


E85 Deployment Issues

UL Update
Working with Fire Marshals, AHJs and
First Responders

Ethanol Roundtable
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Outline of Presentation

- ◆ How do existing Codes apply to E85
 - Listing of E85 Dispensers to meet codes
- ◆ How is E85 different from gasoline
- ◆ How do these differences impact listing of E85 fueling equipment
- ◆ What is being done to resolve these issues
 - UL E85 dispenser certification update
 - Working with Authorities Having Jurisdiction (AHJs) such as Fire Marshals
 - Working with first responders

How do Existing Codes Apply to E85

- ◆ E85 is simply a blend of denatured ethanol and gasoline
- ◆ We have been using E5 and E10 blends for years without any issues
- ◆ While use of E85 has been limited nationally it has experienced few significant issues to date
- ◆ E85 according to the existing codes is classified as a Class 1 fuel the same as gasoline. This is based on its physical properties such as flash point and vapor pressure.
- ◆ The codes state that all Class 1 fuel dispensers, hoses, nozzles and pumps must be 'Listed'.

Listing of E85 Dispensers to Meet Codes

- ◆ The codes define 'Listed' as:
 - 'Listed' - Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction (AHJ) and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.
- ◆ Standards (UL) for 'listing' E85 equipment were completed and published by UL in October 2007

How is E85 Different From Gasoline

- ◆ Ethanol is a polar solvent – that means that ethanol can conduct electricity where gasoline does not. This is a concern for two primary reasons.
 - Ethanol as a conductor of electricity provides an environment where galvanic corrosion can take place inside the piping, pumps, tanks and dispensers of the fueling system
 - Ethanol as a polar solvent also readily adsorbs water impacting fuel quality and greatly affecting the materials and methods for suppressing ethanol fires.
- ◆ E85 also may degrade elastomeric seals and gaskets materials that are compatible with gasoline service

How do These Differences Impact Listing of E85 Equipment

- ◆ In the new UL 87A listing certification, tests now address the impact of a polar solvent
 - Research on materials and additional tests to determine the performance with respect to galvanic corrosion of materials, coatings and combinations of materials used in the fabrication of E85 equipment has been completed
 - These new tests require evaluation of the entire fueling system in both static and dynamic (flowing) conditions. With galvanic corrosion the coupling of dissimilar metals from more than one component part of the system is of concern

Differences Continued -

- Ethanol, as previously mentioned, chemically reacts with some elastomer materials found in seals and gaskets that otherwise perform well in gasoline service
- New testing to determine the performance of seal and gasket materials used in the fabrication of E85 equipment is required in UL 87A

Differences Continued -

- Although not part of the certification testing for listing the fact that Ethanol readily absorbs water and gasoline does not, impacts the operational safety of E85 fueling systems
- Foams that are used by fire fighters to suppress gasoline fires are water based (97% water). These foams when applied to a polar solvent such as ethanol are quickly deflated due the water adsorption and are ineffective. Special alcohol resistant foams are required.
- Research is now underway to determine the flammability range of E85 in fuel storage tanks and how it may be different than gasoline

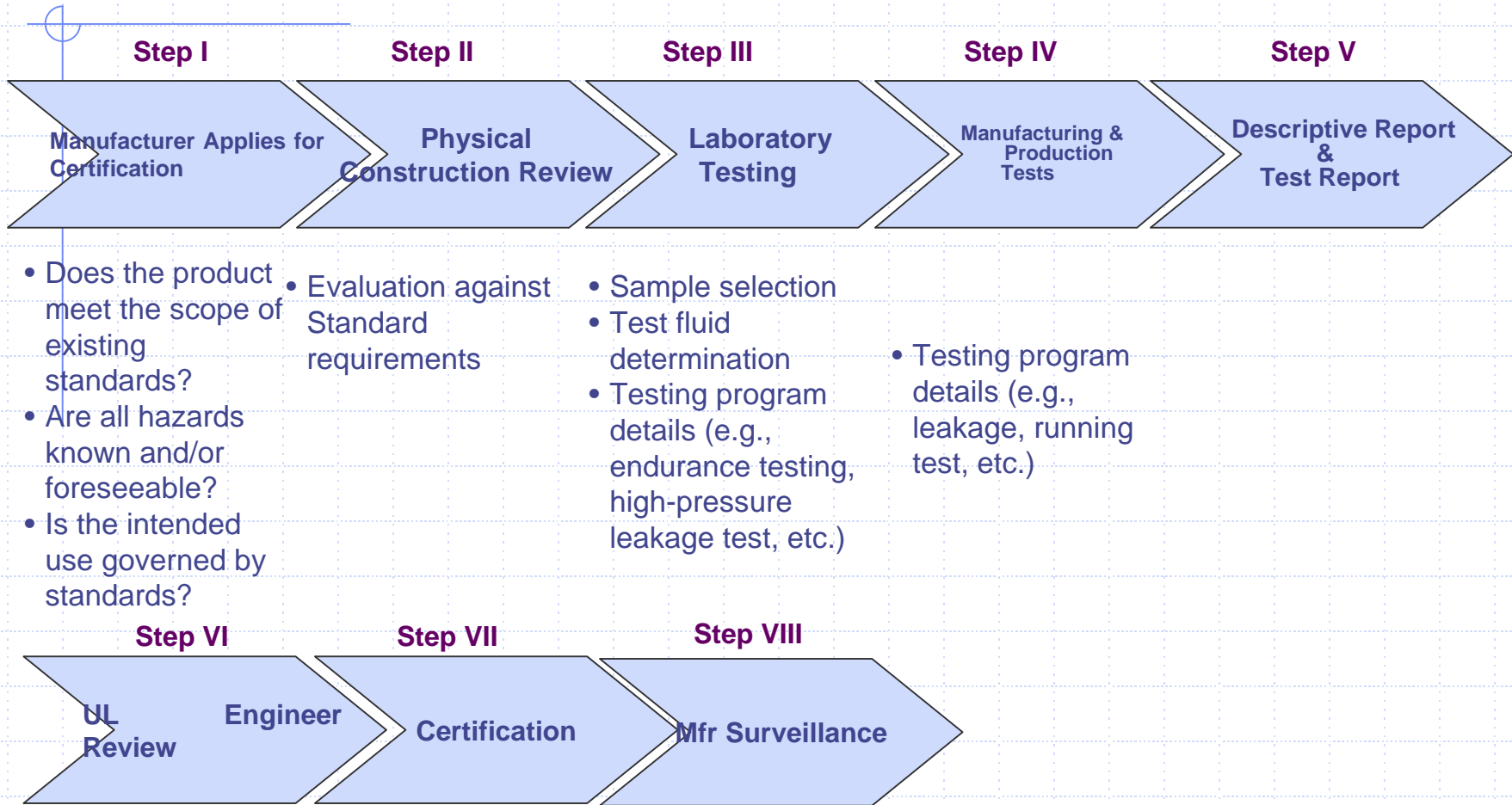
What Has Been Done to Resolve These Issues

- ◆ UL developed E85 dispenser certification procedures (UL 87A) so they may be submitted for certification and listing
- ◆ We are working with Authorities Having Jurisdiction (AHJs) such as Fire Marshals and Building Code Officials to seek continued operation and installation of E85 facilities until listed products are available
- ◆ And are working with first responders – what they need to know about E85 firefighting tactics

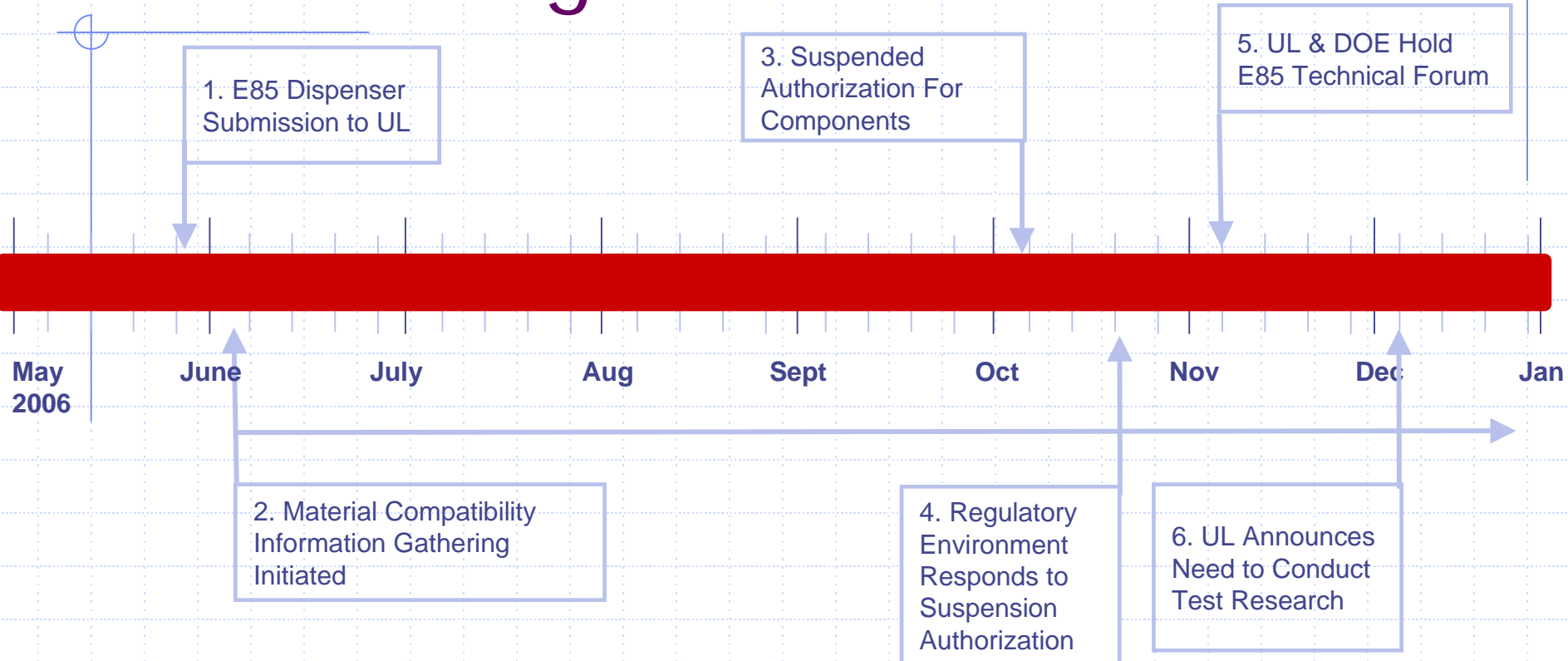
UL E85 Dispenser Certification Update

- ◆ Products have been submitted to UL for certification testing
- ◆ Underwriters Laboratories Inc.
 - Evaluates 19,000 product categories
 - More than 100,000 investigations
 - 6,000 employees
 - More than ½ million factory inspections
 - 19 billion UL Marks
 - Safety testing for 114 years

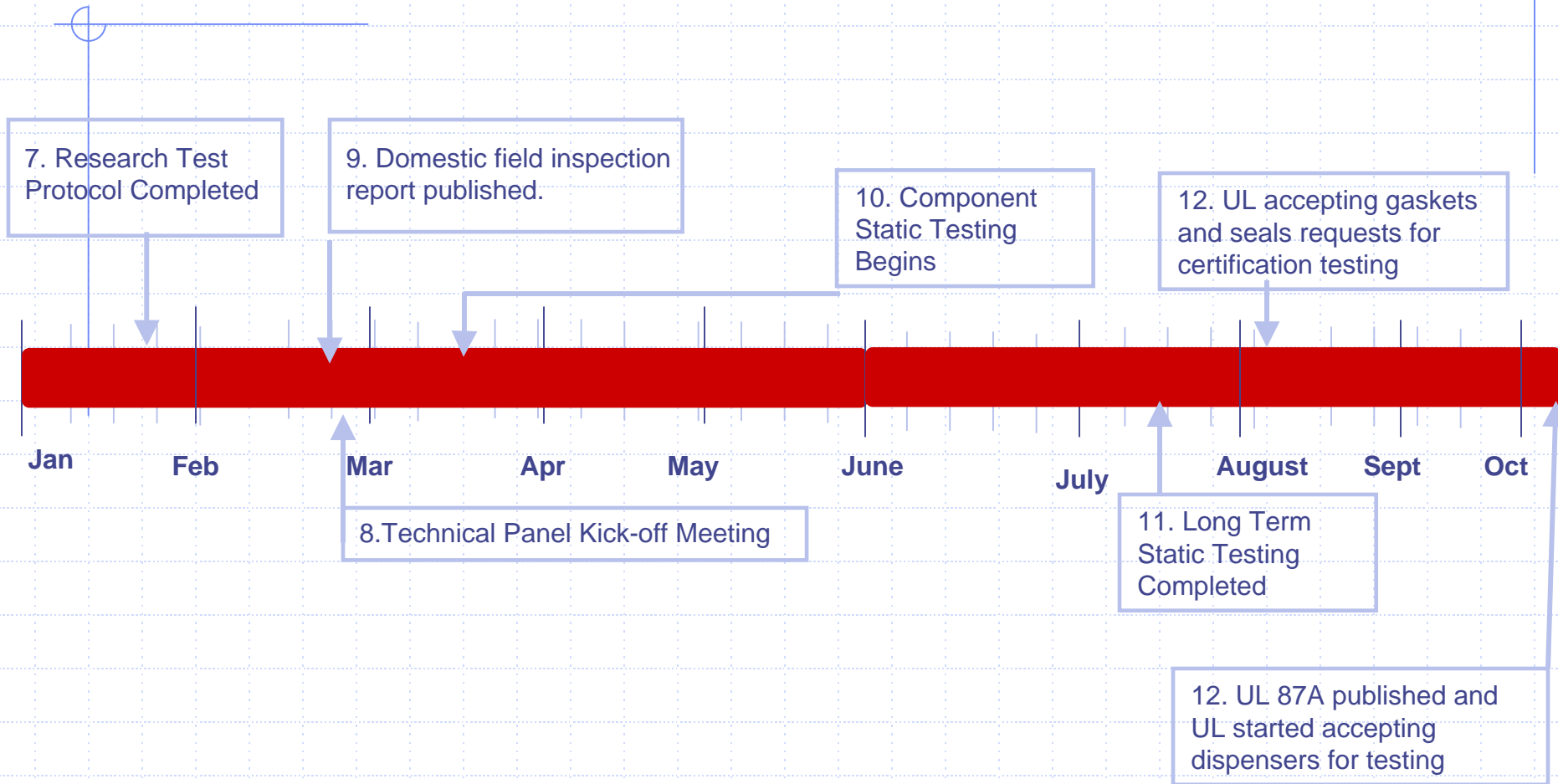
UL Certification Process



E85 Investigation Timeline - 2006



E85 Investigation Timeline -2007



Preliminary Conclusions

- ◆ UL's review of E85 dispensers that have been in service for 1 to 3 years indicates the presence of degradation in some cases.
- ◆ Initial field surveys findings have shown that exposure to E85 fuel has not resulted in significant equipment safety or maintenance problems to date.
- ◆ The research and laboratory testing of seal and gasket material in an E85 environment was completed and certification test procedures validated.
- ◆ On August 2, 2007 UL announced that requests for certification testing of seals and gaskets are being accepted.
- ◆ The 2500 hour accelerated life testing of E85 dispenser components was completed and supports the need for material compatibility requirements.
- ◆ On October 16th 2007 UL 87A was published and UL started accepting dispensers for certification.

Status of Dispenser Certification

- ◆ UL began accepting manufacturer's requests for certification testing of E85 dispensers to be listed effective October 16, 2007. At this time the testing is still under way. Information on the status of a specific UL certification must be obtained directly from the manufacturer not UL.

Other Activities

- ◆ The development of certification test procedures for listing E85 dispensers has been only one part of the activities to support the deployment of E85 fueling infrastructure
 - A management team was formed by DOE to address the technical issues of E85 deployment. The team consists of representatives from DOE, NREL, UL, EPA and other industry experts.
 - A Fire Team was established by UL to address fire safety concerns of ethanol blended fuels. The Fire Team includes members from UL, NREL, IFCA, fire marshals and fire services.

Working with Authorities Having Jurisdiction (AHJs)

- ◆ In most cases the local Fire Marshal is the AHJ for approving installation and modifications of fueling stations
 - In some states the State Fire Marshal has responsibility for some aspects of the installations i.e. underground tanks
- ◆ State Fire Marshal offices (or their equivalent) propose the adoption of the various model codes that become law in their respective states

Codes & Standards for E85 Dispensing Facilities

- ◆ At the present time ethanol blends are not directly referenced by the existing codes but since they are by definition Class 1 flammable liquids the existing motor fuel dispensing facility standards do apply (NFPA 30A)
- ◆ NFPA 30A has been directly adopted or referenced as law in the vast majority of States
 - NFPA 30A requires that all Class I fuel dispensers pumps, hoses and nozzles be 'listed'
- ◆ Certification requirements (UL 87A) for 'listing' E85 equipment was issued October 16, 2007. Standards based on these requirements are under consideration

The Variance Process

- ◆ NFPA 30A as typical with all codes allow for equivalency of design as long as the overall safety requirements are not compromised. This provision is at the heart of the variance process used by AHJs in enforcing the codes.
 - **1.5 Equivalency.** Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.
- ◆ The variance process has been successfully used to bring new technologies to the market prior to the development of the applicable codes and standards.

AHJ Variance Responsibilities

- ◆ Local AHJs normally can approve variances to requirements for existing facilities
- ◆ State AHJs usually are responsible for granting variances for new installations
 - These requests are normally posted for public information on the internet
 - A typical process is stated on the next slide

Typical Variance Process

◆ Request for Modification of Specific Requirements (GA example)

- Upon receipt of a sworn affidavit from the owner stating all relevant facts and circumstances and such other information as may be required, the State Fire Marshal may recommend to the Commissioner that specific requirements of this Chapter (*State code of regulations*) and the NFPA codes, standards and recommended practices adopted herein, be modified to allow alternative arrangements that will secure as nearly equivalent measures as practical for the prevention of injury to persons and property. The Commissioner, in his discretion, may accept the State Fire Marshal's recommendation and grant the requested modification.

AHJ Actions on E85 to Date

- ◆ North Carolina
 - Office of the State Fire allows installation of E85 dispensers with a Professional Engineer's review and seal
- ◆ New York
 - Division of Code Enforcement allowed the NY Thruway Authority to continue to use ethanol/gasoline dispensers installed 4 years ago even though the original listing was not for E85 blends
- ◆ Colorado
 - Division of Oil & Public Safety has required that E85 dispensers to be 'certified' by the manufacturer of its intended use until a listing is available
- ◆ Minnesota
 - State Fire Marshal allows operation & installation of E85 dispensers until listing is available but will review if failures are noted
- ◆ West Virginia
 - Division of Labor, Weights & Measures allows operation & installation of E85 dispensers using gasoline procedures along with 90 day inspections but will remove from service if failures are noted
- ◆ Additional information for Illinois, Iowa, Michigan, Ohio, Oregon and Wisconsin is available at the web site below:

http://www.eere.energy.gov/afdc/resources/technology_bulletin_0307.html

Working with AHJs

- ◆ As we have seen a number of States already allow the continued installation and operation of E85 facilities
- ◆ The key drivers in their decisions are
 - The apparent good safety record of existing E85 fueling facilities
 - The requirement that the E85 dispenser and associated equipment manufacturers certify that their products are suitable for their intended purpose
 - The fact that UL has a number of dispenser products currently under certification testing for listing as required by the codes
 - The fact that ultimately dispensers must be listed

Working with First Responders

- ◆ Typically any new fueling facility would be first approved by the fire marshal or AHJ and then the AHJ would notify fire services of any special fire safety issues
- ◆ Fire service personnel also visit facilities within their district to note contact information and to survey hazards they may face in emergencies
- ◆ E85 fueling station owners, equipment installers, facility contractors and other interested parties such as Clean Cities Coordinators should be proactive in discussing the fire safety requirements of E85 with the local AHJs and fire services

UL Fire Team

- ◆ As part of the UL Technical Team a Fire Team was formed to define issues noted below and make suggestions on suppression of high percentage ethanol fuel fires
 - Ethanol blend fuel mixtures and fire behavior
 - First responder procedures and fire fighting ground tactics
 - Fire fighter education and training will be an important aspect for addressing these concerns.
 - Identification and placarding of facilities
 - Additionally, the need for possible Code revisions, both with respect to ICC (International Code Council) and NFPA Codes will be reviewed

Extinguishing Ethanol - Test

- ◆ Ethanol Emergency Response Coalition tested six commercial products to evaluate their performance in extinguishing high percentage blends of ethanol fires.. The organizations involved are the International Association of Fire Chiefs, Ansul Fire Protection, Industrial Fire World, Renewable Fuels Association, Independent Liquid Terminals Association, Virginia Department of Emergency Response, Williams Fire & Hazard Control and the U.S. Department of Transportation.
- ◆ Results for ethanol fires are summarized as follows:
 - Only Alcohol Resistant products (AR-AFFF & AR-FFFP) were capable of extinguishing any of the top side fire tests.
 - Only Type II applications of the two AR foams were successful in extinguishing ethanol fires. The AR-FFFP required a higher application rate to extinguish the fire.
 - Of the two agents that were capable of passing the extinguishment requirements, only the AR-AFFF was capable of also passing the burn back resistance portion of the test.
 - Only the AR-AFFF was capable of passing all of the top side fire test requirements of UL 162 but only when using a Type II discharge scenario.
 - See the video at <http://www.fireworld.com/index2.php>

Working with First Responders

- ◆ While fire service personnel receive excellent training it is not prudent to assume that they have up to date information on suppression of E85 fires
 - The DOE/UL team is working with IAFC and others to develop a training program on first responder procedures and fire fighting tactics
 - A video of the comprehensive testing done by the Ethanol Emergency Response Coalition is available at <http://www.fireworld.com/index2.php> . All first responders should be encouraged to view the video.
 - Some states, such as New York, require the E85 fueling facility to maintain the proper extinguishing material on site for use by the first responders. Therefore station owners should be aware of the training available and should view the video.

DOE Website for E85 Information

- ◆ Site to get continuous updates on E85 issues and solutions, web cast presentations and links to other sources of information such as UL, EPA and various state AHJs
 - http://www.eere.energy.gov/afdc/ethanol/index.html#letin_0307.html

Summary

- ◆ Higher blends of ethanol and gasoline (E85) require special consideration since ethanol is a polar solvent
 - Certification test for listing must consider galvanic corrosion and degradation of certain elastomer materials
 - Fire suppression procedures and techniques must consider the water adsorption properties of ethanol
- ◆ UL is now accepting request for listing of E85 dispensers
- ◆ Some States are allowing the continued operation and deployment of E85 facilities with certain stipulations
- ◆ Proactive open discussions with AHJs and first responders is effective in the continued safe deployment of E85 fueling infrastructure

We are not done yet !

- ◆ You have just heard about efforts needed to safely deploy one alternative fuel – E85
- ◆ A review of other alternative fuels such as biodiesel is underway to make sure that we can proactively resolve any issues before they can impact deployment

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