F6 Misinterpretation of Common Fire Behaviors and Its Effect on Criminal and Civil Litigation

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The goals of this presentation are to: (1) increase awareness of the propensity for misinterpretation of the effects of commonly encountered fire scenarios leading to improper conclusions as to fire origin; (2) demonstrate useful techniques to identify fire-spread behaviors; and, (3) expand awareness of frequent mistakes made in investigating common fire scenarios.

This presentation will impact the forensic science community by increasing awareness of misinterpretation of fire scene evidence which will reduce the likelihood of baseless litigation in both criminal and civil cases.

For more than 20 years, the fire investigation community has undergone a metamorphosis, transitioning from widespread adherence to an art-based investigative approach to a more science-based style. Historically, explanations offered to explain the creation of burn patterns were based less on scientific fact than on anecdotal beliefs.[1,2] Guidance from documents such as the National Fire Protection Association (NFPA) 921, Guide to Fire and Explosion Investigation and other references along with training and certification programs have emphasized reliance on scientific principles and have nudged investigators along that path of change.[3] Interim developments in federal case law also now require that fire investigation be based on solid scientific principles rather than novel, untested techniques.

In 2005, while presenting a seminar on fire dynamics, Special Agents from the United States Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) designed an exercise to evaluate the information relied upon by investigators in identifying fire origins. Two identical, bedroom-size burn cells were each burned for seven minutes, reaching full fire involvement. Fifty-three fire investigators who had not observed the fires briefly examined the cells to identify which quadrant of the cells they thought each fire had started. Upon evaluating the first cell, only three of 53 investigators (5.7%) correctly selected the quadrant of fire origin. The same percentage (although different investigators) correctly identified the quadrant-of-origin in the second cell.[4]

In similar exercises conducted over the previous 16 years at the Federal Law Enforcement Training Center in Georgia, only 8%-10% of students correctly located the origins of fully involved fires. Investigators not identifying the correct origins typically reported being misled by burn patterns generated during full involvement under ventilation-limited conditions. This was despite such conditions frequently occurring in structure fires.

Follow-on studies of ventilation-limited fires were conducted in places such as the ATF Fire Research Laboratory in Ammendale, MD, and elsewhere. Computer analyses have been used to study such fire behaviors and to explain ventilation flows and the related fire spread. Examination of heat flux, temperature, and gas concentration data as well as the burn patterns have enabled better understanding of the various mechanisms involved. Transfer of such information to the fire investigation community, albeit a seemingly slow process at times, is crucial for improving the accuracy of fire origin determinations.[5]

Several regularly encountered fire scenarios have been shown to result in conditions often at odds with commonly accepted ideas. One such popular belief is that the area of worst fire destruction is indicative of the place the fire burned the longest. Post-flashover and elevated fires are examples of scenarios where this idea is frequently proven wrong. In each case, areas of extensive fire damage may be generated well apart from the origin and misinterpreted as being the actual origin. Techniques such as computer modeling are available to test hypotheses but their use remains limited.[6-8]

Examples of actual investigations will be discussed in which the behaviors of such fires were misinterpreted. In at least two instances, homicide charges were proposed in suspected arson fires later shown to have started on a stovetop. Incorrect fire cause determinations behind convictions that were later overturned will also be reviewed.

References:

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Ventilation-Limited Fires, Fire Patterns, Origin Determinations