Fire Engineering®

Construction Concerns: Temporary Heat—Air Quality

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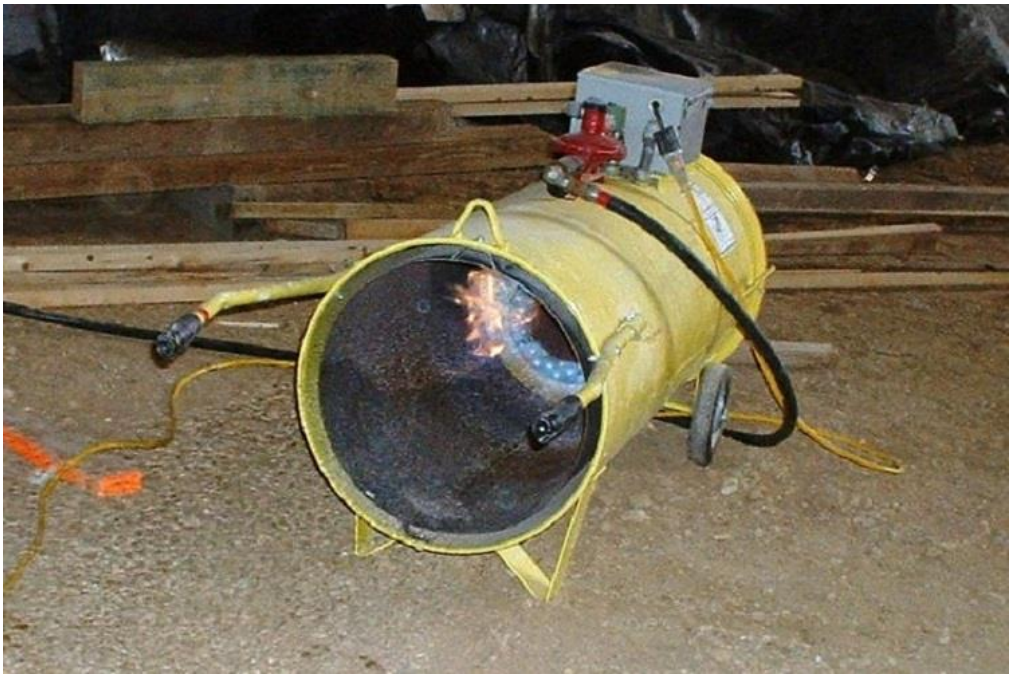
By Gregory Havel

For www.fireengineering.com *Photos by author*.

Construction of new buildings in cold weather often requires the construction of temporary enclosures (photo 1), which must be heated so that the materials are protected and processes can continue. These enclosures are often nothing more than sheet plastic and canvas supported by the scaffolding from which the work inside is being done.

(1)

Existing buildings that are being remodeled and new buildings that have been enclosed also require temporary heat. The most common type of heating appliance in these locations as well as inside temporary enclosures is the “torpedo heater.” Photo 2 shows a high-capacity gas-fired heater inside a building under construction. These heaters are popular because they are inexpensive and can be easily converted from natural gas to liquefied propane (LP) gas.



(2)

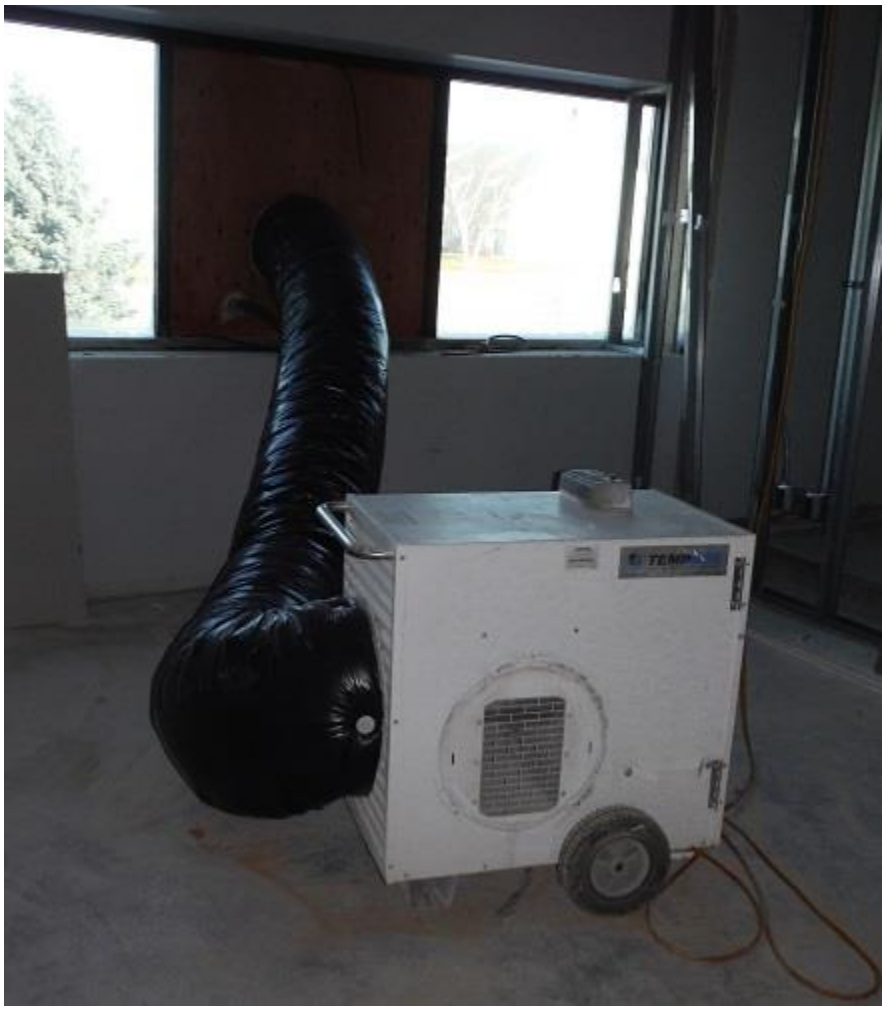
The fuel gas is usually supplied by a hose rated for the pressure and type of gas being used. These heaters are also available using liquid fuels like kerosene and light fuel oil. They require a source of electrical power for combustion controls and fan motors. Although the heater manufacturer’s instructions state the minimum distance required from the heater for fuel storage, gas meters, LP gas tanks, and safety cans for liquid fuels should be outside the heated space to prevent the accumulation of combustible or explosive vapors.

The disadvantage of the torpedo heater is that it draws its combustion air from inside the heated space and discharges its combustion products (heat, carbon dioxide, and water vapor) back into the same space. If the enclosure has inadequate ventilation, this can result in high humidity in the space, creating condensation on the exterior walls, levels of carbon dioxide greater than which is found in outdoor air, and reduced levels of oxygen. When the oxygen levels in the space approach “oxygen deficient” [defined by the Occupational Safety and Health Administration (OSHA) as less than 19.5 percent oxygen], combustion becomes incomplete, and carbon monoxide (CO) begins to form rather than carbon dioxide (CO_2).

If the air in the space has a bad odor or it burns the eyes and nose, or if moisture condensation is running down the outside walls of the space, this indicates that the air

quality is poor, may be becoming oxygen deficient, and may already contain CO. The solution is simple: create a ventilation opening near the heater to supply combustion air and another opening a distance away in the same enclosure to create cross ventilation. When torpedo heaters are used inside buildings or temporary enclosures, air monitoring for CO accumulation is needed to ensure that the space is a safe place to work. The increased fuel consumption required by the added ventilation openings is a small price to pay for maintaining a safe atmosphere in the workplace.

Photo 3 shows a variation on the torpedo heater that is less likely to produce CO. Besides the heater, the fuel supply hose, and a source of electrical power, this heater has a flexible duct at the exterior of the building or enclosure to supply combustion air.

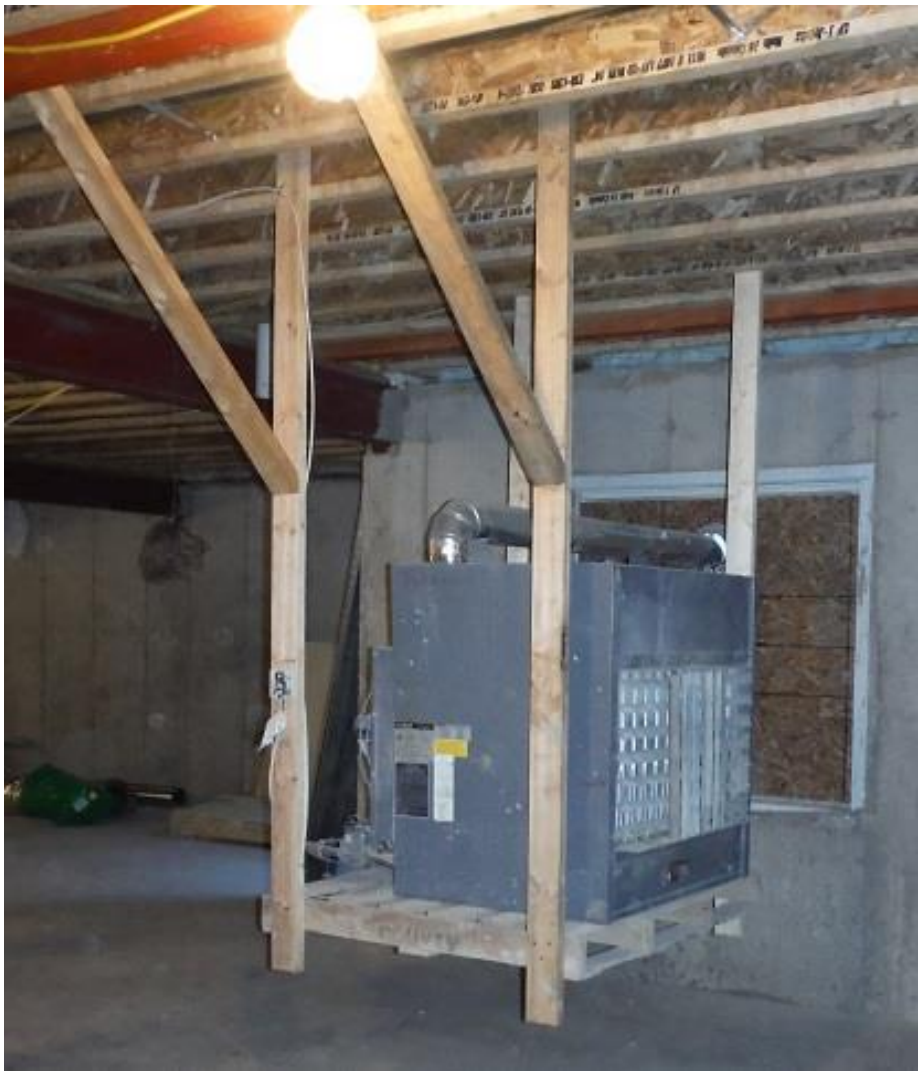


(3)

Since this type of heater does not draw its combustion air from inside the heated space, and since the combustion air is drawn by a fan from outside the space, the heated space is slightly pressurized, forcing some of the air from inside the enclosure to the outside. This results in a lower buildup of moisture, lower levels of CO_2, and a lower chance of

CO from incomplete combustion. Although there is less chance of CO buildup in the heated space, air monitoring should still be done.

Photo 4 shows a temporary heating appliance that draws its combustion air from inside the heated space, that transfers the heat of combustion to the heated space through an air-to-air heat exchanger, and that discharges the remaining products of combustion (CO_2 and water vapor) to the outside of the heated space.



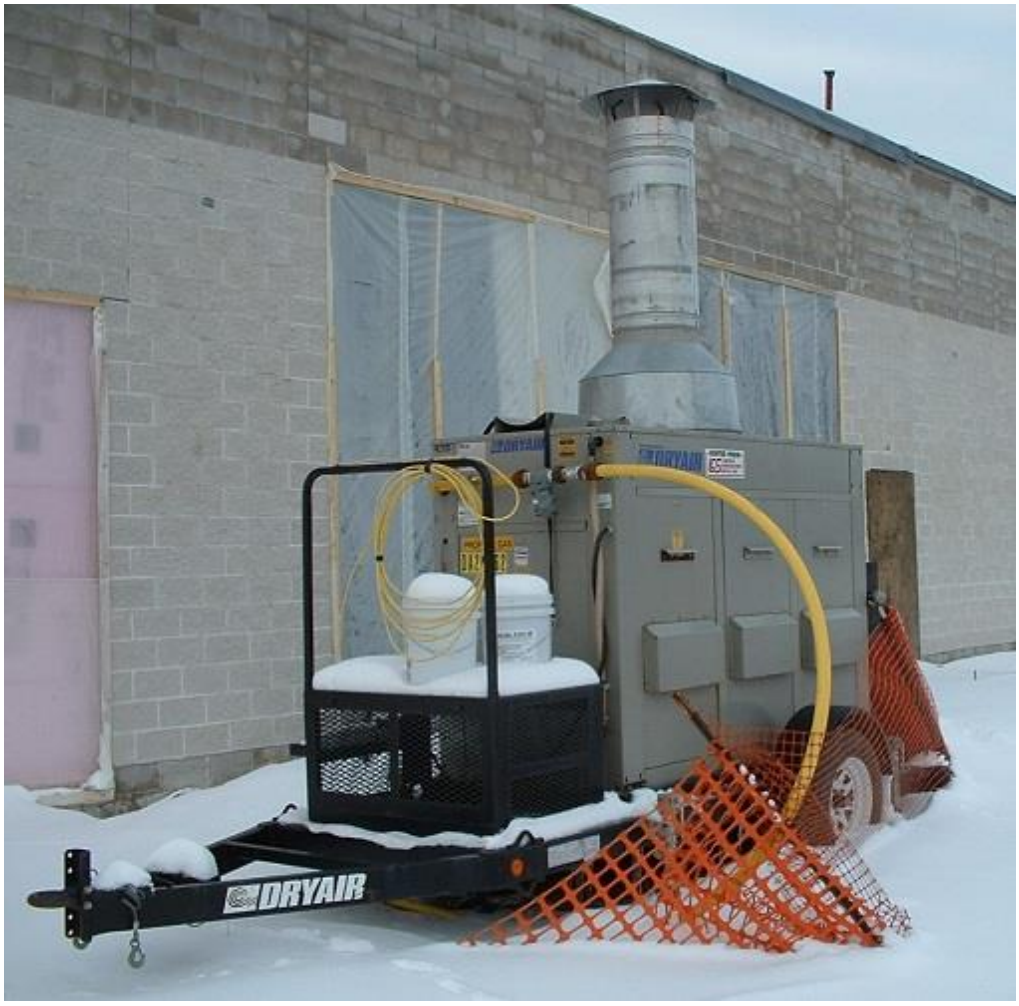
(4)

It functions much like a residential hot air furnace. A properly maintained heating unit of this type will not send CO into the heated space even if the burner is producing CO. CO monitoring should not be necessary in a space heated by one of these appliances unless there are machines or processes inside that are known to produce CO.

A variation of the heating appliance shown in Photo 4 has an enclosed combustion chamber with an added duct that brings its combustion air from outside the heated

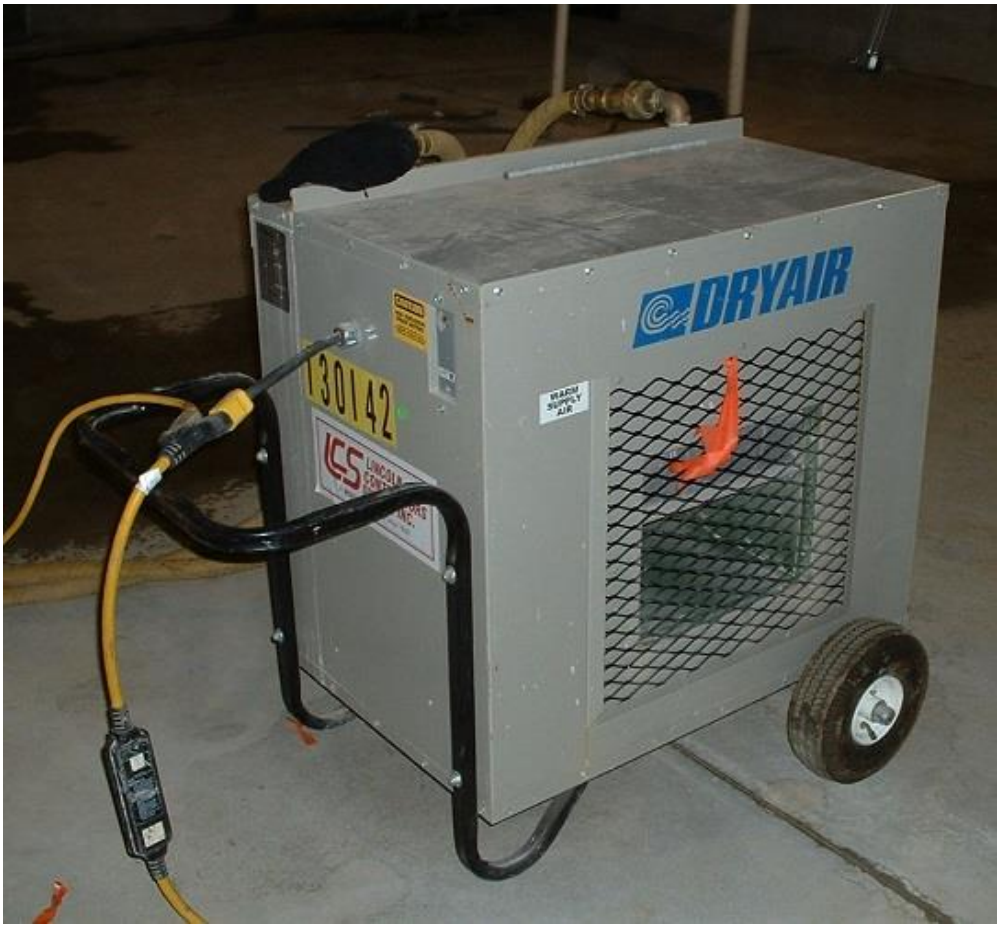
space, resulting in higher efficiency. It functions much like a high-efficiency residential hot air furnace.

Photo 5 shows another type of temporary heating appliance. This unit has the combustion chamber and heat exchanger outside the building or other heated space.



(5)

Heat is carried into the building from the air-to-liquid heat exchanger by antifreeze solution that is pumped from the heater through hoses to remote radiator units (photo 6) with fans inside the heated space. CO monitoring should not be necessary in a space heated by one of these appliances unless there are machines or processes inside that are known to produce CO.



(6)

Heating appliances producing CO are not the only items of concern for air quality. The labels and safety data sheets on products like the solvent cleaner and cement that is used to join plastic pipes contain warnings to use only with adequate ventilation. In addition, the drain, waste, and vent piping inside a building (photo 7) under construction or that is being remodeled is usually open inside the building at the same time it is already connected to the sanitary sewer system outside the building.

(7)

The right combination of wind speed, direction, and other atmospheric conditions can push hydrogen sulfide, methane, and other gases and vapors from the underground sewer system into the building, creating unhealthy conditions.

A common cold-weather dispatch for emergency services is to a “CO call” because someone feels ill. If the building is evacuated and our meters and monitoring instruments show no CO, this should suggest to us that we need to check for another source: methane or hydrogen sulfide from sewers entering the building through incomplete drain, waste, and vent systems (or dry traps in lavatories, toilets, or floor drains) or chemicals and solvents used during construction. If we find one of these, note it in our reports and carry it out with the patient to the medical facility that will provide treatment.

Gregory Havel *is a member of the Town of Burlington (WI) Fire Department; retired deputy chief and training officer; and a 30-year veteran of the fire service. He is a Wisconsin-certified fire instructor II, fire officer II, and fire inspector; an adjunct instructor in fire service programs at Gateway Technical College; and safety director for Scherrer Construction Co., Inc. Havel has a bachelor's degree from St. Norbert College; has more than 30 years of experience in facilities management and building construction; and has presented classes at FDIC.*

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