

Investigation of Chimney Fires

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The winter season produces chimney fires associated with wood-burning appliances. This discussion cannot address all aspects of the investigation of chimney fires, however, a general discussion on areas routinely associated with the fire's origin and cause may help the beginning investigator or adjuster in their investigation.

There are two common types of chimneys: masonry and prefabricated. Each has its weakness. To be a fire cause, both have to satisfy basic dictates: identification of the initial fuel, the ignition source and the ignition sequence, or how the first two came in contact with each other. Each type of chimney will be discussed from the aspect of how they may become a fire cause.

Terminology used in this discussion will be consistent with the definitions used in NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, and NFPA 97M, Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances. The reader is encouraged to obtain a copy of NFPA 211 and become familiar with the code restrictions that apply to these devices.

Masonry chimneys normally sit on a foundation that, in turn, sits in or on the ground. The exception is when a masonry chimney is supported by a framework that is tied to the structure's wall. Examine the manner that the chimney is supported. Look for signs of movement, such as settling or pulling away from the structure or the point of connection for the chimney connector. Do not assume that the chimney is adequately supported and has not moved. Obviously, unexpected movement can result in the escape of combustion gases.

Cracks in the masonry, missing bricks, and broken flue liners have been blamed as causes for fires. In reality, these conditions are not necessarily fire hazards. All can create problems that relate to the structural strength of the chimney, but their presence does not mean the chimney is a fire hazard. Many chimneys can be found that see extensive use and that have these conditions, but do not set the structure ablaze.

A fire cause directly related to chimneys is the failure to maintain adequate clearance between the heat in the chimney and the combustibles found in nearby walls and ceilings. The Code recommends the proper clearances, and the distances specified have enough fudge factor to make any installation that conforms nearly fire proof. Exceptions do exist. One home fire that began at the wall adjacent to an exterior masonry chimney did so because the chimney builder stuffed the small space between the home and the chimney

with old McDonald's lunch sacks and then closed off the 1/2 inch gap between the chimney and the home with boards.

The best approach to investigate a fire caused by inadequate clearances is to document the manner of construction and clearances that were built in and consult the Code for compliance. If the clearances were inadequate, then a "possible" ignition source exists. The initial fuel must still be identified and, of course, the fire's origin must be associated with the area of minimum clearance.

Prefabricated chimneys consist of three types: air-cooled, air-insulated, and mass-insulated chimneys. All are manufactured in various lengths with most being from 12 inches to 36 inches. Because of the ability to cool itself, the air-cooled chimney is the only one that has been installed without a minimum air clearance to combustibles.

"Air-cooled" means that outside air is drawn into the chambers of the chimney and this air absorbs heat that is conducted through the metal walls of the flue. The heat is carried outside by the circulating air through an anticipated path, instead of being absorbed by combustibles that are around the chimney's surface. Obviously, the safety of this design depends on the movement of air into the outer chamber, around the bottom, and up the inner chamber of the chimney. When the passageway is obstructed the exterior skin of the chimney can achieve the temperature of the gases in the flue and, with a marginal clearance, a fire can result. The investigator must check these passages for obstructions. Sometimes obstructions result from creosote accumulation at the cool-air inlet. Sometimes the obstructions are internal.

One fire investigation found a quantity of loose fiberglass insulation inside the passageway that had apparently gotten there when the installers lowered the chimney sections down through a hole cut in the ceiling. Attic insulation fell down into the chimney section and remained there until it was found after the fire. The hazard took eight years before the rear wall had been heated sufficiently to ignite.

With air-cooled chimney sections, the passages need to be maintained as the chimney is built. In some instances, the inner liner, or flue, is installed first. Then the middle liner is placed around the inner liner. Then the outer liner is placed around the middle liner. Some manufacturers have made installation an easier task by assembling the three liners into one section that is positioned in one step. Air-cooled chimney sections can resemble air-insulated chimney sections in appearance. The difference is an air-cooled chimney will have a cool-air inlet in the top section of the chimney while an air-insulated chimney will not. A significant point is that the cool-air inlet must be separated from the hot-air outlet. If heated air is allowed to recirculate back into the cool-air inlet, the positive feedback will increase the temperature of the exterior surface of the chimney.

The air-cooled chimney has been installed as a zero-clearance chimney in many installations. However, at least one manufacturer, Majestic, is requiring a 2 inch air clearance to any combustibles. If the air-cooled chimney is installed with a zero clearance, the unimpeded air flow is a necessity. Air-insulated chimneys do not rely on

such an organized air flow to keep their exterior surfaces cool and, therefore, require a 2 inch minimum clearance to combustibles. The air that is "trapped" inside the air-insulated chimney sections has an insulating ability that will reduce the exterior temperature of the surface. These insulating characteristics result from the circulation of the air within the chimney, and the dilution of this air because the seams of the chimney are not air tight and some fresh air is drawn into the interior space. The quantity of air drawn into the chimney is not nearly as much as with the air-cooled chimney.

The weakness with air-insulated chimneys is the required clearance to combustibles. If the clearance space is not maintained, the heat radiating from the surface of the chimney will deteriorate the nearby combustibles and a fire can begin. In this instance, the time required for the fire to begin is determined by the temperature of the exterior surface of the chimney and the type of fuel being heated. Therefore, if the chimney serves an appliance that is used extensively and the combustibles are touching the surface (or very close to it), a fire can occur within days of the installation. Usually the circumstances are not so aggravated and the fire takes months and sometimes years to develop.

The last type of prefabricated chimney is the mass-insulated chimney, sometimes referred to as double-wall insulated chimney. This type consists of two metal sleeves with a noncombustible filler (not asbestos) sandwiched between them. This type also requires a minimum clearance to combustibles of 2 inches. The weakness of it is the same as the air-insulated type.

All prefabricated chimneys have a common weakness. They are made of metal which can corrode from the acids created in the combustion of wood or coal. The corrosion is offset by using stainless steel in the inner liner or flue. The condition of the flue for these chimneys must be noted when the fire origin involves the chimney.

Another problem related to the inner liner is warpage from excess, or rapid build-up of heat. The metal can warp sufficiently to cause a fissure in the inner liner and hot gasses can enter the internal space of the chimney. A chimney fire need not occur for this warpage to take place. This author had the bottom-most, mass-insulated chimney section in his home warp sufficiently to require its replacement without ever experiencing a chimney flue.

Chimney fires can occur in masonry and prefabricated chimneys. They occur when the creosote accumulation on the sides of the flue ignites and burns. The temperatures generated in chimney fires can achieve 2000 degrees Fahrenheit depending on the amount of creosote and the availability of fresh air to fuel the combustion process. Assuming both factors are present in sufficient quantities, a chimney fire can be quite intense and can create a severe fire hazard in a marginally-installed chimney. Usually, the witnesses report sounds like a "freight train" or "jet airplane taking off." Sometimes turbulence created by the in-rushing air and the combustion process can cause the chimney connector to fall apart or break away from the chimney or appliance.

When a creosote fire occurs, any existing problem in the chimney, like those discussed above, will be aggravated. Pressure in the chimney from the increased rate of combustion can force hot gases out through cracks in the mortar or missing bricks. Marginal clearances with masonry or prefabricated chimneys suddenly become inadequate with the temperatures generated in such fires.

If a fire originates in a chimney that has suffered a creosote fire in its immediate past, then look at the manner of installation. In many instances where fire occurred after a chimney fire, the chimney has been improperly installed or maintained and the creosote fire was the "straw that broke the camel's back."

Not every fire cause has been discussed that relates to these chimneys. However, the points described here will allow the beginning investigator and the less-experienced adjuster to examine some of the more common areas of significance.