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A PERSPECTIVE ON BUILDING FIRE SAFETY AND MODELING: THE GOALS AND OBJECTIVES OF BUILDING FIRE PROTECTION

By Richard Schulte

An article titled "*Reliability of Computer Models in Fire Safety Design*" authored by Dr. Alan N. Beard appeared in the April 2008 issue of Industrial Fire Journal. The article expressed concerns about the capabilities and reliability of fire models, including the Fire Dynamics Simulator, to make accurate predictions in fire scenarios.

One would expect that this article would be of great interest to the fire protection field, particularly to those in the field who extensively utilize fire modeling. But if you thought this, you would be wrong. Dr. Beard's opinions regarding the validity of fire modeling appear to be of little interest in the fire protection field. Of course, this raises the question of why so little interest in such an important revelation.

One response to that question is the following which I received in an e-mail note from a colleague whom I've known for more than 25 years:

> "*Let me just say that not all written articles or comments warrant reply. When statements or articles are extreme, wrong, or outrageous, they sometimes are not worthy of replies. Sometimes, it is simply best to ignore, unless one has nothing better to do. Besides, a reply is only worth it when we deal with people who can claim that they know enough to formulate opinions. I am not sure that Dr. Beard is knowledgeable enough about fire. . .*

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> *However, it is a good exercise and fun to poke holes in everything that appear solid. Kids do that. . .without understanding the damage they probably are causing. I would simply call it, a futile intellectual exercise for people who beg for attention.*"

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This response speaks volumes about the intellectual debate in the field of fire protection, and, unfortunately, is similar to the intellectual debate on other scientific questions of the day. It seems that today's scientific debate is not all that different from scientific debate in Europe in the Middle Ages.

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First, is Dr. Beard competent to have an informed opinion on fire models? Based upon Dr. Beard's credentials and work in the field, their seems to be little doubt that Dr. Beard is not only qualified to express a knowledgeable opinion, but is a leader in the field. Simply because Dr. Beard is not an American, and does not live or work on the East Coast of the United States, should not disqualify him or his opinions on the field of fire protection.

The opinion expressed above certainly smacks of "intellectual elitism" of the sort that we seem to see and hear more and more often these days. Simply because one has an education from an "elite" university, or an advanced academic degree, does not necessarily mean that one has a first-rate intellect. Similarly, simply because one has not attended an "elite" university, or does not possess an advanced degree, does not mean that one cannot be knowledgeable in a field, nor be a leader in a particular field of endeavor.

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History is replete with significant scientific advancements made by those who would be considered to be ordinary folks today. Given the historical record of scientific achievement and advancement, it would seem that the world is a pretty level playing field when it comes to opinions regarding science and, in this world, experience and common sense still more often than not trumps educational background and pedigree. In other words, the scientific establishment has not "cornered the market" on science or common sense in any field, including in the field of fire protection.

Dr. Beard's article referenced above refers to the Dalmarnock fire tests. In these tests, multiple teams of engineers utilized fire models to predict the results of the fire tests prior to the tests being conducted, and then the results of the modeling teams were compared to the results predicted by other teams and the actual results of the tests. In other words, the Dalmarnock fire tests were the "ultimate" test of the fire models. Everyone involved with fire modeling should make themselves familiar with the results of Dalmarnock tests.

The comments above seem to be just plain old-fashioned common sense. Hence, it seems reasonable that the "fire modeling establishment", the "fire modeling elites" if you will, owe the fire protection field a response to Dr. Beard's comments and the results of the Dalmarnock fire tests. Without a discussion of Dr. Beard's comments, or any sort of response at all, "lesser mortals" can only assume that Dr. Beard's comments pertaining to fire modeling are correct.

In essence, the fire modeling establishment has "circled the wagons" around their fire models and basically told the rest of us that they are not interested in hearing or seeing any evidence that their models may have flaws or limitations, even when those flaws and limitations have been exposed and are plain to see. Perhaps, a more appropriate term for the "fire modeling elite" is the "fire modeling snobs".

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You can usually tell who is losing a debate by the side which will not squarely address points made by the other side and by the side of a debate which resorts to name-calling. (Referring to those who exhibit snobbish behavior as "snobs" is not name-calling, it merely puts an easily understood name on the tactics being used in the discussion.) Clearly, the response above does not squarely address any of the points made in Beard's article and referring to Dr. Beard's work as *"a futile intellectual exercise for people who beg for attention*" is the equivalent of "name-calling" in the academic world. Given the above, it seems obvious who is winning the technical debate and it ain't the "fire modeling elite".

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Now to the topic at hand-the goals and objectives of building fire protection. The goals of building fire protection are rather simple and straight-forward and are as follows:

- Reduce the number of fires which occur
- Reduce the number of fire fatalities which occur
- Reduce the number of fire injuries which occur
- Reduce the property damage caused by fires
- Prevent the spread of fire from one building to adjacent buildings

In a nutshell, that's pretty much all of what building fire protection is about. There's only one thing to add and that is to do all of the above at a reasonable cost.

How do we measure progress in the field? The answer to that question is rather obvious- statistics on fire. So let's take a look at some fire statistics. The source of these statistics is a report titled "*Fire Loss in the United States During 2009*" written by Michael J. Karter, Jr. and dated August 2010. It should be noted that these statistics are actually only estimates, but these estimates should be adequate for the purpose at hand.

- In 1977, an estimated 1,098,000 structures fires occurred; in 2009, an estimated 508,000 structure fires occurred. (A reduction of 53.7 percent when compared to 1977.)

- In 1977, an estimated 5,865 fire fatalities occurred in dwelling fires; in 2009, an estimated 2,565 fire fatalities occurred in dwelling fires. (A reduction of 56.2 percent when compared to 1977.)

- In 1977, the estimated average property loss per structure fire was roughly $4,500; in 2009, the estimated average property loss per structure fire was $6,510 (in 1977 dollars) per structure fire. (An increase of 44.6 percent when compared to 1977.)

- In 2009, there were 4.4 fires per thousand population.

- In 2009, there were 9.8 civilian fire fatalities per million population. (1 fire fatality for each 102,040 people.)

- In 2009, there were 55.5 civilian fire injuries per million population.

- In 2009, the fire loss on a per capita basis was $40.80.

- In 2009, an estimated 105 civilian fire fatalities occurred in commercial (non-residential) occupancies. (1 fire fatality for each 2,857,142 people (based upon an assumed population of 300 million people).)

- In 2009, 96.1 percent of the civilian fire fatalities in structure fires occurred in residential occupancies; 3.9 percent of the civilian fire fatalities in structure fires occurred in non-residential fires.

One other statistic worth noting is that the number of civilian fire fatalities which occur in buildings protected by a sprinkler system is only a handful. In other words, the installation of sprinkler protection in buildings reduces the number of fire fatalities to virtually zero.

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The same can be said about the number of fire fighter fatalities. The installation of sprinkler protection in buildings reduces the number of fire fighter fatalities to close to zero.

Given the above, it would appear that the solution to the "fire problem" in the United States is the installation of sprinkler protection. Most new non-residential buildings of any size are already provided with sprinkler protection and, in many jurisdictions throughout the United States, the installation of sprinkler protection in new dwellings, including 1- and 2-family dwellings is mandatory, or will soon be mandatory.

As the percentage of dwellings in the United States protected by sprinkler protection increases, we can expect that the number of fatalities and injuries caused by fire will continue to decline.

Based upon the above, the obvious solution to the "fire problem" in the United States is sprinkler protection. The only problem with this solution is the cost of installing sprinkler protection. While the cost of providing sprinkler protection in buildings has declined significantly since the mid-1970's due to innovations in the field, providing sprinkler protection in buildings is still considered to be an expensive proposition, particularly in 1- and 2-family dwellings.

The solution to the cost issue with regard to sprinkler installations is obviously reductions in passive fire protection requirements in buildings ("sprinkler trade-offs") where sprinkler protection is provided. While this concept has been under attack by manufacturers of passive fire protection products for the last decade, "sprinkler trade-offs" are still the most logical means of reducing sprinkler system installation costs, thereby encouraging the installation of sprinkler protection.

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Typically, the use of fire modeling is limited to large buildings and large buildings are typically protected by a sprinkler system. Since sprinkler protection reduces the number of fire fatalities which occur to close to zero, it is not too difficult to conclude that the use of fire modeling has had little, if any impact on the number of fire fatalities which occur. Hence, it seems reasonable to also say that fire modeling has had little impact on the statistics cited above.

If we can reduce fire fatalities and injuries to close to zero with sprinkler protection, why is it necessary to utilize fire modeling in buildings provided with sprinkler protection? Actually, there seems to be little reason to use fire modeling in buildings provided with a sprinkler system.

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If fire modeling is not really relevant to the goals and objectives of providing building fire protection, why has so much effort been put into developing fire modeling? The answer to that question is also simple. It's about "making the simple complex" in order to justify large engineering fees. In other words, it's about making money on fire protection.

Good engineering should be about "making the complex simple" if possible, not the other way around. Complex solutions to problems rarely work over the long run. (A good example of this is the Federal government's attempts to plan and manage the US economy from Washington. The results of this attempt got us into the economic depression that we're in right now.)

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If you want to understand what's really going on in the field of fire protection, "follow the money".

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