SCHULTE & ASSOCIATES
Building Code Consultants
880D Forest Avenue
Evanston, IL 60202
fpeschulte@aol.com
847/866-7479

BUILDING FIRE PROTECTION: IT'S NOT ROCKET SCIENCE

By Richard Schulte

According to statistics included in a report published by the National Fire Protection Association (NFPA) titled "*Fire Loss in United States During 2009*" authored by Michael J. Karter, Jr., of the Fire Analysis and Research Division of the NFPA, dated August 2010, fire caused an estimated 3,010 fatalities in the United States in 2009. Of these fatalities, it is estimated that 2,695 of these fatalities occurred in structure fires with 96.1 percent of the structure fire fatalities occurring in residential occupancies. In 2009, only 3.9 percent of the structure fire fatalities occurred in commercial (non-residential) occupancies. In actual numbers, the NFPA estimates that roughly 105 fire fatalities occurred in commercial (non-residential) occupancies in 2009.

With respect to residential occupancies, the NFPA estimates that 2,100 fire fatalities occurred in 1- and 2-family dwellings and 465 fire fatalities occurred in multi-family residential buildings. The NFPA report further indicates that 25 fire fatalities occurred in residential occupancies other than 1- and 2-family dwellings or multi-family residential occupancies.

It seems obvious if we want to effect a significant reduction in the number of fire fatalities, we need to concentrate our efforts on reducing fire fatalities in residential occupancies, in particular 1- and 2-family dwellings.

It seems obvious if we want to effect a significant reduction in the number of fire fatalities, we need to concentrate our efforts on reducing fire fatalities in residential occupancies, in particular 1- and 2-family dwellings. With the inclusion of provisions which require that all residential occupancies be provided with sprinkler protection in the Life Safety Code, the International Building Code and NFPA 5000 in the last decade, we are well on our way toward addressing the fire fatality issue in the United States. The number of fire fatalities which occur in residential occupancies protected by a sprinkler system in the United States is a mere handful.

Despite the fact that over 95 percent of the structure fire fatalities in the United States occur in residential occupancies, and that the number of fire fatalities occurring in commercial occupancies varies between 100 and 200 annually, proposals to make the provisions which apply to commercial buildings more restrictive are submitted in each code change cycle. As with residential occupancies protected by a sprinkler system, the number of fire fatalities which occur in commercial buildings protected by a sprinkler system is also just a mere handful.

The fire fatality statistics cited for 2009 are not really new. The statistics for prior years are similar. The overall trend with respect to fire fatalities is down, but the statistics for buildings protected by a sprinkler system have essentially been the same for the last 30 years. Fire fatalities in buildings which are protected by a sprinkler system are indeed rare.

The overall trend with respect to fire fatalities is down, but the statistics for buildings protected by a sprinkler system have essentially been the same for the last 30 years.

Given the statistics above, how can we justify adopting more and more restrictive building fire safety measures, particularly in buildings protected by a sprinkler system? In my opinion, the answer to that question is that we simply can't. It seems rather obvious that the only reason that more restrictive requirements are being proposed continuously is because the model building codes are being used as a marketing tool by manufacturers of fire safety and fire protection products. It's far easier to market a fire safety product or service if the use of the product or service is mandated by the code. Which brings us to a discussion of the cost of fire and fire protection.

According to another NFPA report titled "*The Total Cost of Fire Protection in the United* States" authored by John R. Hall, Jr., Fire Analysis and Research Division, dated February 2011, fire in the United States caused an estimated $20.1 billion in direct and indirect (business interruption) damage in 2008, however, the United States spent a total of in excess of $300 billion to address the fire problem in 2008. Can we justify spending $300^{+} billion on fire protection to address a problem whose cost is only $20.1 billion? Obviously, there's a "trade-off" here-if we spent less than $300^{+} billion, then the fire damage figure might increase, but certainly the increase in fire damage would be minuscule when compared to the $300^{+} billion spent.

Can we justify spending $300^{+} billion on fire protection to address a problem whose cost is only $20.1 billion?

The NFPA report on fire/fire protection costs indicates that 38 percent of the total cost of fire/fire protection is for volunteer fire departments. In this report, the NFPA has assigned a value to the time volunteers devote to public fire protection. One could argue that much of this cost should be excluded from the cost of fire protection because the time is donated by volunteer fire fighters. Regardless, the remaining portion of our expenditures on fire protection is still massive.

The NFPA report indicates that the cost of paid professional fire departments was estimated at $39.7 billion in 2008 and the cost to provide private fire protection in new building construction in 2008 was estimated to be $62.7 billion. In other words, the total cost expended to provide fire protection for buildings in the United States in 2008 was, in round numbers, $100 billion- roughly five times the cost of the damage done by fire. What that means is that building fire protection in its various forms is big business in the United States.

The NFPA report indicates that the cost of paid professional fire departments was estimated at $39.7 billion in 2008 and the cost to provide private fire protection in new building construction in 2008 was estimated to be $62.7 billion.

It seems reasonable to question whether or not spending $100^{+} billion on controlling the hazard of fire in the US is necessary. It also seems reasonable to ask what would happen if we were to reduce the amount spent to provide fire protection. Can the cost of providing fire departments in major cities throughout the US and the cost of providing private fire protection be trimmed without a major increase in the direct and indirect costs of fire?

It seems reasonable to question whether or not spending $100^{+} billion on controlling the hazard of fire in the US is necessary.

Perhaps, a third study published by the NFPA provides a path toward reducing our national expenditures on building fire protection. The report titled "*U.S. Experience with Sprinklers and Other Automatic Fire Extinguishing Equipment*", also authored by John R. Hall, Jr., dated September 2010, indicates that sprinkler protection provided in residential occupancies reduces property damage by 71 percent when compared to residential occupancies not protected by a sprinkler system. Further, this report indicates that the fire fatality rate in residential occupancies is reduced by 83 percent when both sprinkler protection and residential smoke detectors are provided.

. . .sprinkler protection provided in residential occupancies reduces property damage by 71 percent when compared to residential occupancies not protected by a sprinkler system.

These two statistics are quite impressive. Not only is sprinkler protection capable of significantly reducing both fire fatalities and property losses in structure fires, but the number of fire fighter fatalities which occur in buildings provided with sprinklers is also significantly lower. Typically, the number of fire fighter fatalities which occur in sprinklered buildings in the US on an annual basis is one.

It seems clear that the solution to the "fire problem" in the United States is sprinkler protection, however, providing sprinkler protection in all buildings is not an inexpensive proposition. In the late 1960's/early 1970's, the capability of sprinkler protection to both reduce property losses due to fire and to also reduce fire fatalities in building fires was finally recognized. (The first edition of NFPA 13D was developed in the mid-1970's.) It was also recognized that the cost of providing sprinkler protection in buildings was a significant impediment to the use of sprinklers. The solution which was developed to address the cost issue was the concept of sprinkler "trade-offs", that is reduction in the requirements for passive fire protection where sprinkler protection is provided.

The first edition of NFPA 13D was developed in the mid-1970's.

Some of the sprinkler "trade-offs" which were developed specifically for high rise buildings back in the early and mid-1970's were the elimination of fire dampers, reductions in compartmentation requirements and the reduction in structural fire resistance ratings. Since the 1970's, there have been numerous high rise buildings constructed utilizing the "trade-offs" for sprinkler protection permitted and a major fire has yet to have occurred in any one these buildings. It would seem that 30 years of experience with the reduction in passive fire protection requirements when sprinkler protection is provided should be adequate to conclude that we can safely utilize sprinkler "trade-offs" as a means of offsetting the cost of providing sprinkler protection in buildings.

In the past 10 to 15 years, some in the fire protection field have questioned the wisdom of permitting sprinkler "trade-offs". As might be expected, the leaders of this movement are lobbyist employed by the manufacturers of passive fire protection products. Unfortunately, the move to remove at least some of the "trade-offs" which have been developed over the years has gained traction in the fire service.

The increased use of sprinkler protection in the 1990's and the first decade of the 21st century can be directly attributed to the development of "trade-offs" in the 1970's.

While the fire service strongly supported the development of "trade-offs" in the 1970's, younger members of the fire service seem to have forgotten the days when the installation of sprinkler protection in other than mercantile, industrial and storage buildings was rare. The increased use of sprinkler protection in the 1990's and the first decade of the 21st century can be directly attributed to the development of "trade-offs" in the 1970's.

With 30 years of experience with “trade-offs” in the books, it would seem that sprinkler protection has proved itself to be both capable and reliable. Given this, it seems that one means of reducing the cost of providing building fire protection is to go back and re-implement the cost-reduction solution developed in the 1970's-sprinkler “trade-offs”. Reversing the trend away from sprinkler “trade-offs” is just one solution to reducing our national fire protection budget. Including additional sprinkler “trade-offs” in our codes in another solution.

One of the sprinkler “trade-offs” which receives seemingly very little attention these days is the substitution of sprinkler protection for fire fighting personnel. It seems obvious that, if sprinkler protection controls a fire in its early stages, the number of fire fighters required to address a fire can be significantly reduced. Sprinkler protection has several advantages over manual fire fighting. Perhaps the most significant advantage is that the response time of sprinklers to a significant fire is essentially zero. Providing sprinkler protection in a building is like stationing several companies of fire fighters in the building. Another advantage that sprinkler protection has over fire fighters is that sprinklers are impervious to heat, smoke and other toxic products of combustion and, after the fire is controlled and extinguished, any sprinklers injured in the fire need only be removed and discarded.

One of the sprinkler “trade-offs” which receives seemingly very little attention these days is the substitution of sprinkler protection for fire fighting personnel.

Is sprinkler protection a panacea to fire problem in the United States? The answer to that question is a resounding no, of course not. While code requirements which apply to buildings protected by a sprinkler system can be reduced, no one has ever suggested that all egress and passive fire protection provisions be eliminated in buildings protected by a sprinkler system.

Is sprinkler protection a panacea to fire problem in the United States? The answer to that question is a resounding no, of course not.

While sprinkler system failures are few and far-between, there will always be sprinkler system failures. What this means is that sprinkler protection will never be a complete replacement for manual fire fighting, but sprinkler protection can be used to significantly reduce the number of fire fighters required to protect our communities. The use of sprinkler protection as a substitute for fire fighters means that the fire department’s responsibility will change from manual suppression mode to fire prevention mode. With the increased use of sprinkler protection, large fires should be rare events.

As the number of major fires which occur decreases with the increased use of sprinkler protection and fire fighting becomes much safer, fire fighters should be freed up to perform other duties. Several communities in the State of Illinois are protected by public safety departments where the same personnel perform police, paramedic and fire fighting duties.

While many in the fire service oppose the concept of public safety departments due to safety concerns, the safety concerns should be addressed in communities where sprinkler protection provides the bulk of the structural fire protection in the community. Certainly, it would seem difficult to justify separate police and fire departments in communities where major fires and fire fatalities never occur (because of sprinkler protection).

The use of sprinkler protection to provide the bulk of structural fire protection for a community most certainly is not "rocket science", and neither is the design and installation of sprinkler systems. While the design and installation of sprinkler protection is a specialty, sprinkler system designers and installers do not need a degree in "rocket science".

The use of sprinkler protection to provide the bulk of structural fire protection for a community most certainly is not "rocket science", and neither is the design and installation of sprinkler systems.

In my opinion, the attempt by the fire protection profession to make building fire protection complicated is misguided. The solution to the "fire problem" in the United States was developed in the 1970's. If we had implemented the "sprinkler solution" 30 years ago, there wouldn't be a need to be talking about the problem today.

Unfortunately, the manufacturers of passive fire protection products are standing in the way of improving building fire protection, while at the very same time, reducing the amount of capital expended on providing building fire protection. Imagine a future where the number of annual civilian fire fatalities is reduced by 83 percent and property damage due to fire is reduced by 71 percent, all at a cost of far less than 100^{+} billion. Who wouldn't want that?

Imagine a future where the number of annual civilian fire fatalities is reduced by 83 percent and property damage due to fire is reduced by 71 percent, all at a cost of far less than 100^{+} billion.

And that, my friends, is what fire protection engineering should be all about.

* * * * *