VALIDATION? WE DON'T NEED NO STINKING VALIDATION! Part 2

By Richard Schulte

On Jul 8, 11:00 am, Stephen Olenick . . .wrote [on the FDS/Smokeview Bulletin Board]:

> "*. . . Fire dynamics are governed by the laws of science. If FDS and other computer fire models are appropriate for design, it is appropriate for use in fire investigation and reconstruction. Regardless of whether it's pre- or post-fire, the fire dynamics are the same. . .I guess my overall problem with the* [judicial] *opinion is that instead of simply excluding this particular expert and the use of computer fire modeling in this particular case (correctly or incorrectly), the judge took the stance that computer fire modeling is inappropriate for fire investigation and reconstruction as a whole. I couldn't disagree more.*"
>
> "*Thoughts from anyone else?*"

Olenick's comments above, elicited the following response:

> *From: fds-smv@googlegroups.com*
> *On Behalf Of Kevin* [McGrattan]
> *Sent: Thursday, July 08, 2010 11:08 AM*
> *To: FDS and Smokeview Discussions*
> *Subject: [fds-smv] Re: Recent* [court] *ruling on the use of fire modeling in fire investigations*
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> "*In my opinion, fire modeling and fire science are inseparable. The most important results of fire science are incorporated in our models. By models, I mean anything from a simple correlation to something like FDS. A model is nothing more than a calculation method, and to say that "fire models" are not generally accepted in fire investigation is akin to saying that science has no role in that practice. I agree with Stephen that the court should consider how the model is being applied, the same way that it would consider any other form of evidence. This blanket dismissal, based largely on one person's opinion, sends the wrong message.*
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> *And by the way, Stephen is also right about our use of FDS in the NIST WTC Investigation. The temperatures predicted by FDS were used in a sequence of calculations to assess the aircraft impact, fire, thermal penetration of the steel, and eventual collapse of WTC 1, 2 and 7. This was not simply done for "illustrative purposes.*"

While Olenick's observation that the fire dynamics are the same regardless of whether or not it's pre-fire or post-fire is obviously correct, Olenick's statement that *"if FDS and other computer fire models are appropriate for design, it is appropriate for use in fire investigation and reconstruction"* fails to make a distinction between the purpose of design, versus the purpose of a fire investigation or fire reconstruction. In many design applications, the designer only needs to consider the "worst case" scenario to demonstrate that all cases work, while in fire investigation and reconstruction, the investigator is likely only interested in a single scenario-the scenario that existed at the time of the fire.

In many design applications, the designer only needs to consider the "worst case" scenario to demonstrate that all cases work, while in fire investigation and reconstruction, the investigator is likely only interested in a single scenario-the scenario that existed at the time of the fire.

In many fire reconstructions and fire investigations, the combustibles involved in the fire are totally destroyed by the fire or by fire fighting. During the course of fire fighting, the original location of combustibles involved in the fire may be changed. Hence, relevant information necessary to perform an FDS analysis in a reconstruction or an investigation is simply not available. Given this, in order to perform an FDS analysis for fire reconstruction/investigation purposes, it will be necessary to make assumptions with no way to very whether or not the assumptions are accurate. If there is no way to verify the accuracy of the assumptions made in the input for an FDS calculation, how can a court of law consider the results of an FDS calculation to be factual? (Think of "dueling" FDS analyses with multiple "experts" each coming up with a different answer.) Of course, this question assumes that FDS is actually capable of making reliable and accurate predictions given accurate input-an assumption which I am not yet convinced is always accurate.

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This leads us to Dr. McGrattan's statement regarding the NIST World Trade Center (WTC) building collapse reconstructions. Undoubtedly, NIST had to make numerous assumptions in their reconstruction of the collapses of the WTC towers and WTC 7 Building. If NIST were to list all of the assumptions which they made and was then asked to justify each and every one of those assumptions, it would be my guess that NIST would be unable to justify at least one of those assumptions. It is my opinion that "educated guesses" and "best guesses" don't count if an investigator is going to make statements with absolute certainty.

Of late, a number of articles regarding the fire which destroyed the McFrugal's Warehouse in New Orleans on March 21, 1996 have appeared on this website, so a discussion of fires which occur in storage arrays comes immediately to my mind. It has been stated by Dr. McGrattan and others that fires in storage arrays are not very reproducible. When you think about it, this observation makes perfect sense. While cardboard boxes with the same dimensions may all look the same, something tells me that boxes of the same design and dimensions are only similar, but not exactly identical. Something also tells me that humidity of combustibles plays a large part in controlling how fast a fire initially grows. Given this, how can we accurately predict fire growth in a combustible array without knowing the exact details of all the combustibles? While we may come up with a pretty good estimate of the fire growth, any prediction of the fire growth that we make is just an estimate with a range of variation.

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With respect to sprinklers, take two sprinklers of the same model with a temperature rating of 165°F. Now ask yourself the "who is buried in Grant's tomb" question"-what is the operating temperature of the sprinklers? With respect to U. S. Grant's tomb, the answer is obvious. With respect to the sprinklers, the answer to that question of course depends upon the manufacturing tolerances for the sprinkler. My guess is that all sprinklers with a temperature rating of 165°F will not necessarily operate at 165°F. Some sprinklers with a temperature rating of 165°F may actually operate at 160°F, while others may operate at 170°F. I don't ever recall seeing a study on the manufacturing tolerances of sprinklers. (Perhaps, the permissible manufacturing tolerance issue with respect to sprinkler temperature rating is covered in UL 199 or the FM sprinkler approval standard, however, there is no doubt that there is a manufacturing tolerance.) Given this, accurately and reliably predicting the activation time of multiple sprinklers is a difficult task, particularly when there is no information available for each sprinkler installed.

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Admittedly, my confidence in fire modeling has been shaken by how I've seen modeling used by those who are considered to be "experts" in the field. If the "experts" (*e.g.*, Dr. Craig Beyler) can't use fire modeling appropriately, then it seems highly unlikely that the rest of us will have any clue about how to use fire modeling correctly.

One final thought on the subject. Perhaps the best response to Stephen Olenick's comments regarding the use of fire modeling in fire reconstruction and fire investigation can be found in an article titled "*Reliability of Computer Models in Fire Safety Design*" written by Dr. Alan N. Beard. This article was published in the April 2008 issue of the *Industrial Fire Journal*. After you have read Dr. Beard's article, it shouldn't be too difficult to understand why the judge ruled as he did.

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