WHAT FIRE LITIGATORS NEED TO KNOW IN 2017

BY JOHN J. LENTINI

Fires represent a rich source of material for litigation in both the civil and criminal justice systems. But litigation surrounding fires is not what it used to be. There have been momentous changes in the science of fire investigation and in the recognition of the level of expertise required to conduct a valid fire investigation.

The science of fire investigation has been in a constant state of flux since 1992, when *NFPA 921: Guide for Fire and Explosion Investigations* (NFPA 921) was first published. The fire investigation profession had a veritable conniption when this document was first introduced. Many old wives' tales about fire investigation were debunked, but about half of the people investigating fires simply refused to entertain the idea that their mentors had led them astray. They fought NFPA 921 tooth and nail for most of the 1990s. The largest body of professional fire investigators, the International Association of Arson Investigators (IAAI), went so far as to file an amicus brief that stated, "Cause and origin investigations, by their very nature, are 'less scientific' than envisioned by *Daubert*."[1] The amicus brief went on to argue, "If a stringent *Daubert* analysis is applied, the testimony of experts with years of experience and training in their field could be systematically excluded even though their investigations comport with traditional and accepted procedures."[2]

It was the *Kumho*[3] decision in 1999, wherein the Supreme Court held that judges need not distinguish between "scientific," "technical," or "other" expertise, that finally started to change minds. Expert testimony was expert testimony, and all of it had to be reliable. In 2000, the U.S. Department of Justice and the National Institute of Justice published a pamphlet entitled *Fire and Arson Scene Evidence: A Guide for Public Safety Personnel*, which embraced NFPA 921 and stated it should be followed whenever the loss was either large or suspicious or involved a fatality.[4] It was only then that the fire investigation profession accepted the reality that scientific investigations were the wave of the future. Cases litigated prior to 2000 are therefore subject to retroactive challenge, and this has served as the basis for convictions being overturned.[5]

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FIGURE 1

FIGURE 2

While acknowledging the need for science in fire investigations, most of the people involved in fire investigation did not, as they should have, get themselves grounded in the science underlying fire behavior. This has made them an easy target for motions to exclude their testimony, not only because of poor methodology, but also because of the lack of qualifications.

The Standard of Care

Until recently, objections to methodology underpinned most motions in limine to exclude testimony. NFPA 921 is the "standard of care," a characterization to which many fire investigators still object, but which many courts have accepted. By 2007, there was a body of law holding that NFPA 921 should be followed unless an investigator could justify not doing so. In the last decade, even more courts have adopted this position.[6]

Many of the "indicators of arson" relied on for decades are no longer recognized as useful. It is now acknowledged that accidental fires produce many of the same artifacts as arson fires. It is now confirmed that in most cases, the liquid accelerant used to start a fire is almost completely consumed within the first minute on smooth surfaces and within the first five minutes on carpeted surfaces.[7] Most importantly, it is now recognized that the lowest and deepest charring in the fire scene does not necessarily represent the origin of the fire.[8]

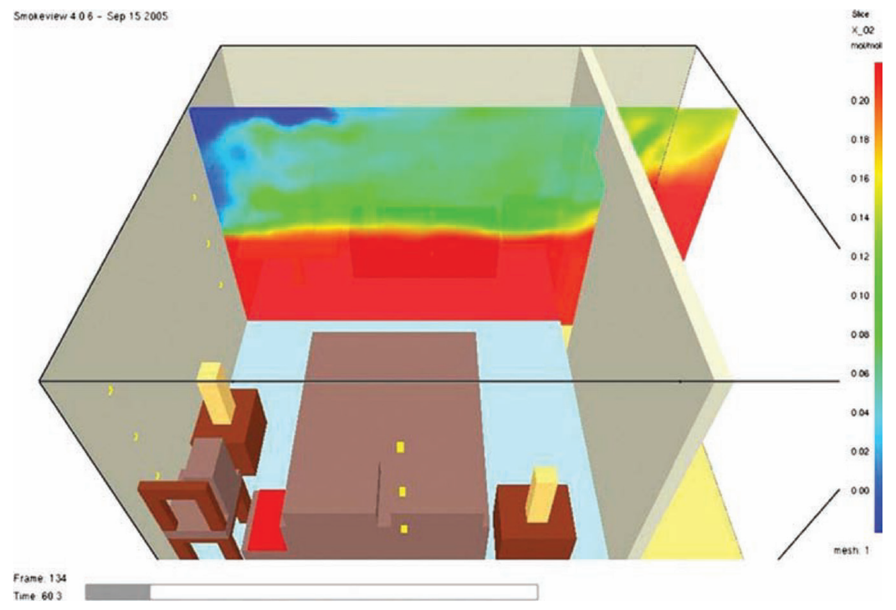

FIGURE 3

The Effects of Ventilation

Fire investigators now understand that once a room becomes "fully involved," meaning that the entire volume is involved in combustion of varying intensities, the rules for interpreting post-fire artifacts change. The patterns produced by the fire are not a result of what has been burning the longest, but where the oxygen is located. When a fire undergoes the transition known as flashover, it changes from "a fire in a room" to "a room on fire." At that point, the fire behaves differently than the fires with which most people are familiar, such as campfires, trash fires, or brushfires. A fire confined inside a structure behaves differently.

One of the first things learned about post-flashover burning was that the method of heat transfer changed from convection, the "heat rises" fire behavior that everyone appreciates, to radiation, which causes burning on all surfaces, including those that are low in the compartment. Irregular patterns on floors, for example, which were once thought of as unmistakable evidence of the use of a liquid accelerant, can be produced in a fully involved compartment with no accelerants necessary. The liquid accelerant theory of irregular pattern interpretation has been disproved. Flashover, it turns out, does more than just change the direction of heat transfer. Because it consumes all, or almost all, of the oxygen in the room, flashover changes the location of the flames based on ventilation.

Most people are familiar with a "fire triangle" involving heat, fuel, and oxygen. When the fire consumes all of the oxygen, it can only burn in places where there is a supply of oxygen. This can result in misleading fire patterns.

In 2005, an experiment was conducted in Las Vegas to gauge the accuracy of fire investigators' ability to determine the origin of the fire, which is supposedly their core competency.[9] The results of the experiment were shocking. In two burn cells set up as bedrooms, fires were started in a trashcan next to the bed, and allowed to burn for two minutes beyond flashover. This is not a typical problem for fire investigators. They are frequently asked to determine the origin of a fire that burned in a fully involved state for tens of minutes. In this experiment, 53 participants were asked to evaluate the fire patterns and determine in which quadrant of the room the fire originated. The lowest and deepest char was noted in the quadrant directly across from an open doorway. This is where 50 of 53 participants thought the fire originated. The test was repeated in a second compartment, and a different three investigators were able to correctly locate the quadrant of origin.

When these results were published in 2008, the fire investigation profession again experienced an epidemic of exploding heads. The spin machine was cranked up into high gear, and several explanations were offered for the astonishingly low rate of accurate determinations. No movement of evidence was allowed, no witness interviews took place, and a certain amount of "groupthink" happened. Additionally, the qualifications of some of the 53 were questioned. The problem with these explanations is that the results would have been no different if the scene had been shoveled out, or if an eyewitness who only saw the fire coming out the door was questioned. Further, even supposing that only 30 of the 53 study participants were qualified, that still left only three of 30 getting it correct. While the test was not designed to provide an "error rate," an inaccuracy rate in excess of 90 percent was disturbing.

The three Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) agents who conducted the experiment repeated it at the ATF Fire Research Laboratory in Ammendale, Maryland, and learned why the biggest burn pattern was opposite the door. The pattern generated by the original fire in the trashcan was still evident after the fire (see fig. 1). The pattern survived, but investigators failed to

recognize its significance. The prominent misleading burn pattern (see fig. 2) was the artifact that the investigators relied on to determine the origin. Using computerized fire modeling, the ATF investigators learned that the big burn pattern was caused by the influx of fresh air in the bottom of the doorway while smoke and hot gases vented out at the top of the doorway. This is demonstrated by the output of the computer model (see fig. 3).[10]

The 2005 experiment was repeated with 70 investigators in 2007, and the results were slightly better but still pretty discouraging. Three fires were set: one that burned for 30 seconds beyond flashover, one that burned for 70 seconds beyond flashover, and one that burned for three minutes beyond flashover. For the room fully involved for 30 seconds, 84 percent of the fire investigators correctly selected the quadrant of origin. For the 70-second fire, 69 percent correctly selected the quadrant of origin, and for the three-minute fire, only 25 percent correctly identified the quadrant of origin.[11] *This result is no better than what would have happened if the quadrant of origin had been selected at random.* Still another test, conducted in 2012, showed 22–26 percent erroneous conclusions when 587 self-selected investigators, working independently, viewed photos and data from a fire that burned for only one minute beyond flashover. These results were similar to the 31 percent erroneous conclusions found in the 70-seconds-beyond-flashover study conducted in 2007.[12]

As the work on understanding the effects of ventilation continues, what we are coming to understand is that reading fire patterns in a fire that has burned for more than three minutes beyond flashover is not likely to lead to a valid finding of the origin of the fire. ATF Special Agent Andrew Cox has elucidated the problem of patterns produced by ventilation, and has proposed an approach to the problem called "origin matrix analysis," which provides a way to think about the significance of fire patterns. Essentially, patterns created after flashover offer little insight into the fire's origin, and should be ignored.[13] All potential sources of ignition in a fully involved compartment need to be considered.

There are still fire investigators who believe that they can walk into a fully involved room and see evidence of more than one origin, or eliminate potential ignition sources because those ignition sources were not located where they believed the fire started. Those people are wrong but do not know it, and are thus able to testify with confidence and conviction. To this day, incorrect origin determinations lead to incorrect cause determinations.

A New Kind of Challenge

Because of the changes in the science of fire investigation over the years, most of the challenges to fire investigators have been challenges to methodology. *Daubert* challenges are among the most common motions filed in fire litigation now, second only to motions for summary judgment in civil cases. But there is a new means of challenging inaccuracies in fire investigation, and that is by attacking the investigator's qualifications. While most judges are reluctant to exclude a witness based on qualifications, particularly if that witness has been allowed to testify dozens of times previously, challenging the investigator on qualifications nevertheless results in many cases being dismissed or settled. An investigator who cannot name the basic units of energy or power, or explain the difference between energy and power, is not an expert, and is not qualified. The same goes for an expert who thinks the air around us is 92 percent oxygen, or one who cannot describe the simplest of all combustion reactions, the burning of hydrogen in air to produce water. The author once witnessed the exclusion of a fire marshal when the judge said, "I'm sorry. If you don't know H2O, you will not be rendering opinion testimony in my courtroom."

In 2009, there was a change in a standard called *NFPA 1033: Standard for Professional Qualifications for Fire Investigator* (NFPA 1033). This standard does not allow for as much wiggle room as NFPA 921, which is "only a guide." NFPA 1033 applies to everyone who investigates fires, whether they are public sector or private sector, licensed engineers or chemists. If they want to testify about fires, they can be shown to be unqualified if they do not have the knowledge required by this standard (see "Subject Matter Expertise Required by NFPA 1033").

The author has been involved in more than a dozen cases in the last five years that have resulted in dismissals of criminal charges or settlements of civil cases, not because the methodology of the investigator was discredited, but because the investigator himself or herself was discredited for not having this basic knowledge. Sponsoring counsel decided not to put such an obviously unqualified individual in the witness chair.

continued on page 31

SUBJECT MATTER EXPERTISE REQUIRED BY NFPA 1033

1.3.7* The investigator shall have and maintain at a minimum an up-to-date basic knowledge of the following topics beyond the high school level:

1. Fire science
2. Fire chemistry
3. Thermodynamics
4. Thermometry
5. Fire dynamics
6. Explosion dynamics
7. Computer fire modeling
8. Fire investigation
9. Fire analysis
10. Fire investigation methodology
11. Fire investigation technology
12. Hazardous materials
13. Failure analysis and analytical tools
14. Fire protection systems
15. Evidence documentation, collection, and preservation
16. Electricity and electrical systems

WHAT FIRE LITIGATORS NEED TO KNOW IN 2017

continued from page 21

Conclusion

Litigators should understand that fire investigation has progressed markedly over the last three decades, and it continues to advance today. The validity of fire origin determination in a fire that has been fully involved for more than a few minutes is now subject to serious question. Chances are if a fire has burned for more than three minutes beyond flashover, the best that a fire investigator can do is identify the room of origin.

Litigators are advised to vet their investigators far more carefully than they have in the past. Adverse counsel is almost certain to bring up the subject matter expertise required by NFPA 1033, and if your expert is unable to define a watt, he or she may be found to be unqualified to testify. Most litigators who do not specialize in fires are likely to encounter one or two fire cases in a career. Such people are advised to consult with an expert and possibly associate with an attorney who has more experience in litigating fire-related cases. ◆

Endnotes

1. Brief for International Ass'n of Arson Investigators as Amici Curiae, *Mich. Millers Mut. Ins. Co. v. Benfield*, 140 F.3d 915 (11th Cir. 1998) (No. 97-2138).

2. *Id.*

3. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).

4. *Available at* https://www.ncjrs.gov/pdffiles1/nij/181584.pdf.

5. Mark Hansen, *Long-Held Beliefs about Arson Science Have Been Debunked after Decades of Misuse*, A.B.A. J. (Dec. 1, 2015), http://www.abajournal.com/magazine/article/long_held_beliefs_about_arson_science_have_been_debunked_after_decades_of_m.

6. John Lentini, *The Standard of Care in Fire Investigations*, Canadian Ass'n of Fire Investigators J., Spring 2007, http://www.firescientist.com/publications.php.

7. Christopher L. Mealy et al., Fire Dynamics and Forensic Analysis of Liquid Fuel Fires (2011), https://www.ncjrs.gov/pdffiles1/nij/grants/238704.pdf.

8. Nat'l Fire Prot. Ass'n, NFPA 921: Guide for Fire and Explosion Investigations § 18.4.1.3 (2017), http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=921.

9. Nat'l Fire Prot. Ass'n, NFPA 1033, Standard for Professional Qualifications for Fire Investigator § 4.2.4 (2014), http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1033.

10. Steven W. Carman, Improving the Understanding of Post-Flashover Fire Behavior, Paper Presented at the Proceedings of the 3rd International Symposium on Fire Investigation Science and Technology (May 19–21, 2008), http://www.carmanfireinvestigations.com/publications/.

11. Note that in the 70-second test, six investigators declared the origin "undetermined," and in the three-minute test, 17 investigators chose that option.

12. Andrew T. Tinsely & Gregory E. Gorbett, Fire Investigation Origin Determination Survey, Paper Presented at the Proceedings of the 5th International Symposium on Fire Investigation Science and Technology 53–68 (Oct. 15–17, 2012), http://fireandarsoninvestigation.eku.edu/sites/fireandarsoninvestigation.eku.edu/files/origin_survey_resubmission.pdf.

13. Andrew Cox, *Origin Matrix Analysis: A Systematic Methodology for the Assessment and Interpretation of Compartment Fire Damage*, 64 Fire & Arson Investigator, no. 1, July 2013, at 37.