

National Tanks Conference 2006

Alternative Fuels and Material Compatibility

The "alternative" fuels of ethanol blended gasoline and bio-diesel are coming if not already being stored and dispensed in your state. The 2005 energy bill and President Bush's State of the Union Address both promoted the increased use of ethanol and bio-diesel fuels. The UST regulations require UST systems to be compatible with the substance stored. The rub for the UST regulator and tank owner is the compatibility to these new fuels with existing UST equipment originally designed for traditional petroleum fuels.

Below are the presentations on material compatibility, compatibility of equipment and enforcement of equipment compatibility presented at the National Tanks Conference.

Ed English of Fuel Quality Services Inc. presented an explanation of fuel and material compatibility problems entitled Brief Overview to Fuels and Materials Compatibility. This is an abbreviated version of the presentation he made at the Petroleum Equipment Institute Convention last fall. If you have any questions, please contact Edward W. English II, Vice President & Technical Director, Fuel Quality Services Inc., P.O. Box 1308, Flowery Branch, GA 30542-0023 Phone: 800-827-9790 or 770-827-9790. Email: eenglish@fqsinc.com

Terry Cooper of Petroleum Equipment Services provided his knowledge of the UST equipment compatibility and his findings in Working With Today's Alternative to Fossil Fuels. If you have any questions, please contact Terry D. Cooper, President, PES Inc., Corporate Centre 200, 200 35th St., Marion, IA 52323 Phone: 319-377-6357 Email: tdc@cc200.com

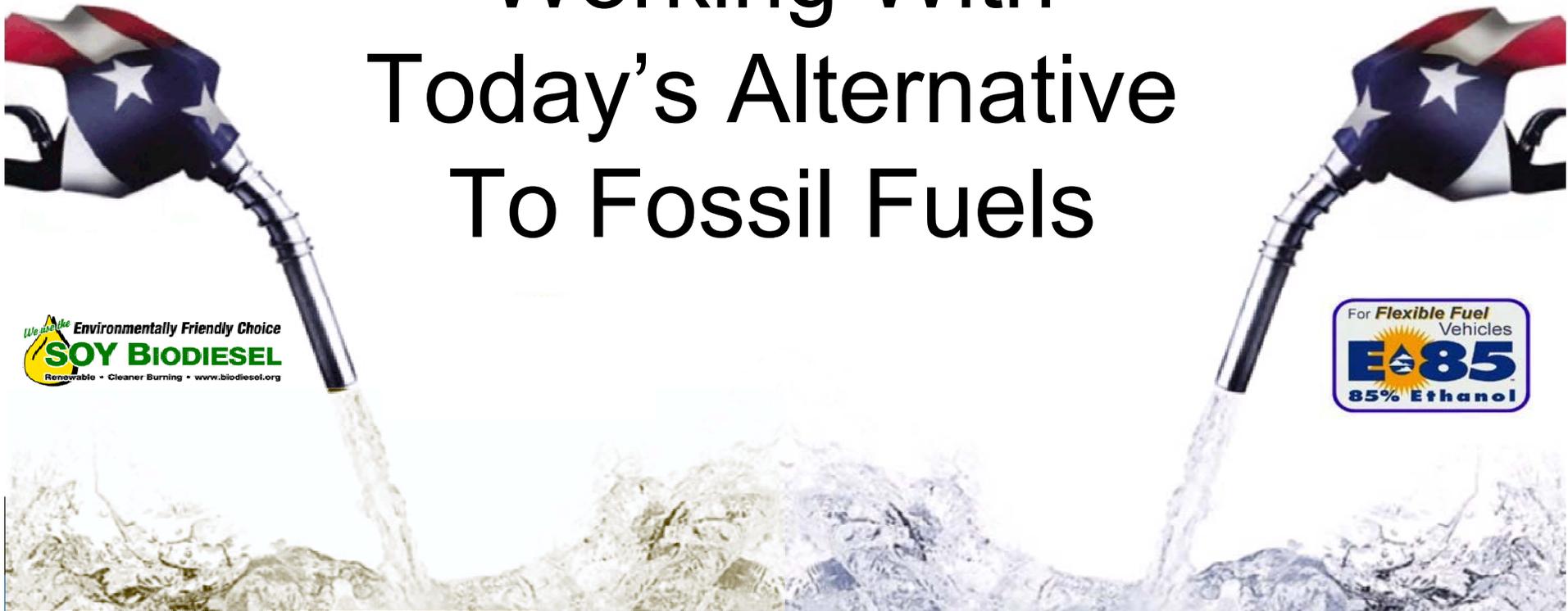
Tom Collins of Iowa Department of Natural Resources shared Iowa's enforcement of equipment compatibility with E-85 and how it came about in E85 Storage and Dispensing . If you have any questions, please contact Tom Collins, Iowa Department of Natural Resources, Wallace State Office Building, 502 E. 9th St., Des Moines, IA 50319-0034. Phone: 515-281-8879. Email: tom.collins@dnr.iowa.gov

If you have any questions concerning this National Tanks session presentation, please contact the session moderator Paul Nelson, Iowa Department of Natural Resources, Wallace State Office Building, 502 E. 9th St., Des Moines, IA 50319-0034. Phone: 515-281-8879. Email: paul.nelson@dnr.iowa.gov



Bio Fuels Today

Working With Today's Alternative To Fossil Fuels



Topics

- Information Challenges
- Product Challenges
- Where Do We Go From Here





Bio Fuels Today

Information Challenges



Political





Bio Fuels Today

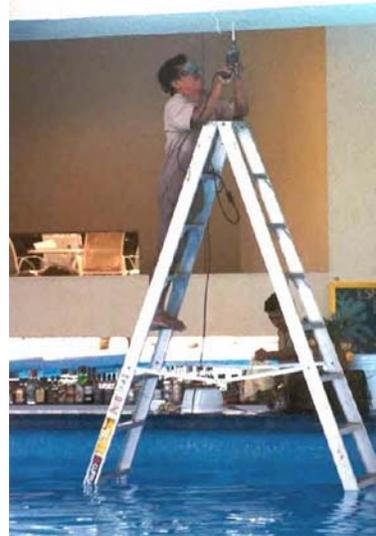
Information Challenges



Performance Myths



Information Challenges



Learning Curve



What is Ethanol?

- Ethanol (ethyl alcohol or grain alcohol) is a clear, colorless liquid with a characteristic, agreeable odor. In dilute aqueous solution, it has a somewhat sweet flavor, but in more concentrated solutions it has a burning taste. Ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, is an alcohol, a group of chemical compounds whose molecules contain a hydroxyl group, $-\text{OH}$, bonded to a carbon atom.





Facts About Ethanol

- Regardless of the blend level, the quality of the ethanol added to gasoline is important. The industry standard for ethanol is **ASTM D 4806** Standard Specification for Denatured Fuel Ethanol for Blending with Gasoline for Use as Automotive Spark Ignition Engine Fuel.

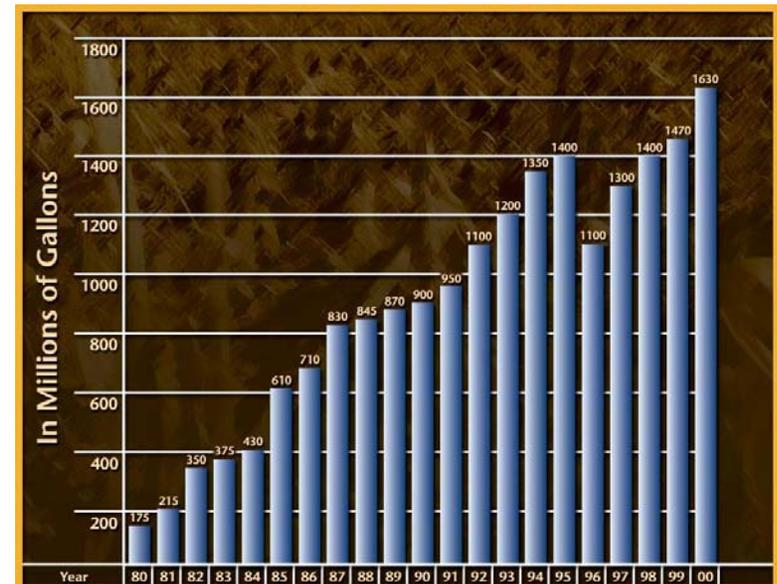




Bio Fuels Today

Facts About Ethanol

- **Ethanol** was 2% of the U.S. motor gasoline sales.
- **Ethanol** blends up to 10% are approved by all the major auto manufactures
- 74 percent of the gasoline sold in Iowa last year contained a 10 percent ethanol blend,
- Sales of E85 tripled last year
- There are about 100,000 vehicles in Iowa with the capacity to operate on E85



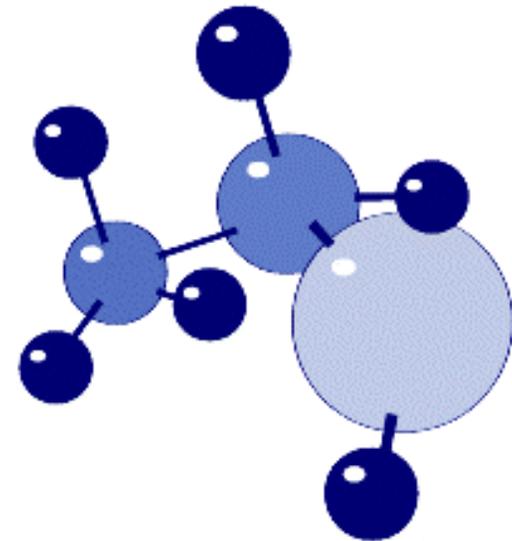
Facts About Ethanol

- Ethanol conducts electricity
- Although E85 use may be lower in some pollutants, E85 fuel is poisonous and flammable.
- E85 should never be confused with beverage alcohol.
- Cigarettes and other open ignition sources should never be allowed in fueling areas.



What is BioDiesel?

- **Biodiesel** is the pure, or 100 percent, biodiesel fuel. It is referred to as B100 or "neat" biodiesel.
- **Biodiesel** is Vegetable Oil Methyl Ester. Biodiesel can be made from methyl, ethyl, isopropyl, and other alcohols, but most biodiesel research focuses on methyl esters and virtually all commercial-production in the United States today uses methyl esters.



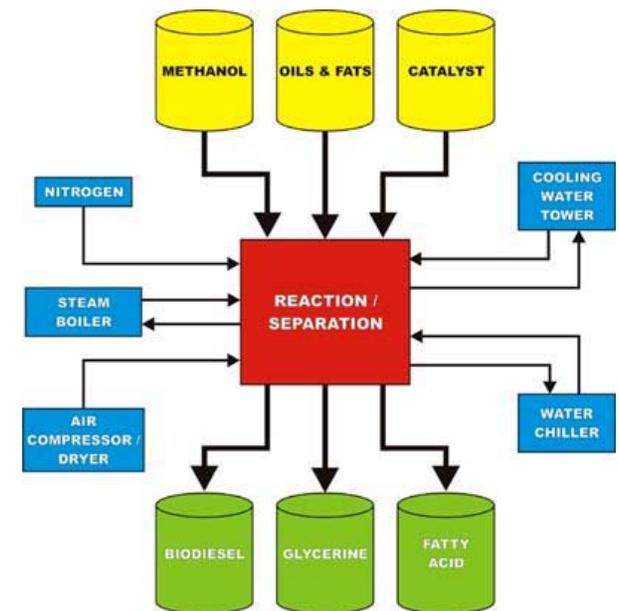
BioDiesel Feedstocks

- Soy bean oil
- Vegetable oil
- Cottonseed oil
- Olive oil
- Rape seed oil
- Corn oil
- Sunflower oil
- Mustard oil
- Peanut oil
- Canola oil
- Coconut oil
- Animal fats
 - * Chicken fat
 - * Leather fat
- Waste cooking oils
 - * Used frying oil
 - * Float grease
 - * Trap grease (yellow grease)



Facts About BioDiesel

- Around since 1994
- 100 lbs of “oil” + 10 lbs of methanol = 100 lbs of biodiesel + 10 lbs of glycerol
- A “***biodiesel***” ***blend*** is pure biodiesel blended with petrodiesel.
 - * ***B2*** blend is 2% biodiesel & 98% petrodiesel
 - * ***B5*** blend is 5% biodiesel & 95% petrodiesel
 - * ***B20*** blend is 20% biodiesel & 80% petrodiesel
 - * ***B100*** blend is 100% biodiesel
- The considerations for B100 are very *different* than lower biodiesel blends





Facts About BioDiesel

- The definition of biodiesel contained in ASTM D6751, along with the physical and chemical property limits, eliminates certain “biofuels” that have been incorrectly called biodiesel in the past.
- Do not be fooled by other so-called “**biodiesel**” products
- Ensure the biodiesel meets the ASTM specification for pure biodiesel (ASTM D 6751) before blending with petrodiesel





Facts About BioDiesel

- Biodiesel supports the growth of bacteria; I.e. algae
- Biodiesel raises the cold weather properties at least 3° F or petrodiesel
- Biodiesel is a good solvent
- Biodiesel has a 6-months shelf life
- B20 has the same handling properties as petroleum diesel. While B100 or "neat" (100%) biodiesel, it may be treated the same as for the storage of vegetable oil.





Facts About BioDiesel

- Look for “Accredited Producers” and “Certified Distributors” accredited by the National Biodiesel Accreditation Commission’s BQ9000 program



Ethanol Incompatibles

Metals

- Aluminum
- Brass
- Copper
- Lead
- Plated Steel
- Pb solder
- Zinc

Elastomers

- Natural rubber
- Leather gasket material
- Cork gasket material)

Polymers

- Polyurethane
- PVC
- Alcohol-based pipe dope



Ethanol Compatibles

Metals

- Unplated steel
- Anodized aluminum
- Black iron
- Bronze
- Carbon steel
- Nickel plated
- Stainless Steel

Elastomers

- Buna-N (hose & gaskets)
- Teflon
- Fluorosilicone
- Neoprene
- Nitrile
- Polysulfide rubber
- Viton (flurorocarbons)

Polymers

- Acetal
- Nylon (Polyamide)
- Polypropylene
- Teflon
- Thermoset plastics
- Fiberglass reinforced plastic



BioDiesel Incompatibilities

Metals

- Copper
- Brass
- Bronze
- Lead
- Tin
- Zinc (galvanizing)

Elastomers

- Buna-N (hose & gaskets)
- Nitrile
- Natural rubber

Polymers

- Plastics
- Polyvinyl



BioDiesel Compatibilities

Metals

- Black iron
- Carbon steel
- Aluminum
- Stainless Steel

Elastomers

- Viton
- Teflon
- Nylon

Polymers

- Polyethylene
- Polypropylene
- Acryl & Epoxy

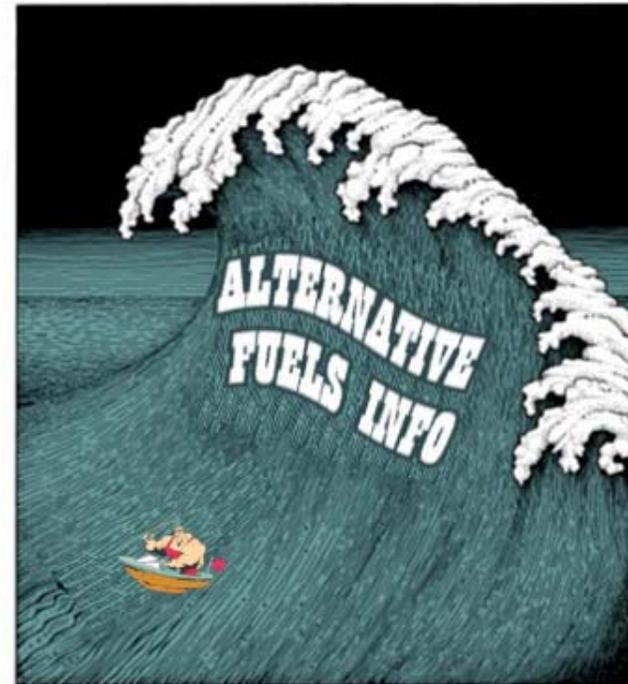
A considerable amount of experience exists in the US with a 20% blend of biodiesel with 80% diesel fuel (B20). Although biodiesel (B100) can be used, blends of over 20% biodiesel with diesel fuel should be evaluated on a case-by-case basis until further experience is available.





Information Challenges

*Manufacturer
Curve*



Information Challenges

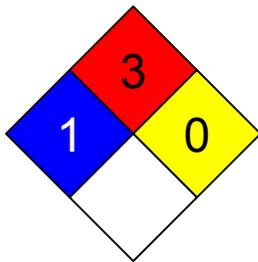
*Regulatory
Curve*



Regulatory - Ethanol

E-10 & E-85

1 Health
3 Flammability
0 Reactivity
Protective Equip



- Must comply with the National Fire Protection Agency (NFPA) codes. NFPA Codes 30 and 30A.
- *Federal Spill Prevention, Control and Countermeasures (40 CFR, Part 112);*
- *State "spill" requirements;*
- *Hazardous waste regulations;*
- *State and local fire codes;*
- *Petroleum product delivery laws; and*
- *Local fire marshals may also need to approve your fueling site design and installation*

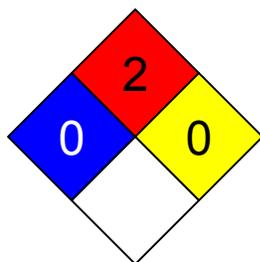




Regulatory - BioDiesel

B20 (125-180°F)

0 Health
2 Flammability
0 Reactivity
Protective Equip



FLAMMABILITY (Red)

4 – SEVERE HAZARD - *Flash Point Below 73°F (C1A):*

Very flammable, volatile or explosive depending on its state.

3 – SERIOUS HAZARD - *Flash Point Below 100°F (C1B):*

Flammable, volatile or explosive under almost all temperature conditions.

2 - MODERATE HAZARD - *Flash Point Below 200°F:*

Moderately heated conditions may ignite this substance.

1- SLIGHT HAZARD - *Flash Point Above 200°F:*

This substance must be preheated to ignite.

0- MINIMAL HAZARD - *Will Not Burn:*

Substances that will not burn.

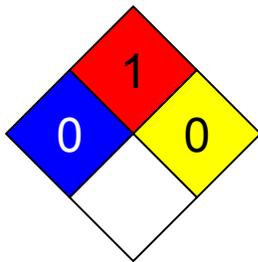




Regulatory - BioDiesel

B100 (266°F)

0 Health
1 Flammability
0 Reactivity
Protective Equip



NFPA CLASSIFICATIONS OF LIQUIDS

CLASS IA - Flash Point <73°F Boiling Point <100°F

CLASS IB - Flash Point <73°F Boiling Point >100°F

CLASS IC - Flash Point >73°F Boiling Point <100°F

CLASS II - Flash Point >100°F & <140°F

CLASS IIIA - Flash Point >140°F & <200°F

CLASS IIIB - Flash Point >200 °F





Where Do We Go From Here

Transition to Bio Fuels *(Four Step Process)*

- Evaluate the current equipment
- Implement
- Prepare to sell biofuels
- Maintenance & Upkeep





Where Do We Go From Here

Transition to Bio Fuels
(Four Step Process)

- **Evaluate the current equipment**
- Implement
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Compatibility – Tanks

- **Mild steel tanks:** compatible unless there is water in the tank, if a corrosion problem exist, it will exasperate an existing problem.
- **Post-1992 single-walled fiberglass USTs** may be used with E85 when approved by Underwriters Laboratories, Inc.
- **FRP – pre 81 tanks:** questionable for any alcohol, OC did not reinstate warranties. These tanks are not UL listed.
- **Retrofit Linings:** no linings if using E-85. E-10 should be checked for manufactures certification for the products stored.
- **Jacketed tanks:** Need to check UL listing.

Most tanks designed to store diesel fuel will store B100 with no problem. Acceptable storage tank materials include aluminum, steel, fluorinated polyethylene, fluorinated polypropylene, Teflon®, and most fiberglass.





Compatibility – Tank Fittings

- **Spill Containment:** Insure that it has no aluminum components are present.
- **Overfill Prevention:**
 - * *Ball valve: will the vapors degrade the ball itself.*
 - * *Automatic shut off at drop tubes: Would have to be nickel plated, or made of other compatible material.*
- **Drop Tubes:**
 - * *Would need to be nickel plated or made of compatible material. Tubes would have to sized before it is plated.*





Bio Fuels Today

Compatibility – Tank Fittings

ONE COMPANY. ONE WORLD. ONE SOURCE.™

ETHANOL?... NO PROBLEM!
INTRODUCING THE NEW E11 SERIES NOZZLES

Listed Nozzles for E85/E100 Service... Only From OPW

OPW

OPW has a complete line of ethanol compatible products for all your fueling applications

Introducing the Complete E85 Ethanol System Solution by OPW

Today 3.5 million vehicles in the U.S. can run on E85 fuel, and with the passage of the new energy bill, this number is expected to increase significantly. E85 is a blend of 85 percent ethanol and 15 percent ordinary unleaded gasoline. It is rapidly becoming a major alternative fuel and stands to gain significant consumer acceptance to combat rising fossil fuel costs.

But – a word of caution – E85 fuel requires special handling by fueling components specifically designed to:

- ◆ Protect above ground and underground fueling systems
- ◆ Protect dispensers, hanging hardware and prevent nozzle problems

OPW offers the most extensive E85 compatible fueling solution in the industry. Our E85 compatible products contain nickel plating and special elastomers to make sure your equipment is protected against corrosion and your fuel is protected against system contamination.

When it comes to fueling, rely on the brand and experience more marketers trust around the world than any other – OPW.

OPW E85 Ethanol Compatible System Solution

All OPW components are designed, built and tested to work together as a unified system solution for E85 and E100.

1. Overfill Prevention Valve	6150M Series	19. Conventional Nozzles	11AP-0482
2. Spill Containment Modules	1200 Series	20. Conventional Nozzles	11SP-0482
3. Extractor Fittings	233 Series	21. Conventional Breakaways	600-0482
4. Ball Float	610M/300M Series	22. Conventional Sockets	241PS-0482
5. Monitoring Caps	610M Series	23. PICES Single and Double Wall Flexible Pipe	All Product Nos.
6. Low Profile Vapor Caps	1711PC-0100	24. PICES Easy Entry and Primary Spig Fittings	All Product Nos.
7. Low Profile Fill Caps	614LPC-0400	25. Bronze F8 AST Spill Connectors	215-0482
8. Vapor Caps	1711F 700E-EVR	26. AST Tank Alarms	140/0441A
9. Fill Caps	614FP 700E-EVR	27. Spring Check Valves	175 Series/175
10. Bronze Vapor Adapters	6111AB-36S	28. Mechanical Tank Cages	2007C
11. Bronze Vapor Signal Adapters	6195A-102E-EVR	29. AST Overfill Prevention Valves	6115TOP-10MM/0100/030A
12. Bronze F8 Adapters	6111F-0100	30. Coupler, Adapters, Over Caps and Over Flaps	62014 Series
13. Bronze F8 Signal Adapters	6154AP-102E-EVR	31. Overfill Spill Connectors	221ACT/11ACT Series
14. 10 Emergency Shut Off Valves	All 90 Series Products	32. Top-Load Top-Load Adapters and Caps	6330A/6310171H Series
15. Stainless Steel Hose Connectors	All FCHXXXXX	33. Emergency Tapes	2012Q Series
16. Phoenix Bottom Valve	523V & 623V Series	34. Anti Siphon Valves	190 Series
17. Balance Nozzles	11VE-0482	35. Full Flow Non-Flow Ball Valves	2187
18. Balance Breakaways	60CL-0482	36. Extended AST Emergency Shut Off Valves	1785

OPW North America Toll Free: 1-800-451-2424 • Fax: 608-431-1200 • Email: general@opw.com
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Compatibility – Tank Monitors

- **Probe Compatibility:**
 - * *Capacitance probes not usable with any level alcohol.*
 - * *Magnetostrictive probes components, stainless steel probes & check float.*
- **Manual Tank Gauging:**
 - * Compatible paste or other level finding product would have to be used
- **Interstitial Monitoring:** Sensors would have to be compatible. Many micro float switches are not compatible.



Compatibility – Dispensers

- Dispensers need to meet NFPA 30A by being UL listed. Retrofitting may void UL listing.
- UL 87 defines dispenser design, but UL has not updated the standard for E-85 or biodiesel above 20
 - Cited lack of test protocol/definition for compatibility
 - Little market demand kept it off the front burner
- Standard equipment is compatible to 15% ethanol; meters for neat ethanol should have internal o-rings and seals designed to withstand ethanol's solvent action.
- Standard equipment is compatible to 20% biodiesel; unless there is an issue with specific elastomers that are not compatible with B20.





Compatibility – Dispensers

- The DNR and Fire Marshall Division require dispensers to bear the UL Mark or be certified by the manufacturer as compatible with the product stored and dispensed. Currently there are no E-Blend compatible dispensers with a UL Listing Mark. Therefore, incompatible dispensers are allowed a two-year phase-in period for E-Blend use.
Deadline for determining compatibility is 1 July 2007.





Compatibility – Dispensers

- CLEAN FUELS TECHNOLOGY (CFT) (September, 2005) submitted to Underwriters Laboratories, Inc. a fully compatible E85 dispenser and will continue to work for a listed device to comply with UL 87 (modified to accept E85).
- CFT is working directly with Dresser Wayne to provide a converted OEM dispenser fully compatible for E85 and also listed by UL.



Compatibility – Dispensers

- Must use iron, unplated steel, or stainless steel, nickel plating or hard anodizing in the fuel path.
 - All castings
 - All hydraulic components
 - All fuel piping
- Seals & o-rings must be upgraded to Viton GFLT



Fuel control valve



Fluid piping and seals

Affected Hydraulics



Compatibility – Dispensers

- In the case of vane-type pumps, avoid impellers made from soft metals (zinc, brass, lead, aluminum).
- Steel or an engineering polymer with a high chemical resistance will give excellent results.

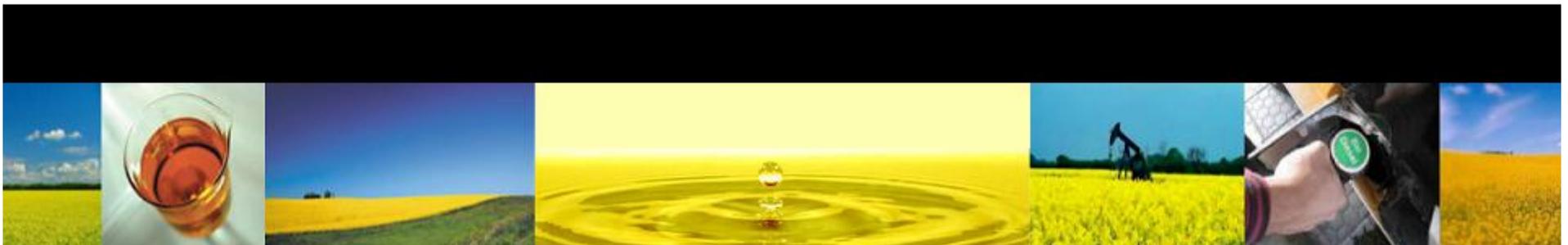


Fuel meter



Manifolds and fittings

Affected Hydraulics





Compatibility – Hose

- Teflon-lined hose with stainless steel ends and fittings
- Studies conducted for the National Biodiesel Board on the materials compatibility of Biodiesel concluded that the only hose and gasket material that was truly resistant to the solvent effects of methyl esters was Viton.
- Has to be UL listed for the application.





Compatibility – Nozzles

- Aluminum nozzles should not be used with E85, and nozzles made from any aluminum alloy must be used with caution.
- A nickel-plated nozzle is the best choice.
- Must be compatible
- Have to UL listed for E-85.





Compatibility – Hanging Hardware (Swivel, Breakaway, Spacer Hose)

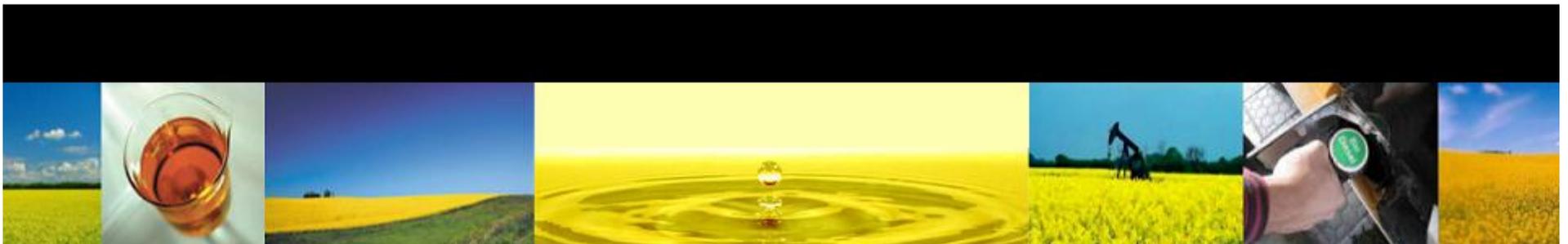
- Must be compatible
- Have to UL listed for E-85.





Compatibility – Filters

- E-85 Applications: 1-micron filter
- B-20 Applications: 2-micron filter
 - * *Due to gelling in colder climates, a 10-micron may be required.*





Compatibility – Pumps

- **Suction pumps:**
 - * Impellers, veins, gaskets
 - * For denatured ethanol, the preferred materials for seals are carbon and ceramic. Teflon impregnated packing materials are recommended for packing construction.
- **Submersible pumps:**
 - * Made for E-85: o-rings, impellers and turbine .





Compatibility – Leak Detectors

- **Mechanical Line Detector:**
 - * Red Jacket FX1 is not compatible must be of the FXV series.
 - * Would have to certified for the product
 - * Would need to be UL Listed for the product



Compatibility – Piping

- Steel: carbon & stainless are best choice for above ground
 - * Galvanized steel problematic
- Non-metallic best choice for under ground
 - * Flex: must be UL listed for 100% ethanol/methanol.
 - * Remember: Vapor recovery systems
 - * Older FRP not compatible.
 - * FRP compatible after 88; fittings and glues would need to be verified on a case by case basis to determine compatibility.
 - * Ameron FRP not UL listed for alcohol until after 92, will not backed or supported until newer glues and fittings.
 - * AO Smith red thread all compatible.





Compatibility – Pipe Sealants

- Pipe dope has to be Teflon
- Alcohol based pipe sealant should be avoided.
- Suitable sealants include:
 - Scotch Brand Pipe Sealant with Teflon, No. 4178
 - Loctite Pipe Sealant with Teflon, No 592
 - Permatex Seals Pipes, No. 804
 - Gasoila 100





Where Do We Go From Here

Transition to Bio Fuels *(Four Step Process)*

- Evaluate the current equipment
- **Implement**
- Prepare to sell biofuels
- Maintenance & Upkeep





Implementation

- Clean the tank.
 - * *Product recirculation*
 - * *Optic Sweep*
 - * *Steam Cleaning.*
 - * *Filter Agitator.*
 - * *Chemical Solvents*
 - * *Robotic cannon*
- Install compatible equipment
 - * *Signage*





Where Do We Go From Here

Transition to Bio Fuels (Four Step Process)

- Evaluate the current equipment
- Implement
- **Prepare to sell biofuels**
- Maintenance & Upkeep





Prepare to Sell BioFuels

- Check for water.
- Follow normal delivery procedures
- Shut down pumps during initial delivery.
- Purge lines from tanks to dispensers.
- Verify proper signage installed.
- Fill tanks to at least 80% of capacity.
 - * *Keep as full as possible for 7 to 10 days.*
- Test for water bottoms at the beginning of each shift for the first 48 hours after initial delivery. Then daily.
 - * *No level is acceptable.*
- Check pump calibration two weeks after initial load(s).





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- Evaluate the current equipment
- Implement
- Prepare to sell biofuels
- Maintenance & Upkeep





Maintenance & Upkeep

- Proper equipment use and maintenance is critical
- Filter changes
- Water removal
- Daily “walk-by” inspections
- Thorough record keeping is a must
 - * *Installations*
 - * *Conversions*
 - * *Inspections*
 - * *Tank & line testing*





Contact Info

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References

- "Fuel Ethanol (E85) Compatibility Standards and Dispensing Equipment List for E85 Fuel Vehicles"
- "Storing and Handling Ethanol and Gasoline/Ethanol Blends at Distribution Terminals and Service Stations" API Recommended Practice 1626
- "Cleaning Petroleum Storage Tanks" API Recommended Practice 2015
- "Biofuels and Agriculture Biofuels and Agriculture; A Fact Sheet for Farmers"
- "Fuel Ethanol Compatibility Standards and Dispensing Equipment List for E-85 Fueled Vehicles", AAMA
- "FUEL ETHANOL, Industry Guidelines Specifications, and Procedures", Renewable Fuels Association,
- "Checklist for Installing or Converting Equipment to Dispenser E85", National Ethanol Vehicle Coalition
- "E85 Fuel Dispensing and Storage", American Coalition for Ethanol
- "Handbook for Handling, Storing and Dispensing E85", Department of Energy
- "Biodiesel Analytical Methods" and "Biodiesel Production Technology" , J. Van Gerpen, B. Shanks, and R. Pruszko - Iowa State University, D. Clements, G. Knothe -USDA/NCAUR
- "BQ-9000 Overview", Leland Tong
- "Specification for Biodiesel (B100)", National Biodiesel Board





Bio Fuels Today

Websites

- U.S. Department of Energy, Alternative Fuels Data Center: www.afdc.doe.gov
- National Ethanol Vehicle Coalition: www.e85fuel.com
- National Renewable Energy Laboratory: www.nrel.gov
- Governors' Ethanol Coalition, Nebraska Energy office: www.ethanol-gec.org
- National Corn Growers Association: www.ncga.com
- Renewable Fuels Association: www.ethanolrfa.org
- The National Ethanol Vehicle Coalition: www.E85fuel.com
- American Coalition for Ethanol: www.ethanol.org
- National Biodiesel Board: www.biodiesel.org
- U.S. Department of Energy: www.eere.energy.gov
- U.S. EPA: www.epa.gov/OMS/models/biodsl.htm
- Iowa State University: www.me.iastate.edu/biodiesel/Pages/biodiesel1.html
- Department of Defense: assist.daps.dla.mil/docimages/0004/29/73/AA59693.PD0





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E85 Storage and Dispensing



Iowa Department of Natural Resources
Underground Storage Tank Section



IOWA'S OIL FIELD

A wide-angle photograph of a cornfield in Iowa. The foreground is filled with tall corn plants, their stalks a mix of vibrant green and golden-brown, indicating they are ready for harvest. The field extends far into the distance, where the corn stalks become a uniform golden-brown color. In the background, a dense line of trees is visible, shrouded in a light mist or fog, creating a soft, atmospheric effect. The sky is a pale, overcast grey. The overall scene conveys a sense of agricultural abundance and a quiet, early morning atmosphere.

PMCI

Iowa DNR Tank Section

□ Mission

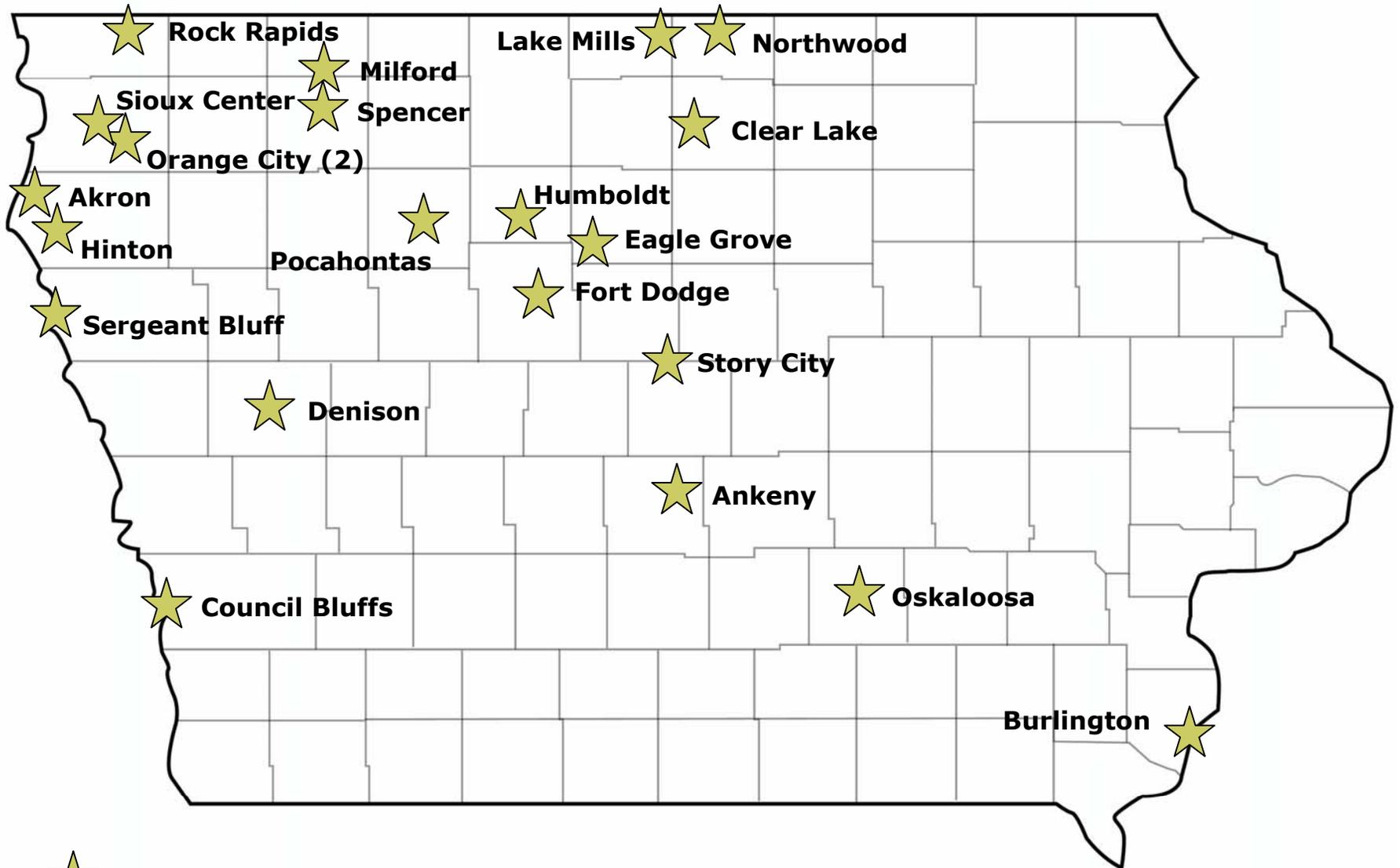
- to prevent releases from UST systems through regulations, outreach, inspections and enforcement
- Implement highest standards of monitoring and cleanup for those sites where releases have occurred (RBCA)

□ Responsibility

- Regulate 7,800 tanks at 3,000 sites
- 1,800 active LUST sites
- 6,000 LUST sites total

Where are the E85 Sites?





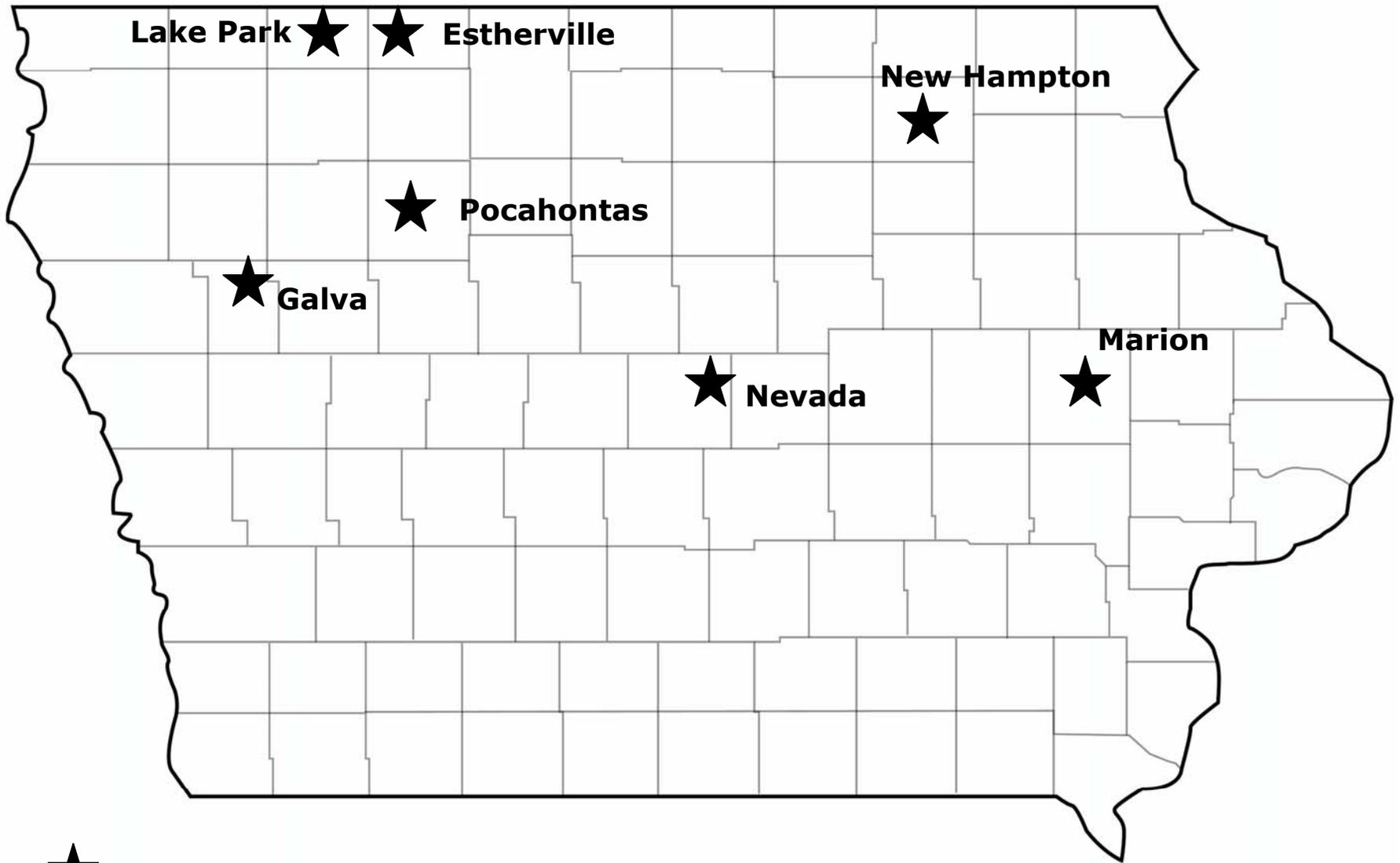
Private retail marketers using USTs to store E85



MIDWEST
FARMERS
COOP
ORANGE CITY



WHERE THE
FARM-TO-FOOD
SYSTEM BEGINS



Private retail marketers using ASTs to store E85

SOLD
HERE

Clean-Air Fuel Choice

E85

85% Ethanol

For Flexible Fuel Vehicles

E85
2007-2011
FLAMMABLE
NO SMOKING

For Flexible Fuel Vehicles Only

E85

85% Ethanol

E85

E85

85% Ethanol

FLAMMABLE
NO SMOKING

CHEVROLET

37A BDR



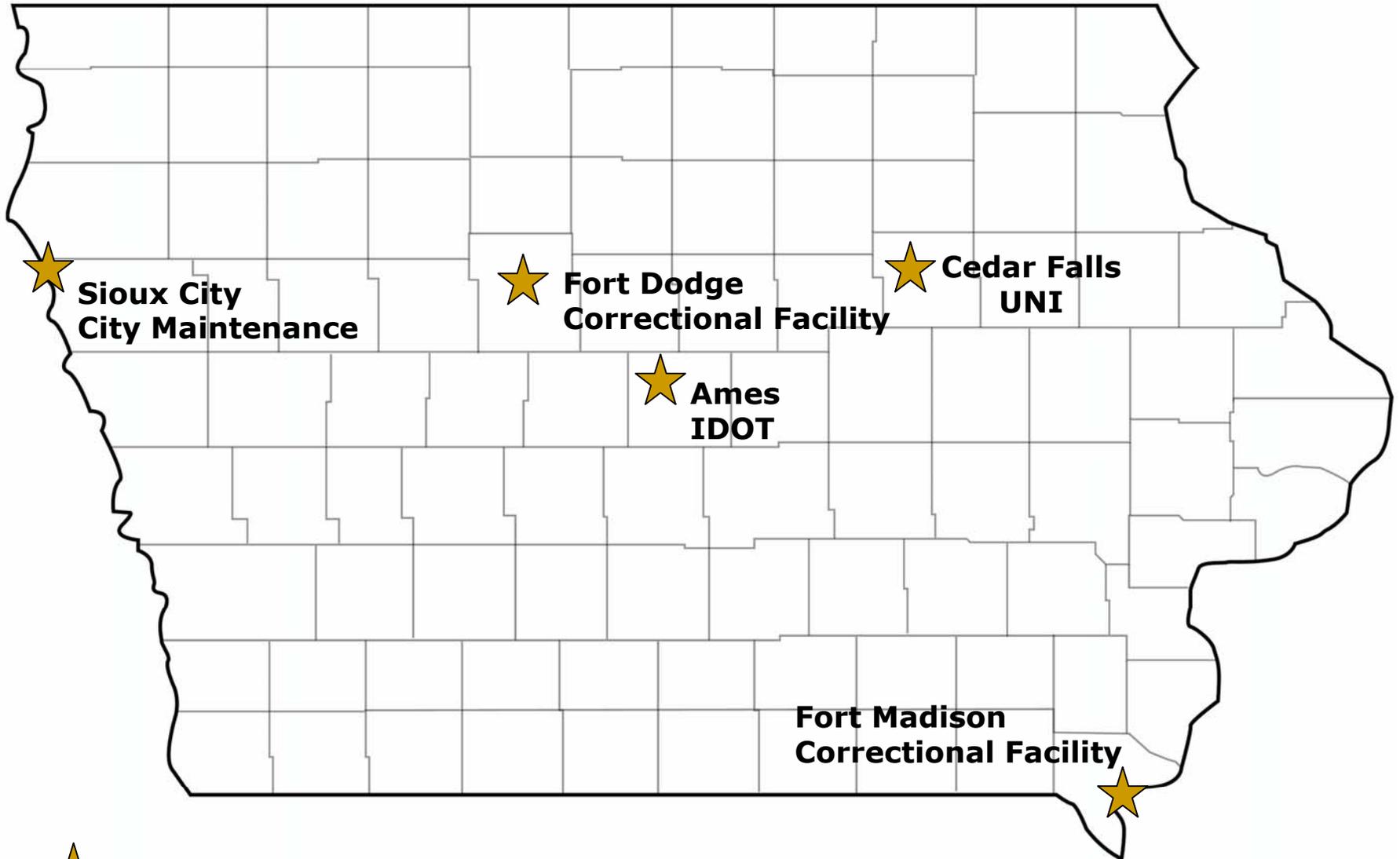
SOLD
HERE

Climate-Friendly Fuel

E85
85% Ethanol

For Flexible Fuel Vehicles





Municipal, County, State Sites using ASTs to store E85

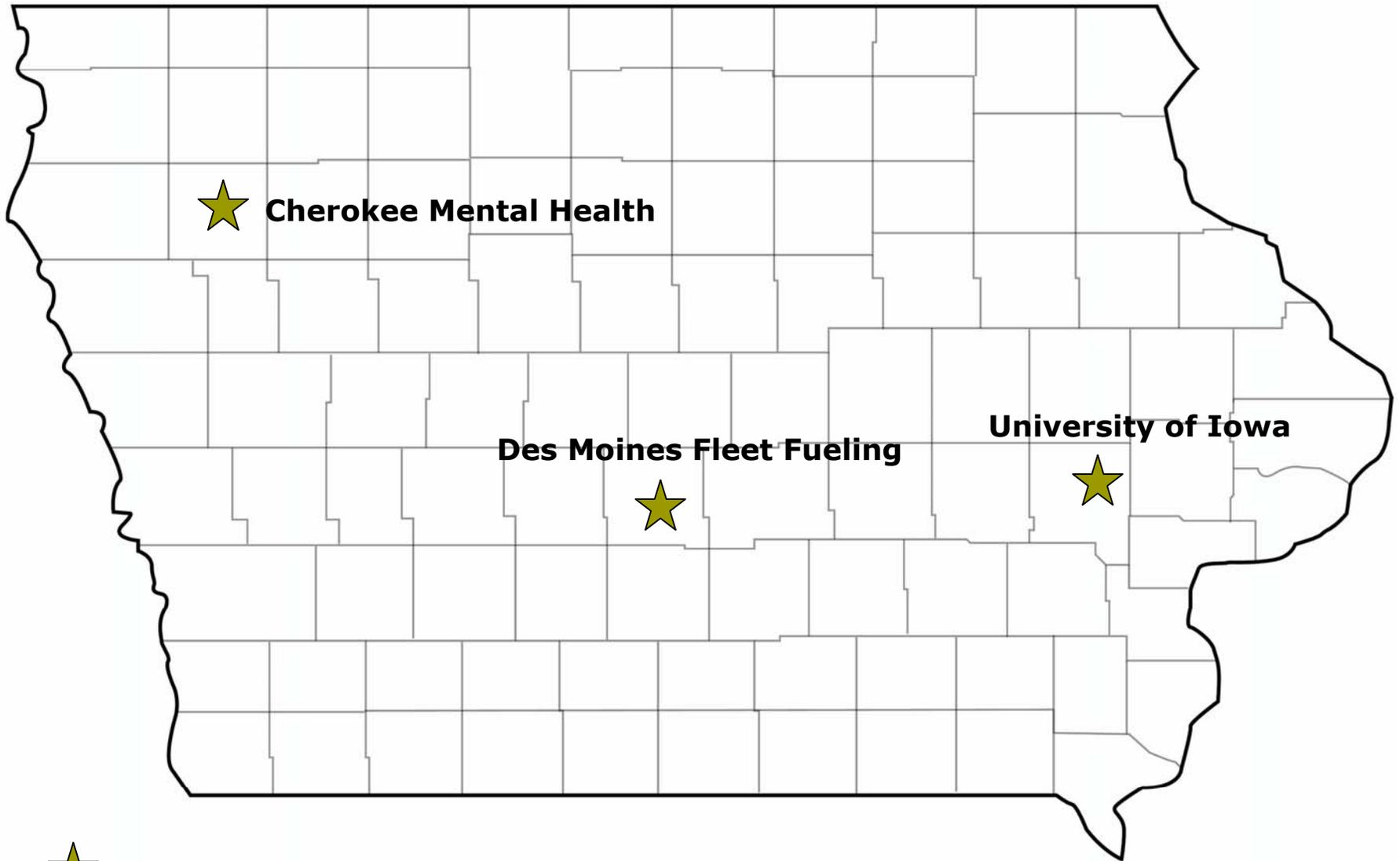


EMERGENCY VENT

DUAL 1000 GALLON

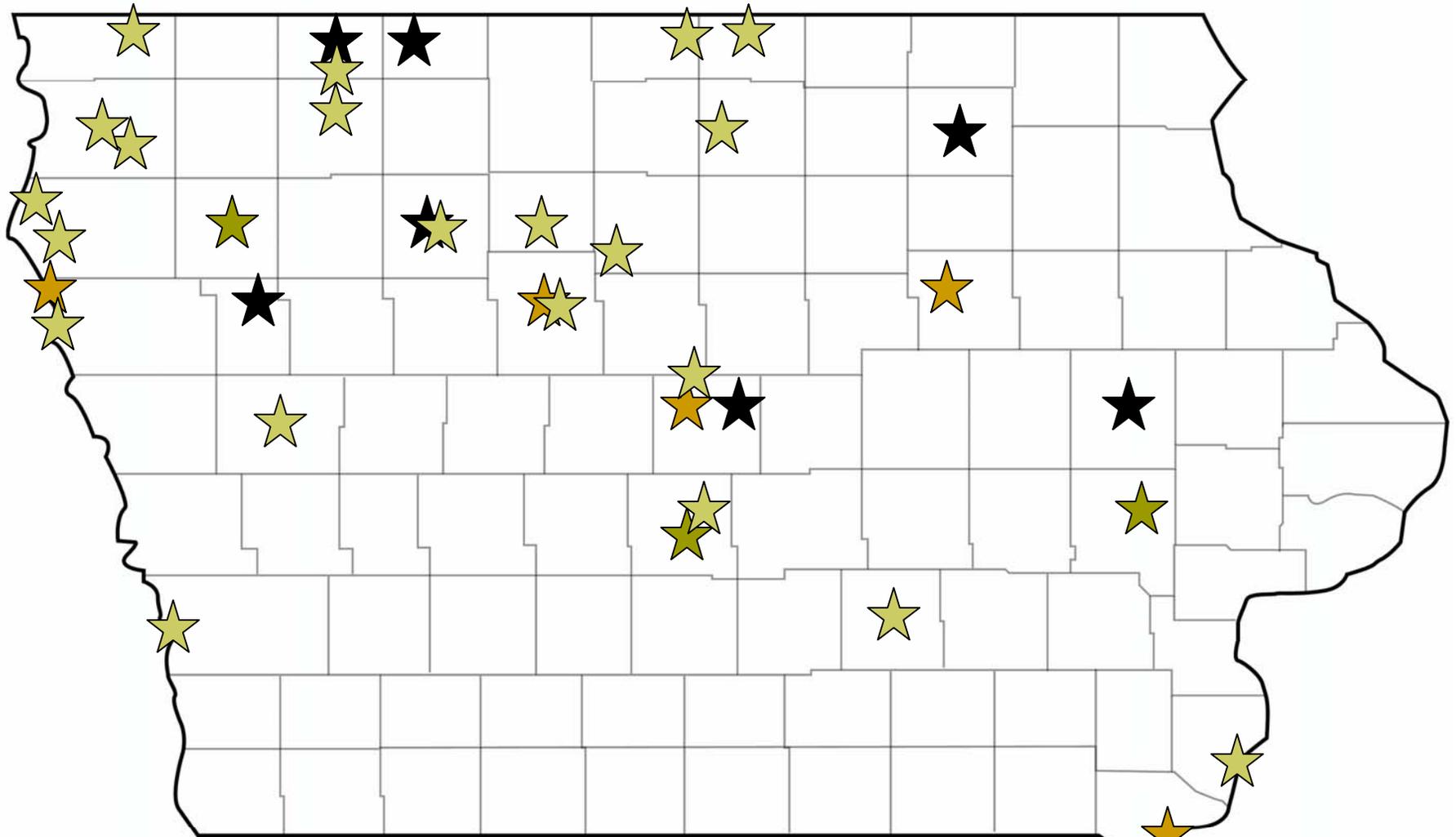






State sites using USTs to store E85





★ Private E85 ASTs

★ State E85 USTs

★ Municipal, county, state E85 USTs

★ Private E85 USTs







Air Inspections



Unpermitted Wastewater Basin



Prohibited Discharge into a Stream



DNR and E85

- ❑ Assist owners/operators to expand the use of E85 while providing protection to the environment and public
- ❑ About 100,000 flexible fuel vehicles in Iowa (about 5 percent of all Iowa vehicles)
- ❑ Provides oxygen for more efficient burn of fuel
- ❑ Lower carbon monoxide and carbon dioxide emissions than gas fueled vehicles (FFVs)

Reduce Oil Imports



E85 Issues and Concerns

- Corrosivity
 - Ethanol can scour corrosion cells inside a tank causing a release.

- Conductivity
 - E85 conducts electricity
 - Gasoline is an electrical insulator





E85 Issues and Concerns

□ Incompatible Metals

- Aluminum
- Brass
- Copper Alloys
- Lead
- Lead Solder
- Zinc
- Plated steel (lead-tin alloy) or terne plated

E85 Issues and Concerns

□ Compatible Metals

- Carbon steel
- Bronze
- Stainless steel
(nozzles, drop tubes, fittings, connectors)
- Unplated steel (tanks)
- Black iron (pipe, fittings, connectors)

E85 Issues and Concerns

□ Phase Separation

- Ethanol and water are completely miscible
- Gasoline and water are not miscible
- Ethanol blends well with gasoline
- Water/Ethanol will phase separate from the gasoline once enough water is present in the tank

E85 Issues and Concerns

□ Compatibility

- There are compatibility issues between E blend fuels and system metals and non-metals

□ Incompatibility: changes in

- physical
- chemical or
- mechanical properties of a material or substance

Compatibility



- ❑ UST system components and equipment were optimized for other fuels, namely *gasoline* and *diesel*.

Compatibility

- Compatibility [Subrule 567-135.4(3)]
- *Owners and operators must use a system made of or lined with materials that are compatible with the substance stored in the UST system*
- *40 CFR 280.32 (1988)*
- Environmental Code

Compatibility

- National Fire Protection Association (NFPA) 30, 2000 Edition
- *The materials of construction for tanks and their appurtenances shall be compatible with the liquid to be stored.*
- Fire Code
- American Petroleum Institute (API) RP 1626
- *All materials in the UST system should be checked for their suitability with ethanol and ethanol blend and replaced as required.*
- Industry Code

Compatibility



- ❑ Petroleum Marketers Management Insurance Company (PMMIC)--insures 2,100 UST sites in Iowa
- ❑ UST system components must meet DNR compatibility requirements (Checklist).
- ❑ Must complete PMMIC Compatibility Assessment
- ❑ Incompatible dispensers must have intact dispenser pans

Contained but Not Intact No Containment



Contained and Intact



E85 and Insurability

- State Funds
- Private Insurance
- Other mechanisms
- Other options (no underwriting differentiation based on product in tank)
 - Zurich
 - ACE
 - AIG
 - Liberty Mutual

E85 Issues and Concerns

- Compatible Elastomers (polymers having the elastic properties of natural rubber)-- flexible hoses, seals, gaskets
 - Buna-N (hoses, gaskets)
 - Neoprene rubber (hoses, gaskets)
 - Nitrile rubber (gaskets, O-rings, seals)
 - Teflon
 - Viton (O-rings and seals)

E85 Issues and Concerns

- Incompatible Elastomers
 - Natural rubber
 - Cork gasket material
 - Neoprene (seals only)
 - Buna-N (seals only)
 - Urethane rubber

E85 Issues and Concerns

- Compatible Polymers (plastics)
 - Reinforced thermoset plastic (rigid fiberglass) for tanks and piping
 - Thermoplastic (flexible or semi-rigid) used for sumps and flex piping



E85 Issues and Concerns

□ Incompatible Polymers

- Polyurethane
- PVC
- Polyamides (certain manufactured fibers)
- Certain epoxies and polyester resins manufactured between 1970s and 80s
- Alcohol-based thread sealant

E85 Issues and Concerns

- Environmental & Fuel Spill: treated the same as gasoline (NFPA 30 and 30A)
 - Ethanol is a Class 1 Flammable liquid (i.e., Flashpoint below 73° F) with a Flash Point of -20 to -4° F.
 - Ethanol will separate from gasoline when it reaches the water table and cannot be recovered
 - Health & Fuel Toxicity: treated the same as gasoline
 - Safety and Health: treated the same as gasoline

E85 and its effects on BTEX

- Three key ways E85 affects BTEX:
 - Cosolvency: BTEX is more soluble in ethanol/water mixtures
 - Interfacial tension: ethanol reduces surface tension of BTEX plume making it more mobile. It can result in the movement of NAPLs. Free phase product may be observed where it hadn't previously been seen.
 - Ethanol can inhibit biodegradation of BTEX by depleting oxygen or other electron acceptors.

Where Leaks Can Occur

- ❑ Submersible Pumps - aluminum pump and motor housing. O-rings, gaskets, seals can degrade. Fire safety hazard as well as environmental.



Where Leaks Can Occur

- Dispenser Components:
 - Aluminum and copper tubing
 - Unions
 - Valve poppets and seals
 - Gaskets
 - O-rings
 - Hoses
 - Nozzles (no aluminum)
 - Swivels





Where Leaks Can Occur

- Leak Detection Monitoring Systems that come in contact with fuel:
 - Aluminum electrical conduit
 - Probes for electrical conduit
 - Epoxy



Meetings to Develop Checklist and Guidance

- Ethanol Industry (producers, marketers, growers)
- Petroleum Marketers and Convenience Stores of Iowa (PMCI)
- PMMIC
- UST Licensed Installers
- Department of Agriculture (Weights and Measures)
- Fire Marshal Division

Compatibility Checklist

- ❑ Procedure (based on available literature, standards and codes) for converting UST systems to E85
- ❑ Owner/operator and Iowa-licensed installer complete checklist.
- ❑ Iowa Licensed Installer ensures completeness, knowledge (vendors, equipment) and objectivity

E85 Checklist

- ❑ Complete equipment checklist for tanks/piping/dispensers
- ❑ Inform insurance carrier. Obtain amended certificate.
- ❑ Check water in tank. No level acceptable
- ❑ Tighten all connections at risers. No vapors escape and no water enters.
- ❑ Clean tank of water and sediment.
- ❑ Label fill ports and paint access covers (API RP 1637). Label dispenser.

First Delivery (first 7-10 days)

- ❑ Fill tank to 80 percent capacity and keep as full as possible.
- ❑ Conduct 0.1 gph tightness test of the tank system
- ❑ Test for water daily (alcohol compatible paste or ATG system)
- ❑ Inspect dispenser daily and maintain inspection record
- ❑ Calibrate the dispenser liquid meter to verify meter accuracy

Ongoing Maintenance

- ❑ Check regularly for water. No level is acceptable
- ❑ Check calibration of the dispenser liquid meter periodically. Particulate materials in the product may cause excessive wear of the meter, which would require more frequent calibration (API RP 1626)
- ❑ Conduct daily, visual inspections of the dispenser and dispenser pan (if installed) and maintain inspection record.

Guidance

- ❑ Prepared guidance based on industry standards, available documents, petroleum experts, and manufacturers.
- ❑ Of primary importance were manufacturers who stated their equipment was or was not compatible.
- ❑ Two-year phase in for dispensers.

Guidance

- ❑ Our responsibility was to inform owners/operators and installers regarding the issues of compatibility
- ❑ Developed checklist and conversion guidance for existing UST systems

Difficulties/Obstacles

- Formidable nexus of ethanol investors, marketers, associations, growers, corporations
- Profit/investor driven
- Politics (pressure from lobbying groups) and concerns from Governor's office
- "Don't be different!" Or: "Why are you more restrictive than other states? Why are you tougher on ethanol than gasoline?"
- "Ethanol is biodegradable! You can drink it!"

Support/Assistance

- ❑ Iowa Petroleum Equipment Contractors Association (IPECA)
- ❑ PMMIC
- ❑ Owners/operators
- ❑ Petroleum Marketers and Convenience Stores of Iowa (PMCI)
- ❑ DNR Upper Management
- ❑ Governor's Office

BioDiesel

- No significant compatibility issues with B20 (BioDiesel Handling and Use Guidelines)
- Physical and chemical properties similar to petro-based diesel

Legislation

□ E85 Proposed

- \$2 million grant program for purchases of compatible UST equipment administered by DNR
- 10 percent ethanol mandate by January 2007
- Income tax credit for selling E85 of 10 cents per gallon from 2007-2012
- Sales of flex fuel and hybrid vehicles exempted from use tax

Legislation

- E85 Current
 - Forgivable Loan Program
 - Provides \$325,000 annually (for three years) on a cost share basis for new and existing E85 retail sites and on-site or off-site biodiesel terminal locations.
 - New sites--not to exceed \$20,000 per location
 - Existing sites--not to exceed \$7,500 per location
 - Biodiesel off-site storage--not to exceed \$50,000 per location
 - 15 sites received ~ \$275,000 for FY '06.



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