Table 1015.1
EXIT ACCESS TRAVEL DISTANCE[a]

OCCUPANCY	WITHOUT SPRINKLER SYSTEM	WITH SPRINKLER SYSTEM
A, E, F-1, I-1, M, R, S-1	200	250[b,d]
B	200	300[c]
F-2, S-2, U	300	400[c]

No Change to Other Entries in the Table

a. No change.
b. No change.
c. No change.
d. A travel distance of 400 feet shall be permitted one story buildings in Groups F-1 and S-1.

Purpose:

The purpose of this proposal is to increase the allowable exit access travel distance in one story buildings classified as F-1 and S-1 occupancies protected throughout by a sprinkler system from 250 feet to 400 feet.

Reason:

The code limits the egress travel distance in order to limit the occupant egress time.

The time which is available for egress from a room or space is dependent upon the size of the fire in the room or space and also the size of the room or space. The size of a fire in a room or space is determined by the type and density of the contents. The larger the volume of the room or space (given the same type and density of combustibles), the more time is available for egress from the room or space. Similarly, flashover occurs sooner in smaller rooms and spaces than in larger spaces (again, given the same type and density of contents). Hence, it can be stated that more time is available for egress from rooms or spaces with greater volumes (given the same size fire).

Given the above, it is reasonable to conclude that more time is available for egress in F-1 and S-1 occupancies which have larger travel distances simply because the rooms and spaces in the building will be larger. Based upon this, it seems reasonable that larger travel distances should be permitted in larger F-1 and S-1 occupancies.

While an increase in the allowable travel distance from 250 feet to 400 feet is a 60 percent increase in the travel distance presently permitted for these two occupancies, it should be noted that an allowable travel distance of 400 feet would result in an egress travel time of 240 seconds (4 minutes) at a walking speed of 100 feet per minute (1.14 miles per hour), while a walking speed of 150 feet per minute (1.70 miles per hour) results in an egress travel time of 160 seconds (2.7 minutes). Hence, this proposed change would result in an egress time of between 2.7 and 4 minutes (once egress begins) walking at a relatively slow pace. Given the size of a building with a travel distance of 400 feet, these egress times are reasonable.

When considering this proposal, it should be noted that section 1015.2 in the 2003 edition of the International Building Code already permits an exit travel distance of 400 feet in single story F-1 and S-1 occupancies which are protected throughout by a sprinkler system and which are provided with roof vents. Given an egress time of between 2.7 and 4 minutes, there is a high probability that the roof vents will not even operate prior to the completion of the evacuation of the building. Hence, there seems to be little connection between an increase in the allowable exit access travel distance and the installation of roof vents. If a travel distance of 400 feet is permitted in a sprinklered building with roof vents, then it seems logical that a travel distance of 400 feet should also be permitted in a sprinklered building without roof vents.

(It should be noted that Table 910.3 in the International Building Code requires that the maximum spacing of roof vents to be between 90 feet and 120 feet depending upon the upon the occupancy of the building and the storage height. NFPA 13 limits the maximum spacing of standard sprinklers to 15 feet on centers. Based upon the spacing of sprinklers with respect to the spacing of roof vents, it is highly probable that sprinklers will activate prior to the roof vents (unless the fire is located in close proximity to a roof vent). If sprinklers operate prior to the roof vents and successfully control the fire, then it is highly improbable that the roof vents will ever operate. Given this, it can be concluded that, in the most highly probable scenario, providing roof vents will have no impact upon the heat or smoke generated by the fire. Hence, it can be concluded that, in most cases, providing roof vents in sprinklered buildings will have no beneficial impact on egress system serving F-1 and S-1 occupancies. In other words, the heat and smoke conditions under which egress will be made will usually be the same in sprinklered buildings with or without roof vents.)

It should also be noted that the 2003 edition of the Life Safety Code permits an exit access travel distance of 400 feet in special purpose industrial occupancies protected throughout by a sprinkler system and ordinary hazard storage occupancies protected throughout by a sprinkler system. (See Tables 40.2.6 and 42.2.6, LSC-2003.) Section 40.1.4.1 in the Life Safety Code defines a "special purpose industrial occupancy" as an industrial occupancy which ". . . conducts ordinary and low hazard industrial operations in buildings designed for, and suitable only for, particular types of operations. Such occupancy is characterized by a relatively low density of employee population with much of the area occupied by machinery or equipment."

Bibliography:

Section 1015.2, International Building Code-2003 edition.

Table 910.3, International Building Code-2003 edition.

Chapter 40, Life Safety Code-2003 edition.

Chapter 42, Life Safety Code-2003 edition.

~~**1015.2 Roof Vent Increase.** In buildings which are one story in height, equipped with automatic heat and smoke roof vents complying with Section 910 and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum exit access travel distance shall be 400 feet (122 m) for occupancies in Group F-1 and S.~~

Purpose:

The purpose of this proposal is to eliminate the code provision which permits an increase in exit access travel distance in Group F-1 and S-1 occupancies which are protected throughout by a sprinkler system and provided with roof vents.

Reason:

The rationale for permitting an increase in the travel distance when roof vents are provided in a building is questionable. Heat and smoke vents are heat-activated devices. The response time of a roof vent depends upon the fire size, the height of the ceiling and the horizontal distance between the fire and the vent. The higher the ceiling, the longer it will take for a heat-activated device located at the ceiling to operate (all other variables being equal). Of course, the operation of sprinklers will also impact the response time of roof vents and, more than likely, roof vents will never operate if sprinklers operate prior to the operation of the roof vents.

(It should be noted that Table 910.3 in the International Building Code requires that the maximum spacing of roof vents to be between 90 feet and 120 feet depending upon the upon the occupancy of the building and the storage height. NFPA 13 limits the maximum spacing of standard sprinklers to 15 feet on centers. Based upon the spacing of sprinklers with respect to the spacing of roof vents, it is highly probable that sprinklers will activate prior to the roof vents (unless the fire is located in close proximity to a roof vent). If sprinklers operate prior to the roof vents and successfully control the fire, then it is highly improbable that the roof vents will ever operate. Given this, it can be concluded that, in the most highly probable scenario, providing roof vents will have no impact upon the heat or smoke generated by the fire. Based upon this, it can be concluded that, in most cases, providing roof vents in sprinklered buildings will have no beneficial impact on egress system serving F-1 and S-1 occupancies. Hence, the heat and smoke conditions under which egress will be made will usually be the same in sprinklered buildings with or without roof vents.

At a walking speed of 150 feet per minute (1.70 miles per hour), the time to walk 400 feet is 160 seconds. Depending upon the fire size and ceiling height, roof vents may <u>not</u> even operate prior to the evacuation of the building being completed. Given this, it makes little sense to allow an increase in the travel distance for the installation of roof vents.

It should be noted that if the proposed change to Table 1015.1 (which will permit an exit access travel distance of 400 feet in sprinklered F-1 and S-1 occupancies) is approved, there will be no need for this code section.

[F] 910.2 Where required. Approved smoke and heat vents shall be installed in the roofs of one-story buildings or portions thereof occupied for ~~the~~ Group H uses as indicated. ~~set forth in Section 910.2.1 through 910.2.4.~~

~~**[F] 910.2.1 Groups F-1 and S-1.** Buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet 4645 m^2) in undivided area.~~

~~**Exception:** Group S-1 aircraft repair hangers.~~

~~**[F] 910.2.2 Group H**. No change.~~

1. No change.

2. No change.

~~**[F] 910.2.3 High-piled combustible storage.** Building and portions thereof containing high-piled combustible stock or storage in any occupancy group in accordance with Section 413 and the *International Fire Code*.~~

~~**[F] 910.2.4 Exit access travel distance increase.** Buildings and portions thereof used as a Group F-1 or S-1 occupancy when the maximum exit travel distance is increased in accordance with Section 1015.23.~~

Purpose:

The purpose of this proposal is to eliminate the requirement for roof vents in F-1 and S-1 occupancies and in buildings which contain high piled combustible storage.

Reason:

In a memorandum dated September 10, 1999, the American Architectural Manufacturers Association (AAMA) announced the commencement of AAMA Smoke Vent Task Group's research project on the use of smoke/heat vents. The announcement states that the purpose of this research project is to "study the interaction between sprinklers, smoke/heat vents and draft curtains" and "to develop scientifically based engineering design criteria for the installation of draft curtains and vents."

The AAMA memorandum is essentially an admission by the AAMA Smoke Vent Task Group in 1999 that we do not presently have sufficient information on the interaction between sprinklers, smoke/heat vents and draft curtains to utilize smoke/heat and draft curtains in buildings which are protected by sprinklers. Given this admission by the AAMA, it would seem questionable that the International Building Code and International Fire Code should mandate the use of smoke/heat vents and draft curtains in buildings which are protected throughout by a sprinkler system.

To date, the AAMA Smoke Vent Task Group has yet to complete the research project announced in September, 1999.

Chapter 10 in Section 5 of the 15th Edition of the Fire Protection Handbook published by the National Fire Protection Association in 1981 states the following:

> "Even though there is no universally accepted conclusion from either fire experience or research, concern has been raised by a recent series of model studies that indicate the following trends when the present Smoke and Heat Venting Guide [NFPA 204M] is implemented:
>
> 1. Venting delays loss of visibility;
>
> 2. Venting results in increased fuel consumption; and
>
> 3. Depending on 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."

Chapter 6 in the 1991 edition of NFPA 204M, the Guide for Smoke and Heat Venting, specifically addresses the use of smoke/heat vents in sprinklered buildings. Section 6-1 in this edition of NFPA 204M states the following:

> "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."

Section 6-2 in the 1991 edition of NFPA 204M further states the following:

> "For occupancies that 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."

In addition to this statement, Chapter 6 in the 1991 edition of NFPA 204M contains the exact same statement quoted above from the 15th edition on the NFPA Fire Protection Handbook.

Chapter 8 in the 1998 edition of NFPA 204 contains the same statements regarding the use of smoke/heat vents in sprinklered buildings as contained in the 1991 edition of NFPA 204M and also the 15th edition of the Fire Protection Handbook. In addition, the 1998 edition of NFPA 204 states the following regarding the use of curtain boards:

> "Large-sale fire tests [Troup 1994] indicates that the presence of curtain boards can cause increases in sprinkler operation, smoke production, and fire damage (i.e. sprinklers opened will away from the fire).

The issue of the use of roof vents in sprinklered buildings is also addressed in Chapter 11 of the 2002 edition of NFPA 204. Section 11.1 in the 2002 edition of NFPA 204 reads as follows:

> "Where provided, the design of the venting for sprinklered buildings shall be based on a performance analysis acceptable to the authority having jurisdiction, demonstrating that the established objectives are met. (See Annex F.3.)"

The provisions for roof vents contained in both the International Building Code and the International Fire Code are specification-oriented and do not require a "performance analysis" required by NFPA 204-2002.

Annex F.3 in the 2002 edition of NFPA 204 contains similar statements regarding the use of roof vents in sprinklered buildings as those contained in previous editions of NFPA 204 (and NFPA 204M). In addition, Annex F.3 of the 2002 edition of NFPA 204 includes the following statements:

> "Vents that are open prior to sprinkler operation in a region surrounding the ignition point, within a radius of 1-1/2 sprinkler spacings, can interfere with the opening of sprinklers capable of delivering water to the fire."
>
> "Draft curtains can delay or prevent operation and can interfere with the discharge of sprinklers capable of delivering water to the fire."

The above is an indication that, from the early 1980's to the present day, questions still persist about whether it is appropriate to use of smoke/heat vents and draft curtains in buildings which are protected by sprinklers.

The installation of roof vents in sprinklered buildings which contain high-piled storage is also specifically addressed in NFPA 13. Section 7.4.1.3.1 in the 1999 edition of NFPA 13 reads as follows:

> "Sprinkler protection criteria is based on the assumption that roof vents and draft curtains are not being used."

Section C-7.4.1.3.1 in the 1999 edition of NFPA 13 also addresses this issue as follows:

> ". . . The design curves are based upon the absence of roof vents or draft curtains in the building."

Section 2-6.1 in the 1995 edition of NFPA 13E, the Guide for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems states the following with regard to routine ventilation in sprinklered storage buildings:

> "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 feet. In some cases, routine ventilation procedures in the early stages of a fire can hinder effective sprinkler operation. It is desirable for the fire department to discuss its pre-fire plan for warehouse occupancies with the occupant, sprinkler designer, and insurance carrier to determine if a modification in procedures is appropriate."

Section 2-6.2 in NFPA 13E (1995 edition) further states the following:

> "For those 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[utes] or more."

The information from NFPA 13E regarding the use of ventilation in storage buildings is further supported by information contained in NFPA 231 and NFPA 231C.

Section 3-2 in the 1998 edition of NFPA 231, the Standard for General Storage, states the following with the respect to the use of smoke/heat vents and draft curtains in sprinklered storage buildings:

> "The protection outlined in the standard shall apply to buildings with or without roof vents and draft curtains."

The exception to this section in NFPA 231 states the following:

> "Where local codes require heat and smoke vents in buildings that are protected by ESFR sprinklers, the vents shall be manually operated or shall have an operating mechanism with a standard response fusible element that is rated no less that 360F. Drop out vents shall not be permitted."

Section A-3-2 in NFPA 231 provides additional information regarding the use of smoke/heat vents in sprinklered buildings to which NFPA 231 is applicable. This section states the following:

> "Smoke removal is important to manual fire fighting and overhaul. Since most fire tests were conducted without smoke and heat venting, the protection specified in Sections 5-1, 6-1 and 7-1 was developed without the use of such venting. However, venting through eaveline windows, doors, monitors, or gravity or mechanical exhaust systems is essential to smoke removal after control of the fire is achieved. (See NFPA 204, Guide for Smoke and Heat Venting.)"

While section 3-2 in NFPA 231 states that the use of smoke/heat vents is acceptable in buildings where NFPA 231 is applicable, the explanatory material contained in Appendix A of NFPA 231 clearly indicates that the use of manually operated roof vents or some other method of ventilation is preferred. The fact that this exception regarding the use of vents with ESFR sprinklers is included in NFPA 231 is an admission that heat/roof vents can affect the operation of ESFR sprinklers. Given the exception to section 3-2 in NFPA 231, along with the information on venting in sprinklered buildings provided in NFPA 204, certainly the wisdom of providing automatic smoke/heat vents in buildings protected by standard sprinklers should be questioned.

NFPA 231C, the Standard for Rack Storage of Materials, also addresses the use of smoke/heat vents in sprinklered buildings. Section 3-3 in the 1998 edition of NFPA 231C reads as follows:

> "Design curves are based on the assumption that roof vents and draft curtains are not being used."

Explanatory material provided in section B-3-3 in NFPA 231 provides further information on the use of smoke/heat vents in sprinklered storage buildings which contain storage racks. This section reads as follows:

"Tests were conducted as a part of this program with eave line windows and louvers open to simulate smoke and heat venting. These tests opened 87.5 percent and 91 percent more sprinklers that did comparative tests without windows and louvers open. Venting tests that have been conducted in other programs were without the benefit of sprinkler protection and, as such, are not considered in this report, which covers only buildings protected by sprinklers. The design curves are based upon the absence of roof vents or draft curtains in the building. During mop-up operations, ventilating systems, were installed, should be capable of manual exhaust operations."

NFPA 231C also contains information on fire department operations for buildings protected by sprinkler systems designed to comply with NFPA 231C. Section A-12-6 in NFPA 231C reads as follows:

"Sprinkler protection installed as required in this standard is expected to protect the building occupancy without supplemental fire department activity. Fires that occur in rack storage occupancies are likely to be controlled within the limits outlined in B-1.1, since no significant building damage is expected. The first fire department pumper arriving at a rack storage-type fire should connect immediately to the sprinkler siamese fire department connection and start pumping operations.

In the test series for storage up to 25 ft [feet], the average time from ignition to smoke obscuration in the test building was about 13 minutes. The first sprinkler operating time in these same fires averaged about 3 minutes. Considering response time for the waterflow device to transmit a waterflow signal, approximately 9 minutes remains between the time of receipt of a waterflow alarm signal at fire department headquarters and the time of smoke obscuration with the building as an overall average.

In the test series for storage over 25 ft [feet], the visibility time was extended. If the fire department or plant protection department arrives at the building in time to have sufficient visibility to locate the fire, suppression activities with small hose lines should be started. . . . .Manual fire-fighting operations in such a warehouse should not be considered a substitute for sprinkler operation.

Smoke removal capability should be provided. Examples of smoke removal equipment include:

(a) Mechanical air-handling systems
(b) Powered exhaust fans
(c) Roof-mounted gravity vents
(d) Perimeter gravity vents

> Whichever system is selected, it should be designed for manual actuation by the fire department, thus allowing personnel to coordinate the smoke removal (ventilation) with mop-up operations."
>
> During the testing program, the installed automatic extinguishing system was capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition. Ventilation operations and mop-up were not started until this point. The use of smoke removal equipment is important."

While it has been stated by proponents of heat/smoke vents that the use of eave line windows is different from the operation of automatic smoke/heat vents, the explanatory materials contained in NFPA 231C clearly states that automatic venting should not be provided. Given the explanatory material cited above, it can be concluded that providing automatic smoke/heat vents in a building which is required to comply with NFPA 231C is, in fact, a violation of NFPA 231C.

The purpose of providing heat/smoke vents in a storage building is to vent both heat and smoke to improve visibility within the building and prevent structural damage to the roof of the building. Venting heat and smoke from the building will more safely permit the fire department to enter the building and attack the fire. Given the information provided in both NFPA 13E and in NFPA 231C, the question is why should the fire department enter the building to attack the fire. NFPA 231C clearly indicates that a sprinkler system designed per NFPA 231C is "capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition." If the sprinkler system is capable of achieving this level of control, why should the fire department enter the building and put its personnel at risk? Providing smoke/heat vents in the building encourages fire department personnel to enter the building and puts firefighters at risk.

Recently (April 2005), the National Institute of Occupational Safety and Health (NIOSH) issued a NIOSH Alert titled “Preventing Injuries and Deaths of Firefighters Due to Truss System Failures”. Page 7 of the NIOSH Alert includes the following statement:

> “Fire fighters should be discouraged from risking their lives solely for property protection activities.”

Given that sprinkler protection is “capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition” and that “fire fighters should be discouraged from risking their lives solely for property protection activities” means that the proper fire fighting strategy in large one story industrial and storage buildings is to delay manual fire fighting activity for a period of at least 30 minutes to allow the sprinkler system to extinguish the fire. In the event that the sprinkler system fails to control and extinguish the fire, no interior manual fire fighting should be attempted merely to protect property. Hence, there is no need to provide roof vents to assist fire fighting in large industrial and storage buildings.

Factory Mutual's opinion of the use of automatic smoke/heat vents is expressed by the following excerpt from FM Data Sheet 8-33 dated January, 1984:

> "Factory Mutual recommended protection is based on roof vents and draft curtains not being provided. Fire tests have not shown automatic vents to be cost effective and they may even increase sprinkler water demand. Hence, permanent heat and smoke vents, if any, should be arranged for manual operation. Smoke removal during mop-up operations can frequently be achieved through eave-line windows, doors, monitors, non-automatic exhaust systems (gravity or mechanical), or manually operated heat and smoke vents. Fire departments can cut holes in steel or wood roofs and also use their smoke exhausters."

If the premier property insurer in the United States is on record as stating that the installation of smoke/heat vents is not cost effective (as early as 1984), then the question should be asked-why should the membership of the International Code Council mandate this fire protection technology?

Prior to the development of the International Fire Code, two of the three model fire prevention codes used in the United States, the Uniform Fire Code and the Standard Fire Prevention Code, required the installation of the smoke/heat vents in large storage buildings, while the third model fire prevention code, the BOCA National Fire Prevention Code, did not include requirements for smoke/heat vents. Given this, it should be a relatively easy research task to compare the property losses from fires in storage buildings in jurisdictions using the BOCA National Fire Prevention Code and the losses from fire in storage buildings located in jurisdictions using the two other model fire prevention codes. If the fire loss statistics for storage buildings in BOCA jurisdictions is not significantly higher than the fire loss statistics in ICBO and SBCCI jurisdictions, this would be an indication that the installation of smoke/heat vents is simply not effective. Prior to commencing the AAMA study of smoke/heat vents, the AAMA should concentrate on providing statistics which demonstrate the effectiveness of vents.

Given the technical information presented above, along with the fact that the manufacturers of smoke/heat vents have presented no statistics that their products are, in fact, effective at reducing property losses, the membership of the ICC should remove the requirements for smoke/heat vents (until such time as the industry provides conclusive proof that vents actually work as represented).

The fire protection field has wrestled with this issue for more that 30 years. There is absolutely no reason why the vent industry couldn't have conducted its proposed research 25 years ago. Eliminating the requirement for vents in the code should be an incentive for the vent manufacturers to quickly complete its testing program and provide conclusive proof one way or the other on the need for vents.

It should be noted that a similar proposal to delete the requirements for roof vents was submitted to the ICC in 2000 (Birmingham, Alabama). The committee hearing this proposal voted to deny the proposal given that the vent industry was involved in a testing program announced in September 1999. Since the committee's denial of this proposal, the vent industry has not published any results from their research program. This fact is a tantamount admission by the vent industry that the proposal to eliminate the requirement for roof vents in sprinklered buildings has merit.

It is my opinion that the installation of roof vents and draft curtains in sprinklered buildings is in the realm of "junk science". In the absence of the independent research which conclusively demonstrates that the installation of roof vents and draft curtains is not only not detrimental to the operation of sprinklers, but is also effective, the requirements for the installation of roof vents and draft curtains should be removed from both the IBC and the IFC.

Bibliography:

Fire Protection Handbook-15th Edition (1981)
FM Data Sheet 8-33, January, 1984
NFPA 13, 1999 edition
NFPA 13E, 1995 edition
NFPA 204M, 1991 edition
NFPA 204, 1998 edition.
NFPA 204, 2002 edition.
NFPA 231, 1998 edition
NFPA 231C, 1998 edition
"Preventing Injuries and Deaths of Firefighters Due to Truss System Failures, NIOSH Alert, April 2005

[F] 910.3.1.2 Sprinklered buildings. Where installed in buildings provided with an approved automatic sprinkler systems, smoke and heat vents shall not be designed to operate automatically.

Purpose:

The purpose of this proposal is to delete the requirement that roof vents in sprinklered buildings operate automatically and to specifically require that roof vents in sprinklered buildings only operate manually.

Reason:

Factory Mutual's opinion of the use of automatic smoke/heat vents is expressed by the following excerpt from FM Data Sheet 8-33 dated January, 1984:

> "Factory Mutual recommended protection is based on roof vents and draft curtains not being provided. Fire tests have not shown automatic vents to be cost effective and they may even increase sprinkler water demand. Hence, permanent heat and smoke vents, if any, should be arranged for manual operation. Smoke removal during mop-up operations can frequently be achieved through eave-line windows, doors, monitors, non-automatic exhaust systems (gravity or mechanical), or manually operated heat and smoke vents. Fire departments can cut holes in steel or wood roofs and also use their smoke exhausters."

The installation of roof vents in sprinklered buildings which contain high-piled storage is also specifically addressed in NFPA 13. Section 7.4.1.3.1 in the 1999 edition of NFPA 13 reads as follows:

> “Sprinkler protection criteria is based on the assumption that roof vents and draft curtains are not being used.”

Section C-7.4.1.3.1 in the 1999 edition of NFPA 13 also addresses this issue as follows:

> “. . . The design curves are based upon the absence of roof vents or draft curtains in the building.”

Given Factory Mutual’s and NFPA 13's statements regarding the use of roof vents in sprinklered buildings, it can be concluded that the installation of automatic roof vents in sprinklered buildings is not considered to be accepted engineering practice. Based upon this, if roof vents are provided in sprinklered buildings, the vents should not operate automatically.

Bibliography

FM Data Sheet 8-33, January, 1984
NFPA 13, 1999 edition

Table 2306.2
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS

Delete column titled “Smoke and heat removal”.

Delete Note j (Table 2306.2)

~~**2306.7 Smoke and heat removal.** Where smoke and heat removal are required by Table 2306.2, smoke and heat vents shall be provided in accordance with Section 910. Where draft curtains are required by Table 2306.3, they shall be provided in accordance with Section 910.3.4.~~

Purpose:

The purpose of this proposal is to delete the requirements for smoke and heat removal (roof vents) in buildings which contain high-piled combustible storage.

Reason:

In a memorandum dated September 10, 1999, the American Architectural Manufacturers Association (AAMA) announced the commencement of AAMA Smoke Vent Task Group's research project on the use of smoke/heat vents. The announcement states that the purpose of this research project is to "study the interaction between sprinklers, smoke/heat vents and draft curtains" and "to develop scientifically based engineering design criteria for the installation of draft curtains and vents."

The AAMA memorandum is essentially an admission by the AAMA Smoke Vent Task Group in 1999 that we do not presently have sufficient information on the interaction between sprinklers, smoke/heat vents and draft curtains to utilize smoke/heat and draft curtains in buildings which are protected by sprinklers. Given this admission by the AAMA, it would seem questionable that the International Building Code and International Fire Code should mandate the use of smoke/heat vents and draft curtains in buildings which are protected throughout by a sprinkler system.

To date, the AAMA Smoke Vent Task Group has yet to complete the research project announced in September, 1999.

Chapter 10 in Section 5 of the 15th Edition of the Fire Protection Handbook published by the National Fire Protection Association in 1981 states the following:

"Even though there is no universally accepted conclusion from either fire experience or research, concern has been raised by a recent series of model studies that indicate the following trends when the present Smoke and Heat Venting Guide is implemented:

1. Venting delays loss of visibility;

2. Venting results in increased fuel consumption; and

3. Depending on 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."

Chapter 6 in the 1991 edition of NFPA 204M, the Guide for Smoke and Heat Venting, specifically addresses the use of smoke/heat vents in sprinklered buildings. Section 6-1 in this edition of NFPA 204M states the following:

"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."

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In addition to this statement, Chapter 6 in the 1991 edition of NFPA 204M contains the exact same statement quoted above from the 15th edition on the NFPA Fire Protection Handbook.

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> "Vents that are open prior to sprinkler operation in a region surrounding the ignition point, within a radius of 1-1/2 sprinkler spacings, can interfere with the opening of sprinklers capable of delivering water to the fire."

> "Draft curtains can delay or prevent operation and can interfere with the discharge of sprinklers capable of delivering water to the fire."

The above is an indication that, from the early 1980's to the present day, questions still persist about whether it is appropriate to use of smoke/heat vents and draft curtains in buildings which are protected by sprinklers.

The installation of roof vents in sprinklered buildings which contain high-piled storage is also specifically addressed in NFPA 13. Section 7.4.1.3.1 in the 1999 edition of NFPA 13 reads as follows:

> "Sprinkler protection criteria is based on the assumption that roof vents and draft curtains are not being used."

Section C-7.4.1.3.1 in the 1999 edition of NFPA 13 also addresses this issue as follows:

> ". . . The design curves are based upon the absence of roof vents or draft curtains in the building."

Section 2-6.1 in the 1995 edition of NFPA 13E, the Guide for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems states the following with regard to routine ventilation in sprinklered storage buildings:

> "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 feet. In some cases, routine ventilation procedures in the early stages of a fire can hinder effective sprinkler operation. It is desirable for the fire department to discuss its pre-fire plan for warehouse occupancies with the occupant, sprinkler designer, and insurance carrier to determine if a modification in procedures is appropriate."

Section 2-6.2 in NFPA 13E (1995 edition) further states the following:

> "For those 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[utes] or more."

The information from NFPA 13E regarding the use of ventilation in storage buildings is further supported by information contained in NFPA 231 and NFPA 231C.

Section 3-2 in the 1998 edition of NFPA 231, the Standard for General Storage, states the following with the respect to the use of smoke/heat vents and draft curtains in sprinklered storage buildings:

> "The protection outlined in the standard shall apply to buildings with or without roof vents and draft curtains."

The exception to this section in NFPA 231 states the following:

> "Where local codes require heat and smoke vents in buildings that are protected by ESFR sprinklers, the vents shall be manually operated or shall have an operating mechanism with a standard response fusible element that is rated no less that 360F. Drop out vents shall not be permitted."

Section A-3-2 in NFPA 231 provides additional information regarding the use of smoke/heat vents in sprinklered buildings to which NFPA 231 is applicable. This section states the following:

> "Smoke removal is important to manual fire fighting and overhaul. Since most fire tests were conducted without smoke and heat venting, the protection specified in Sections 5-1, 6-1 and 7-1 was developed without the use of such venting. However, venting through eaveline windows, doors, monitors, or gravity or mechanical exhaust systems is essential to smoke removal after control of the fire is achieved. (See NFPA 204, Guide for Smoke and Heat Venting.)"

While section 3-2 in NFPA 231 states that the use of smoke/heat vents is acceptable in buildings where NFPA 231 is applicable, the explanatory material contained in Appendix A of NFPA 231 clearly indicates that the use of manually operated roof vents or some other method of ventilation is preferred. The fact that this exception regarding the use of vents with ESFR sprinklers is included in NFPA 231 is an admission that heat/roof vents can affect the operation of ESFR sprinklers. Given the exception to section 3-2 in NFPA 231, along with the information on venting in sprinklered buildings provided in NFPA 204, certainly the wisdom of providing automatic smoke/heat vents in buildings protected by standard sprinklers should be questioned.

NFPA 231C, the Standard for Rack Storage of Materials, also addresses the use of smoke/heat vents in sprinklered buildings. Section 3-3 in the 1998 edition of NFPA 231C reads as follows:

> "Design curves are based on the assumption that roof vents and draft curtains are not being used."

Explanatory material provided in section B-3-3 in NFPA 231 provides further information on the use of smoke/heat vents in sprinklered storage buildings which contain storage racks. This section reads as follows:

> "Tests were conducted as a part of this program with eave line windows and louvers open to simulate smoke and heat venting. These tests opened 87.5 percent and 91 percent more sprinklers that did comparative tests without windows and louvers open. Venting tests that have been conducted in other programs were without the benefit of sprinkler protection and, as such, are not considered in this report, which covers only buildings protected by sprinklers. The design curves are based upon the absence of roof vents or draft curtains in the building. During mop-up operations, ventilating systems, were installed, should be capable of manual exhaust operations."

NFPA 231C also contains information on fire department operations for buildings protected by sprinkler systems designed to comply with NFPA 231C. Section A-12-6 in NFPA 231C reads as follows:

> "Sprinkler protection installed as required in this standard is expected to protect the building occupancy without supplemental fire department activity. Fires that occur in rack storage occupancies are likely to be controlled within the limits outlined in B-1.1, since no significant building damage is expected. The first fire department pumper arriving at a rack storage-type fire should connect immediately to the sprinkler siamese fire department connection and start pumping operations.

In the test series for storage up to 25 ft [feet], the average time from ignition to smoke obscuration in the test building was about 13 minutes. The first sprinkler operating time in these same fires averaged about 3 minutes. Considering response time for the waterflow device to transmit a waterflow signal, approximately 9 minutes remains between the time of receipt of a waterflow alarm signal at fire department headquarters and the time of smoke obscuration with the building as an overall average.

In the test series for storage over 25 ft [feet], the visibility time was extended. If the fire department or plant protection department arrives at the building in time to have sufficient visibility to locate the fire, suppression activities with small hose lines should be started. . . . . .Manual fire-fighting operations in such a warehouse should not be considered a substitute for sprinkler operation.

Smoke removal capability should be provided. Examples of smoke removal equipment include:

(a) Mechanical air-handling systems
(b) Powered exhaust fans
(c) Roof-mounted gravity vents
(d) Perimeter gravity vents

Whichever system is selected, it should be designed for manual actuation by the fire department, thus allowing personnel to coordinate the smoke removal (ventilation) with mop-up operations."

During the testing program, the installed automatic extinguishing system was capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition. Ventilation operations and mop-up were not started until this point. The use of smoke removal equipment is important."

While it has been stated by proponents of heat/smoke vents that the use of eave line windows is different from the operation of automatic smoke/heat vents, the explanatory materials contained in NFPA 231C clearly states that automatic venting should not be provided. Given the explanatory material cited above, it can be concluded that providing automatic smoke/heat vents in a building which is required to comply with NFPA 231C is, in fact, a violation of NFPA 231C.

The purpose of providing heat/smoke vents in a storage building is to vent both heat and smoke to improve visibility within the building and prevent structural damage to the roof of the building. Venting heat and smoke from the building will more safely permit the fire department to enter the building and attack the fire. Given the information provided in both NFPA 13E and in NFPA 231C, the question is why should the fire department enter the building to attack the fire. NFPA 231C clearly indicates that a sprinkler system designed per NFPA 231C is "capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition." If the sprinkler system is capable of achieving this level of control, why should the fire department enter the building and put its personnel at risk? Providing smoke/heat vents in the building encourages fire department personnel to enter the building and puts firefighters at risk

Recently (April 2005), the National Institute of Occupational Safety and Health (NIOSH) issued a NIOSH Alert titled “Preventing Injuries and Deaths of Firefighters Due to Truss System Failures”. Page 7 of the NIOSH Alert includes the following statement:

> “Fire fighters should be discouraged from risking their lives solely for property protection activities.”

Given that sprinkler protection is “capable of controlling the fire and reducing all temperatures to ambient within 30 minutes of ignition” and that “fire fighters should be discouraged from risking their lives solely for property protection activities” means that the proper fire fighting strategy in large one story industrial and storage buildings is to delay manual fire fighting activity for a period of at least 30 minutes to allow the sprinkler system to extinguish the fire. In the event that the sprinkler system fails to control and extinguish the fire, no interior manual fire fighting should be attempted merely to protect property. Hence, there is no need to provide roof vents to assist fire fighting in large industrial and storage buildings.

Factory Mutual's opinion of the use of automatic smoke/heat vents is expressed by the following excerpt from FM Data Sheet 8-33 dated January, 1984:

> "Factory Mutual recommended protection is based on roof vents and draft curtains not being provided. Fire tests have not shown automatic vents to be cost effective and they may even increase sprinkler water demand. Hence, permanent heat and smoke vents, if any, should be arranged for manual operation. Smoke removal during mop-up operations can frequently be achieved through eave-line windows, doors, monitors, non-automatic exhaust systems (gravity or mechanical), or manually operated heat and smoke vents. Fire departments can cut holes in steel or wood roofs and also use their smoke exhausters."

If the premier property insurer in the United States is on record as stating that the installation of smoke/heat vents is not cost effective (as early as 1984), then the question should be asked-why should the membership of the International Code Council mandate this fire protection technology?

Prior to the development of the International Fire Code, two of the three model fire prevention codes used in the United States, the Uniform Fire Code and the Standard Fire Prevention Code, required the installation of the smoke/heat vents in large storage buildings, while the third model fire prevention code, the BOCA National Fire Prevention Code, did not include requirements for smoke/heat vents. Given this, it should be a relatively easy research task to compare the property losses from fires in storage buildings in jurisdictions using the BOCA National Fire Prevention Code and the losses from fire in storage buildings located in jurisdictions using the two other model fire prevention codes. If the fire loss statistics for storage buildings in BOCA jurisdictions is not significantly higher than the fire loss statistics in ICBO and SBCCI jurisdictions, this would be an indication that the installation of smoke/heat vents is simply not effective. Prior to commencing the AAMA study of smoke/heat vents, the AAMA should concentrate on providing statistics which demonstrate the effectiveness of vents.

Given the technical information presented above, along with the fact that the manufacturers of smoke/heat vents have presented no statistics that their product s are, in fact, effective at reducing property losses, the membership of the ICC should remove the requirements for smoke/heat vents (until such time as the industry provides conclusive proof that vents actually work as represented).

The fire protection field has wrestled with this issue for more that 30 years. There is absolutely no reason why the vent industry couldn't have conducted its proposed research 25 years ago. Eliminating the requirement for vents in the code should be an incentive for the vent manufacturers to quickly complete its testing program and provide conclusive proof one way or the other on the need for vents.

It should be noted that a similar proposal to delete the requirements for roof vents was submitted to the ICC in 2000 (Birmingham, Alabama). The committee hearing this proposal voted to deny the proposal given that the vent industry was involved in a testing program announced in September 1999. Since the committee's denial of this proposal, the vent industry has not published any results from their research program. This fact is a tantamount admission by the vent industry that the proposal to eliminate the requirement for roof vents in sprinklered buildings has merit.

It is my opinion that the installation of roof vents and draft curtains in sprinklered buildings is in the realm of "junk science". In the absence of the independent research which conclusively demonstrates that the installation of roof vents and draft curtains is not only not detrimental to the operation of sprinklers, but is also effective, the requirements for the installation of roof vents and draft curtains should be removed from both the IBC and the IFC.

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