

**IAN McAUSLIN, et al v. GRINNELL CORPORATION, et al:
AN ANALYSIS OF TESTIMONY (SUMMARIES)**

By Richard Schulte

Background

At approximately 5:30 in the morning of March 21, 1996, a fire occurred in the McFrugal's Warehouse in New Orleans. The ignition point of the fire was in portable storage racks arranged in a multi-row configuration stacked three high in the east portion of the warehouse. The storage in the multi-row racks was 21 feet high.

Although two levels of in-rack sprinklers were required to protect the portable racks (based upon a Class IV commodity classification), the building owner elected not to install the in-rack sprinklers after receiving a quotation for the installation from Grinnell. Hence, the only protection provided for the multi-row racks was ceiling sprinklers located roughly 50 feet above the top of the storage. The ceiling system was designed to provide a density of 0.45 gpm/SF with an assumed area of operation of 2,500 SF. The ceiling sprinklers were high temperature large orifice sprinklers.

Background

As would be expected, the sprinkler system failed to control the fire, however, with a heroic effort, the New Orleans Fire Department was able to bring the fire under control at approximately 10:30 AM and the fire in the warehouse was extinguished around noon. Roughly three hours later, another fire occurred in the warehouse and this time, with the sprinkler protection throughout the building shut down, the fire destroyed the 1 million square feet building and the storage within the building. The only things remaining after the fire were twisted structural steel, remnants of storage racks, aerosol containers and the concrete exterior walls and floors. (Photos of the remains of the building can be found at the following website address:

<http://www.gerardperrone.com/page2/page2.html>)

Background

Within days of the fire, Lloyd's of London retained legal counsel and eventually filed a lawsuit against the sprinkler contractor, Grinnell Corporation, the architect/general contractor, Broadmoor Corporation, the National Fire Protection Association (NFPA), Underwriters Laboratories Inc. (ULI), Factory Mutual (FM), Southern Building Code Congress, International (SBCCI) and the manufacturer of the portable racks. Experts for the plaintiffs included Dr. Craig Beyler and Richard Custer. Experts for the defendants included John O'Neill for Grinnell Corporation, Richard Schulte for Broadmoor Corporation and Chester Schirmer for NFPA.

Of particular interest in this litigation was the testimony of Dr. Craig Beyler, not only because Beyler (improperly) utilized fire modeling to support some of his opinions regarding the sprinkler protection, but also because Beyler had some rather interesting opinions regarding clearances between storage and the ceiling, the role of in-rack sprinklers and the effect of contents on the fire, as well as the use of smoke/heat vents in sprinklered buildings.

Fire Modeling

Expert Report-Dr. Craig Beyler

Note: Dr. Craig Beyler's expert report is dated February 5, 1999. Paper 21 authored by Dr. Beyler is dated February, 1999.

“In a recent study sponsored by the NFPA Research Foundation, LES3D was used to predict the interaction between sprinklers and heptane spray fires. The sprinkler activation times predicted by LES3D compared well against the heptane spray fire experiments done at Underwriters Laboratories for the same study. . . .”

“. . . This means that a simple representation of the burning racks as a simple surface at the top of the rack is a valid means of specifying the fire for use in performing calculations of the interaction of rack fire plumes/ceiling with the sprinkler spray.”

“The standard clearance fire caused activation of four sprinklers over a period of 100 to 350 seconds. The McFrugal's NODC clearance resulted in a fire that activated nearly 70 sprinklers during the simulation and clearly did not control the fire.”

Fire Modeling

Expert Report-Dr. Craig Beyler

“The graph for the 10 feet clearance indicates that the first operating sprinkler will activate in approximately 100 seconds and that the fire will be controlled by a total 4 operating sprinklers.”

“The graph for the 50 feet clearance indicates that the first operating sprinkler will activate in approximately 215 seconds and that the fire will not be controlled and will continue to grow.”

Testimony-Dr. Craig Beyler

“The computational domain does not include the racks themselves. That does not mean that we aren’t predicting or otherwise know what’s going on within the racks, but that is done as a sub-model as opposed to being a part of the - - fluid mechanics domain. What has been done is the fluid mechanics domain starts at the top of the racks up to the ceiling, of course. We predict using the LES model how much water arrives at the top of the racks and we use other models to establish, one, how the fire grows within the racks, and two, what the effect of that water is. So they are - - they are modeled, but they are not modeled in the fluid dynamical part of the LES 3D.”

Fire Modeling

Testimony-Dr. Craig Beyler

“Those sub-models are a fire growth model that’s described subsequently in the report as well as the effect of water is. There’s a sub-model for that that we added for that.”

“Basically the modeling approach that we adopted that I just described in terms of dealing with the domain only above the commodity is the same approach that’s inherent in the ADD-RDD or RDD-ADD concept that Factory Mutual has been using I’m going to say a couple of decades. . .in terms of how they have conducted experimental programs to understand the interaction of sprinklers and fires. . .It is the underlying basis for a whole body of research that Factory Mutual has done over the years. . .”

“What we’re doing in this part is describing how we’re going to model the commodities in terms of surface areas and then we’ll go on in the subsequent page to burning rate per unit areas and then subsequently into flame spread rates, which are the things that are needed to - - that’s the fire growth model.”

“So as the flow rate from the sprinkler diminishes, as more sprinklers are activated, not only does the flow rate change, which we have produced in our modeling input, but also the mean droplet size changes. . .”

Fire Modeling

Testimony-Dr. Craig Beyler

“I mean the substance of the meaty, you know, the meaty part, the central portion of this, our report, are the modifications that we made to LES to allow the modeling of the effect of sprinkler sprays on the burning of the commodities. We added that, we used that.”

Q. Okay. Multi-row. That is you had that configuration and the same design for the overhead as was at the warehouse, that the overhead, if it was ten feet or less above the top of storage, would control that fire? Is that correct?

A. That’s what the modeling indicated.

[Break in transcript]

A. That is the prediction.

“ . . . There are some - there are some, you know, general ideas, which I think I have tried to indicate in my answer already; that is, comparison, the idea of the validation by comparison of data, you know, doing things - - doing checks on calcs to see that they do what you intend them to do.”

Fire Modeling

Testimony-Dr. Craig Beyler

“The water does flow on to commodities and the water density does affect the burning rate. Those are the ways in which the model includes - - includes, you know, water application. It doesn't accumulate water on surfaces or anything of that sort.”

“. . .And then there's the question of given the - - you know, a correct implementation of the model, how well does that model do relative to data. Those comparisons of model to available experimental data are included in the references we cited. . .I mean they exist.”

Fire Modeling

Analysis

“ . . . While there have been many attempts to model all or part of the interactions of sprinklers and vents, the issues are more complex than can be dealt with using even the most sophisticated modeling methods available today [1999]. . . .the model was unable to predict the corresponding results in the rack storage tests beyond first sprinkler activation. . . .”

Paper 21, Dr. Craig Beyler, February 1999

“ . . . there is no consensus metric in fire protection engineering by which a model is considered validated or not for a particular application.” Dr. Kevin McGrattan, Building and Fire Research Laboratory (BFRL), National Institute of Standards and Technology (NIST), FDS/Smokeview Bulletin Board, February 17, 2009

“ . . .But I hope you understand that I simply cannot make a blanket statement like “*FDS is validated for predicting multiple sprinkler activations.*” Dr. Kevin McGrattan, Building and Fire Research Laboratory (BFRL), National Institute of Standards and Technology (NIST), FDS/Smokeview Bulletin Board, February 17, 2009

Analysis-Fire Modeling

When the “validation” of the FDS was challenged in 2008, Beyler simply refused to address the question of “validation” of the FDS for the purposes of predicting the activation times of multiple sprinklers and the total number of sprinklers that will operate.

Further, it is a well known fact that Version 5 of the Fire Dynamics Simulator is not capable of reliably predicting the effects of sprinkler spray discharge on a fire.

To support his testimony regarding the “clearance issue” at the McFrugal’s Warehouse, Dr. Beyler relied upon an analysis which utilized the LES3D fire model. In other words, the LES3D fire model was the foundation of the support for his testimony.

Analysis-Fire Modeling

Beyler's testimony clearly indicated that it was his opinion that the LES3D fire model is capable of accurately predicting the activation times of multiple sprinklers, the number of sprinklers which will activate over a given time period and the effect of sprinkler spray discharge on the fire and that the fire model had been "validated" for these purposes.

Even more damning than Dr. Beyler's own statement in February 1999 addressing the "validation" of the LES3D fire model used in his analysis of the McFrugal's Warehouse fire is Beyler's response to questions regarding "validation" of the Version 4 of the Fire Dynamics Simulator (FDS) in the Beyler/Hughes Associates Inc.'s research on the concept of the "ganged" operation of roof vents published on February 18, 2008. When the "validation" of the FDS was challenged in 2008, Beyler simply refused to address the question of "validation" of the FDS for the purposes of predicting the activation times of multiple sprinklers and the total number of sprinklers that will operate. If Dr. Beyler was unable to address the "validation" issue for the FDS in 2008, certainly his statements regarding "validation" of the LES3D model in his sworn testimony in 1999 were misrepresentations.

Analysis-Fire Modeling

In other words, Beyler's use of the LES3D model in his expert report on the McFrugal's Warehouse fire in 1999 was simply a sophisticated form of "junk science". Cruder, but perhaps more accurate descriptions of Beyler's modeling work as an expert witness in the litigation over the McFrugal's fire might be "hogwash" or "b.s."

An even more interesting fact is that Dr. Beyler's expert report in the McAuslin, et al v. Grinnell Corporation, et al case and his comments regarding the limitations of the LES3D fire model (excerpted above) were both issued in February 1999. How does an "expert" express completely opposite views on the capabilities of a fire model in the same month?

Sprinkler System Design/Clearance

Expert Report-Dr. Craig Beyler:

“In the east and west high bay areas, the [sprinkler] design as implemented did not protect against fires in those areas at all. The protection provided was simply based on extending the rack ceiling [sprinkler] protection and in anticipation of potential future expansion.”

Testimony-Dr. Craig Beyler

Q. . . .In the hierarchy of deficiencies, it's the excessive clearance that was the primary problem here, correct?

A. It's primary because there was no system with the clearance that was present that could have worked.

Sprinkler System Design/Clearance

Testimony-Dr. Craig Beyler

Q. And based upon your investigation of the NODC, would it be fair to conclude that those spaces at RCDC would also, in your opinion, represent excessive clearances where the sprinkler system would not function in case of a fire in those areas?

A. That's correct.

Q. And I take it from that, that it would be your opinion that whoever designed the Rancho Cucamonga facility did so improperly as it relates to the sprinkler system?

A. In the particular of excessive clearance, yes. . .

“Satisfying the legal and insurance requirements may - - will not necessarily lead to a suppression system that can control fires. It might, but it might not also.”

Sprinkler System Design/Clearance

Testimony-Dr. Craig Beyler

“ . . . I believe that it would be most consistent with [NFPA] 231C to use ten feet for these simply because they have used it for other - - together situation with more advanced technologies; at the same time, acknowledging that the FM data sheets would allow you to go to 20 [feet], for which I think there is - - there is basis. So if you had said more than 20 [feet], I would have agreed with you. With the ten foot number, there's reason to - - to say there are other standards of care, other design documents that reflect a basis for something greater than ten feet.”

Q. Well, I assume you know that in those low bay areas we have roof heights, ceiling heights of 35 [feet] to a little over 40 feet. Correct?

A. Yes.

Q. And to the extent that you have inventory stored on the floor one pallet high, you would have clearances in excess of 20 feet.

A. Yes, you would.

Sprinkler System Design/Clearance

Testimony-Dr. Craig Beyler

Q. Do you have any idea of what the owner intended for the use of these low bay areas with regard to storage?

A. I expected there to be staging there.

Sprinkler System Design/Clearance

Analysis

The McFrugal's Warehouse, also known as the New Orleans Distribution Center (NODC), was designed with excess storage capacity in anticipation of the future warehousing requirements of the building owner. When the building was initially occupied, the storage capacity of the east portion of the high bay section of the warehouse was not needed so high racks were not installed in this portion of the building. Just like the low bay sections of the warehouse, the east portion of the high bay section of the warehouse was to be utilized for the staging of goods which entered the warehouse.

Analysis-Sprinkler System Design/Clearance

Per the equivalency which was negotiated with the City of New Orleans and the Louisiana State Fire Marshal's Office, a 50 percent increase in the travel distance allowed (a travel distance of 600 feet), the contents of the warehouse were limited to Class IV commodities as defined by NFPA 231C. Hence, the east portion of the high bay section of the building was intended to be utilized for the staging of goods classified as Class IV commodities, until such time as the high bay rack structures were extended into this portion of the warehouse. Based upon the hazard classification definitions contained in the 1980's versions of NFPA 13, the storage of materials classified as Class IV commodities to a height of 12 feet or less would have been considered to be an ordinary group 3 hazard. The design criteria required for an ordinary group 3 hazard was 0.21 gpm/SF applied over 1,500 SF with a 500 gpm hose stream demand.

Further, it should be noted that NFPA 13 would permit ordinary temperature sprinklers to be utilized with the design criteria for an ordinary hazard, while high temperature sprinklers were actually provided.

Analysis-Sprinkler System Design/Clearance

“Sprinkler action may be delayed by excessive distance between sprinklers at the ceiling and combustible materials at the floor level. . . When fire occurs in a room with an unusually high ceiling, the temperature at the ceiling directly over the fire is initially less than when under a low ceiling, and system activation is delayed.”

NFPA Fire Protection Handbook, 15th edition, 1981

“Tests have also shown that a relatively coarse discharge density of 0.20 gpm per sq ft from sprinklers at ceiling heights of 30 ft and 50 ft was sufficient for fire control.”

NFPA Fire Protection Handbook, 15th edition, 1981

“In the east and west high bay areas, the [sprinkler] design as implemented did not protect against fires in those areas at all. The protection provided was simply based on extending the rack ceiling [sprinkler] protection and in anticipation of potential future expansion.”

Dr. Craig Beyler, Expert Report, February 1999

Analysis-Sprinkler System Design/Clearance

If Webb's recommendations are considered to be good engineering practice for the design of sprinkler protection for convention centers, then it seems reasonable to assume that the use of these recommendations for the design of the sprinkler system in the east portion of the high bay section of the McFrugal's Warehouse would also be considered to be good engineering practice. . .

Since the overhead sprinkler system in the east portion of the high bay was designed for the extension of the high rack structures into this portion of the building, the ceiling system was designed to provide a density of 0.45 gpm/SF applied over 2,500 SF with a 500 gpm hose stream demand. Given this, the density actually utilized to size the supply piping for the sprinklers protecting the east portion of the high bay area exceeded the minimum required density for an ordinary group 3 hazard by 114 percent and the actual assumed area of operation exceeded the minimum required area of operation for a group 3 ordinary hazard by 66.6 percent. Given that NFPA 13 permits an area of coverage of 130 SF per sprinkler in an ordinary hazard, versus an area of coverage of 100 SF per sprinkler where the density exceeds 0.25 gpm/SF, a minimum of 25 sprinklers were required to be assumed to operate with the design criteria actually utilized, rather than 13 sprinklers for an ordinary hazard. Further, it should be noted that NFPA 13 would permit ordinary temperature sprinklers to be utilized with the design criteria for an ordinary hazard, while high temperature sprinklers were actually provided.

Analysis-Sprinkler System Design/Clearance

Given that the “k” factor of the Grinnell Model C large orifice sprinkler used in the ceiling portion of the sprinkler systems protecting the warehouse was 8.0, the pressure required to achieve a design density of 0.45 gpm/SF (assuming the area protected by each sprinkler is 100 SF) can be computed. That pressure is 31.6 psi.

Similarly, the minimum density which would be developed with the sprinklers flowing at the minimum required operating pressure required by NFPA 13, 7 psi, can also be computed. With an operating pressure of 7 psi, the density which would be achieved would be 0.216 gpm/SF.

Analysis-Sprinkler System Design/Clearance

Based upon the above, the difference in the required sprinkler operating pressure to achieve a density of 0.45 gpm/SF and the minimum required density for an ordinary group 3 hazard is 24.6 psi. Hence, it can be concluded that the area of operation of the system protecting the floor of the east portion of the high bay section of the warehouse was capable of achieving the minimum required density of 0.21 gpm/SF over an area of operation far greater than 2,500 SF. The actual area of operation at the minimum density required would depend upon the system layout, the location of the operating sprinklers with respect to the supply and whether all of the operating sprinklers were supplied by a single system or straddled the boundary between systems. Since the exact location of the ignition was never pinpointed to my knowledge, the actual area of operation which could be achieved by the system with the sprinklers flowing at 7 psi cannot be accurately computed. Suffice it to say that it can be reasonably assumed that the area of operation for the system or systems located over the fire actually exceeded 2,500 SF.

Why is determining the area of operation of the sprinkler system when the operating pressure at the sprinklers is 7 psi of interest? The following is an excerpt from page 17-4 of the 15th edition of the **Fire Protection Handbook** published by the National Fire Protection Association in 1981:

Analysis-Sprinkler System Design/Clearance

“High Ceilings. *Sprinkler action may be delayed by excessive distance between sprinklers at the ceiling and combustible materials at the floor level. As the hot products of combustion from a flaming fire rise, air from the surrounding atmosphere mixes with the gases so that the temperature of the mixture decreases. When fire occurs in a room with an unusually high ceiling, the temperature at the ceiling directly over the fire is initially less than when under a low ceiling, and system activation is delayed.”*

NFPA Fire Protection Handbook, 15th edition, 1981

“Large clearances between sprinklers and combustible below can also magnify the problem of obtaining the correct density and breakup of water discharge from sprinklers for maximum effect on fires, particularly in large masses of combustibles. The upward travel of combustion products creates temperature and draft conditions through which water droplets may have difficulty penetrating if the distance between a relatively intense flaming fire and the sprinklers is too great.” **NFPA Fire Protection Handbook, 15th edition, 1981**

Analysis-Sprinkler System Design/Clearance

“Fire tests have shown the relationship between varying clearances and varying water pressures, the latter governing the density and degree of atomization of the water droplets. The tests showed that high water pressures for sprinklers are of somewhat dubious advantage in compensating for extremes of height. Finely atomized water that must travel down through a strong fire draft is slowed by the upward velocity of the fire gases, and simultaneously the size of the droplets is being continually reduced by evaporation.” NFPA Fire Protection Handbook, 15th edition, 1981

Tests have also shown that a relatively coarse discharge density of 0.20 gpm per sq ft from sprinklers at ceiling heights of 30 ft and 50 ft was sufficient for fire control. The test conditions simulated display booths in an exhibition hall representing a fire loading of 15 to 20 lb per sq ft. The tests indicated that the ratio of sprinklers opening during a fire will increase proportionately with ceiling height, assuming a constant discharge density. Higher fire loadings would require correspondingly higher discharge densities.” NFPA Fire Protection Handbook, 15th edition, 1981

The article in the NFPA Fire Protection Handbook indicates that the information above is based upon the following reference:

“Automatic Sprinklers in Exhibition Halls”, William A. Webb, Fire Technology, Vol. 4, No. 2, May 1968, pp. 115-125.

Analysis-Sprinkler System Design/Clearance

William Webb's research on sprinkler protection for exhibition halls was conducted as a result of the fire which destroyed Chicago's McCormick Place in February 1967. The original McCormick Place building was not protected by a sprinkler system. The research was conducted for purposes of determining the design requirements for the sprinkler protection for the building which replaced the facility destroyed by fire.

Given the information provided in the Fire Protection Handbook, it would appear that Dr. Beyler's assertion that the sprinkler design provided for portions of the high bay section of the building without high rack structures "*did not protect against fires in those areas at all*" is also a misrepresentation of the facts. Whether the designers at Grinnell's office in New Orleans were aware of William Webb's research or not, the sprinkler system design conformed to good design practice for spaces with high ceiling:

- The use of high temperature sprinklers
- The use of reduced sprinkler spacing
- The use of a density of 0.20 gpm/SF
- The use of low operating pressure to achieve a coarse discharge
- The use of an increased area of operation

Analysis-Sprinkler System Design/Clearance

Sprinkler protection designs for convention centers with ceiling heights of 50 feet and higher throughout the United States are based upon William Webb's research conducted after the destruction of McCormick Place. If Webb's recommendations are considered to be good engineering practice for the design of sprinkler protection for convention centers, then it seems reasonable to assume that the use of these recommendations for the design of the sprinkler system in the east portion of the high bay section of the McFrugal's Warehouse would also have to be considered to be good engineering practice, at least in the late 1980's when the Warehouse was designed.

In-Rack Sprinklers

Deposition Testimony-Dr. Craig Beyler

Q. Well, I would like to see. If you can say, yes, say yes, please. Is it yes? It's significantly less with the sprinklers in the racks? Is that correct?

A. It is correct that it would be significantly less.

“...The fire service would be faced with a different fire certainly, something that, you know, might be something on the order of half the size of the fire that they saw. . .So in terms of control, in terms of the area that would burn, you might do a little better, but I'm not envisioning you do a lot better. You would certainly have a harder time - - you would have a less hard time of it, would be less challenging to you physically, but I'm not sure the actual lateral extent of spread would be much different.”

Q. . . . As I appreciate your testimony, the presence of in-rack sprinklers in your view would have been irrelevant to the extent of the damage caused by the first fire. Correct?

A. . . .yes, I did opine that the [in-rack] sprinklers would not have controlled the fire either.

In-Rack Sprinklers

Deposition Testimony-Dr. Craig Beyler

“Well, any - - any fire that in-rack sprinklers would control would not activate a ceiling sprinkler.”

Analysis-In-Rack Sprinklers

“*Factory Mutual has never experienced a catastrophic loss from a fire starting in rack storage where in-rack sprinklers were provided and operated properly.*” FM Loss Prevention Data Sheet 8-33 (January 1984)

“*Protection consisting of ceiling sprinklers and in-rack sprinklers is the preferred method to use. This type of protection results in much less water and fire damage during a fire and assures greater probability of successful control. . .*” FM Loss Prevention Data Sheet 8-33 (January 1984)

“*The [test] data indicates that with sprinklers installed in the racks a reduction is gained in the area of fire damage and sprinkler operations, or water damage.*” NFPA 231C (1991 edition)/NFPA 13 (1999 edition)

Analysis-In-Rack Sprinklers

“ . . .In most cases the in-rack sprinklers were effective in controlling fire below the top level of protection within the racks.”
NFPA 231C (1991 edition)/NFPA 13 (1999 edition)

Given the information on the capabilities of in-rack sprinklers to control fires in rack storage arrays contained in various FM and NFPA standards, Dr. Beyler’s assertion that *“so in terms of control, in term of the area that would burn, you might do a little better, but I’m not envisioning you do a lot better. . .but I’m not sure the actual lateral extent of spread would be much different”* appears to be an erroneous statement, despite what Dr. Beyler’s modeling indicates.

It should be recalled that the NOFD was able to bring the fire under control without the assistance of in-rack sprinklers in roughly 5 hours. The installation of in-rack sprinkler protection within the multi-row racks (as required by NFPA sprinkler installation standards) would not only have made the ceiling protection more effective and reduced the number of ceiling sprinklers which would have operated, but would have been of great assistance to the manual fire fighting efforts of the NOFD.

Analysis-In-Rack Sprinklers

Of particular interest is the supporting data contained in NFPA 13/NFPA 231C which indicates that the use of in-rack sprinklers reduced that area of sprinkler operation by more than two-thirds (2/3) when a density of 0.20 gpm/SF was utilized to protect racks with a storage height of 20 feet when ordinary temperature sprinklers were provided at the ceiling. It can be expected that the area of operation of the ceiling sprinklers might be reduced further with the installation of high temperatures sprinklers at the ceiling (as with the installation at the NODC). Based upon this data, it is a reasonable conclusion that it quite possible, even probable, that the overhead system installation, combined with the in-rack sprinkler protection would have been adequate to control the fire (assuming that the limitation on the type of materials stored in the warehouse, Class IV commodities, prescribed by the equivalency which was negotiated, had been observed by the building owner).

Analysis-In-Rack Sprinklers

The basis for this conclusion is rather simple. Assuming, as did Dr. Beyler, that the in-rack sprinkler protection would have controlled fire spread in the racks below the level of the highest in-rack sprinkler line, the remaining combustibles above the in-rack sprinklers would have consisted of roughly 7 feet of Class IV commodity storage. Is a density of 0.45 gpm/SF applied over 2,500 SF (a minimum of 25 sprinklers operating) adequate to control a fire in a Class IV commodity which is 7 feet high with a clearance of 50 feet when high temperature large orifice sprinklers are provided? According to William Webb's research from 1968, it would seem that this design criteria, which equates to a density of 0.20 gpm/SF applied over an operating area ranging from 3,000 to 4,000 SF, perhaps even greater, is in the ballpark of what would be necessary to control a fire in this hazard (Class IV commodity, 7 feet high).

Of course, if the hazard of the materials stored in the multi-row racks exceeded that of a Class IV commodity, then obviously the analysis outlined above would not be applicable.

Building Contents

Deposition Testimony-Dr. Craig Beyler:

“My understanding is that the outcome would have been the same without regard to which commodity classification was actually in place, yes.”

Q. Are you aware of any FM requirements regarding storage of aerosols and flammable liquids?

A. I know there are some. I couldn't quote you any requirements from it.

“I guess it would be my - - my opinion based on my calculations involving Class II commodities that the outcome isn't sensitive to commodity classification in the area.”

Q. To the extent that there were Group A plastics [in the multi-row racks], would the result have been different?

A. It wouldn't have been.

Analysis-Building Contents

“The heat release rate (Btu/ min or kW) can be three to five times greater for plastic materials than for a similar arrangement of ordinary combustibles.” FM Loss Prevention Data Sheet 8-1, January, 1998

“The heat of combustion of ordinary combustibles (i.e. wood or paper) generally ranges between 6,000 and 8,000 Btu/lb. The heat of combustion for plastics generally ranges between 12,000 and 20,000 Btu/ lb. The burning rate of a commodity is dependent on many things, but plastic materials generally exhibit higher maximum burning rates than similarly arranged ordinary combustibles. This difference can be two to three times higher for many plastic products.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Group C plastic products are those which incorporate plastic materials having a heat of combustion and a burning rate similar to those of ordinary combustibles.” FM Loss Prevention Data Sheet 8-1, January, 1998

Analysis-Building Contents

“Fire tests in the early 1980's showed that replacing one tier of a four-tier high rack array with a higher hazard commodity produced a hazard much higher than that of a rack filled 100% with the lower hazard commodity.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Fire tests where sprinkler protection is adequate for the specific commodity, typically burn only about a 200-300 square feet area of the commodity tested. Only a small amount of material has to burn to create relatively large sprinkler operating areas (1500-2500 square feet) which means that it wouldn't take much of a high hazard commodity to overtax a sprinkler system designed for a lower hazard commodity.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Fire testing has shown that the hazard of mixed commodities with a rack storage array can approach that of the most hazardous commodity present.” FM Loss Prevention Data Sheet 8-33, January 1984

Analysis-Building Contents

“Various commodities located randomly throughout a warehouse can present as severe a fire hazard as a storage of only the most hazardous commodities.” FM Loss Prevention Data Sheet 8-33, January 1984

“. . .Mixed commodity storage shall be protected by the requirements for the highest classified commodity and storage arrangement.” NFPA 13 (1999 edition)

“Storage of high-hazard items, such as plastics, toxic materials, aerosols, or flammable/ combustible liquids, can pose a severe threat even in a fully sprinklered warehouse. Does the nature of items stored remain constant, or are new commodities frequently introduced into the warehouse? If the commodity changes, existing protection might no longer be adequate. . .”
Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

Analysis-Building Contents

In the middle 1980's, the City of New Orleans utilized a building code which was based upon the 1948 edition of the Uniform Building Code. In the late 1980's, New Orleans updated its building code by adopting the 1985 edition of the Standard Building Code.

Constructing underground passageways was considered to be impractical since the site was located on land which was formerly swampland and the site was located near the Mississippi River. With the high water table, constructing underground exit passageways would have required continuous pumping to keep the passageways dry.

- The contents of the building were limited to Class IV commodities (or a lesser hazard) and
- No flammable or combustible liquids were permitted to be stored in the warehouse and
- No aerosol containers (containing either flammable and non-flammable liquids) were permitted to be stored in the warehouse.

Analysis-Building Contents

Did the hazard of the commodities stored in the multi-row racks exceed a Class IV classification? Were aerosol containers stored in the multi-row racks?

With this background, it seems rather curious that Dr. Beyler had no interest in the hazard classification of the storage in the multi-row racks.

Beyler's opinion that the hazard classification of the storage in the multi-row racks would not have influenced the outcome of the fire would cause many in the field to question Beyler's knowledge and understanding of how sprinklers work.

Analysis-Building Contents

“Class 4 commodities are Class 1, 2 or 3 products containing in themselves or in their packaging no more than 25% by volume or 15% by weight of expanded or unexpanded plastic or polyurethane, in ordinary corrugated cartons. The weights or volumes of a pallet load (including the wood pallet) should be used in determining percentages.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Because of the large number of plastics, the complexity of their nomenclature, and the ease of changing burning characteristics with additives, great care in classifying plastics should be used.” FM Loss Prevention Data Sheet 8-1, January, 1998

“The overall hazard of a commodity is a function of its heat release rate (Btu/min). As the heat release rate increases so does the hazard. Plastics pose a significantly greater hazard than ordinary combustibles; therefore, plastics should be classified separately and carefully.” FM Loss Prevention Data Sheet 8-1, January, 1998

Analysis-Building Contents

“Although there is a large number of plastic materials, five generic plastics products account for a large majority of the total plastics produced: polystyrene, polyethylene, polypropylene, polyester, and polyvinyl chloride.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Plastic materials are manufactured into two basic forms, unexpanded and expanded.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Expanded plastics are generally a low-density product and are commonly call “foam plastics” such as polystyrene foam coffee cups, polystyrene foam packaging material, and polyethylene and polypropylene foam sheeting packing materials.” FM Loss Prevention Data Sheet 8-1, January, 1998

Analysis-Building Contents

“Generally the heat release rate for expanded plastics is greater than for unexpanded plastics due mainly to the relatively low density and resulting high burning rate. The heat of combustion for a given plastic material is about the same whether it is expanded or unexpanded.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Group A plastic products are that which incorporate plastic materials having a heat of combustion that is much higher than that of ordinary combustibles, and burning rate higher than Group B plastics. Plastics that would normally fall into this category are thermoplastic polystyrene, and acrylonitrile-butadiene-styrene (ABS).” FM Loss Prevention Data Sheet 8-1, January, 1998

“Plastic materials that fall into the Group B category are thermosetting polyesters and thermoplastics such as polyethylene, polypropylene, polycarbonate, acrylics, cellulose and nylon.” FM Loss Prevention Data Sheet 8-1, January, 1998

Analysis-Building Contents

“Generally in warehouse environments a variety of commodities is being stored. It is tempting to “average the commodities”, but using this “averaging” method to determine sprinkler protection recommendations is not adequate. Protection for the highest hazard commodity should be provided.” FM Loss Prevention Data Sheet 8-1, January, 1998

“Considering all the above, protection should be based on the highest hazard commodity. An alternative is to segregate the high hazard commodities and protect them accordingly. However, keeping the high hazard commodities properly segregated can be very difficult in normal warehouse operations.” FM Loss Prevention Data Sheet 8-1, January, 1998

“In general, where a mixture of commodities is stored, protection should be based on the highest hazard commodity. However there may be isolated cases where the amount of higher hazard commodity is very small and its location can be strictly controlled (via computerization), where the loss expectancy determination may be based on a lesser commodity classification.” FM Loss Prevention Data Sheet 8-1, January, 1998

Analysis-Building Contents

“Changes in the commodities, packaging, or storage methods shall require an evaluation of the existing protection features including sprinkler systems where installed. Protection features shall be in accordance with this standard and NFPA 13 for the changed commodity, packaging, or storage method.” Fire Protection of Storage-NFPA 230, 1999 edition

“Flammable or combustible liquids shall be kept in flammable liquid storage cabinets, in cut-off rooms or in detached buildings. Protection shall be in accordance with NFPA 30, Flammable and Combustible Liquids Code, Chapter 4.” Fire Protection of Storage-NFPA 230, 1999 edition

Analysis-Building Contents

“Specification of the type, amount, and arrangement of combustibles for any commodity classification is essentially an attempt to define the potential fire severity, based on its burning characteristics, so the fire can be successfully controlled by the prescribed sprinkler protection for the commodity class. In actual storage situations, however, many storage arrays do not fit precisely into one of the fundamental classifications; therefore the user needs to make judgments after comparing each classifications to the existing storage conditions. Storage arrays consist of thousands of products, which make it impossible to specify all the acceptable variations for any class. As an alternative, a variety of common products are classified in this appendix based on judgment, loss experience and fire test results.” Fire Protection of Storage-NFPA 230, 1999 edition

“Prudent design should consider reasonable-to-expect variations in occupancy. This design would include not only variations in type of occupancy, but also, in the case of warehousing, the anticipated future range of materials to be stored, clearances, types of arrays, packaging, pile height, and pile stability, as well as other factors.” NFPA 13, 1999 edition

Analysis-Building Contents

“Fire behavior of a given material can vary with such factors as storage height, shelving, presence or absence of vertical flue and aisle spaces, and pile stability. The early collapse of commodities should be considered and anticipated at all times with a warehouse.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

“Each sprinkler system is designed for a specific occupancy and any change in occupancy classification, building layout, contents or storage array might render protection inadequate. Even seemingly minor changes can compromise existing sprinkler protection.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

Analysis-Building Contents

In the middle 1980's, the City of New Orleans utilized a building code which was based upon the 1948 edition of the Uniform Building Code. In the late 1980's, New Orleans updated its building code by adopting the 1985 edition of the Standard Building Code. Since the Louisiana State Fire Marshal's Office utilized the Life Safety Code, the New Orleans adoption of the Standard Building Code included an amendment which deleted the egress provisions contained in the Standard Code and replaced these provisions with the egress provisions contained in the Life Safety Code.

The Life Safety Code limits the travel distance in storage buildings protected by a sprinkler system to a maximum of 400 feet. Given that the dimensions of the McFrugal's Warehouse were approximately 1,000 feet by 1,000 feet, the travel distance in the warehouse exceeded the maximum travel distance permitted by the Life Safety Code. A number of solutions to complying with the travel distance limitations were available including constructing exit passageways at the floor level or by constructing exit enclosures/exit passageways either above or below the floor level. Another alternative solution to the travel distance issue would have been to construct horizontal exits to divide the warehouse into compartments.

Analysis-Building Contents

With the exception of constructing underground exit passageways to limit the travel distance, each of these solutions to compliance with the travel distance limitation would interfere with the operation of the warehouse. Constructing underground passageways was considered to be impractical since the site was located on land which was formerly swampland and the site was located near the Mississippi River. With the high water table, constructing underground exit passageways would have required continuous pumping to keep the passageways dry.

Rather than comply with the travel distance limitations contained in the Life Safety Code, an equivalency to allow a travel distance of 600 feet was negotiated with both the City of New Orleans and the Louisiana State Fire Marshal's Office. The documentation for the equivalency demonstrated that sufficient time was available for occupants to evacuate the building based upon the ceiling height/volume of the building (assuming the failure of the sprinkler system).

Analysis-Building Contents

The equivalency to allow a 50 percent increase in the allowable travel distance was approved based upon several limitations on the use of the warehouse. These stipulations were:

- The contents of the building was limited to Class IV commodities (or a lesser hazard) and
- No flammable or combustible liquids were permitted to be stored in the warehouse and
- No aerosol containers (containing either flammable and non-flammable liquids) were permitted to be stored in the warehouse.

Each of the limitations were based upon the assumptions contained in the analysis of egress time available for the occupants of the building. Hence, the hazard of the contents of the building played an important role in code compliance.

Analysis-Building Contents

The owner/operator of the McFrugal's Warehouse, known as the New Orleans Distribution Center (NODC), also owned and operated another warehouse of similar design in Rancho Cucamonga, California known as the Rancho Cucamonga Distribution Center (RCDC). Hence, it would be expected that the contents of the NODC would be similar to the RCDC. Since the RCDC contained contents which exceeded the Class IV commodity classification after the fire, it was highly probable that the McFrugal's Warehouse also contained contents more hazardous (from a fire growth standpoint) than Class IV commodities.

In addition to the contents exceeding the Class IV commodity classification in violation of the stipulations incorporated into the approval of the travel distance equivalency, aerosol containers were also stored in the warehouse. Did the hazard of the commodities stored in the multi-row racks exceed a Class IV classification? Were aerosol containers stored in the multi-row racks?

Analysis-Building Contents

Given that the contents of the entire building were destroyed, it's difficult to answer those two questions with a 100 percent degree of certainty, however, it appears that there was a high probability that the multi-row racks did indeed contain contents with a hazard greater than a Class IV commodity. Of course, if this were the case, the increased hazard of the contents would have magnified the deficiencies in the sprinkler protection provided for the multi-row racks.

With this background, it seems rather curious that Dr. Beyler would have no interest in the hazard classification of the storage in the multi-row racks. Even without being an expert in the field of fire protection, most in the field would know that the hazard of the contents in a storage occupancy would affect the capability of sprinkler protection provided to control a fire and also affect the capability of fire fighters to manually control a fire.

Analysis-Building Contents

One would have to scratch their heads and wonder why a fire protection “expert” like Dr. Beyler wouldn’t be aware of the impact of increasing the hazard classification of the contents, particularly where the standard requires two levels of in-rack sprinklers with a Class IV commodity and that the building owner/operator made a conscience decision not to provide the required protection. Beyler’s opinion that the hazard classification of the storage in the multi-row racks would not have influenced the outcome of the fire would cause many in the field to question Beyler’s knowledge and understanding of how sprinklers work.

Roof Vents and Draft Curtains

Expert Report-Dr. Craig Beyler:

“. . . The value of smoke and heat vents with draft curtains in sprinklered buildings in cases where sprinkler[s] do not operate or are otherwise ineffective is widely acknowledged, and there is definite evidence that smoke and heat vents are of value when sprinklers do perform as intended.”

“Smoke and heat vents with draft curtains should have been included in the NODC and should have been designed by a qualified Fire Protection Engineer.”

Roof Vents and Draft Curtains

Deposition Testimony-Dr. Craig Beyler:

“. . .They [Factory Mutual] do it on the basis it's just not worthwhile. There have been claims made, you know, casually, as it were, that, you know, they [smoke/heat vents] don't work sufficiently well to be worthwhile. But that's the nature of the discussion, whether they're - - really whether they're cost effective.”

“I mean you could design a smoke and heat vent system that would have done that.”

Roof Vents and Draft Curtains

Deposition Testimony-Dr. Craig Beyler:

Q. I'm asking you whether you have an opinion as to whether you believe that an insurance company who underwrites the risk of the contents would have an understanding or should have an understanding as to the effect of draft curtains and roof vents and smoke vents as it relates to the extent of damage that might occur as a result of a fire in a particular facility.

A. I would say that by and large they don't understand that. Whether they should? I'd like them to, but I don't see that as anything other than what I'd like everyone to understand.

Roof Vents and Draft Curtains

Analysis

“ . . . we need to realize . . . that the use of smoke vents and draft curtains can be detrimental to all sprinklers that are specifically tested for storage applications. . . and that the use of automatic vents may increase the sprinkler water demand.” 13-325 Log #CP43 AUT-SSD

“Do not install automatic smoke and heat vents in facilities equipped with sprinkler protection; manual heat and smoke vents, however, are acceptable.” FM Global Loss Prevention Data Sheet 2-0 , March 2010

“Do not install drop-out-type heat vents over storage areas.” FM Global Loss Prevention Data Sheet 2-0, March 2010

Analysis-Roof Vents and Draft Curtains

“In some cases, routine ventilation procedures in the early stages of a fire can hinder effective sprinkler operation. . .it might be appropriate to allow the automatic sprinklers to continue to operate without further ventilation to enable them to achieve full control of the fire. This might take 20 to 30 min or more.” Guide for Fire Department Operations In Properties Protected by Sprinkler and Standpipe Systems-NFPA 13E, 1995 Edition

“In 1975, a reconfirmation action failed as concerns over use of the guide in conjunction with automatic sprinkler buildings had surfaced.” Guide for Smoke and Heat Venting-NFPA 204M, 1991 Edition

“. . .Test data from work done at the Illinois Institute of Technology Research Institute, which had been submitted to the Committee as part of a public proposal, did not permit consensus to be developed whether sprinkler control was impaired or enhanced by the presence of automatic roof vents of typical spacing and area. . .” Guide for Smoke and Heat Venting-NFPA 204M, 1991 Edition

Analysis-Roof Vents and Draft Curtains

“For occupancies which present a high challenge to sprinkler systems, concern has been raised that inclusion of automatic roof venting may be detrimental to the performance of automatic sprinklers.” Guide for Smoke and Heat Venting-NFPA 204M, 1991 Edition

“Vent design criteria in this guide assume that the mass flow rate through a vent is determined primarily by buoyancy pressure. Mass flow through a vent, therefore, is governed mainly by the free vent area and the depth of the hot layer and its temperature.” Guide for Smoke and Heat Venting-NFPA 204, 1998 Edition

“Venting becomes more effective with smoke temperature differentials between ambient temperature and an upper layer of approximately 110°C or higher. Where temperature differentials of less than 110°C are expected, vent flows might be reduced significantly; therefore, consideration should be given to using powered exhaust.” Guide for Smoke and Heat Venting-NFPA 204, 1998 Edition

Analysis-Roof Vents and Draft Curtains

“To ensure smoke containment, curtain boards should extend down. . .a minimum of 20 percent of the ceiling height.” Guide for Smoke and Heat Venting-NFPA 204, 1998 Edition

“Large-scale fire tests [Troup 1994] indicated that the presence of curtain boards can cause increases in sprinkler operation, smoke production and fire damage (i.e. sprinkler opened well away from the fire).” Guide for Smoke and Heat Venting-NFPA 204, 1998 Edition

“In a large area, smoke tends to lose its buoyancy sooner than it would in a more tightly confined space. This occurs because smoke cools the farther it travels from its source. In all spaces, activated sprinklers also cool any smoke in the immediate area of discharge.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

“Fire fighting inside a very large facility covering acres under one roof is extremely difficult and dangerous.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

Analysis-Roof Vents and Draft Curtains

Warehouses pose one of the greatest challenges to fire control for both automatic fire suppression systems and manual fire fighting. Manual fire suppression cannot take the place of a properly designed, installed, and functioning sprinkler system in a warehouse. If the warehouse is not protected by automatic sprinklers designed for the commodities stored and the configuration in which they are arranged, there is little chance of controlling a fire.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 Edition

“In 1974, research conducted by the Factory Mutual Research Corporation suggested that there may be some deleterious effects on sprinkler system performance from automatic smoke and heat vent operation. The conclusions from this model study are subject to individual interpretation. However, concerning sprinklers and smoke and heat vents, each element has been developed over the years independently of the others. Guidelines for using both sprinkler and vents together for hazard control (e.g., property protection, life safety, water usage, obscuration, etc.) have not been developed and are not presently available.” NFPA Fire Protection Handbook, Fifteenth Edition, 1981

Analysis-Roof Vents and Draft Curtains

“The depth of such curtain board largely determines the height of the “stack”, which so vitally affects the capacity of the vent. If an area is protected by automatic sprinklers, curtain boards have added values: confinement of heat tends to speed up operation of sprinklers over the fire, and obstructed lateral spread of heat minimizes the operation of an excessive number of sprinklers resulting in overtaxing the water supplies.” NFPA Fire Protection Handbook, Fifteenth Edition, 1981

“The significant cooling effect of sprinklers on the near-ceiling gas flow often prevented the automatic operation of vents.” NISTIR 6196-1, September 1998

“There has been a long-standing debate in the fire protection community about the combined use of roof vents, draft curtains (curtain boards) and sprinklers.” NISTIR 6196-1, September 1998

“There is no nationally recognized standards for the combined installation of sprinklers and roof vents.” NISTIR 6196-1, September 1998

Analysis-Roof Vents and Draft Curtains

A methodology to combine the use of roof vents, draft curtains and sprinklers has never been developed and no such methodology exists even today.

The fact that the installation of automatic roof vents in buildings protected by sprinklers is considered to be poor engineering practice has been incorporated in both the 2010 edition of NFPA 13 and the FM Global sprinkler installation standard dated March 2010.

“ . . . Manual fire suppression cannot take the place of a properly designed, installed, and functioning sprinkler system in a warehouse. If the warehouse is not protected by automatic sprinklers designed for the commodities stored and the configuration in which they are arranged, there is little chance of controlling a fire.” Recommended Practice for Pre-incident Planning for Warehouse Occupancies, NFPA 1420, 1993 Edition

Analysis-Roof Vents and Draft Curtains

The fire at the Sofa Superstore in Charleston, South Carolina is just one example of the dangers of interior fire fighting in large warehouse and industrial buildings where the sprinkler protection is impaired.

In Dr. Beyler's expert report in the McAuslin, et al v. Grinnell Corporation, et al litigation, Beyler stated that "*the value of smoke and heat vents with draft curtains in sprinklered buildings in cases where sprinklers do not operate or are otherwise ineffective is widely acknowledged*". Beyler further stated that "*there is definite evidence that smoke and heat vents are of value when sprinklers do not perform as intended.*" The information provided above counters Beyler's assertions regarding the use of roof vents and draft curtains in buildings protected by a sprinkler system.

Analysis-Roof Vents and Draft Curtains

In fact, the information from the various documents excerpted above indicates that concerns that open roof vents may adversely affect sprinkler system operation have been expressed since the mid-1970's. A methodology to combine the use of roof vents, draft curtains and sprinklers has never been developed and no such methodology exists even today.

Given the fact that concerns were expressed regarding potential adverse effects of the open roof vents on the operation of sprinklers, many in the fire protection field consider the installation of roof vents and draft curtains in sprinklered buildings to be poor engineering practice. The fact that the installation of automatic roof vents in buildings protected by sprinklers is considered to be poor engineering practice has been incorporated in both the 2010 edition of NFPA 13 and the FM Global sprinkler installation standard dated March 2010.

Analysis-Roof Vents and Draft Curtains

With regard to the Beyler's assertion that "*smoke and heat vents are of value when sprinklers do not perform as intended*", excerpts from NFPA 1420, *Recommended Practice for Pre-incident Planning for Warehouse Occupancies*, call this statement into question. These excerpts include:

"Fire fighting inside a very large facility covering acres under one roof is extremely difficult and dangerous."

". . . Manual fire suppression cannot take the place of a properly designed, installed, and functioning sprinkler system in a warehouse. If the warehouse is not protected by automatic sprinklers designed for the commodities stored and the configuration in which they are arranged, there is little chance of controlling a fire."

Analysis-Roof Vents and Draft Curtains

Given the above, Dr. Beyler's statement that "*smoke and heat vents with draft curtains should have been included in the NODC and should have been designed by a qualified Fire Protection Engineer*" was highly questionable at the time the statement was made. With the inclusion of the provisions addressing the installation of automatic roof vents in sprinklered buildings now included in NFPA 13 and the FM Global sprinkler installation standards, there is no longer any doubt that this statement is erroneous.

Given that Dr. Beyler is considered (by many) to be an expert in the field, Beyler should have been well aware of both the NFPA 13 committee's and FM's long-held position with regard to the use of automatic roof vents in sprinklered buildings in 1999. The fact that the inclusion of roof vent provisions in NFPA 13 and in the FM Global sprinkler standard occurred around a decade later is no defense for Dr. Beyler's statement above. Simply put, "*a qualified Fire Protection Engineer*" would have known that you don't put automatic roof vents and draft curtains in a sprinklered building (since the mid-1970's).

Conclusions

The *“the central portion of”* Dr. Beyler’s expert report in the McAuslin, et al v. Grinnell Corporation, et al litigation involved a fire modeling analysis. Dr. Beyler utilized fire modeling to predict the activation times of multiple sprinklers, the number of sprinklers which would activate and the effect of sprinkler spray discharge on a fire. Further, Dr. Beyler asserted that the fire model used in his analysis was capable of making accurate and reliable predictions of this data and that the model which he used was “validated” for these purposes. Interestingly enough, in the same month as Beyler’s expert report was issued, Beyler stated in another paper that the fire model which he used was incapable of accurately predicting the activation times of multiple sprinklers in experiments with rack storage conducted at Underwriters Laboratories in 1997/1998.

Conclusions

In February, 2008, Dr. Beyler/Hughes Associates, Inc. issued a report on the concept of “ganged” operation of roof vents in sprinklered buildings. In this report, Beyler/ Hughes Associates concluded that the capabilities of Version 4 of the Fire Dynamics Simulator (FDS) to accurately predict the activation times of multiple sprinklers and the total number of sprinklers was “validated”. When this assertion was challenged after a presentation of the concept of “ganged” operation of roof vents to the ICC Code Technology Committee (CTC), Dr. Beyler once again claimed that the FDS was “validated” for these purposes, however, after no one in the profession “stepped up” to support his assertions regarding “validation”, Beyler no longer makes these claims.

Given the above, it can be concluded that “*the central portion of*” Dr. Beyler’s expert report has been discredited. Beyler’s uses of the fire model in the McAuslin v. Grinnell Corporation litigation are not presently “validated”, nor were Beyler’s uses of the fire model “validated” in 1998/1999 when his expert report was being developed. To put it simply, Dr. Beyler’s use of the LES3D model in this litigation was “junk science”.

Conclusions

With regard to Dr. Beyler's opinion that the sprinkler protection provided for the east portion of the high bay section of the warehouse was not adequate for any type of hazard due to "excessive clearance", Dr. Beyler appears to have been unaware of William Webb's research work on this subject after the fire which destroyed McCormick Place in Chicago in February 1967. Clearances in excess of 20 feet are commonplace in convention centers in cities all around the United States. The sprinkler protection provided for these convention centers is typically designed per Webb's research work.

Was the sprinkler protection provided for the east portion of the high bay section of the warehouse inadequate for the staging of a Class IV commodities 12 feet or less in height? In my opinion, the design criteria utilized, 0.45 gpm/SF applied over 2,500 SF using high temperature large orifice sprinklers with a spacing of 100 SF/sprinkler or less, was in the "ball park" of the design criteria recommended by Webb. The design criteria utilized would have been capable of producing a density of 0.20 gpm/SF applied over 3,000 to 4,000 SF and perhaps even a greater area of operation.

Conclusions

In regards to Dr. Beyler's opinion that the installation of in-rack sprinklers would not have made any difference in the outcome of the first fire which occurred in the warehouse, it should be obvious that this opinion is nonsense, at best. Since the New Orleans Fire Department was able to bring the fire under control after roughly 5 hours, there is absolutely no doubt that the installation of the in-rack sprinklers would have assisted fire fighters by reducing the size of the fire which they initially had to fight. The installation of the in-rack sprinklers would also have made the discharge from the ceiling sprinklers more effective and would have reduced the number of ceiling sprinklers which would have operated at the time the NOFD arrived at the scene.

Conclusions

Would the first fire have spread to rack tiers above the in-rack sprinklers as Dr. Beyler asserted? It is possible that the original fire could have been controlled by the operation of one or two in-rack sprinklers, however, the spread of the fire to the combustibles above the in-rack sprinklers is likely a more probable scenario. Simply because the fire may have spread to the combustible above the in-rack sprinklers does not imply that the ceiling sprinklers would have been unable to control the fire at the top tier of the racks however. With a density of either 0.45 gpm/SF, or 0.20 gpm/SF, applied to the top tier of the racks, it is likely that the fire in the top tier of the racks would have been controlled, or, at the very least, slowed down by pre-wetting of the combustibles. With the ceiling system capable of producing a density of 0.20 gpm/SF with 30 to 40 sprinklers operating simultaneously, pre-wetting of the combustible should have occurred.

Conclusions

With regards to the hazard classification of the combustibles, Dr. Beyler asserted that the hazard classification of the combustibles was not a factor in the fire. Based upon the design of the sprinkler system, as well as the travel distance equivalency which was negotiated during the design of the building, the hazard classification of the contents of the building was limited to a Class IV commodity as defined by NFPA 231C. If the multi-row racks where the first fire originated contained appreciable amounts of Group A plastics, flammable/combustible liquids or aerosol containers (with flammable/combustible liquid contents) would this have generated a far more challenging fire than if the contents of the racks were classified as Class IV commodities? Even the defense attorneys in this case were able to figure out the answer to that question just by studying NFPA 231C. The storing of contents within a higher hazard than Class IV commodities in the multi-row racks magnified the effects of clearance and the lack of in-rack sprinklers.

Conclusions

Lastly, with regards to Dr. Beyler's assertion that a "qualified Fire Protection Engineer" would have recommended that the building be provided with automatic smoke/heat vents and draft curtains, there was more than adequate enough evidence in the late 1980's to conclude that the use of automatic smoke/heat vents in a sprinklered building could adversely affect the operation of the sprinkler system. This information was developed by the premier property insurer in the United States, Factory Mutual, in the 1970's. No "qualified Fire Protection Engineer" with whom I am acquainted would have recommended the installation of roof vents in the McFrugal's Warehouse in the late 1980's, in the 1990's or even today.

Based upon the above, it appears that all of Dr. Craig Beyler's major assertions in the McFrugal's Warehouse fire litigation have been discredited and many of Dr. Beyler's assertions are not even worth serious consideration. One has to wonder how or why Dr. Beyler is considered to be an expert in the field of fire protection. Many of Dr. Beyler's opinions in this case are "so far out in left field" that any serious student of the profession would know that these opinions are nonsensical.

Conclusions

It is my understanding that Dr. Beyler is a Fellow in the Society of Fire Protection Engineers (SFPE) and was awarded the Guise Medal in 2000 for his contributions to the field. Given Dr. Beyler's misuse of fire modeling in a legal proceeding and some of the outlandish "expert" opinions which he expressed in the McFrugal's Warehouse legal matter, it seems reasonable to question SFPE's standards for the awards given to Dr. Beyler.

It is my opinion that the terms "Wizard of Oz" and "Snake Oil Salesman" are more appropriate terms for Dr. Beyler's expertise than the term "expert". Certainly, it would seem that the SFPE should give some consideration to stripping Beyler of the Guise Medal and his designation as a "Fellow" in the Society.

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