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**PRODUCT APPLICATION BULLETIN**

## Four Reasons Municipal Fire Departments Have Implemented F-500 Encapsulator Agent

As new hazards evolve, municipal fire departments are faced with the challenge of adapting to newer fire suppression technologies. Below are four modern hazards that require a different approach to extinguishment that is easily solved by using F-500 Encapsulator Agent.

**Ethanol and Ethanol Blended Fuels** - Based on the production of ethanol and ethanol-blended fuels, there is a paradigm shift taking place in municipal fire departments which greatly increases the need for F-500 Encapsulator Agent. Almost every gas station in the United States is selling E-10, which is gasoline with 10% ethanol. There are also over 17 million flex-fuel vehicles on the road today capable of using E-85, in which gasoline is mixed with 51-83% ethanol.

Over 3,300 fuel stations in the United States are selling E-85. AFFF foam is not adequate for these ethanol applications.



Therefore, the entire foam industry, including ourselves as producers of Pinnacle Foam, are guiding municipal fire departments from a noneffective \$19.95/gallon AFFF to a \$29.95/gallon AR-AFFF. F-500 Encapsulator Agent which can both encapsulate and extinguish ethanol and ethanol blended fuels is more cost effective than AR-AFFF.

The table shows the results of testing comparing the vapor mitigation capabilities of plain water, AFFF foam, AR-AFFF foam and F-500 Encapsulator Agent on diesel fuel, gasoline, E-85 and ethanol. The testing was conducted per *NFPA 18A: Standard on Water Additives for Fire Control and Vapor Mitigation*, Section 7.6. The testing shows whether or not each fire suppression agent can continue to prevent ignition of the fuel after two hours. The F-500 encapsulates all of the fuels, rendering them permanently nonflammable. Water, AFFF foam and AR-AFFF foam all failed to mitigate diesel, gasoline and E-85. All of the agents were able to mitigate ethanol because plain ethanol is a polar solvent, soluble in water and can be diluted to a point where it is not flammable.

| Vapor Mitigation Test Results       |       |           |              |                          |
|-------------------------------------|-------|-----------|--------------|--------------------------|
|                                     | Water | AFFF Foam | AR-AFFF Foam | F-500 Encapsulator Agent |
| Diesel                              | Fail  | Fail      | Fail         | Pass                     |
| Gasoline                            | Fail  | Fail      | Fail         | Pass                     |
| E-85<br>85% Ethanol<br>15% Gasoline | Fail  | Fail      | Fail         | Pass                     |

Vehicles operating within a municipal fire department's jurisdiction can be using diesel fuel or any of several gasoline/ethanol blends. Based on performance and tight budgets, F-500 Encapsulator Agent is positioned as the municipal fire department product of choice.

**Electric Vehicles** – With fuel prices on the rise, we see more consumers purchasing electric and hybrid vehicles with more efficient fuel mileage. These vehicles are traveling through every municipality in America. While they help to reduce fuel consumption, they create problems for the municipal fire departments who are responding to accidents and subsequent vehicle fires. Older hybrid vehicles operate using high-voltage nickel-metal hydride batteries, but newer hybrids use lithium-ion batteries. Hybrids also use ethanol blended fuels (issues outlined above). In addition to the 4 million hybrids on the road today, there are almost 600,000 plug-in cars using lithium-ion batteries.

Although equipped with multiple safety devices, lithium-ion batteries have been known to rupture, ignite and explode. In addition to the battery hazards in these vehicles, automotive manufacturers are using lighter



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metals such as magnesium and zirconium to reduce the weight in all vehicles to improve fuel mileage. It is well documented that plain water and traditional foams are not suitable to extinguish Class D fires due to their explosive reactivity with combustible metals such as lithium, magnesium and zirconium. F-500 Encapsulator Agent has proven to be suitable for Class D type fires. BOSCH company of Germany, the leading manufacturer of electric vehicle batteries worldwide, in conjunction with a German fire service testing facility performed testing on numerous fire suppression agents including plain water, AFFF, AR-AFFF, dry powders and F-500 Encapsulator Agent. BOSCH concluded that F-500 Encapsulator Agent is the best agent for high-voltage vehicle battery hazards. BOSCH shares this information with automobile manufacturers who purchase BOSCH's high-voltage batteries so the automobile manufacturers can filter this information to their clients and responders. F-500 Encapsulator Agent has proven its capabilities on gasoline vehicle fires, but now BOSCH also recommends F-500 EA for hybrid and electric car fires.

**Three-Dimensional Fires** – NFPA 11 - Low, Medium and High Expansion Foam Standard - Annex A.1.1 specifically states, "Foam is not suitable for three-dimensional flowing liquid fuel fires or for gas fires." F-500 Encapsulator Agent has proven itself to be very effective on three-dimensional fires around the world. When municipal fire departments arrive on the scene of a fire, they may encounter flowing fuel fires or flat spill fires. Having a single product that has a multitude of capabilities is desirable over having to choose between various foams required for different types of fires.



**High-Voltage Transformer Fires** - HCT has worked with FDNY and Con Edison in New York City as a result of F-500 Encapsulator Agent's outstanding performance extinguishing a transformer fire. FDNY first deployed 5,000 pounds of dry powder followed by a foam application and could not extinguish the transformer fire. After the dry powder and foam failed, FDNY Haz-Mat Company 1, users of F-500 since 2002 for flammable liquid spill control, suggested the use of F-500 for the transformer fire. The F-500 Encapsulator Agent was applied and extinguished the fire within 2 minutes. These results are not surprising

to those who understand the difference between the fire suppression mechanics of foam vs. an Encapsulator Agent. Based on this incident, HCT worked in conjunction with both FDNY and Con Edison to perform some high-voltage current leakage tests. F-500 Encapsulator Agent, AFFF and AR-AFFF 3% solutions were applied to 50,000 volts and the leakage current back to the nozzle was recorded. Since the AFFF and AR-AFFF have bubble to bubble contact, a current leakage pathway back to the nozzle occurs resulting in currents greater than acceptable (e.g. potential injury or death). On the other hand, the current leakage from F-500 Encapsulator Agent solution, which is not a foam, was well within the acceptable range. Based on this, phase 2 testing with 3% F-500 Encapsulator Agent solution on 345,000 volts was conducted with the same results. The current leakage feedback to the nozzle was well within acceptable limits.

Based on F-500 Encapsulator Agent's three-dimensional, flammable liquid firefighting capabilities and the current leakage testing conducted by FDNY and Con Edison, a Standard Operating Guideline (SOG) for the use of F-500 Encapsulator Agent on high-voltage transformers was written and adopted. After the power is removed, F-500 EA can be safely applied without fear of electrical feedback to the nozzle if the stream comes into contact with nearby energized peripheral equipment. Transformers are not only located at power plants, but also in every community in the United States. With these new SOGs outlining procedures, F-500 Encapsulator Agent will be the product of choice for power plants, as well as municipal fire departments throughout the United States and the world.



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