STI’S RECOMMENDED PRACTICE R111, STORAGE TANK MAINTENANCE
STI’S RECOMMENDED PRACTICE R111

Water is the enemy of fuel storage systems
STI’S RECOMMENDED PRACTICE R111

- Operations and maintenance procedures for water monitoring and removal have been a recommended practice for over thirty years.
- STI developed R111 to assist owners/operators to maintain tanks for optimum operations.
US terminal capacity reduced, while fuel consumption increased.

Therefore, more fuel moves distributed at faster rate = less time to settle out before final delivery.

Industry moving to shared delivery infrastructure, so individual companies have less control over product.
TODAY’S FACTORS AFFECTING TANK MAINTENANCE

❌ Common installation and maintenance procedures contribute to water accumulation:
  ✤ Open vents
  ✤ Low fill areas
  ✤ Sloped tank installations
ABOUT CHANGING FUELS:
TRADITIONAL GASOLINE AND DIESEL

- Fuel injection systems instead of carburetors
- Particulates can clog injectors
- Gasoline is cleaner to accommodate newer, cleaner-burning engines
- Engine exhaust must be cleaner to meet EPA Clean Air regulations
- Oxygenates are added to gasoline for cleaner burning fuel
- Sulfur has been removed from diesel
70% of all gas today is blended with 10% ethanol
EPA has approved E15 in cars 2007 and newer
Only 1% of today’s cars can run on E85 (85% ethanol/15% gasoline)
Fuel grade ethanol must meet ASTM standards 4806 or D5798
MICROBIAL CONTAMINATION

- Reddish, scaly, gritty deposits: corrosion and/or silt in tank
- Black or brown deposits: water contamination has degraded the fuel
- Sludge build-up in tank bottom can be caused by the breakdown of the fuel itself.
- Contaminants like salts in water may:
  - Degrade fuel chemical structure, yielding substances detrimental to system components
  - Cause fuel additives to leave fuel and enter water
As microorganisms grow and thrive, they form a slime.

Over time, sludge is formed from the slime.

Clogs may not be visible, unlike mold growth.

Sludge breaks off and clogs fuel filters and small openings throughout entire system.
MICROBIAL CONTAMINATION: WARNING SIGNS

- Filter life shorter than six months or flow slowed to 3-5 gpm
- Erratic tank gauge readings
- Frequent replacement of valves, rubber seals, hoses, etc.
- Rotten-egg odor from digestion of fuel by microorganisms
- Chemically-altered fuel components attack:
  - Metal
  - Rubber
  - Fiberglass reinforced plastic
  - Tank linings and coatings
MONITORING TANKS: ALL FUELS

- Inspect tanks at least monthly
- Check for water as often as possible
- If 1”+ water is present, must be removed within 30 days
- Best monitoring: automatic tank gauging (ATG) system
  - Some floats may not work with alcohol fuels
- Simpler, less expensive: appropriate water paste on gauge stick
- Water-sensitive filters and watch for slow fueling
When ethanol’s water absorption capacity is reached, excess water separates, causing two distinct layers of product:

- Top layer: lower octane gasoline, possibly out of spec
- Bottom layer: ethanol/water mix, dispose of

Resulting water bottom:
- Allows microbes to proliferate
- Storage system exposed to ethanol concentrations greater than 10%
Ethanol acts as a cleaning agent: loosens any sludge, slime and scale already present in tank.

Therefore, tank must be cleaned before ethanol blended fuel is introduced.

Cleaning prevents excessive filter clogging and potential engine damage from contaminants.
The bottom line for storage tanks and ethanol:

- Check for compatibility with all ethanol compositions
- Steel is compatible with all fuels: see Historical Timeline of Storage Tank Ethanol Compatibility, from the Wisconsin Bureau of Storage Tank Regulation
- Clean the tank before introducing ethanol blended fuels
- Monitor frequently for water and contaminants
- Promptly remove water and contaminants from tank when identified
Material incompatibility with both diesel & biodiesel fuels:

- Brass, bronze, copper, lead, tin or zinc oxidize and create sediments, leading to clogged fuel filters
- Pure biodiesel (B100) or blends higher than B20 cause problems with rubber seals, gaskets and hoses—use biodiesel resistant materials
Problems with tanks that formerly held Number 2 diesel

- Number 2 diesel forms accumulating sediments, sludge and slime
- Biodiesel dissolves these sediments and carries them into vehicle fuel systems
- Can rupture filters and clog fuel injectors
- Tanks should be cleaned before switching to any biodiesel blend
MONITORING TANKS: BIODIESEL

- Higher concentrations = reduced stability
- Use biodiesel within six months of production
- The bottom line for storage tanks and biodiesel:
  - Check for compatibility (steel is compatible)
  - Clean tanks before introducing biodiesel fuels
  - Monitor frequently for water and contaminants
  - Promptly remove water and contaminants from tank when identified
MONITORING AND DETECTION METHODS

- Tank bottom sampling
  + “Bacon bombs” collect samples from tank bottom

- Fuel filters
  + Use water absorbing filters to detect slowed fuel dispensing; filters expand when absorbing water

- Fuel samples from nozzle
  + Visual evaluation by examining fuel caught in clear glass container
MONITORING AND DETECTION METHODS

- Use recommended inspection and maintenance schedules
- Daily monitoring of tanks with ATGs and water level sensors
  - If gauge shows water one day but not the next, may indicate water has been absorbed into ethanol-blend or biodiesel fuel
  - If ATG records are inconsistent, test with water paste or bottom sample
- If one inch or more of water is found, it must be removed within 30 days.
HOW TO REMOVE WATER AND CONTAMINANTS FROM STORAGE TANKS

- Multipoint water pumping
- Fuel filtration/polishing
- Non-entry tank cleaning
- Physical entry tank cleaning
- Dispose of tank bottom water properly
PREPARING TANKS FOR CHANGES IN FUEL TYPE

- Changing between gasoline and diesel fuels
  - Tank and related dispensing equipment must be thoroughly cleaned
  - Tank must be inspected and verified compatible with new fuel to be stored
  - Ensure gasoline is not commingled with any diesel product
R111’S MONTHLY INSPECTION CHECKLIST

- Inspect tanks monthly
- Checklist on pages 12-13 of R111 document
  - Covers all inspection recommendations
  - Your record of tank inspection and maintenance
Thank you!

Lorri Grainawi
Director of Technical Services
STI/SPFA

944 Donata Court
Lake Zurich, IL 60047
Web: www.steeltank.com
Phone: 847/438-8265
Fax: 847/438-8766
E-Mail: lgrainawi@steeltank.com