



## CASE HISTORY

# Dominion-Chesterfield Power Station Improves Turbine and Transformer Fire Protection with F-500 Encapsulator Agent

*F-500 Fire Suppression Encapsulator Agent allows Dominion to improve fire protection system effectiveness at their Chesterfield facility without infrastructure upgrades*

**Client:** Dominion

**Location:** Chesterfield Power Station – Chester, WV

**F-500 Encapsulator Agent CCS Implementation:** 2009

**Fire Protection Engineers:** McDaniel Fire Systems, Valparaiso, IN

**Project Type:** Fire protection upgrades to under floor areas, utilizing F-500 EA for rapid cooling and fire protection at their turbine/generators and transformers



## Overview

Dominion had a prior, unfavorable experience with a transformer failure, and the inability of a pre-installed, .25 gpm/ft<sup>2</sup> system to mitigate the hazard. As a matter of fact, the use of the water deluge system, combined with inadequate containment, made the situation worse.

To improve the delivery system, an F-500 Encapsulator Agent Concentrate Control Supply (CCS) system was specified, because F-500 EA rapidly cools and controls the fire, as well as encapsulates hydrocarbon liquids and vapors, rendering them nonflammable. The F-500 EA CCS system could be added to the existing system to enhance the current system's effectiveness, without having to upgrade the piping, pumps and water supply to provide the recommended .40 gpm/ft<sup>2</sup> coverage upgrade.

## Challenge

When the transformer failure occurred, the local municipal fire department was called to respond. A spewing, Class B fire was underway, as the cooling chamber around the transformer ruptured and leaked hot mineral oil. When the firefighters arrived, the plant was about to turn off the deluge system, because the containment system was going to overflow. The local fire department, having taken over Incident Command, did not want stop the deluge system because the fire threatened adjacent transformers. The water-spray deluge system was allowed to continue to operate and the containment system overflowed, spreading the hazard (burning mineral oil floating on water) to adjacent areas.

FM Global also conducted full-scale, under turbine lube oil spray fire simulations in their calorimeter and published Engineering Bulletin 06-04 in 2004.

Engineering Bulletin 06-04 summary:

- a) 50% of the fires reported in turbine buildings were oil spray fires
- b) Existing water spray densities and sprinkler head spacing are inadequate to control the fire and the high temperatures, which can lead to structural damage at the ceiling.

Dominion testing concluded that the F-500 EA cooled the diesel fuel rapidly, from 1200°F to 200°F, in seconds, whereas the water cooled somewhat at first, but kept fluctuating. Also, at an application density of .20 gpm/ft<sup>2</sup>, F-500 EA extinguished the fire three times faster than plain water at twice the application rate of .40 gpm/ft<sup>2</sup>. The F-500 Encapsulator Agent rapidly reduced the heat, extinguished the fire and encapsulated the fuel, rendering it nonflammable and nonignitable. Removing the heat assured reignition did not occur.

## Substation Fires

- **Burning electrical equipment is already ruined and will be replaced. The safest course of action is to LET IT BURN.**
- Contact Dominion and wait for their personnel to arrive.
- **Never attempt to enter a substation without utility personnel present.**
- **Evacuate the area** and keep everyone **AT LEAST** 300 feet away from the substation.
- Electrical equipment contains oil. **Be alert for explosions and toxic smoke.**
- **Protect area exposures** to prevent fire from spreading
- **If an equipment fire must be suppressed**, utility personnel and the incident commander will tell you how to proceed.



### Solution

The recommendation was to increase coverage from .25 gpm/ft<sup>2</sup> to .40 gpm/ft<sup>2</sup>, switch to higher K-factor sprinklers and reduce head spacing to 5 feet, but this would have been a very expensive conversion. Instead, Dominion decided to supplement the existing sprinkler system with F-500 EA, to exceed the performance of the recommended system.

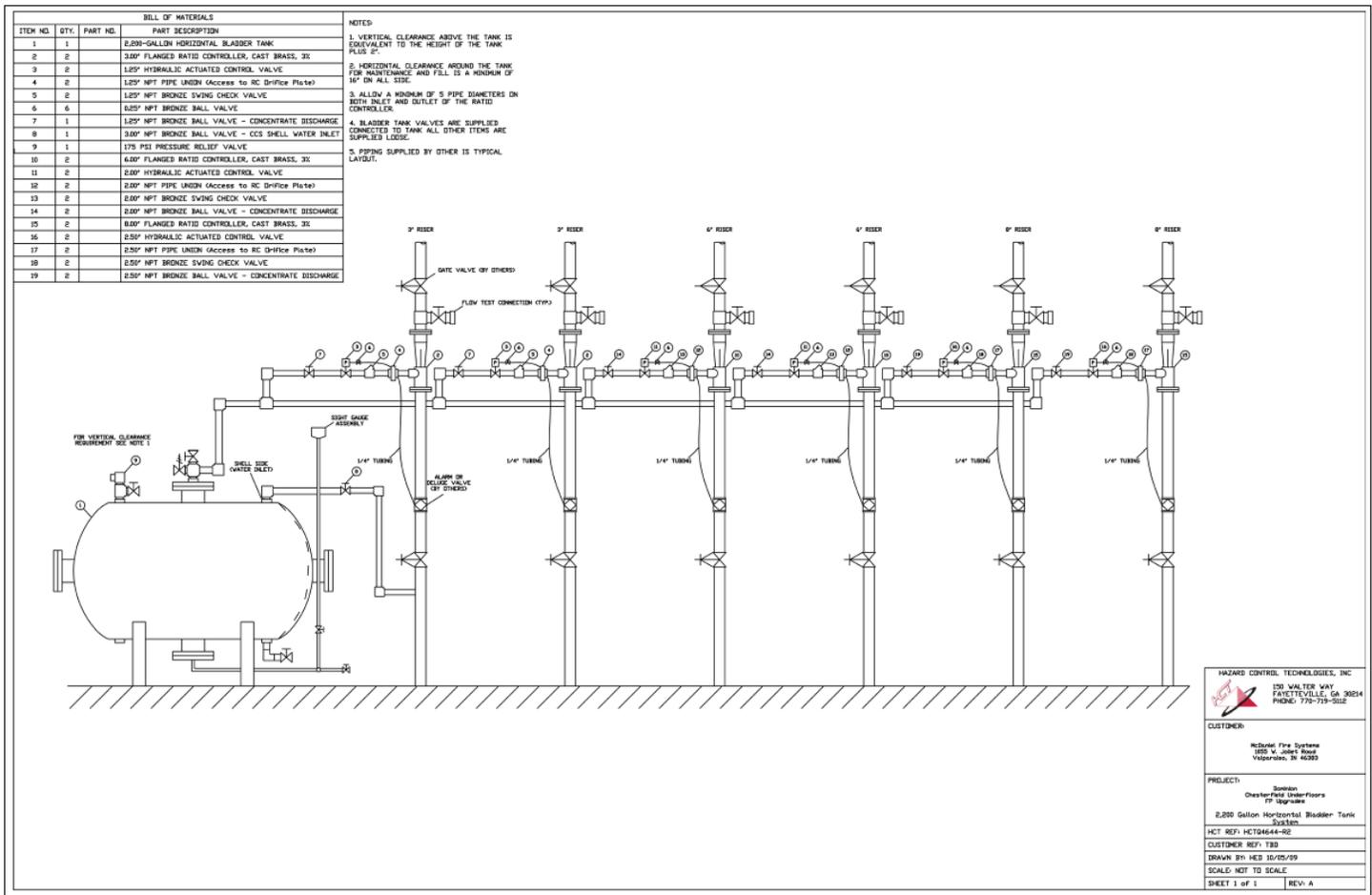
Transformer and Under Turbine Lube Oil Protection is designed in accordance with NFPA 15 to densities prescribed, but there is nothing that precludes a power plant from enhancing those systems by the addition of an F-500 Encapsulator Agent CCS System. With a CCS System, they would be going above and beyond the minimums specified by the code.

### A Chesterfield Plant specification excerpt:

“All pre-action water sprinkler systems shall be pre-connected to an F-500 Encapsulator Agent (EA) storage tank(s) and delivery system(s). The F-500 EA injection for the turbine building pre-action water sprinkler systems shall require manual operation using a quick opening valve, such as a ball valve. The valve position shall be electronically monitored. The means for manual operation shall not require an operator to enter any area that is exposed to any event for which the F-500 EA is needed. The F-500 EA injection for the boiler front pre-action water sprinkler systems shall inject automatically.”

### The F-500 EA Concentrate Control Supply Systems Installed:

- 2 - 2200 gallon Bladder Tanks
- 4 - each of 4", 6" and 8" ratio controllers
- Swing, ball, pressure relief and hydraulically actuated control valves



The F-500 Encapsulator Agent Concentrate Control Supply systems with 3% ratio controllers, were commissioned, tested and approved. The system is based on a 2600 gpm water flow and 30 minutes of enhanced and properly proportioned F-500 EA to protect the under turbine lube oil and transformer areas from fire.

The F-500 EA CCS systems are stationed for quick injection of concentrate into the system risers, and are fully charged and ready to automatically activate on command. There are no electrical parts. The deluge valve activates the entire system when a fire is detected, activating the sprinkler system. As soon as water pressure is sensed across the deluge valve, the F-500 EA CCS Water Actuated Automatic Control Valve is tripped, injecting the agent into the water stream. The resulting 3% solution of F- 500 EA is instantly dispensed throughout the sprinkler array to attack the fire.

Since the F-500 EA solution rapidly cools and extinguishes the fire, damage and runoff are minimized. F-500 EA instantly penetrates, encapsulates and cools to extinguish a fire, making it ideal for three-dimensional fires. Compare F-500 EA to foam, which extinguishes a fire by creating a blanket to separate the fuel from the oxygen. Forming a blanket on a three-dimensional fire further complicates the use of foam. If you can form a blanket, the foam blanket can trap in the heat, above autoignition temperatures. Any break in the blanket will result in reignition of the fuel.

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

Dominion realized the advantages of the F-500 Encapsulator Technology for fire suppression and made it their choice to enhance their turbine lube oil and transformer fire suppression systems at their Mount Storm facility.



## HAZARD CONTROL TECHNOLOGIES, INC.

150 Walter Way  
 Fayetteville, GA

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

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