

## Oil Filled Transformer Protection

### Problem: America's Aging Transformers

- There are approximately 132,000 large power transformers in service in the US
- Installations peaked in the mid-1970's
- Many are approaching retirement age (average age is 40 years old)
- Failures are predicted to increase 500%
- 1 in 5 failures will result in a fire
- **Transformers are a three-dimensional, Class B, flowing fuel fire**

Sources: FERC, IMIA, US Commerce Dept., DOE (April, 2014)



NFPA 11, Annex A.1.1 states, "Foam is not suitable for three-dimensional flowing liquid fuel fires or for gas fires."

Fighting transformer fires used to require special firefighting equipment and hazardous material response procedures to both extinguish the fire and to capture the contaminated mineral oil run-off. For the utility, a single incident could mean hundreds of thousands of dollars in repairs and clean-up costs, plus associated downtime. That is changing.

### Transformer Fire - Queens, NY

In July, 2009, local firefighters responded to a transformer fire. They immediately began to protect adjacent structures with a deck gun and four hand lines, being careful to avoid the energized transformer. Foam lines and Purple K lines were prepared waiting for confirmation from ConEdison the power was turned off. The dike around the transformer could contain several thousand gallons and the mineral oil in the transformer was 3,600 gallons. During the two hours firefighters waited for ConEdison to confirm the power was off, they continued to protect adjacent buildings. Water runoff was so great, a basement began to flood with oil contaminated water.



After receiving word from ConEdison, firefighters began applying Purple K to the transformer from two lines, but it kept re-igniting. So they applied foam and Purple K, but it continued to re-ignite. After 1 1/2 hours, they tried F-500 Encapsulator Agent, mixed with water at 3% through a single hand line. Since F-500 EA has the ability to cool the massive metal transformer and encapsulate the oil, F-500 EA extinguished the fire in less than two minutes.



### Solution: F-500 Encapsulator Agent

This incident led ConEdison to evaluate various firefighting agents for transformer fires. Only one agent was capable of being applied to an energized transformer with imperceptible electrical feedback to the nozzle, F-500 Encapsulator Agent. Final testing by ConEdison included direct application of 3% F-500 EA to an energized 345 KV transformer, streaming from 125 feet.

#### Consider the costs that could have been avoided;

- Multiple departments responding
- Thousands of gallons of foam and Purple K used
- Overflowed containment dikes led to pumping and disposal operations
- EPA fines from run-off
- Neighborhoods evacuated and loss of electrical service

Source: WYNF, 2nd/2010

## Transformer Fire Suppression Systems

Many transformers are protected by water spray fixed systems, commonly called transformer “deluge” or “fire water” systems, intended to extinguish, or at least control, a transformer fire. Protecting the plant structure, adjacent equipment, and reducing hazards to personnel is the primary goal of these systems.

Power plants also experience turbine fires from lube oil leaks. Like transformer fires, turbine fires are Class B, three-dimensional fires. FM Global performed fire tests simulating under turbine lube oil spray fires and found temperatures 30 feet above the turbine exceeded 1,500°F, enough to cause structural damage to the building. They concluded that NFPA recommended fixed suppression system spray densities of .30 gpm/ft<sup>2</sup> were inadequate and recommended an increase to .40 gpm/ft<sup>2</sup>.



Deluge water spray system

Dominion power company experienced a transformer fire and like FM Global, found the fixed suppression system to be inadequate. Since foam performs poorly on three-dimensional fires, Dominion decided to commission independent testing and focus on F-500 Encapsulator Agent due to its ability to cool the structure and encapsulate the fuel.



F-500 EA vs. water fire tests

The tests proved F-500 EA was able to cool and extinguish diesel fires rapidly, where water was unable to sustain cooling. Tests also showed F-500 EA used up to 83% less water to extinguish the same fire. Ultimately, it was determined F-500 EA, applied at .20 gpm/ft<sup>2</sup> was 2 1/2 times more effective than water sprayed at .40 gpm/ft<sup>2</sup> and used less than 25% as much water to extinguish the same fire.

### Why Use F-500 Encapsulator Agent to Protect Transformers?

F-500 Encapsulator Agent rapidly reduces the transformer’s temperature, encapsulates the mineral oil and vapors and interrupts the free radical coalescence. Because of these unique performance attributes, F-500 EA provides quick knockdown, control and extinguishment of these three-dimensional, Class B, transformer fires.

F-500 EA is a unique encapsulator agent formulation that rapidly reduces heat and flames, and renders flammable liquids and vapors inert. It extinguishes fires by attacking three elements of the fire tetrahedron. The ability to form water spherical micelles that encapsulate hydrocarbons, allows it to render fuels and oils nonflammable and non-ignitable.

F-500 EA is specified throughout the power generating facility, providing protection for conveyors, transfer points, storage silos, pulverizer mills, burner fronts, dust collectors, turbines and transformers.

F-500 EA is extremely versatile and effective and can be used in practically any type of equipment or systems. F-500 EA is nontoxic, noncorrosive, non-skin sensitizing and 100% biodegradable.

When F-500 EA is used in conjunction with an HCT piercing rod, it can facilitate pinpoint extinguishment of smoldering coal in storage silos, bunkers or the coal yard.



HCT engineers and packages Concentrate Control Supply (CCS) systems to precisely proportion F-500 Encapsulator Agent into the fire suppression system water stream. These systems typically include a bladder tank or other water-driven proportioning system, sized to maximize sprinkler and spray mist system effectiveness.

- Bladder Tank System
- Balanced Pressure Pump System
- Water Driven Proportioner System

***F-500 Encapsulator Agent***  
**Exceptional performance on three-dimensional,  
Class B, flowing liquid fuel fires**



**HAZARD CONTROL TECHNOLOGIES, INC.**

150 Walter Way  
Fayetteville, GA 30214

Tel: 770-719-5112  
Fax: 770-719-5117

www.hct-world.com  
info@hct-world.com