

Ethanol Blended Fuels

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History of Ethanol use in US

1908 – Henry Ford produced the Model T to run on Ethanol

1940's - First U.S. fuel ethanol plant built and run by the U.S. Army in Omaha, Nebraska

1940's to late 1970's - Due to the low price of gasoline virtually no fuel ethanol was sold in the U.S.

1975 - U.S. begins to phase out lead in gasoline. MTBE eventually replaced lead.

1988 - Denver, Colorado, mandated ethanol oxygenates fuels for winter use to control carbon monoxide emissions. Other cities followed.

1990 - Clean Air Act Amendments - Mandated the winter use of oxygenated fuels in 39 major carbon monoxide non-attainment areas.

1995 - The EPA began requiring the use of reformulated gasoline year round in metropolitan areas with the most smog.

1999 - States begin to pass bans on MTBE because traces of it were showing up in drinking water.

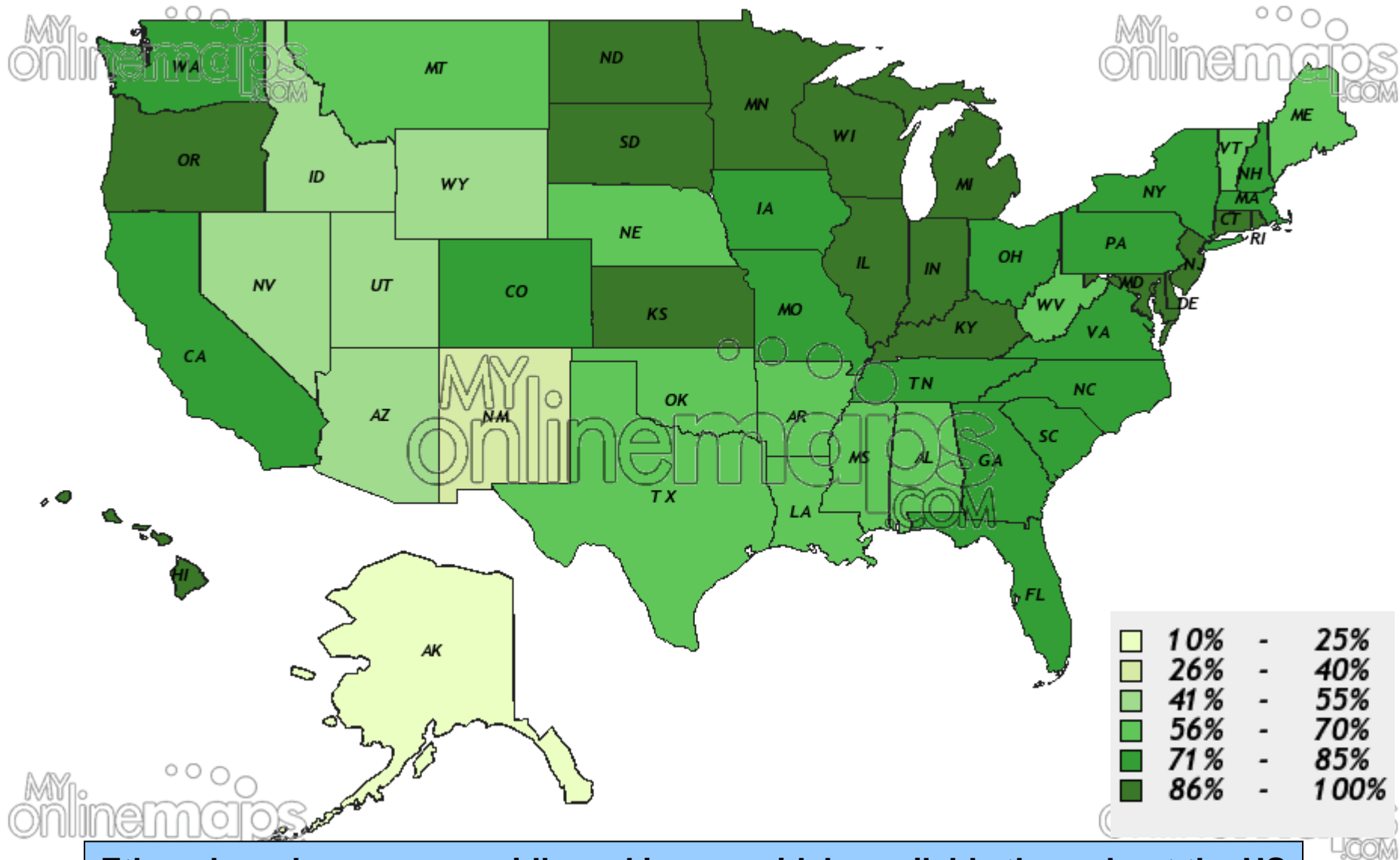
2003 to 2007 - Almost all states ban MTBE, resulting in MTBE being replaced by ethanol.

2006 - The Renewable Fuel Standard Program requires doubling the use of ethanol and by 2012.

2007-2008 - Surge in individual states mandating the use of 10% ethanol E10 gasoline.

Ethanol has been used as a fuel in the US for many years

Ethanol Penetration in the US: 2009



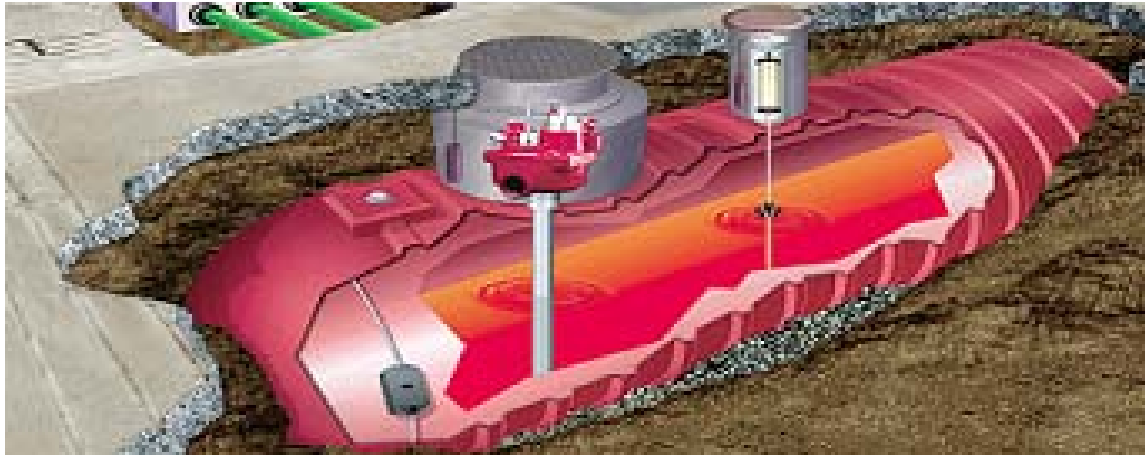
Ethanol use has grown rapidly and is now widely available throughout the US

Ethanol Compatibility

- > More than 50 companies and over 650 products are listed as compatible to some level of ethanol blended fuels
- > Existing EPA Leak Detection Protocols do not require evidence of long term compatibility with alternative fuels
 - > Most products were third party tested in diesel however existing protocols allow listed use in other fuels including blended gasoline
- > Many leak detection methods listed on the NWGLDE web site are compatible with ethanol/gasoline blends
- > Some concern exists for leak detection equipment that may be impacted by fuel components or water detection at the bottom of the tank

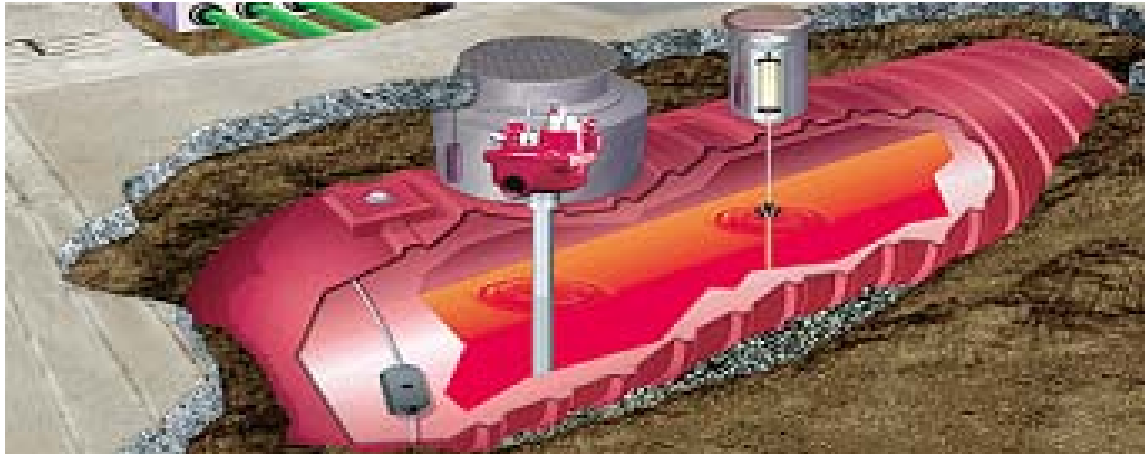
Options Exist for Leak Detection Equipment that is Compatible with Ethanol Blended Gasoline

Water in Underground Storage Tanks



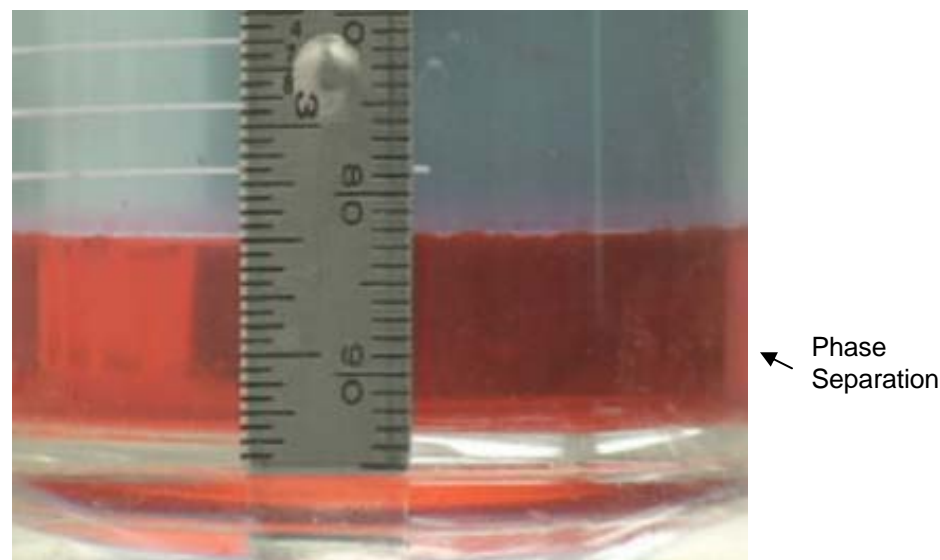
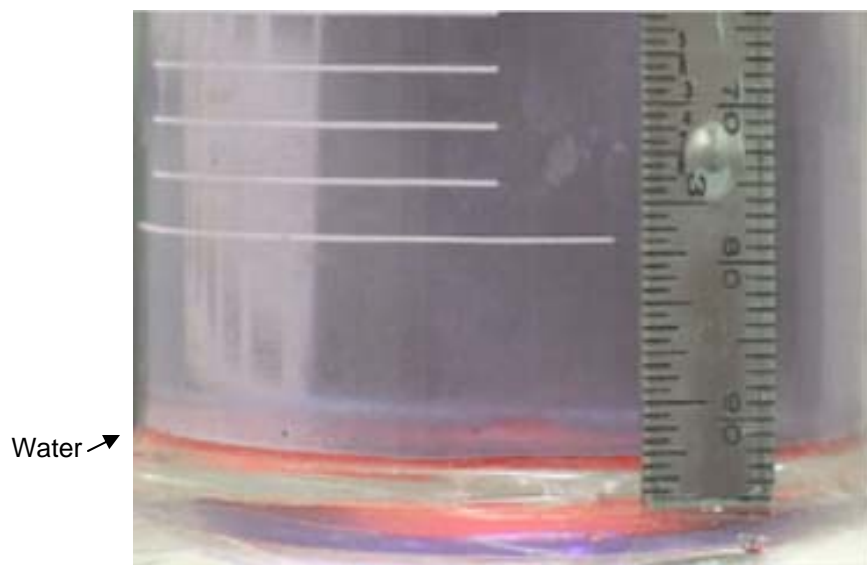
- Fuel is typically stored in Underground Storage Tanks (UST) at gasoline dispensing facilities.
- It is common for water to find its way into underground storage tanks containing fuel
- Since water is more dense than fuel, prior to the use of ethanol blended fuels, water entering a tank would collect at the bottom of the UST where it could be detected and removed
- Most ATG systems today rely on water detection methods that assume water will collect at the bottom of the UST
- Collected water is typically removed before it can adversely affect customers vehicles or fueling system components

Effects of Water in Ethanol Fuel



- When water enters a tank that contains fuel blended with ethanol, the water may not collect on the bottom of the tank
- Depending on the speed of entry and the effect of mixing, the water may be actually be absorbed by the ethanol
- This presents challenges for traditional water detection and removal methods for UST's containing ethanol blended fuels
- When the ethanol becomes saturated with water, phase separation can occur

What is Phase Separation?



- Water enters a tank containing ethanol blended fuel through a leak or delivery event
- As a result of mixing or sufficient time, the water is absorbed by the ethanol blended fuel
- When the ethanol becomes saturated with water, the ethanol will drop out of the fuel and collect on the bottom of the tank
- Creating multiple inches of highly concentrated ethanol/water at the bottom of the UST
- The more ethanol in the fuel the deeper the level of phase separation on the tank bottom

A small amount of water can result in a significant layer of Phase Separation

Effects of Phase Separation

Phase Separation Mixture Pumped in to Vehicles

- > Phase separation can result in stalled cars and damaged engines
- > Brand damage can occur with upset customers



Out of Spec Fuel

- > The remaining fuel will be depleted of ethanol and may be out of spec and unsellable



Damage to Petroleum Equipment Infrastructure

- > Some tanks and components may be incompatible to higher concentrations of ethanol.
- > Prolonged exposure to phase separation can damage tank materials and other components



Current Detection Methods

1. Sticking tank with paste

"Good"



"Bad"



Description

- Put paste on a long stick and insert into tank
- If paste changes color, indication of potential problem

Drawbacks

- Requires frequent use
- May be difficult to follow consistent procedure
- May be difficult to interpret results

2. Dispenser Fuel Filter



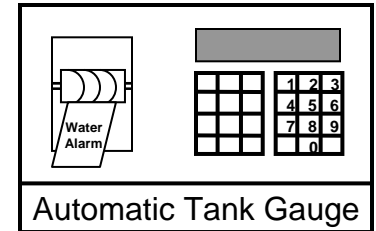
Description

- Use dispenser filter specially designed for phase separation

Drawbacks

- Only detects PS at dispenser, not in tank → remediation costs are higher
- More frequent filter changes adds additional cost
- Filters clog for other reasons

3. Automatic Tank Gauge

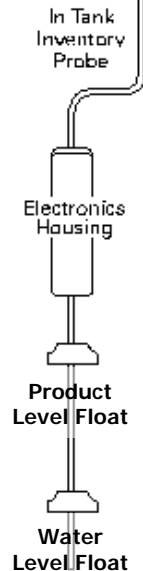


Description

Water float on electronic probe detects level of water in tank

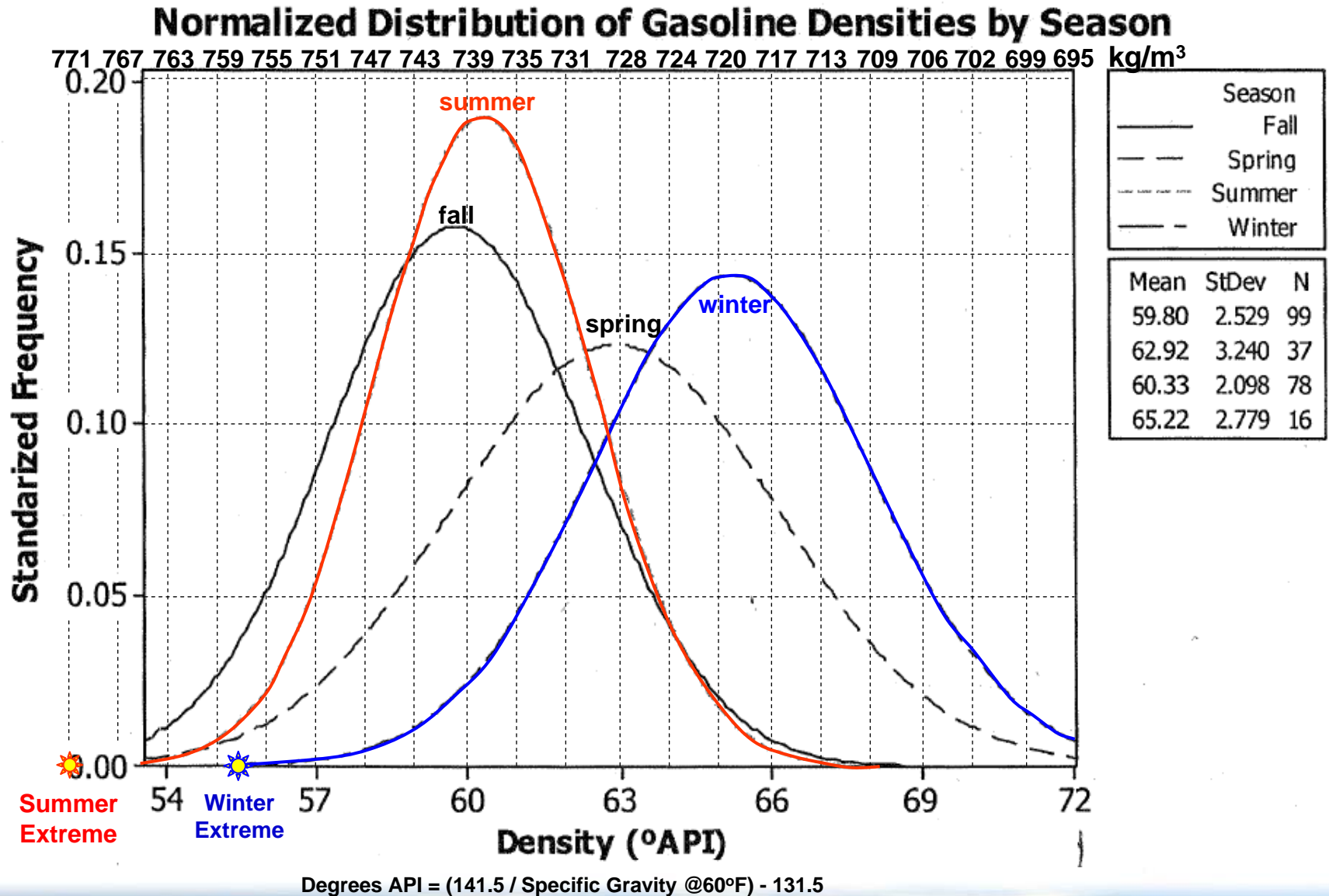
Drawbacks

Density of phase separation may be too low to raise water float, making PS undetectable

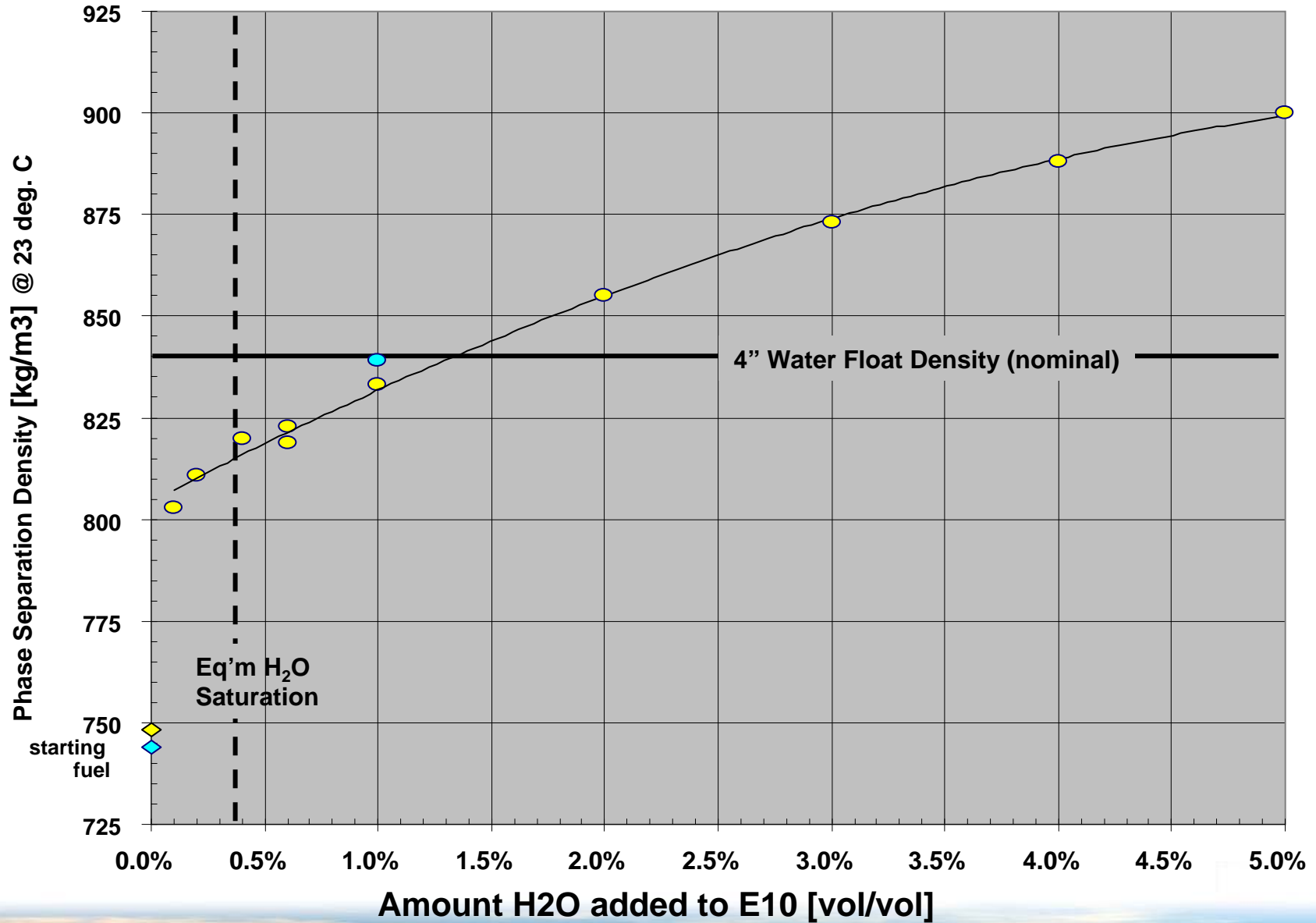


Most water floats were designed for water. However, with the introduction of ethanol-blended gasoline, seldom will you have pure water at the bottom of a tank.

Fuel Density Range



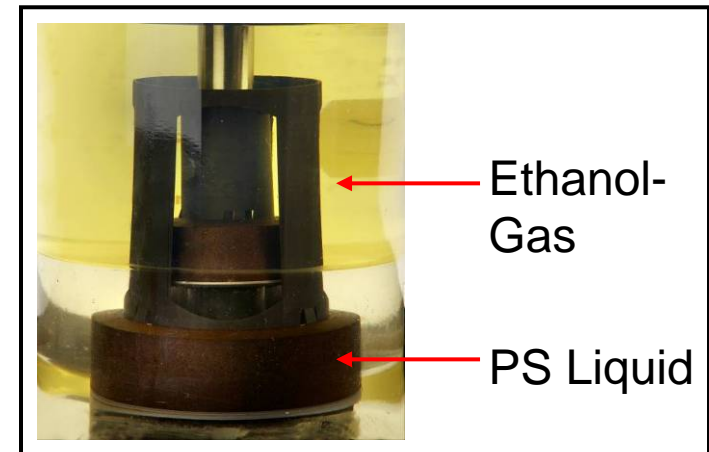
Fuel Density Dynamics



New Phase Separation Detection Solution



- > Multi density float provides reliable detection of water or phase separation
- > Replaces water float on existing monitoring systems



Phase Separation Detected

The Veeder-Root Phase Two Water Detector gives you early detection to a problem, protecting against catastrophic events

Phase Separation: Summary

If water enters a tank of ethanol-blended gasoline, Phase Separation may occur

Water may no longer be reliably detected at the bottom of the tank

Better detection options may be necessary to protect station owner and customer investments

The best solution to avoiding the risks associated with phase separation is reliable early detection and remediation

Questions?

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