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IAN McAUSLIN, et al v. GRINNELL CORPORATION, et al: AN ANALYSIS OF TESTIMONY

By Richard Schulte

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.

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>)

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:

“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. First ring sprinkler activation times were predicted to within about 15 percent, and second ring sprinklers activation times were predicted to within about 25 percent. Predictions of the total number of sprinklers activated by the spray fires were generally very good with most predictions within 25 percent with greater deviations in three of the 21 tests.”

“ . . . 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.”

“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.”

“The modeling results provided in this report confirm that the excessive ceiling clearance in the NODC sprinkler design caused the failure of the sprinkler system.”

“The graphs on this page indicate the estimated operating times of sprinklers for a fire in a Class II commodity which is three tiers high with top of storage to ceiling clearances of 10 feet and 50 feet.”

“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.”

“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.”

“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.”

Deposition Testimony-Dr. Craig Beyler:

Page 418

Q. If I understood your response, the model does not include or can't determine what goes on within the rack itself. Is that correct? Did I repeat what you had stated earlier accurately?

[Break in transcript]

A. 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.

Q. Which portions are they modeled in and what sub-programs or models are those two phenomenon?

“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.”

A. 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. Both of those are - - We'll talk about them in detail, I'm sure. Both of those come out of work done at Factory Mutual.

“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.”

Q. And the effect of the size of the flue does have an effect or is part of that equation, is it not?

A. The - -

Q. If you change the flue size, it will change the outcome?

A. The testing that was done that supports those sub-models were with the standard six-inch flue spaces and, yes, there is a - - there is an effect of flue space width on, you know, the air flow through the commodity.

“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. . .”

Page 423, Line 3

Q. Let's mark that as 34 then. And let the record reflect the correction to Exhibit 34. Now, with respect to the Yao and Chan articles, your purpose was to discuss RDD [required delivered density] and ADD [actual delivered density]?

- A. Yes. 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, but I'm not absolutely sure, in terms of how they have conducted experimental programs to understand the interaction of sprinklers and fires. They in fact have reduced it, I don't mean reduced in the sense of diminish, but reduced it that is, developed it to the point where it's actually a standard type of a test that they use to establish the commodity classification of some commodity that may not have been tested previously or for whatever reason they have some doubt as to how it's expected to burn. So the intention of including these here is simply to indicate that this is not an approach without precedent. It is the underlying basis for a whole body of research that Factory Mutual has done over the years. And obviously if the prior references we talked about, You and Kung and Kung, You and Spaulding, if those weren't true they wouldn't be doing it. But in fact, they have been and have been successful.

Page 430, Line 21

- Q. Okay. Now we pick up the first - - Is this, on page 19, the first of the algorithms that were imported into the program. Is that what that is at the top of page 19?

- A. Yeah. 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. And, you know, which are coming out, as we're seeing here, as out of data in correlations of data provided by various authors at Factory Mutual.

“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.”

Page 450, Line 1

- Q. And then explain the significance, the role of Exhibit 42.

A. Sure. Bert did experiments in which he looked at a range of sprinklers and looked at the drop size distributions that were produced and correlated those drop size distributions. This is a report of that work. And you will find that equation 13 is included in Bert Yu's work as a means of correlating the mean droplet diameter to the flow rate and we are using this correlation. 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, and that is also reflected through the use of this correlation developed by Bert Yu in Exhibit 42.

“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. . .”

Page 490, Line 14

Q. Would you be able to model that by use of a different program or do you have to make a qualitative decision, non-quantitative decision as to the effect of the water discharged by the sprinklers in the rack?

A. 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. What we did would be - - is applicable to ceiling sprinkler systems, and as indicated yesterday and again today, that I don't know how to expand that to in-rack sprinklers.

“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.”

Page 1359

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.

Page 1397, Line 20

Q. This is still a point where I am a little bit confused and I need you to assist me if you would. Are the fire growth rate and suppression algorithms used in your model based upon tests and experiments done on double row racks or multi-row racks?

A. The two configurations of tests that were used in the testing, as I best remember them, some were arrays of four racks, two by two. Typically the calorimetry tests are done in that geometry. And then there are other tests that are a double row rack. That is, the one dimension being longer than the other.

Q. That partially answers my question. Let's split it in half.

A. Okay.

Q. For the suppression algorithms, - -

A. Yes.

Q. - - does it use double row racks or multi-row racks?

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.

- A. Those are tests, and I think those were Bert Hughes' tests that are a two by two array.

Page 1412, Line 10

- Q. We talked about this a little bit earlier. Going back to the model. What is the proper, in your mind, or in your opinion, method for validating computer fire models? Let me restate it again. All right. Do you understand the question, sir?

- A. I'm going to review it again, but I think I do. You used the word "proper" and I'm not sure I can define for you what "proper" is. That is, I'm not sure I could give you a definition of "proper" versus "improper" validation. Not a word I would have picked, but, you know, you did.

- Q. What word would you pick? Is there a correct method for validating a model, computer model?

- A. There's not a well established protocol per se. 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. But I don't think there's a prescription that, you know, this is the proper method. There are certainly - -

“. . .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.”

there's information around as to the process, but I don't know what I could identify this is a proper one and this is an improper one.

Page 1414, Line 15

- Q. Okay. The model, the LES3D model encompasses or takes into account pre-wetting. Is that correct? Or does it?

- A. 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.

Q. Had Mr. McGrattan, et al disclosed what their margin of error or error rate is with respect to the LES3D program? At least as of the margin that you used?

A. I think the published papers, you know, that are cited in the report include comparisons with data that are illustrative of the margins of error and I think we talked about some of those last time.

Q. Okay. And with respect to the inclusion of additional suppression algorithms that were proprietary or have been asserted to be proprietary to Hughes & Associates, have they been subjected to review for determination of how they affect rate of error?

A. As I indicated last time, the models that we used, the models aren't proprietary. It's the source code. And, of course, the models that were used are in the open literature and have comparisons available, data versus - -

Q. You said models. I was referring to algorithms. Were you using them - -

A. Algorithms are an implementation of a model.

Q. Okay.

A. And so I mean you have the question there of does the source code do what you want it to do, and that's error checking, which was done. 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, which I believe are all exhibits to my deposition. I mean they exist.

“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.”

Page 1426, Line 24

Q. In the model, the suppression algorithm decreases the rate of heat release over time?

A. The heat release rate is reduced by the application of water.

Analysis

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.

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.

The following statements, including a statement by Dr. Beyler himself, indicate that Beyler’s assertions regarding the “validated” capabilities of the LES3D fire model and the Fire Dynamics Simulator (FDS) are simply incorrect.

“ . . . 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 most clear indication of this is the recent NFPRF research project. While modeling of the fluid mechanical aspects of the problem were quite successful in predicting aspects of sprinkler activation in the first heptane spray fire series, **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**

“ . . . 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. . . .”

Dr. Craig Beyler, February 1999

“The purpose of the FDS Validation Guide is to present comparisons of FDS predictions against full-scale measurements. . . 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**

“. . . there is no consensus metric in fire protection engineering by which a model is considered validated or not for a particular application.”

“. . .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**

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.

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. If the FDS cannot be used to accurately predict the effects of sprinkler discharge on a fire in 2009/2010, most certainly Beyler’s modeling could not have done so in 1999.

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.

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?

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."

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."

Deposition Testimony-Dr. Craig Beyler:

Page 694, Line 12

- Q.** All right. Would you agree with the proposition that the primary hazard here was the clearance, the excess clearance, in the hierarchy of hazards?
- A.** In the hierarchies of deficiencies, I would put the clearance at the highest. But in terms of hazards, the clearance isn't as much a hazard as a deficiency. The type of commodity and form of storage is normally what's regarded as the hazard.

[Break in transcript]

- Q.** All right. I'll use your terminology and refer to it as a deficiency. 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.

Page 1260, Line 5

“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.”

- Q.** Okay. The second sentence in that paragraph refers to a tour of the storage facility at Rancho Cucamonga by representatives of Broadmoor and Grinnell. What forms the basis of your statement that “The purpose of this tour was to allow the design team to develop an understanding of the intended use of the facility? Is that what you understood it to be?
- A.** It is.

[Break in transcript]

- Q.** Do you know that Rancho Cucamonga has areas within their facility where there are clearances from stored inventory to ceiling sprinklers that exceed ten feet?
- A.** That was my understanding, yes.
- Q.** And would you agree with me that there in fact are instances, based upon your knowledge and information, where the distance between inventory and ceiling sprinklers is approximately 40 feet?
- A.** That's consistent with my understanding.

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.

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. So it's your opinion that both facilities had areas where there were problems with the design, which means that there could be fires which would not be controlled by the in-place sprinkler systems. Is that correct?

A. That's correct.

Q. So it's your opinion that both facilities had areas where there were problems with the design, which means that there could be fires which would not be controlled by the in-place sprinkler systems. Is that correct?

A. Yes.

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. Not having seen detailed designs, I certainly wouldn't be in a position to make any more specific commentary.

Q. Right. And it would be your opinion that to the extent that the Rancho Cucamonga facility was using portable racks stacked three high, a total of 21 feet, that without [in-rack] sprinklers that that would have violated [NFPA] 231C?

A. If we're talking about the same three tier - -

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. Multiple row racks.

A. Right. We're talking the same configuration.

Q. Class IV commodity, greater than 16 feet between aisles.

A. Yes.

Page 1275, Line 8

Q. Is it your opinion that Mr. Martin [Grinnell] did not determine that the east end of the building would not be used for storage?

A. My recollection of this deposition, he didn't know how it was going to be used.

[Break in transcript]

Q. Is it your opinion that by meeting the insurance and legal requirements that you will not get a design which will control fires which start in the facility? Let's leave it at that.

A. 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.

[Break in transcript]

Q. Has your review and investigation indicated to you whether the sprinkler system in place at those two ends of the building could in fact control certain fires that started in those areas?

A. Obviously I haven't made a study of what fires I think it could have controlled. They would be typified by certainly very isolated fuel packages. Small, isolated fuel packages I would expect to be controlled.

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."

Q. Did, in your review and investigation, you determine whether a single pallet high of stored inventory in the east end of the building would be in fact controlled by the sprinkler system?

A. You mean in these general arrangements that we had there at the time?

Q. Yes.

A. I don't know.

Q. Did you at all examine the sprinkler system in the low bay sections?

A. I mean, I know I looked at the drawings, but that was not a focus of my attention certainly.

Q. Well, we have, do we not, clearances over ten feet between - -

A. I'm sure we do.

Q. Is it your opinion that those areas are not designed properly? Or do you have an opinion?

A. I pause because you used the ten foot one. 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.

“ . . . 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.

Q. And if that is fact the case, is it your opinion that there is something wrong with the sprinkler design in those areas?

A. They have excessive clearances, yes.

[Break in transcript]

Q. You wouldn't be able to tell me whether a fire that could start in the low bay area in single pallet high storage could be controlled by the sprinkler system that was installed?

A. I simply hadn't looked at it.

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.

Q. Is it your opinion that if there's staging in those areas, that they are treated as if it's stored materials?

A. I do.

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.

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.

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.

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.

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.

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.

	Ordinary Group 3 Hazard	Actual Design Criteria Utilized
Density	0.21 gpm/SF	0.45 gpm/SF
Area of Operation	1,500 SF	2,500 SF
Number of Sprinklers	13 sprinklers	25 sprinklers
Hose Stream Demand	500 gpm	500 gpm

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.

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.

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.

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:

“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.*

“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.”

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.

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.

“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.”

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.”

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.

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.

“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.”

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

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.

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. . .

In-Rack Sprinklers

Deposition Testimony-Dr. Craig Beyler:

- 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. If by that you mean if we had the 21 foot racks with two tiered in-rack sprinklers at two heights, that is, at the top of the first and second tier, with the third tier unprotected, that is, relying on the ceiling sprinklers as would normally occur, **yes, I did opine that the [in-rack] sprinklers would not have controlled the fire either.**

[Break in transcript]

Q. Now, would you agree with me, Mr. Beyler, that the fire dynamics of a fire that starts in portable racks that are stacked three high, eight deep, some 50 long, with sprinklers in the racks, is going to be different from one that doesn't have sprinklers in the racks?

A. I mean we both understand that's an incomplete hypothetical, but as a general principle, I would say yes.

[Break in transcript]

Q. Right. Would you agree with me under that same scenario, with all other things being equal, that the amount of heat and smoke generated by one fire in the racks that were sprinklered would be less than that which was generated by the racks that were not sprinklered. Would be less than the racks that were not sprinklered? Do you understand my question?

A. Yes. It's possible that they could be similar. It's possible. But it's also possible that the in-racks would reduce the damage.

[Break in transcript]

Q. - - if you have two like situations and the only difference in the sprinklers in the racks versus not sprinklered in the racks?

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.

- A. The addition of in-racks, which is basically what we're talking about, may have no effect on the damage or - - or may reduce the damage. If I didn't say that, and from your reaction I may not have. That's my intention. **It makes no difference or may make it better. That is, less damage.**

[Break in transcript]

- Q. Right. Let's take the question and place it within the context of what we had out at the facility here in New Orleans. Would your answer be any different.

The configuration as you know it to have existed at the time of the fire with the system, sprinkler systems in place, the only difference between the two factual scenarios is one has in-rack sprinklers, and I'll qualify that it in accordance with [NFPA] 231C, and one does not; would you expect to have an instance where a fire that occurred within the rack system would generate the same amount of smoke and heat, one having sprinklers, one not having sprinklers?

- A. No, it wouldn't.

[Break in transcript]

- Q. My specific question is, would not the generation of heat and smoke be significantly less?

- A. Oh. I thought I was saying yes a minute ago.

- 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.**

- Q. Is it possible to measure that effect, that significant effect?

- A. Are you asking whether - - it's certainly possible to measure, and measure usually mean experimental, and I also think it's possible to estimate the effect.

- Q. Okay. Did you make any attempt to do so?

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.

A. Quantitatively, no.

[Break in transcript]

Q. A fire that occurred in sprinklered racks in the configuration that existed at the NODC at the time of this fire would be a fire that would be much more easily controlled by either personnel with the facility or the fire department, is that not correct, than what we had out there at the time of March 21st, 1996?

A. I don't give much hope to the personnel in the building in either case. So I'll focus on the fire services if that's okay.

Q. Whatever way you want to answer the question, go ahead.

A. Well, I guess I'll answer in two parts. The two parts as you dealt with, I don't think that the in-racks would have helped the building personnel put the fire out. 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. Because of the multiple row nature of the commodity, they're largely restricted to obviously working from the periphery, which in some measure means you have to wait for the fire to come to where you are because you don't have access to the fire very well within the core of the multiple row racks. 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.

“ . . .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.”

[Break in transcript]

Q. Mr. Beyler, if we had this fire in the exact location and there had been in-rack sprinklers in those racks, would we have had a fire where flames burned a hole through the ceiling of the facility 70 feet up in the air?

A. Yeah, I can't say whether the - - the fire with the in-racks would have caused venting or not. Obviously it's not going to get any worse. It can only get better. This is less likely that it will vent. I can't say specifically that I - - that I know that if in-racks had been provided we wouldn't have had venting. I don't know one way or the other.

[Break in transcript]

Q. Would you agree with this statement? If early control of the fire by in-rack sprinklers installed in the portable racks was achieved, the area where ceiling sprinklers would have operated would have likely been limited to the vicinity of the fire?

A. If we have in-rack sprinklers that are in fact able to control the fire - - did you say in its early stages? Well, it would be, if it did at all, it would be that.

[Break in transcript]

Q. Right. Would there not be situations where if in fact the fire occurred directly below an in-rack sprinkler that you wouldn't even have ceiling sprinkler activation with the clearances that we're talking about here, 50 feet?

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

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

Analysis

FM Loss Prevention Data Sheet 8-33 (January 1984)

“Factory Mutual has never experienced a catastrophic loss from a fire starting in rack storage where in-rack sprinklers were provided and operated properly.”

"A fire in clothing in cartons on 16-tier, 39 feet high racks was well controlled by [the operation of] four in-rack sprinklers and one ceiling sprinkler. In-rack sprinklers were provided at four levels. Two small hoses were need to complete extinguishment. Property damage \$145,000. Business interruption \$2,000."

"The premier trend evolving from a survey of 147 rack storage losses is the overwhelming success in fire control which can be attributed to in-rack sprinklers. To date, Factory Mutual has not experienced a catastrophic loss in rack storage when in-rack sprinklers were installed and in service at the time of the fire."

"Factory Mutual has never experienced a catastrophic loss from a fire starting in rack storage where in-rack sprinklers were provided and operated properly." 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. Ceiling sprinklers alone, where allowed for rack storage protection, is a less desirable alternative."

NFPA 231C (1991 edition)/NFPA 13 (1999 edition)

"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."

"The following table illustrates that increased [ceiling sprinkler] densities and in-rack sprinklers reduce fire damage and the area of sprinkler operation. The table is based upon testing for 20 foot high storage using the standard commodity."

"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. . ." January 1984

"Therefore, if the goal of smaller areas of fire damage is to be achieved, sprinklers in racks should be considered."

Density	Fire Damage In Test Array		Sprinkler Operation Area w/ 165°F Sprinklers
0.30 gpm/SF (Ceiling Only)	22%	395 SF	4500-4800 SF
0.375 gpm/SF (Ceiling Only)	17%	306 SF	1800 SF
0.45 gpm/SF (Ceiling Only)	9%	162 SF	700 SF
0.20 gpm/SF (Ceiling Only)	28-36%	504-648 SF	13,100-14,000 SF
0.20 gpm/SF (Ceiling/In-Rack)	8%	144 SF	4,100 SF

“One of the purposes of the [over 25 foot] tests was to determine arrangement of in-rack sprinklers that can be repeated as pile height increases and that provide control of the fire. . . Many of these tests, however, produced appreciable fire spread in storage in tiers above the top level of protection within the racks. (In some cases, a total burnout of the top tiers of both the main rack and the target rack occurred.) . . . In most cases the in-rack sprinklers were effective in controlling fire below the top level of protection within the racks.”

“In all except one case, using the standard commodity, with one line of sprinklers installed in racks, only two sprinklers opened. In the one exception, two sprinklers opened in the main rack, and two sprinklers opened in the target rack.”

“In the 20-ft. high test series, ceiling sprinklers operated before in-rack sprinklers. In the 30-ft. high series, ceiling sprinklers operated after in-rack sprinklers. The 50 ft. high test did not operate ceiling sprinklers. They would, however, be needed if fire occurred in upper levels.”

“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.”

“These results indicate the effect of in-rack sprinklers on storage higher than 25-ft. From the ceiling operation standpoint, expected high-heat-release-rate fire was converted to a fire with a much lower heat release rate.”

“. . . In most cases the in-rack sprinklers were effective in controlling fire below the top level of protection within the racks.”

“Since the fires developed slowly and opened sprinklers at two levels in the racks, only a few ceiling sprinklers were needed to establish control. Thus, sprinkler operating area is not varied with height for storage over 25-ft high or for changes in sprinkler temperature rating and density.”

NFPA 1420 (1993 Edition), Recommended Practice for Pre-incident Planning for Warehouse Occupancies

“1978 NY. AT&T Warehouse. *The warehouse was over 500,000 ft in area. The 27 ft high storage racks contained pallets of rubber cable products. Sprinkler protection consisted of ceiling and in-rack heads supplied by the public water system and a 2,500 gpm fire pump with a 300,000 gal suction tank.*

An arson fire activated three ceiling and three in-rack sprinklers during the nonoperating hours of the facility. The sprinkle water flow alarms activated at the guard station, and the guard alerted the fire department. Fire department operations were limited to salvage and overhaul. Damage was limited to three pallet loads of product, about \$20,000.”

“February, 1981 KS. AT&T Warehouse. *The warehouse was over 500,000 ft in area. The 27 ft high storage racks contained pallets of electronic components and packaging materials. Sprinkler protection consisted of ceiling and in-rack heads supplied by two 2,000 gpm fire pumps with two separate 300,000 gal suction tanks.*

A maintenance employee was repairing a lift truck in the warehouse and heard a “crackling” sound. He investigated, saw fire and smoke, and saw an in-rack sprinkler in operation. A 1-1/2 in. hose line from a nearby hose station was used to attack the incipient fire. As outlined in the facility’s emergency action plan (EAP), a fire evacuation alarm was sounded, a sprinkler water flow alarm was activated at the guard station, a back-up phone call was placed to the guard station, the plant emergency organization (PEO) responded, and the public fire department was notified.

The PEO personnel connected a large hose line to a yard hydrant and stretched the line inside the warehouse. This 2-1/2 in. line supplied two 1-1/2 in. back-up hose lines. These operations were completed within 10 minutes of the fire and before the fire department's arrival. The fire had been controlled and fire department operations were limited to salvage and overhaul. Damage was limited to several pallets loads of product that totaled approximately \$10,000."

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 another 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.

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.

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).

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).

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:

Page 1010, Line 9

Q. Now, in your review and investigation, were you able to determine to what extent there were Group A plastics stored in these portable racks at the time of the fire?

A. No, I wasn't able to.

[Break in transcript]

. . .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.

Q. From your standpoint it didn't make any difference whether there were Group A plastics or not as you conducted your investigation?

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

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

Q. And what's the basis for that?

A. Well, I modeled Class II commodity and the sprinkler system couldn't control the fire and so clearly anything above a Class II commodity would have shared that same problem. So if it had been III, IV or Group A plastic, the outcome would have been the same. This is, the fire would not have been controlled.

[Break in transcript]

Q. But as with regard to ten foot clearance, it could have made a difference? Yes or no.

A. Three tiered, ten foot clearance, multi-row racks, the presence or absence of encapsulation and the commodity classification, be it IV or V, under those hypotheticals could well have made a difference in the control of the fire.

Page 1100, Line 7

Q. Now, is it your understanding that the fire protection systems for this facility were designed based upon a Class IV commodity?

A. In the high rack areas.

Q. Do you know of any other area where the building was designed to meet a different commodity classification?

A. I don't know of a different commodity classification.

Q. So it's your understanding it's Class IV commodity. So if we did have a circumstance where we exceed this 15 percent, you would agree with me that that would be a change in commodity classification which would require a review of the existing fire protection systems - -

A. Yes.

Q. - - in the facility? Okay. And based upon your knowledge of FM and 231C and all the other NFPA requirements, you would agree with me that there would have to be some change or modification to those systems as they were in place at the time of this fire if in fact we had at least 15 percent Group A plastics?

A. Yes.

Q. Now, with regard to storage of aerosols and flammable liquids, to the extent that those aerosols or flammable liquids, are those permitted to be stored under commodity class IV?

A. Don't recall.

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.

Q. Do you know whether or not there are requirements that include isolating those aerosols and flammable liquids from other inventory by means of either a separate area specially protected for storing them outside the facility?

A. Or in some cases caging them, yeah.

Q. Yes. Do you recall that there are such recommendations or requirements of FM in that regard?

A. Yeah. That's their recommendation about how to protect them, 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.

Q. To the extent that the owner in this particular facility was storing flammable aerosols and flammable liquids with the warehouse under the existing protection, not any special protection, do you believe that that should have required an evaluation of the existing systems to determine whether those systems were adequate to protect that facility?

A. To the extent that it's known or not known that the aerosols in question can be protected by Class IV, you know, - - are protectable by systems designed for Class IV, yes. That is, if you don't already know better.

“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. Do you have any opinion, Mr. Beyler, whether the storage of plastics in the facility at the time of the fire had any effect on the extent of the loss of the merchandise as a result of the first fire?

A. 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. Well, I realize what you did by way of calculations and modeling, but my question relates specifically to what was out there versus what you modeled, which we have already established was not what was out there.

A. Right.

Q. Now, from the standpoint, do you have an opinion as to whether the storage of plastics of any type in the facility, and specifically in these portable racks, had any effect on the extent of the loss that's claimed here by Lloyd's in this litigation?

A. Well, we knew Group B and Group C would not affect it.

Q. Okay.

A. NFPA [231C] says Group [Class] IV protection is perfectly fine for those commodities. They are lumped into Group [Class] IV. So having those plastics there versus just having, you know, other, you know, Class IV commodities, we know from that is not material. Obviously Class IV commodities do have plastics in them, so it's not - - not an either/or proposition. It would be my opinion that if there were no Group A plastics in the portable racks at all, that all the sprinkler heads at the ceiling, throughout the facility would have fused just like they were in the incident as they occurred. That would be my way of saying that no, I don't think the damage would be different.

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

FM Loss Prevention Data Sheet 8-1 (January, 1998)

"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."

"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."

"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."

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.

"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."

“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.”

“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.”

“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.”

“Plastic materials are manufactured into two basic forms, unexpanded and expanded.”

“Expanded plastics are generally a low-density product and are commonly called “foam plastics” such as polystyrene foam coffee cups, polystyrene foam packaging material, and polyethylene and polypropylene foam sheeting packing materials.”

“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.”

“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.”

“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).”

“Plastic materials that fall into the Group B category are thermosetting polyesters and thermoplastics such as polyethylene, polypropylene, polycarbonate, acrylics, cellulose and nylon.”

“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.”

“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.”

“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.”

“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.”

“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.”

“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.”

“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.”

“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.”

“Plastics mixed with Class 3 or 4 commodity should be evaluated as plastics and Class 4 commodities mixed with Class 3 commodities should be evaluated as a Class 4 commodity.”

FM Loss Prevention Data Sheet 8-33 (January 1984)

“Fire testing has shown that the hazard of mixed commodities with a rack storage array can approach that of the most hazardous commodity present.”

“Various commodities located randomly throughout a warehouse can present as severe a fire hazard as a storage of only the most hazardous commodities.”

Fire Protection of Storage-NFPA 230 (1999 edition)

“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.”

“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 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.”

“Fire testing has shown that the hazard of mixed commodities with a rack storage array can approach that of the most hazardous commodity present.”

NFPA 13 (1999 edition)

“Protection requirements shall not be based on the overall commodity mix in a fire area. Mixed commodity storage shall be protected by the requirements for the highest classified commodity and storage arrangement.

“Various commodities located randomly throughout a warehouse can present as severe a fire hazard as a storage of only the most hazardous commodities.”

Exception No. 1: Up to 10 pallet loads of a higher hazard commodity as described in 2-2.3 and 2-2.4, shall be permitted to be present in an areas not exceeding 40,000 SF. The higher hazard commodity shall be randomly dispersed with no adjacent loads in any direction (including diagonally). If the ceiling protection is based on Class I or Class II commodities, then the allowable number of pallet loads for Class IV or Group A plastics shall be reduced to five.

Exception No. 2: The higher hazard material shall be permitted to be confined to a designated area and properly protected for that area.”

“. . .Mixed commodity storage shall be protected by the requirements for the highest classified commodity and storage arrangement.”

“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.”

“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.”

Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 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. Recording the commodity class of the plan allows subsequent identification of changes.”

“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.”

“Many warehouse operators do not separate flammable liquids and aerosol container storage from general merchandise storage, even though this is a recommendation of NFPA and insurance agency.”

“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.”

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.

“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. . .”

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 McFugal'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.

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).

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:

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 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.

The owner/operator of the McFrugal's Warehouse, know as the New Orleans Distribution Center (NODC), also owned and operated another warehouse of similar design in Rancho Cucamonga, California know 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?

- 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.

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?

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.

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.

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.

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. At the time NODC was designed, the Standard Fire Prevention Code required smoke and heat vents with draft curtains in sprinklered storage facilities and insurance companies like IRI similarly required their use. Had a properly designed smoke and heat vent system with draft curtains been designed for this building, the activation of sprinklers throughout the building could have been avoided, and the distribution of burning brands throughout the facility would have been controlled. As this is not a standard building, the design of this system would have required an engineering approach. This is clearly anticipated in the note to Table 3607 in the 1988 edition.”

“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. Their inclusion in the NODC would have prevented the activation of sprinklers throughout the facility and would have controlled the distribution of burning brands. As such, the damage resulting from the rekindle would have been eliminated.”

“. . . 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.”

Deposition Testimony-Dr. Craig Beyler:

Q. . . . but is it fair to say that there is significant disagreement in the literature with respect to the efficacy of smoke and heat vents?

A. There's disagreement - - I mean the principal people who think that smoke and heat vents needn't be used is Factory Mutual. I mean they are - - they are the principal organization who advocates against their use. So Factory Mutual has, you know, for decades said they aren't - - the basis for not, quote, liking them or not wanting them to be used is they don't regard them as cost effective. They don't make an argument on the - - primarily on the basis of

“ . . .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.”

efficacy. They 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 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.

Q. Just so that the record is clear, is it your testimony that it's only FM that opines against or does not advocate the installation of draft vents and smoke removal systems?

A. No, they're the one who advocate against it.

Q. Let me rephrase the question. Other than FM, to your knowledge does anyone take a similar stance that FM takes with regard to heat vents and smoke removal systems?

A. There certainly are people who do.

Q. Professionals in the field?

A. Sure.

- Q.** Professionals in the field who have published outside of Factory Mutual?
- A.** We could refer to that. As I sit here, and obviously the review paper I prepared was for the purpose of reviewing this, it's probably better than my memory, but I can't think of anybody outside of FM who's published a research paper to that effect.

[Break in Transcript]

Page 959, Line 3

- Q.** To what extent, Mr. Beyler, did you evaluate the effect that smoke or heat vents, and/or draft curtains would have had on the loss that was incurred as a result of the first fire?

- A.** Well, I have considered how a smoke and heat vent system could have benefitted us in this - - in this fire, but absent a specific design, because none was in place, of course, I have not specifically evaluated the role of a smoke and heat vent system in - - hypothetically in an incident like this.

- Q.** So you have no opinion as to what effect, if any, smoke and heat vents had on the amount of the loss that was suffered as a result of the fire?

- A.** Smoke and heat vents could have prevented the spread of heat to remote parts of the building by providing venting.

- Q.** Could have or couldn't? You said could have?

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

- A.** Could have. I mean you could design a smoke and heat vent system that would have done that.

[Break in transcript]

- Q.** Well, I want to ask you this question then. Had there been some type of smoke and heat vents with draft curtains installed in this building, can you tell me with any degree of certainty that would have had any impact, any effect on the amount of the loss resulting from the fire?

A. I could envision a smoke and heat vent system included a draft curtain between the high rack area and the east bay area of substantial depth with smoke and heat vents in the east bay, not that it wouldn't be elsewhere. But I'm interested in focusing on that because of the fire, that would have contained the heat and smoke from that fire to the east bay area such that sprinklers above the high back - - excuse me, the high bay racks and the in-rack sprinklers in the high bay racks would not have been exposed to heat, and, hence, would not have operated. And I can similarly envision that system not allowing the spread of burning embers from the east high bay area to the high - - the high rack - - high bay rack area as well. Those having been accomplished, the sprinkler operations would have been limited to the east bay area and obviously we have the potential of never having had the second - - the rekindle, because the ember would not have traveled to where it did, and certainly the sprinkler system would not have been activated in those areas, and, hence, we wouldn't have had - - had that second - - the rekindle occur. We would have - - at least have had an operational sprinkler system in that area of the building with presumably very different outcome.

Q. Have you ever designed such a system that you just described?

A. No.

Q. Do you know of anyone in your firm that has designed such a system?

A. Not that I am aware of.

Page 970, Line 1

Q. Do 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 that particular facility?

A. So if I understand that correctly, do I have an opinion as to what an insurance company should know?

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.

Q. A fire protection engineer would understand it, wouldn't he?

A. I would hope so.

Q. Do you know if Lloyds' of London ever inspected this facility?

A. I don't know.

Q. The lack of draft curtains, smoke vents, and roof vents is pretty obvious when you walked into this building; isn't that correct?

A. I would have thought that.

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.

Page 971, Line 22

Q. You would agree with me, would you not, that there are many, many buildings that have been designed and constructed that do not have smoke vents, roof vents or smoke control systems?

A. Yes.

Q. And there are in fact code organizations that do not require smoke vents, draft curtains, roof vents, is that correct?

A. I mean, for instance, at this particular time, two of the three national codes do require [vents and draft curtains]. The third does not.

Q. Would you agree with me that the fact that draft curtains or roof vents were not designed into a building does not in and of itself constitute some deviation from a standard of care?

A. Could you repeat the question?

Q. Sure. Would you agree with me that the fact that draft curtains or roof vents were not designed into a building does not in and of itself constitute some deviation from a standard of care? And the standard of care I'm talking about is people who design buildings and fire protection systems.

A. It need not in and of itself.

Q. Do you consider the decision to install draft curtains and roof and smoke vents to be an economic decision to be made by the owner?

A. It's - - sometimes.

Q. Okay. In what instances would it be an economic decision.

A. Well, the first thing would be one where it isn't required by law. Obviously if it's required by law, then it's not an economic decision. And then assuming that life safety is not impacted by that, which would include both fire fighters and the building occupants, or obviously impact the community in some fashion.

Q. Is it your opinion that smoke and roof vents and draft curtains were not required by law in this particular instance for this building?

A. My recollection - - my recollection was that smoke removal was required, but not smoke and heat vents in particular.

Q. Is there not a distinction between smoke and heat vents and smoke removal systems?

A. Smoke removal systems is a broader term in my view.

Q. Is the basis of your understanding the 1985 Standard Fire Prevention Code?

A. Yes.

Q. Does the 1985 Standard Fire Prevention Code distinguish between smoke vents and roof vents and smoke removal systems? Do you understand my question?

A. I don't remember what the '85 Fire Prevention Code says about smoke and heat vents, but I would imagine it makes a distinction in the same way that I indicated a smoke removal system is different, a broader term which is inclusive of smoke and heat vent systems and other means of removing smoke.

[Break in transcript]

Q. So in that particular situation, it's your opinion that roof vents and draft curtains were not a legal requirement in connection with the design of this project. Is that correct?

A. Yes, as I have previously indicated that.

Q. Okay. Would you agree with me that in fact persons in the fire protection engineering community in fact disagree as to the need of smoke and roof vents with draft curtains in connection with the design of fire protection systems for a building such as this particular building, MacFrugal's?

A. I think my paper reflects that - - that there are people and organizations and particularly Factory Mutual who does not regard them as cost effective and, hence, as a result, do in fact disagree about the - - whether they should be included or not.

Q. All right. And would it be fair to say, based upon your experience and knowledge, that that type of disagreement has been existing for at least back to 1988, 1989 when this project was designed?

A. That had been Factory Mutual's position at that time, yes.

Q. And others in the fire protection community, including fire protection engineers?

A. Well, Factory Mutual certainly does include fire protection engineers.

Q. I understand.

A. Yes.

Q. Is it still Factory Mutual's position today that roof vents and draft curtains and smoke vents should not be installed or not mandated to be installed by FM?

A. They still regard them as not cost effective, yes.

Q. And that position was also their position in the late '80s?

A. Yes.

Analysis:

NFPA 13 (2010 edition)

"12.1.1.1 Manually operated roof vents or automatic roof vents with operating elements that have a higher temperature classification than the automatic sprinklers shall be permitted."

"Substantiation: *The intent of the [NFPA 13] standard is that roof vents and draft curtains should not be used in conjunction with storage protection. Previous language was unenforceable.*" (13-325 Log #CP43 AUT-SSD)

"Explanation of Negative [Ballot]: MULTER, T.: *The following original proposal on ROP documents dated 10/20/2007 should be accepted as proposed but with a change to the annex statement."*

12.1.1 Roof Vents and Draft Curtains. *Roof vents and draft curtains shall not be used in conjunction with the sprinkler protection criteria for storage in this standard.*

A.12.1.1 *The design parameters in NFPA 13 were developed based upon the absence of roof vents or draft curtains. (See Annex C.6) Fire tests for sprinklers specifically listed for storage applications are tested without vents or draft curtains. References to control mode sprinklers in other building standards pertain to standard spray sprinklers that were not specifically tested by the laboratories for storage applications. With the advent of K-*

“ . . .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.”

11.2 and larger sprinklers for storage applications and now Specific Application Control Mode sprinklers (being revised to CMSA), we need to realize that ESFRs are not the only storage sprinklers and that the use of smoke vents and draft curtains can be detrimental to all sprinklers that are specifically tested for storage applications. FM Global’s recommended storage protection designs are based upon vents not being provided and that the use of automatic vents may increase the sprinkler water demand.”

FM Global Loss Prevention Data Sheet 2-8N (March 2010 edition)

“2.2.1.7.1 Heat and/or Smoke Vents *Do not install automatic smoke and heat vents in facilities equipped with sprinkler protection; manual heat and smoke vents, however, are acceptable. If local codes require the installation of automatic smoke and heat vents, do one of the following:*

- (a) *Install vents that are FM Approved for occupancies protected by quick-response Storage sprinklers.*
- (b) *Install FM Approved vents equipped with a standard-response 360°F (182°C) nominal thermal activating device.*

“Do not install automatic smoke and heat vents in facilities equipped with sprinkler protection; manual heat and smoke vents, however, are acceptable.”

(c) Install quick-response sprinklers directly under the vent opening on a maximum 4 ft (1.2 m) linear and 16 ft² (1.5 m²) area spacing. . . See Figure 24a for a diagram of this arrangement.

“Do not install drop-out-type heat vents over storage areas.”

Do not install drop-out-type heat vents over storage areas. If local codes require the installation of drop-out type heat vents over storage areas, install vents that are FM Approved for occupancies protected by quick-response Storage sprinklers.”

Guide for Fire Department Operations In Properties Protected by Sprinkler and Standpipe Systems-NFPA 13E, 1995 Edition

*“Occupancies with a wide variety of configurations and a wide range of storage commodities might need special procedures, particularly where storage heights are in excess of 15 ft. **In some cases, routine ventilation procedures in the early stages of a fire can hinder effective sprinkler operation.**”*

“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.”

*“For cases where search and rescue operations have been completed prior to ventilation work being performed by the fire department, **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 Smoke and Heat Venting-NFPA 204M, 1991 Edition

“In 1975, a reconfirmation action failed as concerns over use of the guide in conjunction with automatic sprinkler buildings had surfaced.”

“The Technical Committee and Subcommittee members agreed that the state of the art has progressed sufficiently to develop improved technologically based criteria for design of venting, and therefore, the 1982 edition of the document represented a major advance in engineered smoke and heat venting, although reservations over vent/sprinkler applications still existed.”

“In 1975, a reconfirmation action failed as concerns over use of the guide in conjunction with automatic sprinkler buildings had surfaced.”

“The 1985 edition again revised Chapter 6 on the subject of venting in sprinklered buildings. 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. The revised wording of chapter 6 encourages the designer to use the available tools and data referenced in the document while the use of automatic venting in sprinklered buildings is under review.”

“. . . 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. . . .”

“A broadly accepted equivalent design basis for using both sprinklers and vents together for hazard control (e.g., property protection, life safety, water usage, obscuration, etc.) has not been universally recognized.”

“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.”

“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.”

“Depending upon the location of the fire relative to the vents, the necessary water demand to achieve control is either increased or decreased over an unvented condition. With the fire directly under the vent, water demand is decreased. With the fire equidistant from the vents, water demand is increased.”

“While the use of automatic venting in sprinklered buildings is still under review, the designer is encourage to use the available tools and data referenced in this document for solving problems peculiar to a particular type of hazard control.”

Guide for Smoke and Heat Venting-NFPA 204, 1998 Edition

“The majority of the information provided in this guide applies to non-sprinklered buildings. A limited amount of guidance is provided in Chapter 8 for sprinkler buildings.”

“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.”

“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.”

“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.”

“Flow through a vent in this guide is calculated on the basis of buoyancy pressure. It is assumed that openings exist to the outside and, therefore, no pressure results from the expansion of gases. Wind effects are not taken into account, as wind might assist or interfere with vent flows, depending on specific circumstances. It is also assumed that the fire environment in a building space is divided into two zones—a hot upper layer and a relatively cool, clear (comparatively free of smoke) lower region. Where a fire grows to a size approaching ventilation-limited burning, the building might no longer maintain a clear lower region, and this guide would no longer be applicable.”

“To ensure smoke containment, curtain boards should extend down. . . a minimum of 20 percent of the ceiling height.”

*“The feasibility of roof venting should be questioned when the heat release rate approaches values associated with ventilation control of the burning process (i.e. where the fire becomes controlled by makeup air replacing the vented hot gas and smoke). **Ventilation-controlled fires might be unable to support a clear layer.**”*

“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.”

“To ensure smoke containment, curtain boards should extend down. . . a minimum of 20 percent of the ceiling height.”

“A series of tests was conducted to increase the understanding of the role of automatic roof vents simultaneously employed with automatic sprinklers [Waterman, 1982]. The data submitted did not provide a consensus on whether sprinkler control was impaired or enhanced by the presence of automatic (roof) vents for the typical spacing and area.”

“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).”

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“In an independent analysis of these tests, Gustafsson noted that sprinklers near the fire source were often delayed or did not operate altogether [Gustafsson 1992].”

Recommended Practice for Pre-incident Planning for Warehouse Occupancies-NFPA 1420, 1993 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.”

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“Automatic venting details should be noted in the pre-incident plan, as this could affect fire behavior.”

“Fire spread is often beyond public fire department suppression capability by the time of arrival, even with sprinkler activation, immediate alarm, and timely response.”

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

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“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. Likewise it must be recognized that even the best designed sprinkler system might not extinguish a warehouse fire and manual fire suppression can be required to effect final extinguishment. For warehouse fire fighting operations to be successful, the pre-incident plan should be developed with a full knowledge of the design and capabilities of the sprinkler system within the warehouse.”

“These systems play a vital role in providing adequate overall fire protection for many occupancies. If these systems fail to control or extinguish the fire, it is quite possible that it will be impossible to prevent deaths, injuries or substantial property losses, even with a large commitment of manual fire-fighting forces.”

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Fire Protection Handbook- Fifteenth Edition (1981)

“Great impetus to the subject of smoke and heat venting was provided by the General Motors fire at Livonia, Michigan, in 1953, when fire spread horizontally under an unvented metal roof, some 34 acres of undivided area. Fire protection engineers were in general agreement that this fire could have been greatly reduced in extent if there had been effective roof venting.”

“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. In this regard, there are likely to be some combined element (vent/sprinkler) systems that provide greater hazard control, in some sense, than a single element approach and other that provided less hazard control than a single element approach.”

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*“The function of curtain boards is to delay and limit the horizontal spread of heat by providing the horizontal confinement need to obtain the designed “stack,” action. **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.”*

“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.”

Sprinkler, Smoke & Heat Vent, Draft Curtain Interaction-large Scale Experiments And Model Development (NISTIR 6196-1), September, 1998

“The overall goal of the testing and modeling program was to investigate the effect of roof vents and draft curtains on the time, number and location of sprinkler activations; and also the effect of sprinklers and draft curtains on the activation time, number, and discharge rates of roof vents.”

“The significant cooling effect of sprinklers on the near-ceiling gas flow often prevented the automatic operation of vents.”

*“The significant cooling effect of sprinklers on the near-ceiling gas flow often prevented the automatic operation of vents. . **In one cartoned plastic commodity experiment, a vent did not open when the fire was ignited directly beneath it.** The model simulations could not predict this phenomenon.”*

“Model simulations indicated that the cooling effect of sprinkler sprays reduced the total vent discharge rate from that assumed in design calculation for un-sprinklered buildings.”

“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. Numerous studies have been conducted over the past few decades, yet many questions remain about the interaction of these devices.”

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“There is no nationally recognized standards for the combined installation of sprinklers and roof vents.”

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“Even though the practice of installing vents in sprinklered buildings has been debated for decades, and in spite of several projects involving large scale tests and numerical modeling, there is still disagreement about how roof vents and draft curtains affect the time, number and location of sprinkler activations; and how sprinklers and draft curtains affect the activation time, number and discharge rates of roof vents. As a result, there is a great disparity among building codes as to the proper treatment of these fire protection devices. The issue is even more important today because of the popularity of large warehouse-type retail stores that combine the function of sales and storage. Typically these stores will contain merchandise stacked up to 6 m (20 ft), with ceilings as high as 9 m (30 ft), an in areas over 10,000 m² (100,000 ft²).”

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.

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.

“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.

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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.”

“ . . .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.”

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.

The fire at the Sofa Superstore in Charleston, South Carolina is just one example of the dangers of interior fire fighting in large buildings where the sprinkler protection is impaired. The Sofa Superstore was not provided with sprinkler protection.

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 sprinkler, 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.

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”.

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.

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”.

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.

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.

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

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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.

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 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.

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.

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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