

Ethanol is not gasoline! – Test results raise fire safety issues

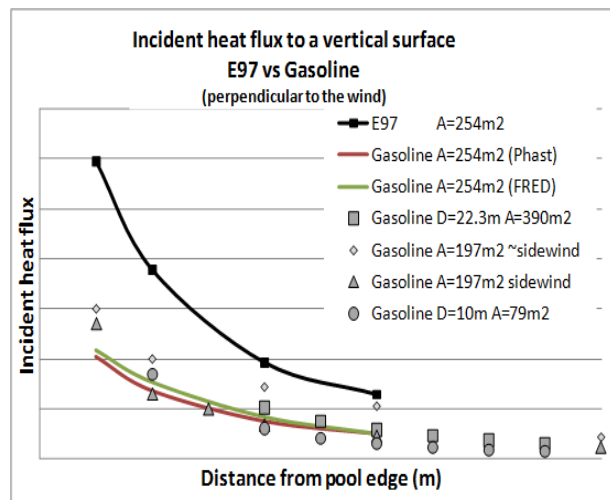
The overall goal of the ETANKFIRE project is to provide a platform of knowledge ensuring proper investment in fire protection of ethanol storage facilities. Phase 1 of the ETANKFIRE project is now complete. Phase 1 included two large scale free-burning tests and 43 tank fire extinguishing tests in reduced scale. The project has clearly shown many important differences between ethanol and other hydrocarbon fuels, e.g. gasoline.



The tank fire extinguishing tests indicate that fighting ethanol tank fires would very likely result in a failure to extinguish if standard firefighting operations are used. However, the test results also indicate important parameters that would improve the possibilities for a successful extinguishment.

Heat exposure as much as 3 times higher for ethanol than gasoline!

One of the main goals of the ETANKFIRE project has been to compare heat exposure from large scale ethanol fires to gasoline heat exposure. In small scale, the heat flux from an ethanol fire is considerably lower than gasoline, e.g. in a 2 m² pool fire the heat flux is only about 50 % that of gasoline. However, the results from the large scale tests conducted in August 2012 showed that the heat flux from a 254 m² (Ø 18 m) ethanol pool fire was 2-3 times *higher* than that of a similar gasoline fire. The risk for fire escalation is also significantly higher and the heat exposure to firefighting personnel is increased as well, making firefighting operations more difficult. Full details from the tests are available in SP Report 2015:12.



Tank fire extinguishing tests provide more realistic challenge than standard test methods

Another goal of the ETANKFIRE project was to focus on tank firefighting operations. Two series of fire extinguishing tests in reduced scale have been conducted to understand the influence of foam application techniques, foam characteristics and application rates. Tank fire conditions were simulated by using a large amount of fuel and long preburn times. Some tests also included alternative extinguishing media such as cellular glass, liquid nitrogen and aqueous vermiculite dispersion (AVD). In total 29 extinguishing tests were conducted in the first test series using a 0,41 m² fire tray and 14 tests were conducted in the second test series using a 3,14 m² fire tray.





Enhanced foam characteristics are crucial for successful tank fire extinguishment

The test results emphasized the importance of the characteristics of the finished foam. In several tests the fire could not be controlled at all, or controlled only when the fire was significantly influenced by dilution. However, using higher foam expansion ratios and longer drainage times significantly improved fire performance. These improved foam characteristics are dependent on the foam application hardware and the foam concentrate formulation. To obtain these improved characteristics the foam concentration was



increased to 6 % from a nominal value of 3 %. On the other hand, the improved foam characteristics allowed the application rate to be reduced by 50 % without compromising extinguishing performance. This shows that the performance requirements in existing test standards for foam (e.g. UL 162, EN 1568) do not adequately simulate a tank fire scenario and do not provide an incentive for manufacturers to formulate their foam to handle more severe fire conditions, such as a tank fire.

The test results also indicate that gentle application of the foam is not guaranteed by the use of foam pourers (Type II discharge outlet according to NFPA 11) as the foam could not flow gently along the tank wall due to high steel temperatures. With respect to alternative media, applying a layer of cellular glass followed by foam application made the extinguishing operation more robust. The results from the tests will be published in a SP Report soon.

ETANKFIRE Phase 2 – Important to confirm test results in larger scale

The overall conclusion is that fighting ethanol tank fires would ***very likely result in a failure to extinguish*** if standard firefighting operations are used. However, the test results from also indicate important parameters that would improve the probability of successful extinguishment. The test scales used in the Phase 1 tests were very limited compared to real tank fires, it would therefore be of great importance to verify the most promising results at a larger scale as suggested for Phase 2 of the ETANKFIRE project. The results could also provide a basis for improvement of foam system standards such as NFPA 11 and EN 13565-2 for extinguishment of water-miscible fuels, as well as test standards for foam concentrates such as UL 162, EN 1568-4.

The planning of the Phase 2 is about to begin and we need further partners to obtain the necessary funding. We are also seeking possible test locations in Europe, USA or other suitable locations.

How to join the project

ETANKFIRE is open for participation to all stakeholders. We especially welcome the ethanol industry, tank storage operators and the fire protection industry. International participation is encouraged to ensure that the project adequately addresses international peculiarities concerning safe storage of large volumes of ethanol (and other water-miscible fuels) and to facilitate fast implementation of results.

More information is available at www.sp.se/en/index/research/etankfire. If you have any questions, and would like to discuss participation in more detail, please respond to any of us in the project group listed below.

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