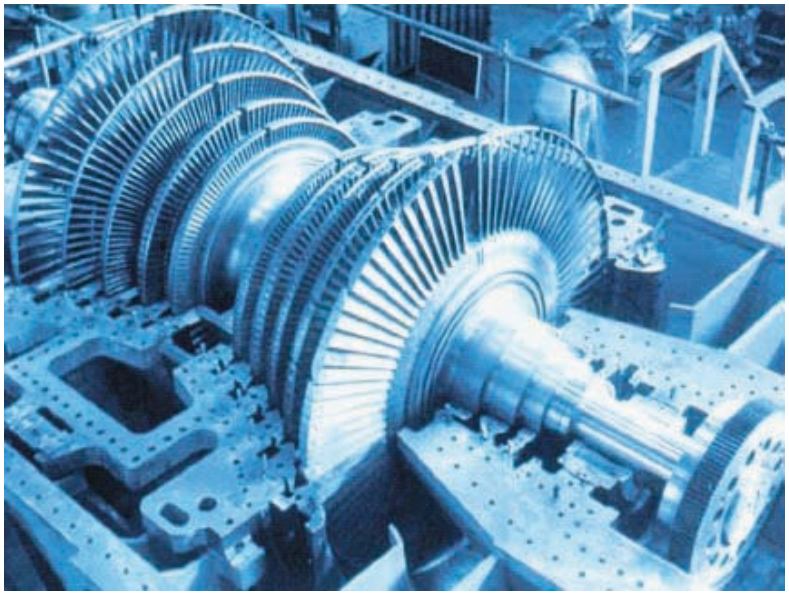
I-500 ENCAPSULATOR TECHNOLOGY

PRODUCT APPLICATION BULLETIN

Under Turbine Lube Oil Protection

Lubrication, hydraulic, control and seal oil fires occur more often than most utilities care to admit. The reservoir used to supply the lubricant to these bearings can range from a few thousand to 20,000 gallons.
If there is a break anywhere in the lube oil supply system, the turbine must trip off before catastrophic damage occurs. In addition to the obvious mechanical damage potential, there is a very real and serious fire hazard to consider.



FM Global's Evaluation

- 3-dimensional, Class B fire potential
- Inadequate fire protection exists
- Fire temperatures can reach 1500°F
- Intense heat compromises structural integrity
- Higher application rates recommended
  - .40 gpm/ft² instead of .25 gpm/ft²

Source: FM Global Engineering Bulletin #06-04.

An EPRI study concluded that, based on a 30-year plant life, there has been one fire in roughly 200 unit-years. This means that one out of seven turbine generators in operation will experience a fire.

The average property loss attributed to this type of fire is $26 million per incident, and the service outage can last from 2 to 48 weeks, depending on the extent of the damage. There are also the additional costs from business interruptions, and obligatory contract penalties stemming from service guarantees and fuel purchasing commitments.

By contrast, in six turbine-building fires where recommended protection was installed, the average property damage was $700,000 and the turbines were out of service from only one to seven weeks. Still incurring some expense and interruption, but significantly less severe in amount, scope, and duration.

The Four Simple Steps

Understanding fire is one thing, but preventing it is another. To prevent a lube oil fire, or at least substantially mitigate the damage it causes, the following four steps are imperative:

1. Safely shut off the oil
2. "Contain and drain"
3. Emergency response plan in place
4. Properly designed sprinkler systems

Source: Power Engineering Magazine

MOST COMMON CAUSES OF OIL RELEASES

Cause	Frequency of cause
Fitting failures	50 percent
Operator error	30 percent
Vibration	6 percent
Electrical failure	6 percent

In the event of a turbine lube-oil fire, the oil flow should be terminated quickly to stop the continued fueling of the fire. However, immediately stopping the lubrication system before the turbine stops rotating can result in very costly damage to the mechanical equipment. Emergency shutdown procedures, based on site-specific conditions, are critically important to the sequence of events that must take place. Because of this, proper shutdown could take anywhere from 20 to 45 minutes.

This can seem like an eternity in the face of a growing, 3-dimensional, flowing fuel fire. With this type of fire, ceiling temperatures can reach 1,500°F, leading to steel deformation, structural problems, and roof failure.

PRODUCT APPLICATION BULLETIN

Fire sprinkler system experts can help design the best suppression means and configuration to protect the under turbine lubrication system.

The critical areas for consideration in the protection scheme are:

- lube oil tank and pumping unit
- diked area surrounding the lube oil tank
- high & intermediate pressure turbine housings
- foundation & under turbine area

This fire suppression system should include an F-500 Concentrate Control System, to inject the properly proportioned amount of the encapsulator agent directly into the sprinkler risers.

In addition, emergency response procedures should be established, and all employees should be trained on these procedures and systems. The facility should also educate the local municipalities on the types of hazards to expect. Proper planning, preparation, and procedures can mean the difference between a major disaster and a minor distraction.

Why Use Hazard Control Technologies' Encapsulator Technology to Protect Turbines?

The F-500 Encapsulator Agent reduces surface tension, provides rapid heat reduction, encapsulates flammable liquids and vapors, and interrupts free radical coalescence. Because of this unique collection of performance attributes, it provides quick knockdown, control, and extinguishment of Class B fires.

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

FM Global's generator mock-up, simulates oil spray, pool, and pressurized 3-dimensional fires – typical components of a turbine lube oil fire scenario.
In a recent study, over a 15-year period, FM Global found that fire protection deficiencies for lube-oil systems were a major factor in 17 large turbine building fires.

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

F-500, when used in conjunction with an HCT piercing rod, facilitates the pinpoint extinguishment of smoldering fuel in the storage silos as well as in the coal yard.

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