

State of Texas }
 }
County of Travis }

SECOND AFFIDAVIT OF GERALD HURST, Ph.D

BEFORE ME, the undersigned authority personally appeared Gerald Hurst, and
being sworn, stated as follows:

I.

My name is Gerald Hurst. I am over the age of 18 and have
knowledge of the matters discussed within this affidavit. I am a consultant
in the field of explosion and fire analysis. I earned a BS in Chemistry from
Central State University in 1959, pursued graduate studies in Chemistry at
Iowa State University in 1960, and received a Ph.D. in Chemistry from
Cambridge University, in Cambridge, England in 1963. I have been a
private consultant in the field of fire and explosion analysis since 1972.
From 1963 to 1980, I worked as a research scientist in the fields of study
including fire initiation, propagation and arson techniques, propellants, and
explosives. I hold approximately a dozen patents in United States and many
other countries for inventions relating mainly to explosives technology. I
have spoken on the subjects of fire and explosion science matters before the
National Safety Counsel, United States Forest Service, United States Army,
and United States Air Force. In addition to working for private individuals,
I have also provided consultation to several military and civilian
government agencies, including the Federal Bureau of Investigation, the
Bureau of Alcohol Tobacco and Firearms, and the United States Forrest
Service.

II.

I have previously given Affidavit regarding my review of the

scientific testimony and other arson-related evidence given in the prosecution of Raphael Holiday. During his testimony, the State's fire expert, John DeHaan made mention that his PhD thesis was inspired by his earlier "candle experiment" conducted on an undetermined date in Australia. After submitting my first affidavit, I was provided by Mr. Holiday's post-conviction counsel a copy of DeHaan's thesis, entitled *The Reconstruction of Fires Involving Highly Flammable Hydrocarbon Liquids*, which he prepared as part of his studies at the University of Strathclyde, in Glasgow, Scotland. Mr. Holiday's counsel asked me to review the thesis to determine whether, and to what extent it might support or refute Mr. DeHaan's testimony in this case.

I have reviewed DeHaan's thesis and found several portions which either do not support, or flatly conflict with DeHaan's testimony at trial. I have set my observations out as follows:

1. DeHaan's methodology in conducting the experiments differed from, and did not necessarily correspond to the circumstances which existed in the fire at the Wilkerson residence. DeHaan ran only small vapor flow experiments from pools and wetted substrates. He did not measure the vapor concentration gradients above the "spills" but merely tracked the vapor roughly with a smoke pen. This is significant in the context of his testimony during the Holiday trial. Under the methodology employed in the experiments, DeHaan did not measure the limiting height at which ignition of the vapors would occur. The height at which gasoline vapor ignition would occur was a significant question at Mr. Holiday's trial.
2. DeHaan's measurements of the velocity of vapor flow show that a layer of vapor could easily have flowed from the area of initial pour to the gas stove in the reported time frame. He observed that pours from a height of one meter resulted in the evaporation of 25% of the pentane poured. He

further noted that the initial evaporation of gasoline (top 25%) occurs a rate comparable to pentane. Therefore, the pour by Mrs. Mitchell over the chairs in the living room would have created a large volume of flowing gas vapor. This vapor would have been deeper than that from a simple evaporating spill, the type created by DeHaan in his experiments.

3. DeHaan acknowledged that the movement of vapors could be speeded up by the convective flow from an ignition source. On page 268, DeHaan wrote "Such sources as fireplaces, water heaters, furnaces, gas or electric room heaters, kerosene lamps, even a candle in some circumstances, could all provide convective flows of various strengths that could entrain vapours from the spill and enhance their horizontal spread." It implicitly follows from this acknowledgment, that the convective flow (of a pilot light) could also draw vapors both toward it and upward.

4. DeHaan qualified the applicability of his experiments outside of the controlled situation in which he conducted the experiment. In his summary, DeHaan warned that his method of estimating the behavior of spill vapor is not applicable to situations involving moving air. On page 296 he writes: "This model is valid only for rooms with no mechanical ventilation, with minimal leakage due to exterior doors or windows, and that do not have significant human or vehicular traffic."

5. There is another part of DeHaan's thesis, located behind the appendices, on page 361, which is particularly important in the context of his testimony in the Holiday case, because it undermines the accuracy of DeHaan's reliance upon his own "candle experiment" in relation to the circumstances leading to the fire at the Wilkerson residence. DeHaan wrote in his thesis:

"Conditions and Cautions

Because these processes are slow and easily affected by environmental features. [sic] Leaks at floor level will reduce the overall contribution to the developing layer. Reductions in ambient temperature (or allowances for evaporative cooling) will reduce the evaporation rate. The use of camping fuel will reduce evaporation rate. Draughts, a turbulent pour, or mechanical movement in the room will all increase the amount of vapour in the room and produce localized (and unpredictable) distributions of vapour/air mixtures. If these localized plumes of vapour occur in the vicinity of a competent ignition source, there can be ignition before the time predicted here." (underlining mine)

In light of this discussion, DeHaan's testimony that his candle experiment results were applicable to the Holiday fire scene was incorrect. DeHaan maintained in his testimony that the moving air in the Wilkerson's house would *reduce* the likelihood of ignition as compared with his candle experiment in relatively still air. This testimony is in direct contradiction to what he later cautioned within his thesis. The following excerpt from the DeHaan's testimony (page 197, 1st testimony sequence) should be compared to the previous quote from his thesis:

9 Well, for instance, the air conditioner is an
10 example of how something can affect the distribution of
11 vapors. It's going to pick the vapors up. It's going
12 to cause faster distribution of the vapors throughout
13 the room. But that means it's also diluting the vapors
14 further and further as it mixes them through the room.
15 And that dilution is many times the effect of basically
16 pushing the vapors away and causing the pool to
17 evaporate faster.

18 So if I turned a fan on, for instance, I'm going to
19 get vapors spread faster, but they will be so dilute
20 they are almost impossible to ignite at any position.

This testimony in relation to *dilution* of vapors through air movement is plainly inconsistent with DeHaan's thesis. Even more to the point, on pages 104 through 109 of DeHaan's second testimony sequence there is an extended exchange in which DeHaan insists in the midst of overruled Daubert objections that air circulation would tend to inhibit ignition. The testimony flies in the face of the conclusion in the thesis. (And, as I have mentioned in my first statement, it is categorically wrong based on the experiments reported by the Consumer Product Safety Commission/Arthur D. Little in the water-heater ignition experiments).

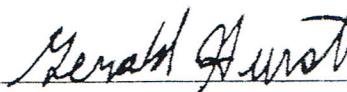
6. Finally, DeHaan's leaves an open question about whether DeHaan possessed at the time of the thesis a sufficient base of information to subsequently conclude, during Holiday's trial, that the gasoline vapors would not have ignited at the level of the pilot light flame within the broiler. DeHaan's vapor ignition experiments were all conducted after the "candle experiment" in Australia. DeHaan indicated near the end of this thesis that he did not have enough data to predict whether or not ignition of a substance containing similar ignition properties to gasoline would occur six inches above a spill. He explained that he planned future experiments to make this determination using hexane:

"Tests of the ignitability of layers of hexane vapors are planned for the Fire Research Station - Cardington during 1995. These tests will involve the production of a floor-level layer of hexane vapour by evaporation from a 1 m² pool at 20°C in the 20 m³ explosion test chamber. This vapour layer will be ignited via a sequence of electric match devices at

heights of 0.5, 0.35, 0.15, and (if necessary) 0.05m. The pressures produced at various locations within the chamber will be monitored."

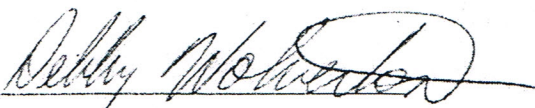
Hexane is somewhat less volatile than gasoline, meaning that it is less likely to ignite at a given temperature. Thus if DeHaan had inadequate information from his experiments to determine whether Hexane would ignite at 0.15 m (6 inches) above the spill, he could not, based upon the information he had at the time he was conducting these experiments, predict the corresponding behavior of gasoline. DeHaan's testimony at trial strongly suggests that he never actually performed the proposed experiments with Hexane; if he had, then it seems likely that, in utilizing the scientific method in support of his theory about the fire's causation, he would have cited this later experiment, rather than the "candle experiment" at least if it were favorable to his theory of ignition in the Holiday case.

Further, affiant sayeth not.



Gerald Hurst

SUBSCRIBED AND SWORN TO, before me on the 16th day of June 2005.



Notary Public, State of Texas

