

## Burn Patterns

When I first started Pyro-Technical Investigations 27 years ago, I published a quarterly newsletter with articles meant to educate my clients on topics of interest. I recently had an opportunity to review those articles and found that many of them are as relevant today as they were when they were first written. One article in particular, on the interpretation of burn patterns, brought up issues that have only recently become part of the mainstream dialogue.

The significance of ventilation on burn patterns was first recognized in a paper authored by Steve Carman, reflecting a 2005 test that was conducted at a training seminar. The 2008 edition of NFPA 921 was the first edition of this document to address ventilation generated burn patterns. Since that time, many of the newer texts on fire investigation (e.g. Lentini) have also addressed this topic. Below is my original article, which may have been ahead of its time. In the article I give specific examples from my own experience that illustrate the remarkable influence ventilation can have on a fire and the patterns that remain after the fire is extinguished.

Any text or course on fire investigation will talk about burn patterns and how to “read” these patterns to determine where a fire originated. The material covered will include the fact that fire burns in an upward and outward fashion. Further, the fire will tend to burn in a somewhat symmetrical fashion except as influenced by building structures such as walls and ceilings.

Another influence on burn patterns that does not always receive a lot of attention is the effect of ventilation. Oxygen is a necessary requirement for combustion. As a fire burns, if oxygen is not reintroduced into the fire environment, the fire will burn itself out. The source of the oxygen that replenishes the fire can have a significant effect on a fire and the burn patterns.

Several years ago I investigated a fire in a bowling alley. This was a large structure with a high ceiling. The fire appeared to have originated just in front of the pin area for an alley several lanes from the south end of the building. The burn patterns progressed from this area toward the southeast corner of the building, creating a fan shaped burn pattern. This was a very unusual burn pattern and had led the local authorities to label the fire as incendiary. An examination of the southeast corner of the building revealed the presence of a steel framed doorway. There was a rather large and obvious air-gap between the door and the door frame. The burn

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pattern was now rather obvious, since the fire was being drawn towards the source of oxygen that was necessary to sustain the fire.

Another example is a residential fire that appeared to have started at the rear of the building, on an enclosed first floor porch. Further examination of the building revealed extensive fire damage to the finished dormer attic area, including extensive fire damage to the roof. Some of the heaviest fire damage in the attic occurred in opposite corners of the attic. These burn patterns were very suspicious and led to further investigation to determine if this fire may have been incendiary. No evidence of trailers or other floor level damage was observed in the building. Contact was made with the local authorities and it was learned that the fire department had used positive pressure ventilation at the scene prior to realizing that there was a stairway at the rear of the building leading to the dormer attic. The ventilation actually "pushed" the fire into the attic, thus causing the unusual burn patterns.

While the situations illustrated by the above examples tend to be the exceptions, they do point out the fact that there can be very logical and innocent explanations for what appear to be unusual burn patterns. The fire investigator must keep in mind that fire is a physical phenomenon and adheres to the laws of science. Only by giving proper consideration to the scientific principles of combustion can one make the ultimate determination of whether there is a natural explanation for an unusual burn pattern.

Contact your forensic experts at Pyro-Technical Investigations by phone, 800.377.1352, or by email [info@ptiforensic.com](mailto:info@ptiforensic.com), to help solve your fire investigation challenges.