

US EPA E15 Waiver

ATTENTION

E15

Up to 15% ethanol

Use only in

- 2001 and newer passenger vehicles
- Flex-fuel vehicles

Don't use in other vehicles, boats or gasoline-powered equipment. It may cause damage and is **prohibited** by Federal law.



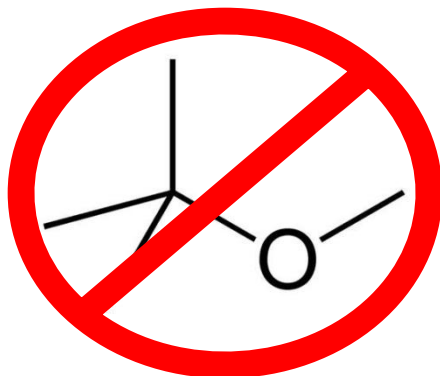
pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

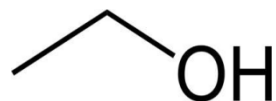
How did we get here?

- **2004** – Methyl tert-butyl ether (MTBE) banned in Pennsylvania as a gasoline oxygenate
 - Ethanol introduced as alternative gasoline oxygenate
 - Gasoline with 10% ethanol (E10)

MTBE



Ethanol



- **2005** – **Energy Policy Act of 2005**

- Passed by US Congress on July 29, 2005 and signed into law by President George W. Bush on August 8, 2005
- Contains provisions that require all gasoline sold in the US contain a minimum volume of renewable fuel

➤ Energy Independence & Security Act of 2007

- Signed into law on December 19, 2007 by President George W. Bush
- Required, in part, that the total amount of biofuel gasoline additives be increased from the 2007 level of 4.7 billion gallons annually to 36 billion gallons annually by 2022



Calendar year:

**Applicable volume of renewable
fuel (in billions of gallons):**

2006	4.0
2007	4.7
2008	9.0
2009.....	11.1
2010	12.95
2011.....	13.95
2012	15.2
2013	16.55
2014	18.15
2015	20.5
2016	22.25
2017	24.0
2018	26.0
2019	28.0
2020	30.0
2021	33.0
2022	36.0

Underwriters Laboratories (UL)

- February 2009 - UL announced that using UL87 certified equipment to dispense blends of no more than 15% ethanol should not result in critical safety concerns.
 - UL clarified that E15 itself has the potential to contain more than 15% ethanol because of variations in mixtures; therefore, UL does not specifically approve equipment for E15 rated fuel.

Waiver Request Submitted to US EPA

- March 2009 – US EPA received a formal Clean Air Act waiver request from Growth Energy and 54 ethanol manufacturers to raise the allowable ethanol content in gasoline for passenger vehicles from 10% (E10) to 15% (E15).
- EPA received over 78,000 comments on the submitted waiver.

Waiver Request Approved by US EPA

- October 13, 2010 – US EPA approved the Clean Air Act waiver request to increase the amount of ethanol allowed in gasoline from E10 to E15, but only for model year 2007 and newer light-duty motor vehicles.

Waiver Extended by US EPA

- January 21, 2011 – US EPA extended the E15 waiver to increase the amount of ethanol allowed in gasoline for model year 2001 and newer light-duty motor vehicles.



Exceptions to the Waiver



A person cannot place E15 into the following:

- All motorcycles
- All vehicles with heavy-duty engines, such as school buses, transit buses, and delivery trucks
- All off-road vehicles, such as boats and snowmobiles
- All engines in off-road equipment, such as lawnmowers and chain saws
- All Model Year 2000 and older cars, light-duty trucks, and medium-duty passenger vehicles (SUVs)



Conditions of the Waiver

➤ Fuel Quality Conditions

- Ethanol used for E15 must meet ASTM purity specifications required of ethanol for blending with gasoline
- The Reid Vapor Pressure for E15 is limited to 9.0 psi during the summer

➤ Health Effects Conditions

- Testing required to determine possible adverse health effects of E15

Emissions and Health Effects Data Requirements – Waiver Conditions Met

- Feb 2012 – US EPA released an evaluation of information submitted by the Renewable Fuels Association (RFA) and Growth Energy for satisfying the **emissions and health effects data requirements** for registration of E15. The evaluation document concludes that the submission would be sufficient to satisfy those requirements.

Conditions of the Waiver – E15 Misfueling Mitigation Plan

- Labeling: Retail fuel dispensers must have labels indicating that E15 is only for use in model year 2001 and newer motor vehicles
- Product Transfer Documentation (PTD): Product transfer documents must accompany the shipment of a gasoline produced with greater than 10 volume percent ethanol and no more than 15 volume percent ethanol properly document the volume of ethanol.
- Survey: Participation in a survey of compliance at fuel retail dispensing facilities.

Renewable Fuels Association
Model
E15 MISFUELING MITIGATION PLAN

March 2, 2012

Director, Compliance Division
Office of Transportation and Air Quality
U.S. ENVIRONMENTAL PROTECTION AGENCY
1200 Pennsylvania Avenue, NW
Mail Code 6405J
Washington, D.C. 20460

Note: This is a model plan that companies may choose to adopt and submit to EPA for approval for the purpose of meeting the requirement for a misfueling mitigation plan under the E15 partial waivers. The Renewable Fuels Association is not responsible for implementation of this plan or liable for any failure to implement the plan. For a company adopting this plan, the plan should be read as including the company's name in each place where "plan submitter" occurs.

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Labeling - Conditions Met

- March 15, 2012 – US EPA informed the Renewable Fuels Association (RFA) that its Model E15 Misfueling Mitigation Plan would generally be sufficient to satisfy the partial waivers' requirement for a misfueling mitigation plan.



Domestic Fuels Act of 2012

- March 29-30, 2012 – House Bill 4345, the “Domestic Fuels Protection Act of 2012” and Senate Bill 2264, the “Domestic Fuels Act of 2012” are introduced.

- If passed, these bills would:
 - Limit liability on the part of fuel producers, equipment manufacturers, and retailers
 - Require the development of standards for determining compatibility of UST system components and ancillary equipment with E15
 - Protect retailers from liability in the case of misfueling incidents, so long as the misfueling mitigation plan is followed

Production Begins

- Early April 2012 – US EPA approved 24 registration applications from 20 companies to begin producing ethanol to blend into E15 gasoline.
- April 23, 2012 – RFA announces all federal requirements for E15 commercial sales, as set under the partial E15 waiver granted by the US EPA, have been met. The nationwide fuel sampling survey required under the E15 Misfueling Mitigation Plan will begin on May 1, 2012.
- Retailers may be able to begin selling E15 to the public as early as summer of 2012.

Concerns

- Compatibility
- Microbial Corrosion
- Phase Separation
- Biofuel Releases

Compatibility

- Older Underground Storage Tanks (UST) and UST components may not be compatible with E15 gasoline.
 - Tanks and components manufactured prior to the introduction of E15 may be compatible, but may not be certified as compatible by Underwriters Laboratories (UL), the tank manufacturer, or any other nationally recognized association or independent testing laboratory.

Compatibility

- Federal UST regulations include compatibility requirements in 40 CFR 280.
- 25 PA code, Sections 245.433, 245.432, and 245.421 also require USTs and components to be compatible with the substance stored.
- EPA's waiver of E15 gasoline does not alleviate a UST system owner or operator from complying with Federal and State UST requirements.

Compatibility

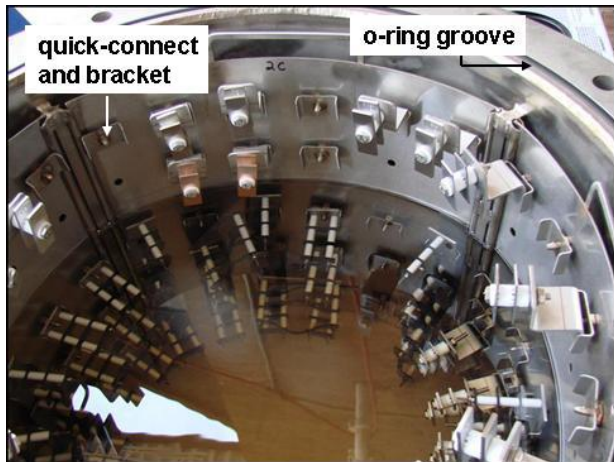
- Failure to demonstrate compatibility violates EPA's UST regulations and may also violate UST insurance requirements.
- 40 CFR 280.32
 - “Owners and Operators must use a UST system made of, or lined, with materials that are compatible with the substance stored in the UST system.”

Compatibility

- The EPA categorizes the following UST system components as critical for demonstrating compatibility.
 - Piping
 - Line leak detector
 - Tank or internal lining
 - Flexible connectors
 - Spill and overfill prevention equipment
 - Drop tube
 - Shear valve
 - Fill and riser caps
 - Submersible turbine pump
 - Sealants, to include pipe dope and thread sealant
 - Fittings, gaskets, o-rings, bushings, couplings and boots
 - Release detection sensors, floats and probes
 - Containment sumps

Compatibility

- UL issued a study on UST component compatibility in 2010
 - Some components displayed limited compatibility with E15 and other fuels with high ethanol contents.
 - Non-metals, especially gaskets and seals, were routinely involved with compatibility complications.



Experimental setup at Oak Ridge National Laboratory

Compatibility

Oak Ridge National Laboratory –

Study of common dispenser component material compatibility.

Metals

Compatible

1020 Solid Steel
1100 Aluminum
201 Nickel
304 Stainless Steel

Discoloration/Mild Corrosion

Brass
Phosphor Bronze
Zinc Plated (galvanized steel)
Lead Plated (terne) Steel

Non-Compatible

Elastomers

Compatible

Fluorosilicon Rubber
Fluoroelastomers

Uncertain

Styrene Butadiene Rubber
(SBR)
Nitrite Rubber

Non-Compatible

Silicone Rubber
Polyurethane
Neoprene

Sealants

Compatible

Gasoil E-Seal

Non-Compatible

E-Seal Standard PTF E-Sealant
Rector Seal

Compatibility

- March 2010 – UL announces that, under UL 87A-E25, the first dispensers have been certified for ethanol blends above E10.
- June 2010 – UL announces that the first fuel-dispensing system including the dispenser, hose, nozzle, swivel, breakaway, and shear valves have been certified for fuel up to and including E85.
- July 2010 – UL announces that the first blending dispensers have been approved for fuel up to and including E85.

Compatibility

- E15 compatibility information can be obtained from tank manufacturers
- Letters of equipment compatibility are also maintained by industry trade associations
 - Steel Tank Institute (STI), Petroleum Equipment Institute (PEI), Fiberglass Tank and Pipe Institute (FTPI), American Petroleum Institute (API), etc.

Microbial Corrosion – What have we learned from E10?



What's going on here?

Microbial Corrosion

- Rapid corrosion has been observed in some ethanol blended gasoline STP sumps with limited ventilation.
- These sumps contain high ethanol vapor concentrations with microbial activities forming acetic acid.
- Water condensate and temperature appear to influence the rate of corrosion.
- Future studies need to be performed to determine the severity of the STP sump corrosion and the best ways to control the corrosion.

Microbial Corrosion



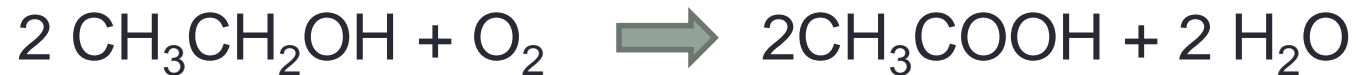
E10 STP from Edwin C French IV, Senior Environmental Compliance Specialist, Storage Tank Section, Leon County, Florida

Microbial Corrosion

- During the summer, the contents of a UST tend to be cool with respect to the atmosphere. There is a tendency for water to condense from the air onto cool metal fixtures in a sump. The sump can also collect precipitation.
- The vapors in the ullage of the UST contain high concentrations of ethanol.
- If the vapors escape the UST, they can dissolve in standing water in the sump or in water that has condensed on metal fittings.

Microbial Corrosion

Acetic acid bacteria can use Oxygen from the atmosphere to rapidly transform the Ethanol into acetic acid.



The acetic acid produced by biological degradation of ethanol can facilitate the corrosion of metals

Microbial Corrosion

➤ Corrosion Characteristics

- Severe STP sump corrosion occurs in sumps with limited ventilation.
- Corrosion deposits have globular shape (tubercles) which could be indicative of MIC.
- Corrosion rate seems related to sump temperature.



Microbial Corrosion

➤ Prevention and Control

- Detecting and Reducing Vapor Leaks
- Using more corrosion resistant STP components
- Improving STP sump ventilation
- Corrosion resistant coatings
 - Examples- Tape Coat TC-7100 or 3M 323
- Biocides
- Fuel additive: corrosion inhibitor

Microbial Corrosion

Six months???



March 2010

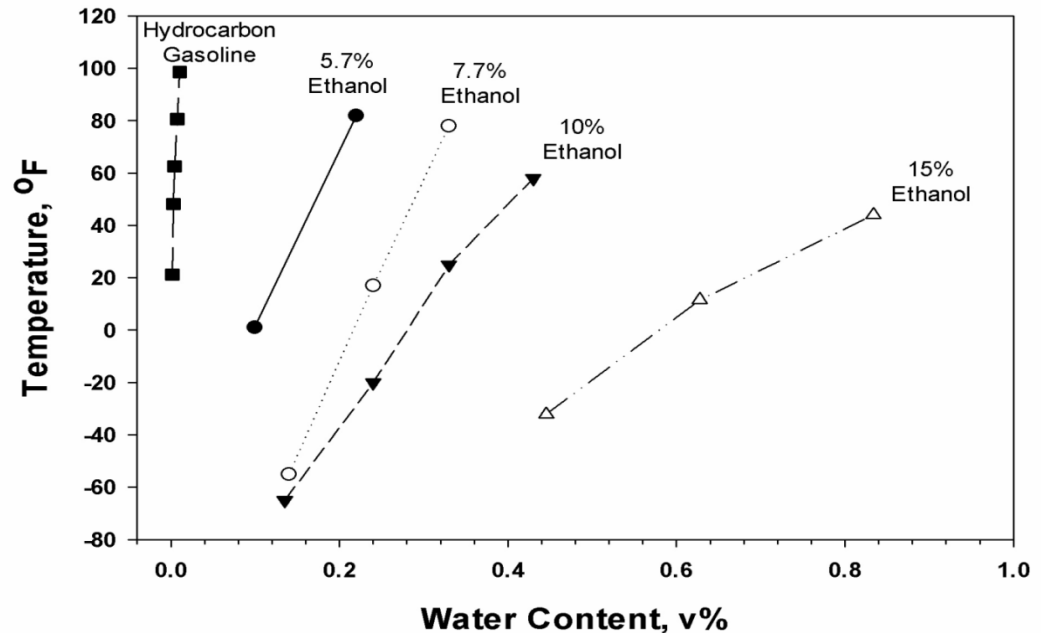


August 2010

Phase Separation

➤ Water tolerance

- Because of ethanol's chemical properties, ethanol blended fuels are more prone to dissolve water.
- Water tolerance is positively related to product temperature.



Phase Separation

- If excessive amounts of water are present inside an ethanol blended gasoline storage tank, phase separation can occur.
- Phase separation occurs when the ethanol and water mixture physically separates from the gasoline.
 - A common ratio of the phase separation layer is 75% ethanol, 20% water and 5% gasoline.
 - **High Corrosive Potential**

Phase Separation



Clean Gasoline

**Phase Separated
Gasoline**

← Ethanol Depleted Gasoline

← Phase Separation

Phase Separation

- When too much water is present in an underground storage tank, the ethanol and water will mix and sink to the bottom of the tank.
- The ethanol/water mixture is less dense than water, so conventional water floats on automatic tank gauges (ATGs) will not reliably detect it.
 - A specialized “Phase Separation” float must be used to detect the phase separation layer.

Phase Separation

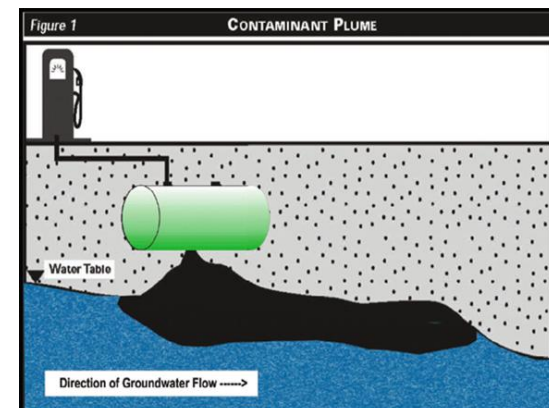
- Because ethanol is used as an octane enhancer, phase separation lowers the octane level of the remaining gasoline.
- Phase Separation Mixture
 - Can cause severe damage to engines
 - Compared with water and E10 gasoline, the mixture is highly corrosive
 - Can corrode metals, including underground storage tanks, increasing the risk of a product release into the environment

Phase Separation

- When exposed to E10 and E15 gasoline, Zinc and other soft metals are especially vulnerable to corrosion.
- Elastomers, polymers, rubber, glues and pipe sealants are prone to corrosion as well.
- Tank components may be at risk of corrosion if phase separation is pumped through them.
 - product piping
 - submersible turbine pumps
 - dispenser components

Other Considerations – Releases of Gasoline Mixed with Ethanol

- Ethanol may cause remobilization of any existing contamination & expansion of the contamination plume
- The higher the concentration of ethanol, the higher the concentration of degradation products. The degradation products will inhibit the biodegradation of benzene.
- During biodegradation of ethanol, microbes produce methane gas
 - Indoor air quality
 - Explosion risk
 - Change in local soil chemistry



Acknowledgments



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