

## ETHICAL USE OF THE FDS

By Richard Schulte

The following post appeared on the FDS and Smokeview Discussions bulletin board on June 3, 2009:

*"While there was no response on the bulletin board to my query on the capability of the FDS to predict the effects of sprinkler spray discharge, two veteran fire modelers did respond privately to my question. The short answer to my question was "no", not at the present time. The short answer was followed by further explanation as to why the answer was "no".*

*The reason for my query, however, was not that I did not know the answer to the question, but to verify that what I already knew hasn't changed recently. Now here is the situation:*

*Recently (within roughly the last 12 months), a "renowned expert" in the field of fire science stated in a presentation to the ICC Code Technology Committee (CTC) that he utilized the FDS to analyze a sprinklered building provided with individually-activated smoke/heat vents to demonstrate that smoke/heat vents "work" (in sprinklered buildings). His FDS analysis showed that 4 smoke/heat vents would operate and that smoke/heat vents would maintain the smoke layer at a shallow depth. The very same "expert" had previously stated in other venues that a maximum of one smoke/heat vent would operate in sprinklered building and that often no vents would automatically open. The FDS analysis presented was unpublished by the "expert" and the "expert" made no attempt to explain why the FDS showed that 4 roof vents would operate, rather than either 1 vent or no vents as he has previously stated (based upon testing).*

*In this same presentation to the ICC CTC, the expert presented an FDS analysis of the concept of "ganged" operation of smoke/heat vents in a sprinklered building. The purpose of the FDS analysis was to show that the activation times of the sprinklers would not be significantly affected by the simultaneous opening of multiple roof vents at a point in time 60 seconds after the activation of the sprinkler system water flow device. When asked if the FDS had been "validated" for the purpose of accurately predicting the activation times of multiple sprinklers, the expert responded with a simple "yes". When queried as to whether or not there were any limitations as to the "validation of this FDS capability, the expert responded that there were no limitations on the validation and further stated that the FDS was even capable of predicting sprinkler "skipping".*

*In a deposition in the litigation on the McFrugal's Warehouse fire in the spring of 1999, an expert witness for the plaintiff stated that the installation of in-rack sprinklers in multi-row racks containing a Class IV commodity with a height of 20 feet would not have had any affect on the outcome of a fire because the portions of the storage array above the level of in-rack sprinklers was protected by sprinklers located 50 feet above the top of the storage of the racks. Common sense indicates that the operation of in-rack sprinklers would have reduced the volume of fire which the New Orleans Fire Department (NOFD) would have had to address. It took the NOFD approximately 3 hours to control the fire with[in] the multi-row racks protected only by ceiling sprinklers. The installation of in-rack sprinklers in the multi-row racks would not only reduced the volume of fire which the NOFD had to fight, but likely would have reduced the number of ceiling sprinklers operating, thus making the sprinkler discharge over the fire more effective. The expert witness' opinion that in-rack sprinklers would have been ineffective was bolstered by a CFD analysis.*

*The same expert witness in the McFrugal's Warehouse case (again in 1999) also stated that he had utilized CFD to predict the effect of sprinkler spray discharge on the fire in the multi-row racks and that his CFD analysis indicated that ceiling sprinklers located roughly 50 feet above the top of the storage would have been unable to control the fire. (The expert did not acknowledge that sprinkler installations more than 50 feet above the top of storage is not that uncommon and that testing at Underwriters Laboratories after the McCormick Place fire in Chicago in 1967 demonstrated that sprinkler protection located in "high bay" areas is still effective. The UL research indicated that clearances between the top of combustibles and the ceiling typically found in convention centers in large cities across the United States can be addressed simply by increasing the assumed area of operation to 100 times the ceiling height.)*

*To summarize:*

- 1. The FDS is used by a "renowned fire scientist" to predict the number of roof vents which would operate in a sprinklered building and determines that a total of 4 vents would open. In other venues, this same fire scientist has stated that the maximum number of vents which will operate in a sprinklered building is one. (May, 2008; November, 2008)*
- 2. The FDS is used by a "renowned fire scientist" to predict the activation times of multiple sprinklers. When asked whether the FDS has been "validated" for this purpose, the fire scientist states that the FDS has been validated for this purpose with no limitations on the use of the FDS for this purpose. (This statement was contradicted by Dr. Kevin McGrattan on the FDS bulletin board on February 17, 2009.) (May 2008; November, 2008)*
- 3. CFD is used by an expert witness to come the conclusion that in-rack sprinkles would not have been useful in assisting the New Orleans Fire Department in controlling a fire which occurred in multi-row racks with a storage height of 20 feet. (1999)*

4. *CFD is used by an expert witness to predict the effect of sprinkler spray discharge on a fire with a clearance between the top of storage and the ceiling of roughly 50 feet and concludes based upon his CFD analysis that sprinklers with a 50 foot clearance from the top of storage would not be effective (despite research to the contrary conducted after the McCormick Place fire). (1999)*

*The expert witness for the plaintiff in the McFrugal's Warehouse fire litigation in 1999 discussed above and the "renowned fire scientist" who made the presentation to the ICC Code Technology Committee in 2008 are one in the same person [Dr. Craig Beyler].*

*Here we have a case where the "renowned expert" indicates that CFD/FDS is capable of predicting the effect of sprinkler spray discharge on a fire in 1999, predicts that 4 roof vents will open in a sprinklered building in 2008 when research conducted in 1998 showed that no more than 1 vent will open and that the FDS is capable of accurately predicting the activation times of multiple sprinklers (with no limitations).*

*And perhaps now you understand why I have suggested that a moratorium on the use of the FDS be considered until we can sort things out. If a "renowned expert" in the fire science field is unaware of the limitations of the use of the CFD/FDS, then it is likely that others in the field may also be using the FDS improperly. Certainly, it seems that the above is, at the very least, worth discussing.*

*From my perspective, it's pretty sad that I would have to write the above. I'm not intelligent enough to understand the fluid dynamics being used in the FDS and I haven't programmed in Fortran for over 35 years, but I have enough "common sense" to know when the FDS is being used as a "cover" for illogical concepts and thinking.*

*I understand that a discussion of ethics is likely not a popular discussion, particularly when it's one of your own, but unethical use of the FDS is a reflection on the FDS model and also on my profession. I'm most concerned about the latter.*

## **Discussion**

The ethical use of fire modeling is not a popular subject of discussion in the fire protection field for obvious reasons. The above post on the FDS and Smokeview Discussions bulletin board addresses this issue head-on. Without "validation" that the model actually generates meaningful output, the use of a fire model simply generates meaningless data.

Unfortunately, many in the professional utilize fire models as if the output from the model is gospel. The above is a cautionary tale on the inappropriate use of fire modeling by a "renowned expert".

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