NOT JUST ANOTHER FIRE

10-Minute Training

UNDERSTANDING THE DANGERS OF INDUSTRIAL HEAT TRANSFER FLUIDS

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Case study: A fire department is called to a power generating station for a report of fire in a hydraulic unit (August 2013). Three firefighters were transported to the hospital after getting the oil on their hands and their gear, as well as having minor eye irritation.

Important details to know for a response to this call: The oil involved was actually part of a heat transfer system, likely operating at a superheated temperature. This is typical for equipment utilizing thermal oil, or "heat transfer fluid", which is primarily used to provide a specific heating or cooling function in a manufacturing or other industrial process.

Thermal oils, often called heat transfer fluids or HTF, are used in a wide variety of processes where heat needs to be transferred into or away from a specific process. The HTF is often used in place of steam when a process needs a higher temperature or greater thermal density than steam can provide.

Facilities and related processes that utilize this equipment vary greatly, but include many types of manufacturing applications, including molding, blowmolding, extrusion, and laminating. This equipment can also be used in certain food, chemical, and pharmaceutical processes, such as cooking, baking, drying, and dehydration.

Thermal oil systems are very diverse, but often include a few key components: 1) a heater, 2) a process where the oil is used, 3) a circulating pump, and 4) a bulk tank and/or expansion tank. The systems are often closed-loop systems, designed with some sort of engineered pressure relief.

Typical heating units are powered by electric or a form of gas, and for fire preventative reasons, they are often installed in a remote location isolated from the process. This means firefighters responding into a facility where HTF is used must be aware of oil lines that may run throughout the plant, carrying oil from tank to heating unit to process and back. Additionally, this means the highest potential for a fire in a process using HTF may not be at the point of processing.

Shown above is a relatively small buffer tank with the expansion tank above. This particular unit is being used on a small plywood lamination press. Some systems may use as little as 20-25 gallons, while others may use thousands.

Systems range greatly in size and volume of oil. Some units supply heat to presses that are only big enough for lamination of a 4' x 8' sheet of plywood and may use as little as 15 gallons of oil, while large systems that heat the presses used in mills that actually produce the plywood often employ thousands of gallons of HTF.

Heating units may be small enough to fit in a closet, or in the case pictured above, the units may be full-sized boilers that are installed within fire-rated isolation rooms. These rooms are typically diked to contain an oil spill and may be equipped with a self-contained fire suppression system. Note the excellent housekeeping, which is a necessity to prevent fire extension in the event of a leak.

A key thing to understand with this type of equipment is that the fluids used within these systems often operate at superheated temperatures, sometimes well above the auto-ignition temperatures of the fluid. Because the fluids are used within a closed system where no oxygen is available, the fluids carry the heat without incident. However, if even a very small, pinhole-type leak occurs within a system's components, the resulting spray, no matter how small, can instantly erupt into a fireball. This is very important for firefighters making a response into a facility, so that they are careful to not cause damage to a system that is not already losing fluids.

Some systems are designed to operate below the auto-ignition temperature of the fluid, and in a system that is operating properly, safety limit switches should shut down the heating unit in the event of programmed limits. However, as in most cases resulting in fire, a failure in the system is likely to be occurring at the time of a fire. This means that even a system that typically does not pose this risk must be treated as if it could have oil that will ignite upon exit from the system. In any case, these systems will be well-insulated. Depending on the type of materials used, this may either reduce or contribute to a fire situation in the event of a leak.

Other dangers of any oil system include the potential for a high-pressure spray to penetrate skin and injure firefighters. Individuals must be cognizant of the pressure that may be held within a system, in addition to the heat and volume concerns.

Once a safe response can be initiated, the key approach is to provide cooling of the components and the oil to a temperature below the auto-ignition temperature, and eventually below the flash point. If a fire is persistent and is sustaining the temperature in the danger zone, it may be best to use a chemical or foam extinguishing agent to combat the fluid fire, based on the firefighting approach outlined in the MSDS or SDS for the specific fluid.

Similar case study: A multiple-alarm fire in July 2013 caused extensive damage to an industrial building, specifically resulting in excess of $750,000 damage. In this case, a large diameter hose used to transport combustible heat transfer fluid became disconnected from a processing machine. When the hose failed, some of the combustible fluid escaped into the building environment. Very soon after the release, the superheated oil vapors reached an ignition point, and subsequently ignited some of the building's materials.

Per news reports, this incident took a number of hours for dozens of firefighters to bring the fire under control. There were no reports of injuries. However, all protective gear worn by firefighters who entered the burning building had to be destroyed after the fire because it was deemed permanently contaminated.

Included photos by the author.
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