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Trial Court No. 24,4670 (B)

EX PARTE & IN THE DISTRICT COURT  
& 366<sup>th</sup> JUDICIAL DISTRICT  
CAMERON TODD WILLINGHAM & NAVARRO COUNTY, TEXAS

REPORT OF DR. GERALD HURST

The fire investigation report of the Texas State Fire Marshal's Office in this case is a remarkable document. On first reading, a contemporary fire origin and cause analyst might well wonder how anyone could make so many critical errors in interpreting the evidence. However, when the report is looked at in the context of its time and in light of a few key advances that have been made in the fire investigation field in the last dozen years, it becomes obvious that the report more or less simply reflects the shortcomings in the state of the art prior to the beginning of serious efforts to introduce standards and to test old theories that had previously been accepted on faith.

Within a few weeks of the issuance of the Fire Marshal's report, the first edition of NFPA 921, "A Guide to Fire and Explosion Investigation" was published by the National Fire Protection Association. This landmark publication was developed by a committee of over 30 well-respected fire experts elected by NFPA members. It was assembled through a process which met all the requirements of an ASTM standard. Since then, NFPA 921 has become the de facto standard of care for the fire investigation community and will appear in its 5<sup>th</sup> edition in early 2004. As will be shown later, most of the conclusions reached by the Fire Marshall would be considered invalid in light of current knowledge.

The following is a list of key references containing information which is relevant to the present case and which became known only after the subject fire investigation:

1. NFPA 921, "A Guide to Fire and Explosion Investigation," The National Fire Protection Association, 1992, 1995, 1998, 2001
2. "Unconventional Wisdom: The Lessons of Oakland," *The Fire and Arson Investigator*, Vol. 43, No. 4, June 1993.
3. "The Lime Street Fire: Another Perspective," *The Fire and Arson Investigator*, Vol. 43, No. 1, Sept. 1992.

[Cites a full-scale reproduction of a fire analogous to Willingham's in which a fire thought to start in a hall by an accelerant is shown to have resulted from flashover in an adjacent room. Test was run by prosecution, who dropped arson case.]

4. USFA Fire Burn Pattern Tests, FA 178, 7/97 Federal Emergency Management Agency, United States Fire Administration, 1997
5. Flammable and Combustible Liquid Spill/Burn Patterns, NII Report 604-00, 1997
6. "Kirk's Fire Investigation," Fifth Edition, Copyright 2002

#### **The fire scene**

The fire scene structure was a small wood-frame house. The areas relevant to origin and cause determination were a bedroom in the northeast corner of the house, connected via a doorway in the west wall to a hallway which ran north and south. The southern end of the hallway opened through the front (north) door onto a cement porch. The doorway to the porch had an aluminum threshold plate.

The bedroom contained, presumably inter alia, two baby cribs, a bed and a heater. The room had one window in the south wall and two on the east wall. During the fire, extensive flaming had occurred out through the windows and there was extensive and variable fire damage to the floor as well as low burn on walls.

The heavy damage to the floor extended out the bedroom door into the hallway, where it ran a short way to the south and all the way north to the cement porch.

There was also peripheral low charring to the walls adjacent to the northern portion of the hallway and to the exterior face of the north wall of the bedroom adjacent to the porch.

The front door was consumed by fire, a screen door showed charring under its base and the wood under the aluminum threshold was charred.

In the bedroom there was a window with remnants of crazed glass present.

#### **The Fire Marshal's Conclusions vs. New Technology**

In his report, the Investigator for the Texas State Fire Marshal's Office announced that he had found more than 20 indicators of incendiaryism. The indicators he cited as such were crazed glass, multiple origins, brown rings on a cement porch, low burns on walls in the Bedroom/hall area, V-patterns on walls, charring to the base

of a screen door, a positive analysis for kerosene ("mineral spirits of kerosene"), burned wood under an aluminum threshold, tiles burned from underneath, and an unnumbered occurrence of so-called "trailers," "pour patterns," and "puddle-configurations."

**Trailers, pour patterns and puddle configurations:** A decade ago, fire investigators would often look at a post-flashover fire scene and note various burn patterns of varying degree which appeared to be shaped like irregular pours of liquid. It was fairly common practice for the investigator to cite these patterns as proof of the use of an accelerant. With the advent of NFPA 921, it became more and more widely realized that post-flashover burning in a room or hallway produces floor burn patterns which cannot be differentiated from burns imagined to be caused by liquid accelerants. Full scale testing, as reported in reference 6 above, showed that post-flashover burning, even of relatively short duration, makes it impossible to identify accelerant burns visually. Thus it becomes impossible to visually identify accelerant patterns under these conditions.

The subject fire included post-flashover burning of considerable duration as evidence by the hallmark of flashover, flames pouring from windows and doors.

**Multiple Origins:** The Fire Marshal reported multiple fire origins. Actual multiple fire origins create a powerful case for arson. However, multiple origins can only be demonstrated when two or more areas of fire are completely isolated from one another. In this post-flashover fire, all of the burn areas were clearly contiguous in the sense that they were at least joined by obvious radiation and/or conduction mechanisms. The finding of multiple origins was inappropriate even in the context of the state of the art in 1991.

**V-Patterns:** Contrary to the Fire Marshal's report, V-patterns are only sometimes indicators of the point of origin of a fire and only rarely indicators of the use of a liquid accelerant. If a fire is snuffed out before flashover, a V-pattern, such as one above a coffee maker may suggest that the object below the V started the fire. However, once a fire passes the flashover stage, original patterns often become overwhelmed and new V-patterns will form from the burning of such common items as wooden door frames, combustible objects on the floor, etc. The effect of post-flashover burning on the appearance and disappearance of V-patterns parallels the effects on floor patterns.

**Burned wood under aluminum threshold:** The fire Marshal alleged that the charring of wood under the aluminum threshold was caused by a liquid accelerant burning under the threshold. This phenomenon is clearly impossible. Liquid accelerants can no more burn under an aluminum threshold than can grease burn in a skillet even with a loose-fitting lid. The charring of wood under a threshold is a

common occurrence in post-flashover fires. The thermal radiation at doorways is extremely high because of the turbulent mixing of hot, fuel-rich gases with incoming fresh air. This radiation is often high enough to actually melt the threshold (660 degrees C).

Ten years ago melted thresholds or charred underlying wood were routinely classified as accelerant-induced phenomena. Today, it is textbook knowledge that the effects are caused by radiation. See "Kirk's Fire Investigation," Fifth Edition, Copyright 2002.

**Tiles burned from accelerant underneath:** A liquid accelerant will not burn underneath a tile on the floor any more than it will under an aluminum threshold. Burning underneath a tile is caused by the tile curling under post-flashover radiation and thereby exposing its lower surface to the heat. Kerosene-like materials will burn only with great difficulty even on the top surface of tile material. They tend to self-extinguish leaving unburned kerosene behind and have little effect on the tile. See reference 5 above, *Flammable and Combustible Liquid Spill/Burn Patterns*, NJ Report 604-00, 1997

**Crazed Glass:** The idea that crazed glass is an indicator of the use of a liquid accelerant is now classified by the fire investigation as an "Old Wives Tale." Crazed glass is caused by the rapid chilling of hot glass by water used to extinguish the fire. This information was first published following the investigation of a fire storm in Oakland which destroyed many homes and later confirmed by laboratory tests. See reference 2 above, "Unconventional Wisdom: The Lessons of Oakland," 1993.

**Brown rings on the cement porch:** The identification of the presence of an accelerant based on brown rings on a cement floor is baseless speculation. A great deal of brown rust and soluble iron salts is created at fire scenes. When the puddles of fire hose water evaporate they often leave brown material trapped in the surface pores of the cement. The presence of an accelerant can only be established by chromatographic analysis in the laboratory.

**The Positive Accelerant Analysis:** The fire Marshal reported that kerosene was found in a single sample of wood taken from bottom the doorway adjacent to the cement porch. What the analyst actually reported was "mineral spirits of kerosene," which is not the same thing as kerosene. A burned can of charcoal lighter was also found on the same concrete floor. Charcoal lighter fluid belongs to the class of liquids labeled "mineral spirits of kerosene." Therefore, the presence of this material is an expected natural occurrence in the wake of a fire. Fluid from the can would be dispersed and floated across the concrete by the action of the immiscible water from the fire hoses.

Signed on the 13 day of February 2004.

*Gerald Hurst*  
Dr. Gerald Hurst