraded fuel quality
  - Can generate biosurfactants leading to inverse emulsions
- Filter Plugging
  - Microbial influence corrosion leads to particulate generation, plugged filters

https://crcao.org/reports/recentstudies2014/CRC%20667/CRC%20667.pdf

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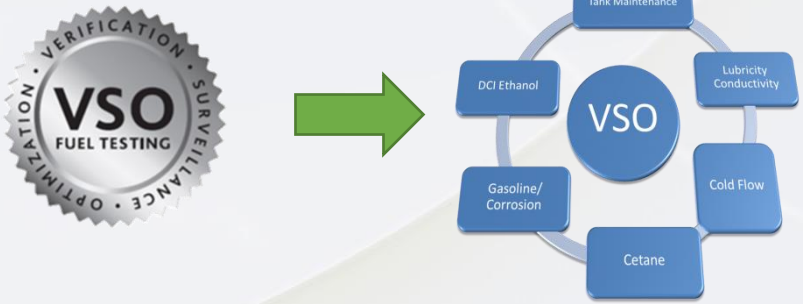
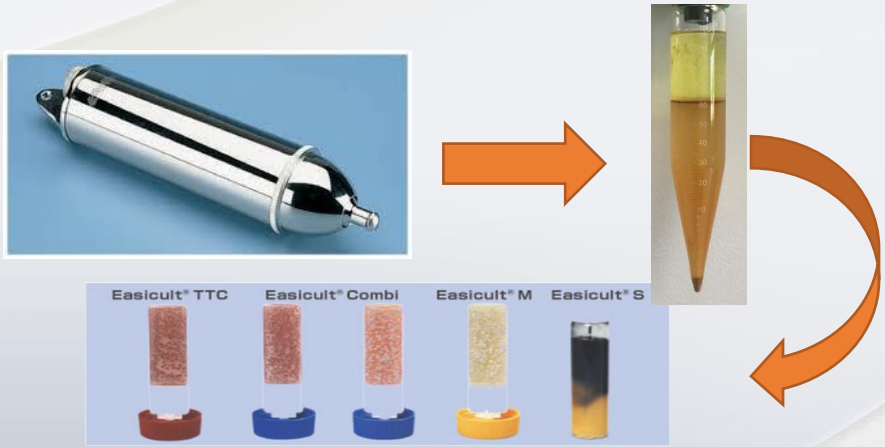
Underground Storage Tank Corrosion
- Solution: Create a Tank Maintenance/Housekeeping Program





- Tank Maintenance Program
  - Partner with a company that provides existing means of evaluating system
  - Program should include
    - Site Responsibilities
      - Fuel offloading inspection (white bucket)
      - Monthly/Quarterly Sampling
      - Equipment inspection
      - Desiccant filters
      - Dispenser filter inspection
    - 3rd Party Responsibilities
      - Sample Testing (BS&W, Microbial)
      - Filter Analysis (Foreign material, short life)

Koehler Instruments – Fischer Scientific
LifeSign – Easicult Microbial Test Kit

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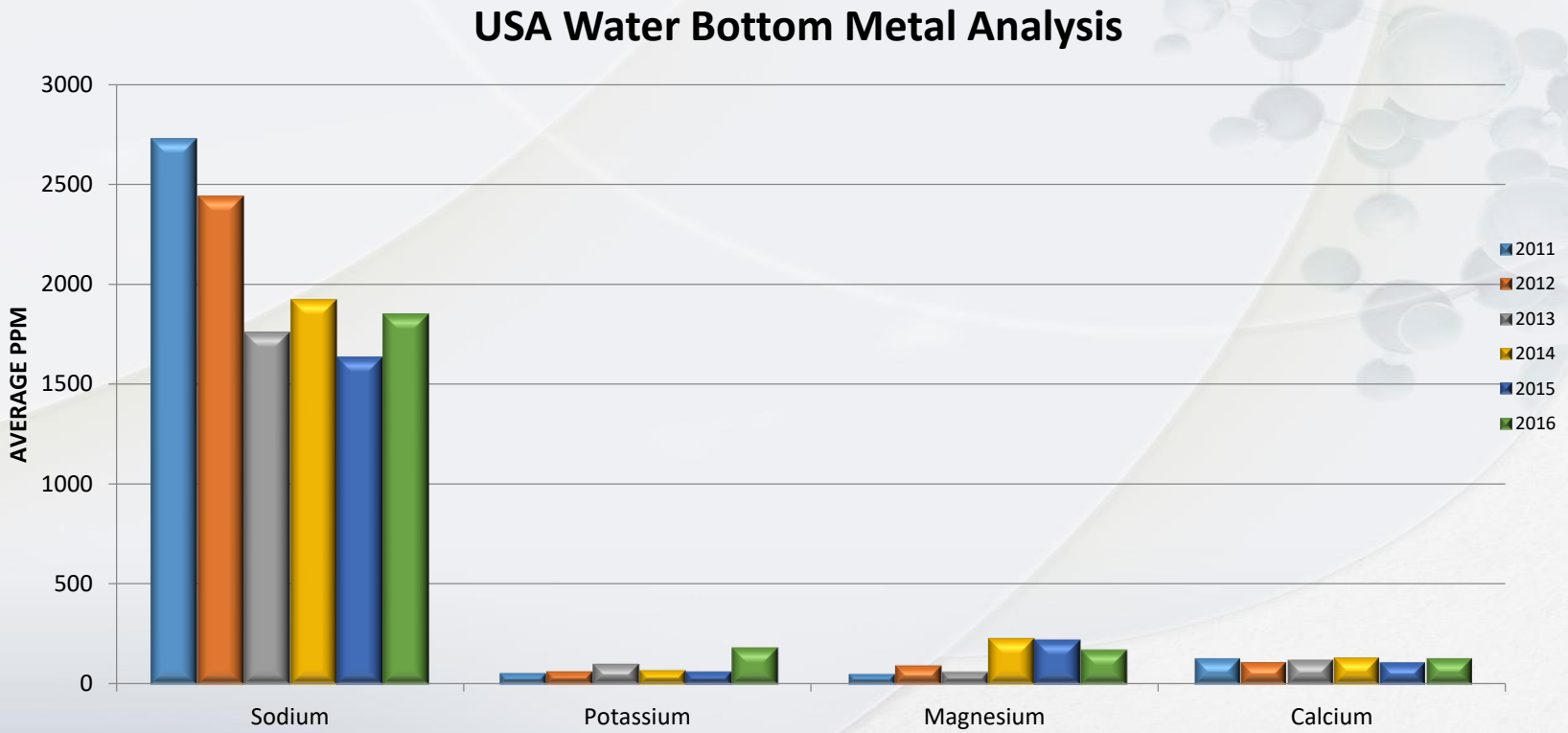
2018 VSO BOTTOM TESTING

- 3855 Bottom Samples Analyzed across 48 Contiguous States
- BS&W Testing
  - 3117 samples showed signs of BS&W
  - 2176 samples passed D975
  - **892 samples Failed D975 (>0.05%)**
  - **417 samples >1% BS&W**
- Microbial Testing
  - **20% of all samples test positive for microbial contamination (771)**
  - Anaerobic – 183 positive tests
  - Aerobic Bacteria – 636 positive tests
  - Aerobic Yeast – 287 positive tests
  - Aerobic Fungi – 171 positive tests
  - 21% show heavy contamination

2018 BOTTOM SAMPLE METAL ANALYSIS



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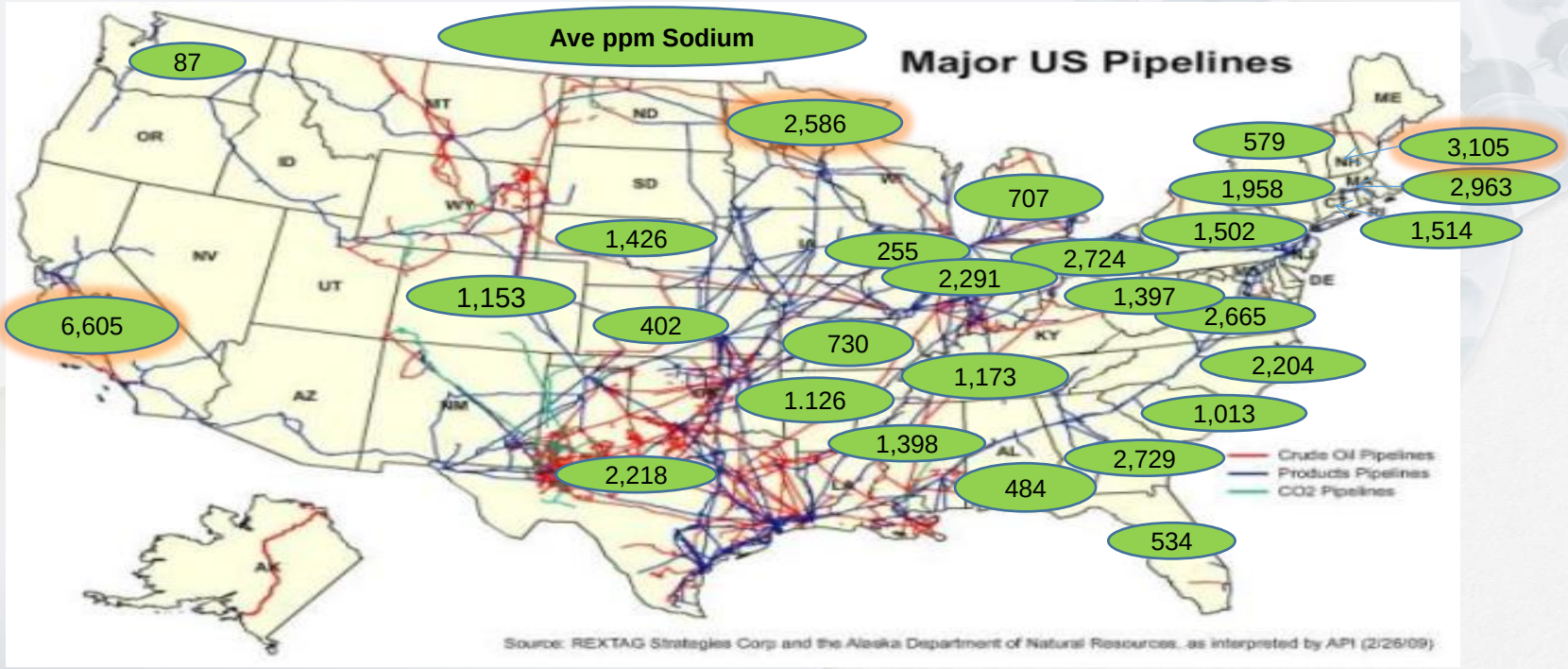
SODIUM CONTENT BY STATE



297 Tank Water Bottoms Across 38 States

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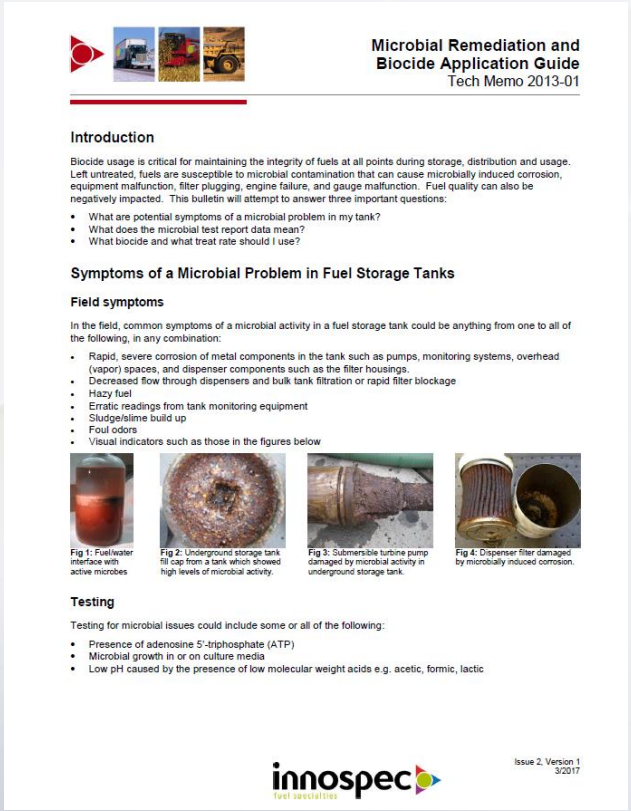
Underground Storage Tank Corrosion
- Solution: Deploy Biocide



Microbial Remediation and Biocide Application Guide
Tech Memo 2013-01

Introduction

Biocide usage is critical for maintaining the integrity of fuels at all points during storage, distribution and usage. Left untreated, fuels are susceptible to microbial contamination that can cause microbially induced corrosion, equipment malfunction, filter plugging, engine failure, and gauge malfunction . Fuel quality can also be negatively impacted. This bulletin will attempt to answer three important questions:

- What are potential symptoms of a microbial problem in my tank?
- What does the microbial test report data mean?
- What biocide and what treat rate should I use?

Symptoms of a Microbial Problem in Fuel Storage Tanks

Field symptoms

In the field, common symptoms of a microbial activity in a fuel storage tank could be anything from one to all of the following, in any combination:

- Rapid, severe corrosion of metal components in the tank such as pumps, monitoring systems, overhead (vapor) spaces, and dispenser components such as the filter housings.
- Decreased flow through dispensers and bulk tank filtration or rapid filter blockage
- Hazy fuel
- Erratic readings from tank monitoring equipment
- Sludge/slime build up
- Foul odors
- Visual indicators such as those in the figures below

Fig 1: Fuel/water interface with active microbes

Fig 2: Underground storage tank fill cap from a tank which showed high levels of microbial activity.

Fig 3: Submersible turbine pump damaged by microbial activity in underground storage tank.

Fig 4: Dispenser filter damaged by microbially induced corrosion.

Testing

Testing for microbial issues could include some or all of the following:

- Presence of adenosine 5'-triphosphate (ATP)
- Microbial growth in or on culture media
- Low pH caused by the presence of low molecular weight acids e.g. acetic, formic, lactic

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Issue 2, Version 1
3/2017

- If a positive microbial result is returned:
  - Treat/Remove the water bottoms
    - Apply a water soluble biocide
    - Remove the water bottoms
  - Treat Fuel Layer
    - Choose an acceptable biocide from a reputable supplier (Oil/Water Soluble)
    - Reference the product application guide for information on successful use
    - Retest the tank multiple times for microbial contamination after application

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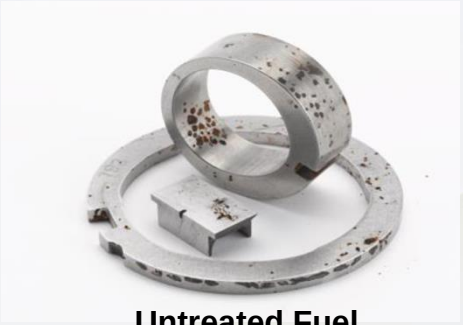
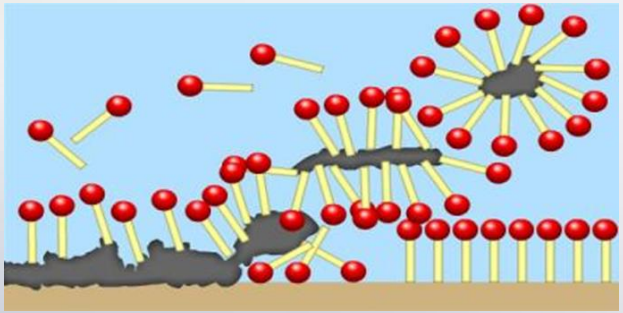
Underground Storage Tank Corrosion
- Solution: Deploy Corrosion Inhibitor, Diesel Multifunctional Additive

Immersion Testing of Fuel Pump Internal Parts (ring, roller housing, small ring)



Untreated Fuel

Treated Fuel



Detergents will lift and remove sludge

- Protect your assets with additives:
  - Corrosion Inhibitor
    - Creates boundary between water and metal surface
    - Applied at the refinery but can be included in finished fuel additives
    - Can partition into the water layer from fuel layer
  - Diesel Multifunctional Additive
    - Typically contain surfactant technology that provide end-user equipment and fuel storage protection
    - Can help keep dissolved water in solution as temperature/water solubility curve changes
    - Prevents fuel degradation
    - Will lift and clean sludge-like materials, corrosion by-products found in tanks

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QUESTIONS?

- Important Links
  - Preventive Maintenance for Diesel Storage and Dispensing Systems
    - https://www.cdfa.ca.gov/dms/programs/petroleum/CRC_DieselStorageSystem.pdf
  - Diesel Fuel Storage and Handling Guide
    - https://crcao.org/reports/recentstudies2014/CRC%20667/CRC%20667.pdf
  - Russ Lewis Presentation to NCWM on CRC 667
    - https://www.ncwm.net/_resources/dyn/files/75344820ze5e81330/_fn/Technical+Session+-+Russ+Lewis.pdf

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