CTC Meeting #25
CTC ROOF VENT STUDY GROUP
GROUP B CODE CHANGE DRAFT IN PROGRESS
11/21/2012

This report includes one Group B code change draft from the Roof Vent SG.

Fxx - 13

910 (IBC [F]910);

Proponents: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee

1. Revise as follows:

SECTION 910 (IBC [F]910)
SMOKE AND HEAT REMOVAL

910.1 (IBC [F]910.1) General. Where required by this code ~~or otherwise installed~~, smoke and heat vents or mechanical smoke ~~exhaust~~ removal systems and draft curtains shall conform to the requirements of this section.

Exception~~s~~:

~~1.~~ Frozen food warehouses used solely for storage of Class I and II commodities where protected by an *approved automatic sprinkler system*.

~~2. Where areas of buildings are equipped with early suppression fast-response (ESFR) sprinklers, automatic smoke and heat vents shall not be required within these areas.~~

910.2 (IBC [F]910.2) Where required. Smoke and heat vents or a mechanical smoke removal system shall be installed ~~in the roofs of buildings or portions thereof occupied for the uses set forth in~~ as required by Sections 910.2.1 ~~and 910.2.2~~ through 910.2.3.

Exception: In occupied portions of a building where the upper surface of the story is not a roof assembly, mechanical smoke ~~exhaust~~ removal in accordance with Section 910.4 shall be installed ~~an acceptable alternative~~.

910.2.1 (IBC [F]910.2.1) Group F-1 or S-1. Buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m2) of undivided area.

Exception: Group S-1 aircraft repair hangars.

910.2.2 (IBC [F]910.2.2) High-piled combustible storage. Smoke and heat removal required by Table 3206.2, for buildings and portions thereof containing high-piled combustible ~~stock or rack~~ storage shall be installed in accordance with section 910.3 for smoke and heat vents ~~in any occupancy group when required by Section 3206.7.~~

910.3 (IBC [F]910.3) Smoke and heat vents ~~Design and installation~~. Where required by Section 910 in buildings not protected by an automatic sprinkler system, the design and installation of smoke and heat vents ~~and draft curtains~~ shall be ~~as specified~~ in accordance with Sections 910.3.1 through 910.3.3 ~~910.3.5.2 and Table 910.3~~.

~~**TABLE 910.3**~~
~~**REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS**~~
(Delete the table and its footnotes in their entirety.)

910.3.1 (IBC [F]910.3.1) ~~**Design**~~ **Listing and labeling.** Smoke and heat vents shall be *listed* and labeled to indicate compliance with UL 793 or FM 4430.

~~**910.3.2 (IBC [F]910.3.2) Vent operation.** Smoke and heat vents shall be capable of being operated by *approved* automatic and manual means. Automatic operation of smoke and heat vents shall conform to the provisions of Sections 910.3.2.1 through 910.3.2.3.~~

~~**910.3.2.1 (IBC [F]910.3.2.1) Gravity-operated drop-out vents.** Automatic smoke and heat vents containing heat-sensitive glazing designed to shrink and drop out of the vent opening when exposed to fire shall fully open within 5 minutes after the vent cavity is exposed to a simulated fire, represented by a time-temperature gradient that reaches an air temperature of 500°F (260°C) within 5 minutes.~~

~~**910.3.2.2 (IBC [F]910.3.2.2) Sprinklered buildings.** Where installed in buildings provided with an *approved automatic sprinkler system*, smoke and heat vents shall be designed to operate automatically.~~

~~**910.3.2.3 (IBC [F]910.3.2.3) Nonsprinklered buildings.** Where installed in buildings not provided with an *approved automatic sprinkler system*, smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (38°C) and 220°F (104°C) above ambient.~~

~~**Exception:** Gravity-operated drop-out vents complying with Section 910.3.2.1.~~

~~**910.3.3 (IBC [F]910.3.3) Vent dimensions.** The effective venting area shall not be less than 16 square feet (1.5 m_2) with no dimension less than 4 feet (1219 mm), excluding ribs or gutters having a total width not exceeding 6 inches (152 mm).~~

910.3.2 (IBC [F]910.3.2) ~~**910.3.4 (IBC [F]910.3.4)**~~ **Vent locations.** Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent *lot lines* and *fire walls* and 10 feet (3048 mm) or more from *fire barriers*. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2, with consideration given to roof pitch, draft curtain location, sprinkler location and structural members.

910.3.3 Smoke and heat vents area. The required gross area of smoke and heat vents shall be calculated as follows:

$A_{VR} = V/9000$ **(Equation 9-4)**

Where:

A_{VR} = the required gross vent area (ft^2)

V = volume of smoke compartment (ft^3) that must be displaced twice per hour

~~**910.3.5 (IBC [F]910.3.5) Draft curtains.** Where required by Table 910.3, draft curtains shall be installed on the underside of the roof in accordance with this section.~~

~~**Exception:** Where areas of buildings are equipped with ESFR sprinklers, draft curtains shall not be provided within these areas. Draft curtains shall only be provided at the separation between the ESFR sprinklers and the non-ESFR sprinklers.~~

~~**910.3.5.1 (IBC [F]910.3.5.1) Construction.** Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other *approved* materials that provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.~~

~~**910.3.5.2 (IBC [F]910.3.5.2) Location and depth.** The location and minimum depth of draft curtains shall be in accordance with Table 910.3.~~

910.4 (IBC [F]910.4) Mechanical smoke removal systems ~~exhaust~~. ~~Where *approved* by the *fire code official*, engineered~~ Mechanical smoke removal systems ~~exhaust~~ shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7 ~~an acceptable alternative to smoke and heat vents~~.

910.4.1 Automatic sprinklers required. The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

910.4.2 (IBC [F]910.4.2) Exhaust fan construction. Exhaust fans that are part of the mechanical smoke removal system shall be rated for operation at ambient temperatures. Exhaust fan motors shall be located outside of the exhaust fan air stream.

910.4.3 (IBC [F]910.4.3) System design criteria. The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based upon the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute. Make-up air shall be provided within six feet (add metric) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of make-up air inlets shall be 8 ft^2 per 1000 cfm of smoke exhaust.

910.4.4 (IBC [F]910.4.4) Activation. The mechanical smoke removal system shall be activated by manual controls only.

910.4.5 (IBC [F]910.4.5) Manual control location. Manual controls shall be located so as to be accessible to the fire service from an exterior door of the building and be protected against interior fire exposure by not less than 1-hour fire barriers constructed in accordance with Section 707 of the *International Building Code* or horizontal assemblies constructed in accordance with Section 712 of the *International Building Code*, or both.

~~**910.4.1 (IBC [F]910.4.1) Location.** Exhaust fans shall be uniformly spaced within each draft-curtained area and the maximum distance between fans shall not be greater than 100 feet (30 480 mm).~~

~~**910.4.2 (IBC [F]910.4.2) Size.** Fans shall have a maximum individual capacity of 30,000 cfm (14.2 m^3/s). The aggregate capacity of smoke exhaust fans shall be determined by the equation:~~

~~$C = A \times 300$ **(Equation 9-4)**~~

~~where:~~

~~C = Capacity of mechanical ventilation required, in cubic feet per minute (m^3/s).~~

~~A = Area of roof vents provided in square feet (m^2) in accordance with Table 910.3.~~

~~**910.4.3 (IBC [F]910.4.3) Operation.** Mechanical smoke exhaust fans shall be automatically activated by the *automatic sprinkler system* or by *heat detectors* having operating characteristics equivalent to those described in Section 910.3.2. Individual manual controls for each fan unit shall also be provided.~~

910.4.6 (IBC [F]910.4.6) ~~**910.4.4 (IBC [F]910.4.4)**~~ **Wiring and control.** Wiring for operation and control of mechanical smoke removal systems ~~exhaust fans~~ shall be connected ahead of the main disconnect and be protected against interior fire exposure ~~to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes. Controls shall be located so as to be immediately accessible to the fire service from the exterior of the building and protected against interior fire exposure~~ by not less than 1-hour *fire barriers* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assemblies* constructed in accordance with Section 711 of the *International Building Code,* or both.

~~**910.4.5 (IBC [F]910.4.5) Supply air.** Supply air for exhaust fans shall be provided at or near the floor level and shall be sized to provide a minimum of 50 percent of required exhaust. Openings for supply air shall be uniformly distributed around the periphery of the area served.~~

910.4.7 (IBC [F]910.4.7) ~~**910.4.6 (IBC [F]910.4.6)**~~ **Interlocks.** ~~On combination comfort air-handling/smoke removal systems or independent comfort air-handling systems, fans shall be controlled to shut down in accordance with the *approved* smoke control sequence.~~ Where building air handling and smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *International Mechanical Code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.

910.5 Maintenance. Smoke and heat vents and mechanical smoke removal ~~exhaust~~ systems shall be maintained in an operative condition in accordance with Section 910.5.1 or 910.5.2, respectively ~~NFPA 204~~.

910.5.1 Smoke and heat vents. Smoke and heat vents shall be maintained in an operative condition in accordance with NFPA 204 and Section 910.5.1.1

910.5.1.1 Fusible links. Fusible links for smoke and heat vents shall be promptly replaced whenever fused, damaged or painted. ~~Smoke and heat vents and mechanical smoke exhaust systems shall not be modified.~~

910.5.2 Mechanical smoke exhaust systems. Mechanical smoke exhaust systems shall be maintained in an operative condition in accordance with the equipment manufacturer's maintenance instructions and Sections 910.5.2.1 through 910.5.2.4.

910.5.2.1 Frequency. Systems shall be operationally tested not less than once per year. Testing shall include the exercise of all system components, including control elements.

910.5.2.2 Testing. Operational testing of the smoke control system shall include all equipment such as fans, controls and make-up air openings.

910.5.2.3 Schedule. A routine maintenance and operational testing program shall be initiated and a written schedule for routine maintenance and operational testing shall be established.

910.5.2.4 Written record. A written record of mechanical smoke exhaust system testing and maintenance shall be maintained on the premises. The written record shall include

the date of the maintenance, identification of the servicing personnel and notification of any unsatisfactory condition and the corrective action taken, including parts replaced.

2. Revise as follows:

901.6.1 Standards. *Fire protection systems* shall be inspected, tested and maintained in accordance with the referenced standards *listed* in Table 901.6.1.

TABLE 901.6.1
FIRE PROTECTION SYSTEM MAINTENANCE STANDARDS

SYSTEM	STANDARD
Portable fire extinguishers	NFPA 10
Carbon dioxide fire-extinguishing system	NFPA 12
Halon 1301 fire-extinguishing systems	NFPA 12A
Dry-chemical extinguishing systems	NFPA 17
Wet-chemical extinguishing systems	NFPA 17A
Water-based fire protection systems	NFPA 25
Fire alarm systems	NFPA 72
~~Mechanical smoke exhaust systems~~	~~NFPA 204~~
Smoke and heat vents	NFPA 204
Water-mist systems	NFPA 750
Clean-agent extinguishing systems	NFPA 2001

3. Revise as follows:

3206.7 Smoke and heat removal. Where smoke and heat removal is ~~are~~ required by Table 3206.2, ~~smoke and heat vents~~ it shall be provided in accordance with Section 910. ~~Where draft curtains are required by Table 3206.2, they shall be provided in accordance with Section 910.3.5.~~

4. Add new standards to Chapter 80 (IBC Chapter 35) as follows:

FM

4430-07	Approval Standard for Heat and Smoke Vents	910.3.1

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/CTC/Pages/default.aspx. Since its inception in April/2005, the CTC has held twenty five meetings - all open to the public.

This proposed change is a result of the CTC's investigation of smoke and heat removal through the Roof Vent Study Group, which is part of the area of study, entitled "Balanced Fire Protection."

The scope of the activity is noted as: *"To investigate what constitutes an acceptable balance between active fire protection and passive fire protection measures with respect to meeting the fire and life safety objectives of the IBC."*

The purpose of this proposed code change is to update the provisions which mandate roof vents in industrial and storage buildings based upon technical information on the operation of roof vents which has been developed in the United States over the last 20 years. The Roof Vent Study Group has based its proposed revisions to the roof vent provisions based upon the following:

1. The results of research on the interaction of sprinklers, roof vents and draft curtains conducted at Underwriters Laboratories (UL), Inc. in 1997/1998.

2. The capability of standard spray (control-mode) sprinklers to both control and extinguish a fire in high-piled storage within 30 minutes of sprinkler operation, without supplemental fire department activity.

3. Provisions for the use of roof vents in sprinklered buildings included in the 2010 edition of NFPA 13, including the substantiation statement for the NFPA 13 roof vent provisions.

4. Recommendations contained in NIOSH 2005-132, *Preventing Injuries and Deaths of Fire Fighters Due to Truss Systems*, and NIOSH 2010-153, *Preventing Deaths and Injuries of Fire Fighters using Risk Management Principles at Structure Fires*.

5. Recommendations contained in the Initial Report of the FEMA/NFFF® Firefighter Life Safety Summit held on April 14, 2004 in Tampa, Florida.

The research on the interaction of sprinklers, roof vents and draft curtains conducted at UL in 1997/1998 (summarized in NISTIR 6196-1) indicates that the operation of standard spray (control-mode) sprinklers interferes with the automatic opening of individually-activated roof vents where the temperature rating of the sprinklers and the roof vent fusible element is the same. The research indicates that the maximum number of roof vents will likely open automatically is limited to one and that no vents will open in many cases (where the sprinkler system is operational and successfully controls the fire).

The roof vent provisions included in the 2010 edition of NFPA 13 require that the roof vent fusible element be one temperature rating classification higher than the temperature classification rating of the sprinklers. The substantiation statement for the roof vent provisions included in NFPA 13 indicates that roof vents should not be used in storage buildings protected by a sprinkler system.

NIOSH 2005-132 recommends defensive (exterior) fire-fighting tactics be utilized in buildings in which floors or roofs are supported by trusses which are not protected by fire resistive materials (or sprinkler protection).

NIOSH 2010-153 recommends that risk management principles be utilized to determine whether offensive (interior manual) fire-fighting tactics or defensive (exterior) fire-fighting tactics be utilized. This NIOSH Alert indicates that number of fire fighters and equipment available at the scene be used to determine whether offensive or defensive tactics should be used.

The Initial Report from the Firefighter Life Safety Summit held in 2004 recommends risk management principles be utilized in determining whether offensive or defensive fire-fighting tactics should be utilized.

Using the above information, the CTC Roof Vent Study Group determined the following:

1. Individually-activated automatic roof vents provided in buildings protected by standard spray (control-mode) sprinklers will likely be required to be opened manually after fire fighters arrive at the

scene in order to vent heat and smoke (if the sprinkler system is operational and successfully controls the fire).

2. Since individually-activated automatic roof vents will likely be required to be opened manually, the venting of heat and smoke originally assumed to occur when the provisions for roof vents were included in building codes (in the 1970's/1980's) will not actually occur.

3. Most industrial and storage buildings are constructed with non-rated roof construction and the roof construction of many of these buildings is supported by steel trusses or long-span steel bar joists.

4. Given the construction and size of most industrial and storage buildings, NIOSH 2005-132, NIOSH 2010-153 and the Initial Report of the FEMA/NFFF Firefighter Life Safety Summit (held in Tampa in 1994) recommend defensive (exterior) fire-fighting tactics be used in the event of sprinkler system failure.

Considering the above, the Roof Vent Study Group came to the following conclusions:

A. In the event that the sprinkler system operates successfully, supplemental interior fire fighting is not necessary and a fire in high-piled storage will be controlled and extinguished by the sprinkler system in 30 minutes or less.

B. In the event that the sprinkler system does not operate successfully, risk management principles dictate that exterior manual fire fighting operations be utilized.

Based upon these two conclusions, the Study Group determined the following:

1. The installation of individually-activated automatic roof vents does not provide any additional protection for the building during the active phase of the fire in the event that the sprinkler system operates successfully (because the vents will not operate automatically and the buildings are typically too large to safely conduct interior manual fire fighting operations).

2. The installation of individually-activated automatic roof vents do not provide any additional protection for the building in the event that the sprinkler system fails to control the fire (because defensive fire-fighting tactics are recommended due to the roof construction of the buildings and because the buildings are typically too large to safely conduct interior manual fire=fighting operations).

Although automatic roof vents will not provide any additional protection for industrial or storage buildings protected by standard spray (control-mode) sprinklers during the active phase of the fire, the Study Group determined that ventilation provided for these types of buildings can be of assistance during the over-haul of the building (i.e., post (active) fire). This code change proposal provides two design options for ventilation which can be utilized during the over-haul phase of fire-fighting operations-a mechanical exhaust system or roof vents.

The mechanical exhaust system permitted by this change will be required to be sized to exhaust the building at a rate of 2 air changes per hour based upon the volume of the building (when the building is empty). In lieu of providing a mechanical exhaust system, roof vents will be permitted to be provided. The roof vents are intended to be utilized to allow positive pressure ventilation of the building by fire fighters or as make-up air for exhaust fans provided by fire fighters.

The following is a summary of the specific changes made in the roof vent provisions presently contained in the IBC/IFC:

Draft Curtains: The specifications and requirements for draft curtains (910.3.5 through 910.3.5.2; 3206.7) have been eliminated. The basis for this change is that research conducted by Factory

Mutual Research Corporation (FMRC) in 1994 and the research conducted at UL in 1997/ 1998 (referenced above) demonstrated that draft curtains distort the sequence of sprinkler operation and could have a detrimental effect on the capability of the sprinkler system to control the fire. Draft curtains required by NFPA 13 to separate building areas protected by control-mode sprinklers from areas protected by early suppression fast response (ESFR) sprinklers per NFPA 13 would still be required.

Mechanical Exhaust System Exhaust Rate: (under development)

Mechanical Exhaust System Make-Up Air Provisions: (under development)

Mechanical Exhaust System Design Requirements: (under development)

Mechanical Exhaust System Controls: (under development)

Mechanical Exhaust System Protection From Heat: (under development)

Mechanical Exhaust System Power Supply Protection From Heat: (under development)

Mechanical Exhaust System Power Source: (under development)

Roof Vent Sizing Basis-Buildings Protected by a Sprinkler System: (under development)

Roof Vent Sizing Basis-Buildings Not Protected by a Sprinkler System:

Mechanical Exhaust System Maintenance and Periodic Testing: (under development)

Roof Vent Maintenance: (under development)

It should be noted that this proposed code change does not make reference to NFPA 204 for the design of roof vent systems in either buildings protected by a sprinkler system or unsprinklered buildings. The rationale for this is that NFPA 204 does not address the use of roof vents for post-fire ventilation purposes (in sprinklered buildings) and the design provisions for roof vents presently included in NFPA 204 are too complex for application to relatively small buildings where vents would be permitted without sprinkler protection (i.e., buildings with high-piled storage less than 12,000 square feet in floor area).

The proposed code change developed by the Roof Vent Study Group is intended to incorporate the latest technology and research available on the interaction of sprinklers, roof vents and draft curtains, as well as the evolving thinking on fire fighter safety promoted by the National Fallen Firefighter Foundation (NFFF), into the code provisions.

Much of the information on which this code change proposal is based did not exist when the provisions for roof vents were first included in the building/fire codes in the 1970's and 1980's. This proposal is a much needed update in the fire protection provisions for large industrial and storage buildings.

Bibliography

2009 NFPA Technical Committee Report on Proposals (13-325, Log #CP43 AUT-SSD, page 13-8).

FEMA/NFFF® Firefighter Life Safety Summit (April 14, 2004, Tampa, Florida)-Initial Report.

NIOSH 2005-132, Preventing Injuries and Deaths of Fire Fighters Due to Truss Systems.

NIOSH 2010-153, Preventing Deaths and Injuries of Fire Fighters using Risk Management Principles at Structure Fires.

Standard for the Installation of Sprinkler Systems (NFPA 13)-2010 edition (Section 12.1.1).

Cost Impact: This proposal will not increase the cost of constructing industrial and storage buildings, and, in many cases, reduce the cost of constructing these types of buildings.

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NOTE: After preparation of this code change draft, the following review comments on the draft reason statement were received. Due to time constraints, these discussions could not be vetted through a conference call and so are included here so that all study group information on this subject is available to the CTC:

1. -----Original Message-----

From: William Koffel [mailto:wkoffel@koffel.com]
Sent: Thursday, November 15, 2012 2:58 PM
To: fpeschulte@aol.com; Bill Rehr; carl.wren@ci.austin.tx.us; cbaldassarra@RJAGroup.com; richard.davis@fmglobal.com; hansenj@fdny.nyc.gov; isman@nfsa.org; kevin.reinertson@fire.ca.gov; ClementsRo@chesterfield.gov; rnickson@nmhc.org; wschock@ci.san-leandro.ca.us
Cc: Beth Tubbs; rjd@davidsoncodeconcepts.com; rcsconsult@myfairpoint.net; Ed Wirtschoreck; garner.palenske@aon.com; hal.key@mesaaz.gov; imacdonald@cityoforange.org; jharrington@hgi-fire.com; hugo@nfsa.org; jeff.tubbs@arup.com; jim.doctorman@boeing.com; john.harrington@fmglobal.com; JWoestman@kellencompany.com; Julruth@aol.com; ntrauernicht@ucdavis.edu; bob.sampson@acralight.com
Subject: RE: Roof Vent Code Change Proposal-Draft Reason Statement (MS Word)

My comments……

Bill

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss ~~contemporary~~ complex code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as “areas of study”.

(Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/cc/ctc/index.html. Since its inception in April/2005, the CTC has held seventeen meetings - all open to the public.)

The first issue assigned by the ICC Board of Directors to the Code Technology Committee (CTC) in 2005 was to study the issue of "balanced" fire protection. As part of the CTC's review of the "balanced" fire protection issue, the CTC formed a Study Group to review the issue of whether or not smoke/heat vents were necessary in large industrial and storage buildings protected by a sprinkler system. The scope of the activity was defined as the review the current IBC/IFC requirements for smoke/heat vents and draft curtains relative to the issue of "balanced" fire protection.

The purpose of this proposed code change is to update the provisions which mandate roof vents in industrial and storage buildings based upon technical information on the operation of roof vents which has been developed in the United States over the last 20 years . The Roof Vent Study Group has based its proposed revisions to the roof vent provisions based upon the following:

$ The results of research on the interaction of sprinklers, roof vents and draft curtains conducted at Underwriters Laboratories (UL), Inc. in 1997/1998.

$ The capability of standard spray (control-mode) sprinklers to both control and extinguish a fire in high-piled storage within 30 minutes of sprinkler operation, without supplemental fire department activity.

$ Provisions for the use of roof vents in sprinklered buildings included in the 2010 and 2013 editions of NFPA 13.

$ Recommendations contained in NIOSH 2005-132, *Preventing Injuries and Deaths of Fire Fighters Due to Truss Systems*, and NIOSH 2010-153, *Preventing Deaths and Injuries of Fire Fighters using Risk Management Principles at Structure Fires*.
Recommendations contained in the Initial Report of the FEMA/NFFF® Firefighter Life Safety Summit held on April 14, 2004 in Tampa, Florida.

The research on the interaction of sprinklers, roof vents and draft curtains conducted at UL in 1997/1998 (summarized in NISTIR 6196-1) indicates that the operation of standard spray (control-mode) sprinklers interferes with the automatic opening of individually-activated roof vents where the temperature rating of the sprinklers and the roof vent fusible element is the same. The research indicates that the maximum number of roof vents will likely open automatically is limited to one and that no vents will open in many cases (where the sprinkler system is operational and successfully controls the fire).

The roof vent provisions included in the 2010 and 2013 editions of NFPA 13 require that the roof vent fusible element be one temperature rating classification higher than the temperature classification rating of the sprinklers.

Comment [w1]: Substantiation statements are the thoughts of the Submitter.

NIOSH 2005-132 recommends defensive (exterior) fire fighting tactics be utilized in buildings in which floors or roofs are supported by trusses which are not protected by fire resistive materials (or sprinkler protection).

NIOSH 2010-153 recommends that risk management principles be utilized to determine whether offensive (interior manual) fire fighting tactics or defensive (exterior) fire fighting tactics be utilized. This NIOSH Alert indicates that number of fire fighters and equipment available at the scene be used to determine whether offensive or defensive tactics should be used.

The Initial Report from the Firefighter Life Safety Summit held in 2004 recommends risk management principles be utilized in determining whether offensive or defensive fire fighting tactics should be utilized.

Using the above information, the CTC Roof Vent Study Group determined the following:

$ Individually-activated automatic roof vents provided in buildings protected by standard spray (control-mode) sprinklers will likely be required to be opened manually after fire fighters arrive at the scene in order to vent heat and smoke (if the sprinkler system is operational and successfully controls the fire).

$ Since individually-activated automatic roof vents will likely be required to be opened manually, the venting of heat and smoke originally assumed to occur when the provisions for roof vents were included in building codes (in the 1970's/1980's) will not actually occur.

$ Most industrial and storage buildings are constructed with non-rated roof construction and the roof construction of many of these buildings is supported by steel trusses or long-span steel bar joists.

$ Given the construction and size of most industrial and storage buildings, NIOSH 2005-132, NIOSH 2010-153 and the Initial Report of the FEMA/NFFF Firefighter Life Safety Summit (held in Tampa in 1994) recommend defensive (exterior) fire fighting tactics be used in the event of sprinkler system failure.

Considering the above, the Roof Vent Study Group came to the following conclusions:

$ In the event that the sprinkler system operates successfully, supplemental interior fire fighting is not necessary and a fire in high-piled storage will be controlled and extinguished by the sprinkler system in 30 minutes or less.

$ In the event that the sprinkler system does not operate successfully, risk management principles dictate that exterior manual fire fighting operations be utilized.

Based upon these two conclusions, the Study Group determined the following:

$ The installation of individually-activated automatic roof vents may not provide the originally intended protection for the building during the active phase of the fire in the event that the sprinkler system operates successfully (because the vents will not operate automatically and the buildings are typically too large to safely conduct interior manual fire fighting operations).

$ The Study Group determined that ventilation provided for industrial and storage buildings can be of assistance during the over-haul of the building (i.e., post (active) fire). This code change proposal provides two design options for ventilation which can be utilized during the over-haul phase of fire fighting operations-a mechanical exhaust system or roof vents.

The mechanical exhaust system permitted by this change will be required to be sized to exhaust the building at a rate of 2 air changes per hour based upon the volume of the building (when the building is

empty). In lieu of providing a mechanical exhaust system, roof vents will be permitted to be provided. The roof vents are intended to be utilized to allow positive pressure ventilation of the building by fire fighters or as make-up air for exhaust fans provided by fire fighters.

The following is a summary of the specific changes made in the roof vent provisions presently contained in the IBC/IFC:

$ Draft Curtains. The specifications and requirements for draft curtains has been eliminated. The basis for this change is that research conducted by Factory Mutual Research Corporation (FMRC) in 1994 and the research conducted at UL in 1997/ 1998 (referenced above) demonstrated that draft curtains distort the sequence of sprinkler operation and could have a detrimental effect on the capability of the sprinkler system to control the fire. Draft curtains required by NFPA 13 to separate building areas protected by control-mode sprinklers from areas protected by early suppression fast response (ESFR) sprinklers per NFPA 13 would still be required.

$ Mechanical Exhaust System Exhaust Rate. . . . . .

$ Mechanical Exhaust System Make-Up Air Provisions. . . . . .

$ Mechanical Exhaust System Design Requirements. . . . . .

$ Mechanical Exhaust System Controls. . . . .

$ Mechanical Exhaust System Protection From Heat. . . . .

$ Mechanical Exhaust System Power Supply Protection From Heat. . . . .

$ Mechanical Exhaust System Power Source. . . . .

$ Roof Vent Sizing Basis-Buildings Protected by a Sprinkler System. . . . .

$ Roof Vent Sizing Basis-Buildings Not Protected by a Sprinkler System. . . .

$ Mechanical Exhaust System Maintenance and Periodic Testing. . . . .

$ Roof Vent Maintenance. . . . . .

It should be noted that this proposed code change does not make reference to NFPA 204 for the design of roof vent systems in either buildings protected by a sprinkler system or unsprinklered buildings. The rationale for this is that NFPA 204 does not address the use of roof vents for post-fire ventilation purposes (in sprinklered buildings) and the design provisions for roof vents presently included in NFPA 204 are too

Comment [w2]: I thought we changed this to provide two approaches, one of which was NFPA 204

complex for application to relatively small buildings were vents would be permitted without sprinkler protection (i.e., buildings with high-piled storage less than 12,000 square feet in floor area).

The proposed code change developed by the Roof Vent Study Group is intended to incorporate the latest technology and research available on the interaction of sprinklers, roof vents and draft curtains, as well as the evolving thinking on fire fighter safety promoted by the National Fallen Firefighter Foundation (NFFF), into the code provisions.

Much of the information on which this code change proposal is based did not exist when the provisions for roof vents were first included in the building/fire codes in the 1970's and 1980's. This proposal is a much needed update in the fire protection provisions for large industrial and storage buildings.

Cost Impact: This proposal will not increase the cost of constructing industrial and storage buildings, and, in many cases, reduce the cost of constructing these types of buildings.

Comment [w3]: I am not sure this is true since the mechanical system will have a cost and we may be requiring more roof vents than the current code, when that option is used.

-----Response-----

From: fpeschulte@aol.com [mailto:fpeschulte@aol.com]
Sent: Thursday, November 15, 2012 5:20 PM
To: wkoffel@koffel.com; Bill Rehr; carl.wren@ci.austin.tx.us; cbaldassarra@RJAGroup.com; richard.davis@fmglobal.com; hansenj@fdny.nyc.gov; isman@nfsa.org; kevin.reinertson@fire.ca.gov; ClementsRo@chesterfield.gov; rnickson@nmhc.org; wschock@ci.san-leandro.ca.us
Cc: Beth Tubbs; rjd@davidsoncodeconcepts.com; rcsconsult@myfairpoint.net; Ed Wirtschoreck; garner.palenske@aon.com; hal.key@mesaaz.gov; imacdonald@cityoforange.org; jharrington@hgi-fire.com; hugo@nfsa.org; jeff.tubbs@arup.com; jim.doctorman@boeing.com; john.harrington@fmglobal.com; JWoestman@kellencompany.com; Julruth@aol.com; ntrauernicht@ucdavis.edu; bob.sampson@acralight.com
Subject: Re: Roof Vent Code Change Proposal-Draft Reason Statement (MS Word)

Bill, thank you for your comments. I haven't had enough time to digest all of your comments. With respect to your comments on the last page, your memory is correct. We did include an option to use NFPA 204 for small unsprinklered buildings.

Regarding the cost of the mechanical exhaust installation, I expect that the cost of providing a mechanical system will be negligible for storage or industrial buildings already provided with a mechanical ventilation system. The only thing that will be required is that the normal ventilation system will have to modified (redesigned) to comply with the requirements outlined for mechanical exhaust. The provisions for mechanical exhaust do not require a separate system and the typical ventilation system will be easily adopted for use as the exhaust system. In my estimation, the cost will be negligible (almost zero, but technically not zero).

rich

2. -----Original Message-----

From: Ken Isman <isman@nfsa.org>

To: 'William Koffel' <wkoffel@koffel.com>; fpeschulte <fpeschulte@aol.com>; brehr <brehr@iccsafe.org>; carl.wren <carl.wren@ci.austin.tx.us>; cbaldassarra <cbaldassarra@RJAGroup.com>; richard.davis <richard.davis@fmglobal.com>; hansenj <hansenj@fdny.nyc.gov>; kevin.reinertson <kevin.reinertson@fire.ca.gov>; ClementsRo <ClementsRo@chesterfield.gov>; rnickson <rnickson@nmhc.org>; wschock <wschock@ci.san-leandro.ca.us>
Cc: BTubbs <BTubbs@iccsafe.org>; rjd <rjd@davidsoncodeconcepts.com>; rcsconsult <rcsconsult@myfairpoint.net>; ewirtschoreck <ewirtschoreck@iccsafe.org>; garner.palenske <garner.palenske@aon.com>; hal.key <hal.key@mesaaz.gov>; imacdonald <imacdonald@cityoforange.org>; jharrington <jharrington@hgi-fire.com>; hugo <hugo@nfsa.org>; jeff.tubbs <jeff.tubbs@arup.com>; jim.doctorman <jim.doctorman@boeing.com>; john.harrington <john.harrington@fmglobal.com>; JWoestman <JWoestman@kellencompany.com>; Julruth <Julruth@aol.com>; ntrauernicht <ntrauernicht@ucdavis.edu>; bob.sampson <bob.sampson@acralight.com>
Sent: Thu, Nov 15, 2012 3:57 pm
Subject: RE: Roof Vent Code Change Proposal-Draft Reason Statement (MS Word)

All,

On page 3, the following paragraph appears:

"The roof vent provisions included in the 2010 and 2013 editions of NFPA 13 require that the roof vent fusible element be one temperature rating classification higher than the temperature classification rating of the sprinklers."

This paragraph is incomplete and technically incorrect. NFPA 13 does not require the use of any specific fusible element temperature rating. Instead, section 12.1.1.1 states that vents with operating elements of a higher classification than the sprinklers are permitted. There is a big difference between what is permitted and what is required. The protection contemplated by the sprinkler committee would preferably be without vents and draft curtains. The following paragraph would be more accurate and maybe should replace the one cited above:

The protection criteria in NFPA 13 have been developed from hundreds of successful full-scale fire tests in facilities without roof vents or draft curtains. Research (summarized in NISTIR 6196) has shown that certain combinations of fire location, vent activation temperature, draft curtain arrangement, and commodity can create a situation that is detrimental to sprinkler system performance. In the 2007 and previous editions of NFPA 13, a preference for installing sprinkler systems in buildings without vents or draft curtains was expressed with a simple statement that the discharge criteria in the standard was developed without the presence of vents or draft curtains. This position was impossible to deal with for building owners due to the fact that building codes, including the International Building Code required certain buildings to have vents and draft curtains, which put building owners and sprinkler contractors in a position where they had to violate NFPA 13 to install sprinklers in a building in accordance with the building code. In recognition of this difficult position, NFPA 13 was modified in the 2010 edition (and those rules continue in the 2013 edition) to recognize that it is acceptable to have roof vents as long as the activating link for the vents is at least one temperature classification higher than the sprinklers. If this is the case, the odds are that the fire will not open the vent as long as the sprinkler system is controlling the fire. Draft curtains are still not contemplated in the protection criteria provided in NFPA 13.

-----Response-----

From: fpeschulte@aol.com [mailto:fpeschulte@aol.com]
Sent: Thursday, November 15, 2012 4:59 PM
To: isman@nfsa.org; wkoffel@koffel.com; Bill Rehr; carl.wren@ci.austin.tx.us; cbaldassarra@RJAGroup.com; richard.davis@fmglobal.com; hansenj@fdny.nyc.gov;

kevin.reinertson@fire.ca.gov; ClementsRo@chesterfield.gov; rnickson@nmhc.org; wschock@ci.san-leandro.ca.us
Cc: Beth Tubbs; rjd@davidsoncodeconcepts.com; rcsconsult@myfairpoint.net; Ed Wirtschoreck; garner.palenske@aon.com; hal.key@mesaaz.gov; imacdonald@cityoforange.org; jharrington@hgi-fire.com; hugo@nfsa.org; jeff.tubbs@arup.com; jim.doctorman@boeing.com; john.harrington@fmglobal.com; JWoestman@kellencompany.com; Julruth@aol.com; ntrauernicht@ucdavis.edu; bob.sampson@acralight.com
Subject: Re: Roof Vent Code Change Proposal-Draft Reason Statement (MS Word)

Ken,

I agree with your comment that NFPA 13 does not **require** automatic roof vents with a higher temperature rating activating mechanism, but rather **permits** automatic roof vents with a higher temperature classification than the sprinklers to be provided. The IBC/IFC presently requires the roof vents. Once roof vents are required by the IBC/IFC, however, the NFPA 13 provisions then become mandatory, hence, the NFPA 13 roof vent provisions become mandatory. As they say in legal circles "perhaps a distinction without a difference".

With respect to your suggested wording, all of the information provided is technically correct, but perhaps is a little wordy. My preference is to be as brief as possible while conveying the essence of the code change. Recall that the Study Group's work relates to the issue of "balanced" fire protection.

The original proposal to the NFPA 13 committee was to flat-out prohibit roof vents in sprinklered buildings. The NFPA 13 committtee chose not to accept this proposal, but to "permit" automatic roof vents under specific conditions. The comment by Multer reads as follows:

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-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.

The NFPA 13 roof vent provisions provide a way of use roof vents without interfering with sprinkler operation (by rendering automatic roof vents inoperative if sprinkler operation is successful.)

My recommendation regarding your proposed language is that it needs to be "slimmed down" a bit.

rich

3. -----Original Message-----

From: fpeschulte@aol.com [mailto:fpeschulte@aol.com]
Sent: Saturday, November 17, 2012 4:39 PM
To: Bill Rehr; wkoffel@koffel.com; carl.wren@ci.austin.tx.us; cbaldassarra@RJAGroup.com; richard.davis@fmglobal.com; hansenj@fdny.nyc.gov; isman@nfsa.org; kevin.reinertson@fire.ca.gov; ClementsRo@chesterfield.gov; rnickson@nmhc.org; wschock@ci.san-leandro.ca.us
Cc: Beth Tubbs; rjd@davidsoncodeconcepts.com; rcsconsult@myfairpoint.net; Ed Wirtschoreck; garner.palenske@aon.com; hal.key@mesaaz.gov; imacdonald@cityoforange.org; jharrington@hgi-fire.com; hugo@nfsa.org; jeff.tubbs@arup.com; jim.doctorman@boeing.com; john.harrington@fmglobal.com; JWoestman@kellencompany.com; Julruth@aol.com; ntrauernicht@ucdavis.edu; bob.sampson@acralight.com

Subject: Re: RVSG-Response to Bill Koffel Comments

Ladies and Gentlemen-

See the attached.

rich schulte
Schulte & Associates

Content of the attached PDF Document entitled "Response to William Koffel Comments from November 15, 2012.pdf (44KB):

RESPONSE TO WILLIAM KOFFEL'S COMMENTS ON THE DRAFT REASON STATEMENT

Ladies and Gentlemen-

The following are Schulte's comments relative to Bill Koffel's suggested revisions to the draft reason statement. The page numbers refer to the MS Word document dated November 13, 2012 (as revised and annotated by Koffel on November 15, 2012), not the page number of the pdf of the draft reason statement.

1. **Page 1.** It was proposed to add a reference to the 2013 edition of NFPA 13. This change is appropriate.

2. **Page 1.** It was proposed to strike a reference to the substantiation statement for the proposal to include roof vent provisions in the 2010 edition of NFPA 13.

The substantiation statement for the roof vent provisions provides the basis for including the provisions in NFPA 13. The substantiation statement clarifies the intent of the NFPA 13 roof vent provisions. Hence, it is appropriate to make reference to the substantiation statement for the NFPA 13 roof vent provisions. (The substantiation statement clearly indicates that roof vents and draft curtains should not be used together with the sprinkler protection criteria for protecting storage occupancies included in NFPA 13.)

3. **Page 3.** Once again, it is proposed to strike the reference to the substantiation statement for the NFPA 13 roof vent provisions. Bill indicates that the substantiation statement is the opinion of the Submitter of

the proposal and not of the NFPA 13 subcommittee which reviewed the proposal. Based upon the record included in A2009 ROP, it appears that Bill's comment relative to the Substantiation statement is incorrect. The proposal by the Submitter was to “flat-out” prohibit the use of roof vents and draft curtains in sprinklered storage buildings. Apparently, the original proposal was modified by the subcommittee responsible for reviewing the proposal (AUD-SST subcommittee) and the subcommittee's review resulted in a complete modification of the original proposal. Given this, it would then be the AUD-SST subcommittee's responsibility to develop a new substantiation statement.

The purpose of the NFPA 13 roof vent provisions is to allow the use of roof vents only where the roof vent installation is prevented from operating automatically (if the sprinkler system operates successfully). In other words, the NFPA 13 roof vent provisions allow the installation of automatic roof vents so long as the vents are designed not to automatically operate (in the event of successful sprinkler operation).

The substantiation statement makes the intent of the roof vent provisions included in NFPA 13 clear. Automatic roof vents are not to be provided in storage buildings unless the automatic feature is "neutered".

4. **Page 5.** It is suggested that positive statement with respect to the protection provided by roof vents in sprinklered buildings be altered to a conditional statement (by the use of the word "may").

The Roof Vent Study Group started its work in January 2007. The original study group reviewed the results of the research conducted at UL in 1997/1998 outlined in NISTIR 6196-1. The results of the research clearly indicate that automatic roof vents are unlikely to operate in sprinklered buildings when the temperature rating of the sprinklers and the roof vent activating mechanism is the same. This information is incorporated into Annex F.3 in NFPA 204 and Dr. Craig Beyler, Hughes Associates, Inc., the former representative of the Smoke Vent Task Group, is in complete agreement with this statement (based upon numerous written statements made by Dr. Beyler).

Subsequent to the 1997/1998 research on sprinklers, roof vents and draft curtains, the NFPA 13 committee included requirements for the use of roof vents in sprinklered storage occupancies. The NFPA 13 roof vent provisions only permit the use of automatic roof vents in sprinklered storage buildings where the automatic feature of the vents have been "neutered" (by making the temperature classification of the vent operating element one temperature classification higher than the temperature classification of the sprinklers). If automatic vents are unlikely to operate where the temperature rating of the vent operating mechanism is equal to the temperature rating of the sprinklers, then it would appear to be an obvious conclusion that no automatic roof vents will operate if the vent operation mechanism is one temperature classification higher than the temperature classification of the sprinklers.

To date (2007-2012), the representatives of the Smoke Vent Task Group, Rick Thornberry, Dr. Craig Beyler and Bill Koffel, have not presented any information, research or test data which provides a rebuttal to the conclusion that roof vents with a temperature rating which is one temperature classification higher will actually activate where the sprinkler system successfully controls the fire.

Given the above, it seems reasonable to assume that there is no disagreement over the fact that roof vents with an activating mechanism one temperature classification higher than the sprinkler temperature

classification will not open (assuming successful sprinkler operation). If the automatic roof vents will not open automatically if the roof vent installation complies with the NFPA 13 roof vent provisions, then it appears logical to conclude that the vents must be opened manually by fire fighters. This means that the vents will not be opened until sometime after the arrival of fire fighters at the fire scene. Previous documentation submitted and reviewed by the RVSG provides information (code change proposal F , National Association of State Fire Marshals (NASFM) as to the typical response times for fire departments in the United States. This information indicates that there is typically a substantial delay in arrival of fire fighters at a fire scene.

The documentation provided for the 1997/1998 research on sprinklers, vents and draft curtains conducted at UL includes ceiling temperature data measured as a function of time. This data shows a rapid decrease in ceiling temperatures both at the ceiling directly over the fire and at points farther away from the fire after the operation of the first sprinklers.

When the fire fighter response time and the ceiling temperature data are combined, it can be seen that temperature at the ceiling is well below 200oF above ambient at the time of the arrival of fire fighters. In order for roof vents to operate optimally, NFPA 204 indicates that the average temperature of the smoke layer collecting below the ceiling must be at least 200oF above ambient. The ceiling temperature data from the 1997/1998 research at UL indicates that the ceiling temperatures will be less than 200 oF above ambient. It should be noted that the temperatures measured are at a single point (relatively) close to the ceiling. The average temperature of the fire gases collecting below the ceiling should be far less than the single point temperature measurement (because heat rises).

Given the above, it can be concluded that roof vents which are manually opened by fire fighters after their arrival will actually provide little, if any venting. In many cases, fires in storage buildings will already be controlled or extinguished by the operation of the sprinkler system and the ceiling temperatures will be at or very near ambient at the time of the arrival of fire fighters.

It should be noted that the temperature rating of the sprinklers utilized in the 1997/ 1998 research was 165oF (ordinary temperature classification). As has been noted, NFPA 13 sprinkler design criteria permits (and encourages) the use of high temperature sprinklers to protect high-piled storage. The typical temperature rating of sprinklers with a high temperature rating is 286oF. Hence, the difference in operating temperature of the sprinkler mechanism between a high temperature sprinkler and the ordinary temperature sprinklers used in the research is roughly 120oF. Given this, the temperatures measured at the ceiling where high temperature sprinklers are provided could be as high as 200oF above the ceiling temperature data provided in the documentation for the 1997/1998 research (NISTIR 6196-1). Even with higher ceiling temperatures where high temperature ceiling sprinklers are utilized, rather than ordinary temperature sprinklers, the ceiling temperatures measured at the ceiling should still be less than 200oF above ambient at the point in time when fire fighters arrive.

Given the above, there is a high probability that the statement that roof vents will not provide the protection originally intended is an accurate statement in most cases.

Rather than make this statement in a 100 percent probability format, a modifier such as a “very high probability” could be added to the statement to account for the rare instance where vents will actually work as originally intended where the sprinkler system operates successfully.

5. **Page 5.** It was suggested that the conclusion regarding the lack of capability of roof vents to provide any additional protection in the event of sprinkler system failure be deleted.

It is my opinion that the statement as written is technically accurate based upon the recommendations contained in NIOSH 2005-132 and NIOSH 2010-153, as well as based upon the recommendations contained in the Initial Report of the FEMA/NFFF Firefighter Life Safety Summit held in Tampa in 2004). The basis for this opinion is outlined on the top of Page 5.

Note: The Firefighter Life Safety Summit took place in 2004, not 1994 as indicated in the reason statement.

The fire at the Sofa Super Store in Charleston, South Carolina illustrates the dangers of conducting interior manual fire fighting operations in large single-story buildings not protected by a sprinkler system or protected by a sprinkler system which fails. In the Sofa Super Store fire, 9 fire fighters died as a result of becoming lost in smoke and running out of air. It should be noted that the portion of the building where the fire fighters died was actually relatively small in comparison to the typical industrial and storage building and, further, it should be noted that the Sofa Super Store fire started out as a relatively minor fire which grew into a major larger fire after fire fighters had entered the building.

If the risk management practices recommended in NIOSH 2010-153 and the FEMA/ NFFF Life Safety Summit (2004) had been practiced at the Sofa Super Store and the recommendations contained in NIOSH 2005-132 had been implemented, it is highly probable (almost certain) that the nine fire fighter fatalities would not have occurred at the Sofa Super Store fire.

6. **Page 7.** The comment indicates that the Study Group had decided to specifically permit NFPA 204 to be used as an alternative to prescriptive provisions. This comment is correct.

It should be noted that NFPA 204 does not contain specific criteria on which to base the roof vent design. Based upon this, the designs which are acceptable to the enforcing authority could be different in different jurisdictions. Based upon this, it is my recommendation that the code language which indicates that NFPA 204 is an acceptable design alternative be removed.

7. **Page 7.** The comment indicates that their will be a cost to providing a mechanical exhaust system, hence, this code change proposal will increase costs.

This code change proposal permits the installation of a mechanical exhaust system, while existing code language requires the installation of roof vents. Most industrial and storage buildings are already provided with a mechanical system. In order to comply with the proposal, the typical mechanical system in an industrial or storage building will

only need to be reconfigured. The cost of reconfiguring the typical ventilation system for these types of buildings to comply with the mechanical exhaust system requirements should be minimal, hence, the cost of the mechanical exhaust system will be negligible. Since the mechanical exhaust system replaces the presently required roof vent system, it would be expected that compliance with the code change proposal should reduce costs-the elimination of the roof vent system offsetting any small increase in costs for reconfiguring the typical ventilation system in industrial and storage buildings.

* * * * *