Ethanol Emergency Response Coalition

The Ethanol Emergency Response Coalition (EERC) was formed to address safety concerns with the transport and handling of renewable fuels. The Coalition has made a commitment to making safer the handling of this new generation of automotive fuels. As increasing amounts of renewable fuels are produced, transported, stored, and consumed, it is imperative that the safety community possess the knowledge necessary to respond to incidents that may occur along the way. The primary goal of the Ethanol Emergency Response Coalition is to evaluate the information currently available to the first responder community and address any gaps in educational or training materials. The initial work completed by the EERC was to conduct the firefighting foam evaluation summarized herein.

The EERC is a group of organizations representing emergency responders, industry and government that came together to help identify and address emergency response issues related to the increased production, distribution and use of ethanol and ethanol blended fuels. The organizations participating in the EERC include the Renewable Fuels Association (RFA), Aventine Renewable Fuels Inc., the International Liquid Terminals Associations (ILTA), International Association of Fire Chiefs (IAFC), TYCO/Ansul Fire Protection, Industrial Fire World, Williams Fire and Hazard Control, as well as other organizations.

Responding to a call for improved information on the proper foam selection when addressing ethanol blended fuels, the coalition recruited the assistance of ANSUL in developing resource information. The EERC produced a fire safety video, "Responding to Ethanol Incidents", which provides crucial information for first responders, and the proper foam selection required to combat fires involving ethanol blended fuels. The response from this video has been overwhelmingly positive and has only whetted the appetite for additional safety information related to fuel ethanol and related fuels. Some of the specific projects underway include the evaluation of various flammable liquid extinguishing agents, development of training materials, tactical response procedures and protocols, and other resources for emergency responders that may be confronted with emergency incidents involving ethanol or ethanol blended fuel. A priority for these and all EERC initiatives is communicating the information to those who need it most.

EERC
Ethanol Emergency Response Coalition

For further information about the EERC contact us at: EERC@ethanolrfa.org

RESPONSE TO ETHANOL-BASED INCIDENTS

Foam Performance Test Results

www.ethanolresponse.com

EERC

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Overview of Findings

The EERC recently concluded testing on various foam agents against ethanol fuel fires to determine which foam types were most effective in extinguishing fires and maintaining vapor suppression. The tests were conducted over a two-week period in February 2007 at Ansul Fire Technology Center, in Marinette, Wisconsin. The following types of foams were tested:

- Alcohol-resistant, aqueous film-forming foam (AR-AFFF)
- Traditional aqueous film-forming foam (AFFF)
- Class-A foam intended for fire involving ordinary combustible, or Class A materials
- An emulsifier
- Conventional fluoroprotein foam
- Alcohol-resistant film-forming fluoroprotein (AR-FFFP) foam

The results indicate that AR-AFFF was the only foam agent that successfully passed all the tests against both 95% ethanol solutions and 10% ethanol solutions blended with gasoline. While some of the other foams may have had some degree of effectiveness, the tests confirmed that AR-AFFF will be the most effective and most versatile foam for fires or spills involving ethanol-blended fuels. Conventional AFFF foams were only partially effective in fighting low concentration ethanol blended gasoline fires, such as 10% ethanol blended gasolines.

About the Study

Purpose: The purpose of the test program was to evaluate the effectiveness of various foam concentrates and other water additives on these two types of fuels.

Fuels: A series of performance fire tests were conducted on denatured ethyl alcohol, ethanol, (95 % ethanol that was denatured with 5 % gasoline) and on gasohol (defined by API as regular unleaded gasoline with up to 10% by volume ethyl alcohol).

Agents Tested:

The following generic foam concentrates and water additives were evaluated:

A. Alcohol Resistant AFFF (AR-AFFF)
B. Class A Foam
C. Regular AFFF
D. Emulsifying Agent
E. Regular Fluoroprotein
F. Alcohol Resistant Film Forming Fluoroprotein (AR-FFFP)

Where possible, 3% versions of each of these agents were used.

All of the above agents tested, were commercially available products and are not considered to be manufacturer or brand specific. Results, therefore, are for generic types or classes of foam agents rather than brand specific products. Personnel involved in the fire testing were not informed as to the brand or manufacturer of the agents being used but were informed as to the type of agent being used.

Test Protocols:

Fire testing protocols were based on the methods established for top-side and sprinkler testing as outlined in UL 162; Standard for Safety - Foam Equipment and Liquid Concentrates; 7th edition . This standard establishes fire test protocols for applying agent to the fire by various application techniques using specified application rates.

UL DEFINITIONS

Top Side Fire Tests

"Type II" application

- fixed discharge applied to a vertical surface so as to provide a more gentle application
- minimal plunging or submergence

"Type III" application

- agent applied directly to the surface of a burning liquid fuel
- technique allows for plunging and submergence of the agent when applied to the fire.

Sprinkler Application

- Allows for testing out of either air-aspirated or non-aspirated sprinkler devices as would be found in fixed protection for loading racks or other fuel transfer areas.

Application rate is defined as gallons per minute of unexpanded foam solution flow divided by the fire area. An Application Rate of 0.06 multiplied by a 50 square foot surface area equals a 50 gallon per minute flow.

UL defines agent applied directly to the surface of a burning liquid fuel as a "Type III" application. This application technique allows for plunging and submergence of the agent when applied to the fire.

They further define a "Type II" application as a fixed discharge applied to a vertical surface so as to provide a more gentle application with minimal plunging or submergence.

Type II and Type III applications are classified as "top side" (for storage tank) fire tests by UL. Generally Type II and Type III applications can be used for hydrocarbon fuels while Type II are most effectively used for polar solvent/ water miscible fuels such as ethanol.

Finally, sprinkler application of the agent allows for testing out of either air-aspirated or non-aspirated sprinkler devices as would be found in fixed protection for loading racks or other fuel transfer areas. For both top side and sprinkler tests, UL 162 requires not only successful extinguishment but also a level of resistance to re-ignition and burn back (typically, simply called "Burn back resistance").

All agents were evaluated on both fuel types. For ethanol fires, all agents were evaluated on both Type II and Type III fire scenarios. Any agent capable of passing either of these fire scenarios was further evaluated on a sprinkler fire. For gasohol fires, only Type III fires were conducted. Again, any agent capable of passing the top side test was further evaluated on a sprinkler fire.

For detailed testing data please visit www.ethanolresponse.com

Technical Summary of Results:

I. Only Alcohol Resistant products (AR-AFFF & AR-FFFP) were capable of extinguishing any of the top side fire tests.
II. Only Type II fires were successfully extinguished with the two AR type products. The AR-FFFP required a higher application rate to extinguish the fire.
III. 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.
IV. 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.
V. Only the AR-AFFF was capable of passing the sprinkler test with non-aspirating sprinkler heads. Each manufacturer's UL Listing will have to be referenced relative to the proper application rate for a sprinkler system.

Results for gasohol (10% ethanol) fires are summarized as follows:

I. Only AR-AFFF and Regular AFFF were capable of extinguishing the Type III fires at the recommended UL test rate of 0.06gpm/sq.ft.
II. An increased application rate was required for the AR-AFFF to pass the burn back portion of the test.
III. Regular AFFF was not able to pass the burn back requirement even at an application rate as high as the NFPA minimum application rate for spill fires of 0.10 gpm/sq. ft.
IV. AR-AFFF was able to pass sprinkler testing on gasohol using non-aspirating sprinkler heads.
V. Regular fluoroprotein foam was able to pass the UL sprinkler test with air-aspirating sprinkler heads.

General Observations:

I. Denatured ethyl alcohol fires, E 95, can only be extinguished with AR type foams (AR-AFFF & AR-FFFP). All other types of foams or water additives are ineffective as the foam blanket is destroyed when it strikes the fuel surface.
II. AR type foams must be applied to ethyl alcohol fires using type II gentle application techniques. For responding emergency services, this will mean directing the foam stream onto a vertical surface and allowing it to run down onto the fuel. Direct application to the fuel surface will likely be ineffective unless the fuel depth is very shallow. (ie. ? inch or less)
III. Gasohol, E10, fires may be extinguished using conventional AFFF or AR-AFFF but increased application rates may be necessary especially for prolonged burn back resistance. A type III direct application with these foams onto the fuel surface may be used with gasohol.
IV. Non-aspirating sprinkler head systems may be used with AR-AFFF for ethyl alcohol fuel fires, E95, and for gasohol, E10, fires such as in loading rack installations. All other foams proved to be ineffective at the application rates tested.
V. Use of regular fluoroprotein foam through air-aspirated sprinkler systems at standard design rates proved to be effective on gasohol fires but not on denatured ethyl alcohol fires.

Overall, AR-AFFF proved to be the most effective and most versatile agent tested. It was the only agent that was successful in all fire test scenarios