



Christian Dubay, P.E.  
Secretary, Standards Council

1 October 2008

To: Interested Parties

Subject:

Standards Council Decision (Final): <b>D#08-19</b> Standards Council Agenda Item: <b>SC #08-7-38</b> Date of Decision*: 24 July 2008
NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles

Dear Interested Parties:

At its meeting of 22-24 July 2008, the Standards Council considered an appeal on the above referenced matter.

Attached is the final decision of the Standards Council on this matter.

Sincerely,

A handwritten signature in black ink, appearing to read 'Christian Dubay', written over a circular scribble.

Christian Dubay, P.E.  
Secretary, NFPA Standards Council

c: D. Berry, M. Brodoff, G. Colonna, R. Coté, G. Harrington, J. Lake, D. Matthews,  
J. Moreau-Correia, L. Nisbet, R. Solomon  
Members, TCC on Automatic Sprinklers (AUT-AAC)  
Members, TCC on Building Code (BLD-AAC)  
Members, TC on Fire Code (FCC-AAA)  
Members, TC on Pyrotechnics (PYR-AAA)  
Members, TCC on Safety to Life (SAF-AAC)  
Members, TC on Smoke Management Systems (SMO-AAA)  
Members, NFPA Standards Council (AAD-AAA)  
FPRF Fireworks Research Panel  
Individuals Providing Appeal Commentary

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\*NOTE: Participants in NFPA's codes and standards making process should know that limited review of this decision may be sought from the NFPA Board of Directors. For the rules describing the available review and the method for petitioning the Board for review, please consult section 1.7 of the NFPA Regulations Governing Committee Projects and the NFPA Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council. Since this Council decision is not "related to the issuance of a document" as referenced in 1.7.2 of the Regulations Governing Committee Projects, notice of the intent to file such a petition must be submitted to the Clerk of the Board of Directors within a reasonable time period from the availability of this decision.



Standards Council Decision (Final): **D#08-19**

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NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail  
Sales of Fireworks and Pyrotechnic Articles

This decision concerns the question whether NFPA should continue to develop standards provisions for the retail sale and storage of consumer fireworks. NFPA began, amid some controversy to do so beginning in 1999. We begin with a summary of the history of that activity.

### I. Background

NFPA, as a safety organization, has since at least the early Twentieth Century, and continues to have, a long-standing advocacy position opposing, on well-documented safety grounds, any use of fireworks by consumers or other members of the general public. In light of that policy, the Standards Council did not allow any standards development activities related to the use of fireworks by the general public until 1995. (See, e.g., Agenda Item 93-98, Standards Council Meeting of October 14-15, 1993; Agenda Item 94-125, Standards Council Meeting of October 13-14, 1994.) In 1995, however, the Standards Council, based on requests from the Technical Committee on Pyrotechnics, began to question whether it might, consistent with the NFPA policy against the use of consumer pyrotechnics, nevertheless have the authority to allow standards to be developed for the storage and retail display and sale of consumer fireworks. (See Agenda Item 95-48, Standards Council Meeting of October 18-21, 1995.) This led to a review of NFPA policy concerning consumer fireworks by the NFPA Board of Directors. A task group of the Board was split 3-2 in favor of permitting the development of NFPA standards on the retail sale and storage of consumer fireworks. The majority emphasized that, despite NFPA's opposition to the use of fireworks by consumers, 40 states at that time allowed such use, and enforcement authorities in those states needed the guidance that NFPA standards could develop and provide on the retail sale of consumer fireworks. The minority doubted the efficacy of such an activity and feared that it would undercut the push for prohibition of consumer use of fireworks and the NFPA message against the use of such fireworks. The Board of Directors, weighing these countervailing factors, decided that, on balance, the Standards Council should be given the authority to authorize the development of standards on the retail sale of consumer fireworks and effectuated this decision through at its November 14, 1999, Board of Directors meeting through revisions to its Standing Rule 88-002, as revised through November 14, 1999.

Following the Board action, the Standards Council authorized standards development activities that initially led to provisions concerning the retail sales and storage of consumer fireworks being developed in NFPA 1, *Fire Prevention Code* (2000 edition), and subsequently, with jurisdiction clearly and, after some controversy, definitively assigned to the Technical Committee on Pyrotechnics (hereafter, the Technical Committee), with the incorporation of consumer retail storage and sales provisions into an expanded chapter 6 and new chapter 7 of NFPA 1124, *Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnics Articles* (2003 edition).

Without further recounting the entire detailed and sometimes contentious history of those activities, it is significant for these purposes to note that, from its inception, the Council has continually confronted difficulties engendered in significant part by a lack of adequate technical justification for provisions or proposed provisions concerning the regulation of retail sales of consumer fireworks. This has included disagreements between Technical Committee projects over the extent and type of regulation appropriate for the storage and retail sales of consumer fireworks. (See Standards Council Decision # 00-1 [Agenda item 001/99-100, January 13, 2000].) In addition, it has posed difficulties for the Council itself in resolving appeals as the Council has strained to rationalize, revise, or, in some cases, reject actions of the Technical Committee on Pyrotechnics related to the consumer provisions. [See, e.g., Standards Council Decision # 03-13 [Agenda item 03-1-10-a, January 17, 2003] [rejecting Technical Committee position exempting existing facilities from certain requirements, based on various complications and concerns, including “the Council’s own concerns whether the safety issues with respect to exempting new facilities from . . . have been given adequate consideration”]; Standards Council Decision # 03-14 [Agenda item 03-1-10-d, January 17, 2003] [rejecting as technically unjustified the Technical Committee’s recommended 12,000 square foot area threshold for requiring an automatic sprinkler system in permanent retail sales facilities, noting the lack of adequate large scale fire testing to justify the effective treatment of consumer fireworks as an ordinary hazard occupancy as defined by NFPA 13, *Standard for the Installation of Sprinkler Systems*, and accepting instead a 6,000 square foot area threshold]; Standards Council Decision # 04-05 [Agenda item 04-4-13/14/15/16, April 15, 2004] [accepting a Tentative Interim Amendment extending the area threshold for automatic sprinkler requirements to 7,500 square feet for existing permanent facilities, but noting further review and consideration should be forthcoming during the full revision cycle]; Standards Council Decision # 06-04 [Agenda item 06-3-11, March 21, 2006] [rejecting Technical Committee request to enter three new draft fire test standards on packaging, covered fuses, and flame breaks used in the retail sale and display of consumer fireworks where “little if any research or testing was produced to support the draft standards and there is no clear prospect that the standards development process, once begun, would be supported by adequate technical substantiation”].)

Against this background of concern with the technical adequacy of the provisions concerning the retail storage and sale of consumer fireworks, the Fire Protection Research Foundation, on October 1, 2007, issued a report, authored by Jonathan Perricone, P.E., Schirmer Engineering Corporation, entitled *Fire Safety in Consumer Fireworks Storage and Retail Facilities – Hazard Assessment* (hereafter, the Research Foundation Report). Subsequently, the Standards Council considered this report and concluded that it raised serious concerns regarding the technical basis for the retail sales provisions of NFPA 1124 and “calls into question whether sufficient research and other technical substantiation exists to support meaningful standards development in this area.” (See Standards Council Agenda Item # 08-1-8, January 10, 2008 [revising previous minute item # 07-10-35, October 3-4, 2007].) Based upon the findings presented in the report, the Council indicated that it was contemplating the following actions:

- Revising the scope of the Technical Committee on Pyrotechnics so that it no longer covers the retail sale of consumer fireworks, and
- Taking steps to revise the scope of NFPA 1124 to exclude the retail sales of consumer fireworks and to delete chapter 7 from NFPA 1124.

Prior to making a final decision on the issue, the Council gave notice that it would conduct a hearing and receive written submissions on the Council’s contemplated course of action or on other proposed courses of action that may be submitted for the Council’s consideration. A public

hearing was thereafter held on June 2, 2008, at the NFPA World Safety Conference and Exposition.

## II. Discussion

Now having the benefit of the Council's own knowledge of the history of the treatment of standards development concerning the storage and retail sales of consumer fireworks and the Research Foundation Report, as well as the full record, including the hearing and the written submissions filed in response to the Council's request for public input, the Council must decide whether NFPA standards development in the area of storage and retail sales of consumer fireworks should continue.

In this regard, the Council places significant weight on the conclusions of the Research Foundation Report. That report identified numerous and serious inadequacies or lack of sufficient technical basis to support the storage and retail sales provisions in NFPA 1124. The testimony at the hearing and the written submissions did not detract from those conclusions or give the Council comfort that a serious effort to find answers was forthcoming. In this regard, the Council was particularly disappointed by the response of the representatives of the consumer pyrotechnics industry. Despite the efforts of the Research Foundation to solicit all available research relevant to its literature review and hazard assessment and despite the requests of the Council before, during, and after the June hearing, representatives of this industry have yet to submit for scrutiny the full reports of tests that they assert have been conducted and completed.

In considering the appropriate course of action, it is important to acknowledge that the absence of full technical knowledge and reliable data to fully support all aspects of a standard is not, in the abstract, a reason to forego the development of standards. The Council recognizes that standards development processes generally rely on available outside input to provide standards bodies with information, experience, data, and research to inform their activities. Frequently, standards developers must act in the absence of full knowledge, either because of the lack of research or because the state of the science in a particular area is insufficiently developed. In such cases, standards developers must draw approximate lines based on judgment and the information that is available. To do so, even in the absence of full knowledge, can be important for promoting safety as it provides a basis to regulate hazardous activities.

Nonetheless, there may be situations that arise in which the state of knowledge is so deficient that the Standards Council, exercising its jurisdictional authority, may be compelled to conclude that standards development activities in a given area are not appropriate and may even impede the promotion of safety. Such a situation would be rare, indeed, but declining to issue a standard based on lack of adequate technical validation is not without precedent. (See Standards Council Decision # 99-14 [Agenda item 99-62(a)(b), July 22, 1999] [air purifying respiratory protective escape devices]; Standards Council Decision # 00-13 [Agenda item 98-113, April 28, 2000] [early streamer emission lightning protection systems].)

In this instance, a number of factors raise questions about the continued viability of NFPA's consumer pyrotechnics activity.

- The Research Foundation Report identified the serious lack of data and clear scientific or technical basis underlying many of the retail sale and storage provisions in NFPA 1124. (See, especially, the nine specific areas of concern identified in the Research Foundation Report and discussed in greater detail below.)

- The strong NFPA policy disapproving the use of consumer fireworks made the NFPA Board of Directors and this Council reluctant in the first place to embark on the development of storage and retail sales requirements for consumer fireworks lest it be seen as undercutting the important safety message to consumers. NFPA was persuaded to go forward because it was argued that such standards were needed to assist enforcers in those many jurisdictions that allowed the sale and use of consumer fireworks. Such arguments, however, begin to lose their force if the standards that are developed lack adequate and sufficient basis in the form of meaningful research, testing, and other technical substantiation.
- As documented earlier in this decision, the lack of adequate supporting data has led to chaotic processing, including jurisdictional and substantive disputes between the NFPA 1 and NFPA 1124 technical committees and complicated appeals where the Council itself has had to develop solutions and/or call for further review and substantiation. The Council is concerned that the lack of adequate technical data at some point leads to arbitrary decision making that can undermine confidence in the consensus standards development process.
- As suggested earlier, the industry, despite claims to the contrary, has shown little inclination to devote the energy and resources to filling in the technical gaps in knowledge concerning the safe storage and sale of consumer pyrotechnics. They have even failed to provide research data and reports which they claim exist. Indeed, at the hearing on this matter, an oral presentation concerning recent testing at Southwest Research Institute (SwRI) was presented to the Council without supplying the actual report itself. Given the notice provided by the Council and the seriousness of the inquiry that it was undertaking, this failure, which persists to this day, is inexplicable.

All of the above factors lead the Council toward a serious inclination to end the standards development activities in the area of storage and retail sales of consumer pyrotechnics. The Council, however, is highly mindful of the countervailing views expressed by the Technical Committee on Pyrotechnics and others, including, most significantly, the enforcement community. They urge that the retail storage and sales provisions of NFPA 1124, even though imperfect, are essential to their enforcement activities as these provisions establish some undeniably important limits on the storage and retail sale of consumer fireworks. Indeed, this has been the argument that caused the Council and the NFPA Board to even entertain the possibility of having NFPA develop standards in this area despite the strong institutional policy against the use of consumer fireworks. The Council does not subscribe to the view, without qualification, that the development of a standard by the NFPA is invariably better than no NFPA standard. Indeed, it is possible that a standard set at a low level and without adequate support can, at some point, impede rather than promote progress and safety. NFPA does not wish to be associated with sustaining a weak standard, without limit, based solely on the argument that it is better than nothing.

Nevertheless, based on all that has been presented before it, the Council believes that it may still be possible to materially improve and validate standards for the storage and retail sale of consumer pyrotechnics and that, given the expressed need for such standards and the expressed desirability of having them produced through the NFPA standards development system, it is premature to end NFPA standards development efforts in this area.

### III. The Council's decision and directions for further processing

The Council, therefore, based on the record before it, has concluded the 2006 edition of NFPA 1124 should remain issued for the present in its current form and that standards for the retail storage and sale of consumer pyrotechnics in NFPA 1124 should not be eliminated at this point. However, the Council is directing that standards development activities in this area should proceed through one additional revision cycle, extending no further than the Annual 2012 revision cycle, in line with the guidance set forth as follows.

A. Procedures for correlation and input from other Technical Committees

The Council notes that a number of key safety concerns, as identified below, must be resolved and properly addressed prior to the publication of the next edition of NFPA 1124. The nine safety concerns are gathered largely from the Research Foundation Report and overlap to a certain degree with the scope of other NFPA Technical Committees. Because it has been demonstrated that the resources necessary to adequately address the concerns extend beyond those of the Technical Committee on Pyrotechnics, the Council is seeking additional input and judgment from other Technical Committees to establish the appropriate level of safety concerning the storage and retail sale of consumer pyrotechnics.

The Council has put forth the following procedure to ensure that those provisions in the next edition of NFPA 1124 concerning the nine safety concerns are adequately addressed. The Council directs that the Technical Committee on Pyrotechnics develop and properly substantiate the relevant provisions in NFPA 1124 concerning the nine safety concerns. A pre-ROP ballot of the Technical Committee on Pyrotechnics will be conducted, in accordance with the general rules of NFPA, to obtain the position of the Technical Committee on Pyrotechnics on these provisions. The provisions and substantiation put forth by Technical Committee on Pyrotechnics will then be forwarded to other NFPA Technical Committees, referred to here as Approval Committees, for approval.

The Approval Committees will hold either a physical meeting or a conference call meeting to discuss the provisions and substantiation put forth by the Technical Committee on Pyrotechnics and take one of the following actions:

- 1) Accept the provisions and substantiation put forth by the Technical Committee on Pyrotechnics; or
- 2) Indicate that the provisions are not supported by the substantiation and recommend that the Technical Committee on Pyrotechnics develop other provisions based upon the substantiation and/or other information the Approval Committee has available for review; or
- 3) Indicate that the provisions are not supported by the substantiation and recommend other provisions that are supported by the substantiation and/or other information the Approval Committee has available to it; or
- 4) Indicate that the provisions are not supported by the substantiation submitted or any other information available to the Approval Committee. The default recommendation in that case will be that standards development on this subject be suspended until further research is conducted to support such standards development.

The Approval Committees will secure their position via letter ballot after the completion of their meetings or conference calls. A two-thirds affirmative vote of the Approval Committees, in accordance with NFPA rules, will be necessary to obtain the position of the Approval Committees. Where the Approval Committees cannot obtain the necessary two-thirds vote, the Approval Committees must continue addressing the matter until a two-thirds majority letter ballot vote of the committees is obtained. Following a two-thirds affirmative vote, the Technical Committee on Pyrotechnics will consider the position of the Approval Committees.

Where new provisions are put forth by the Approval Committees, as indicated in item [3] above, the Technical Committee on Pyrotechnics will be balloted to determine if it is in agreement with the new provisions. If such a ballot is not successful, the Technical Committee on Pyrotechnics will need to reconsider the matter, and if it develops revised provisions, as could also be the case in item [2] above, these revised provisions will need to be submitted for approval by the Approval Committees. The process will continue until agreement between the Technical Committee on Pyrotechnics and the Approval Committees is obtained. Once such agreement is obtained, the Technical Committee on Pyrotechnics can move forward with the publication of its Report on Proposals (ROP) for the next edition of NFPA 1124. Where the Approval Committees accept the provisions and substantiation put forth by the Technical Committee on Pyrotechnics as indicated in item [1], a follow-up ballot of the Technical Committee on Pyrotechnics is not necessary and the Pyrotechnics committee can continue with the publication of its ROP.

The same process will occur for the Report on Comments (ROC) stage of the process. The Technical Committee on Pyrotechnics and the Approval Committees will need to be in agreement on any provisions pertaining to the nine concern areas below or other issues raised by the Approval Committees in order for the ROP and ROC to move forward.

The Council notes that NFPA 1124 has been entered into the Annual 2010 revision cycle. The Council anticipates that obtaining agreement among the affected committees can require significant time and effort but expects that all work can be completed in time for the Annual 2012 cycle. If such agreement among the affected committees is not obtained by the Annual 2012 cycle, meaning that the next edition of NFPA 1124 cannot be developed in that time period, the Council will take the following actions:

- Revise the scope of the Technical Committee on Pyrotechnics so that it no longer covers the storage and retail sale of consumer fireworks, and
- Take steps to revise the scope of NFPA 1124 to exclude the storage and retail sales of consumer fireworks and delete chapter 6 and chapter 7 from NFPA 1124.

**B. Specific areas of concern for further investigation, substantiation, and processing**

The nine safety concerns and the Approval Committees that must approve the associated provisions for the next edition of NFPA 1124 are identified below. In addressing these nine areas of concern, the Technical Committee on Pyrotechnics needs to consider the range of consumer pyrotechnics involved, including aerial devices, as well as the storage and retail sale of such consumer pyrotechnics in tents and stands.

1. Threshold Values for Application of NFPA 1124. Paragraphs 6.1.3 and 7.3.1 of NFPA 1124 state that the requirements of chapters 6 and 7 do not apply to consumer fireworks retail sales (CFRS) facilities or stores where the consumer fireworks are in packages and where the total quantity of consumer fireworks on hand does not exceed 125 lb (net) [56.8 kg] of pyrotechnic composition, or in a building protected

throughout with an approved automatic sprinkler system installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, with not more than 250 lb (net) [113.6 kg] of pyrotechnic composition on hand. The Research Foundation Report indicates that “while it is clearly reasonable to exempt small amounts of commodity from more robust protection requirements, the exact limit and the dependence of this limit on sprinkler protection is still not well understood. Preliminary bench-scale experiments conducted by Battelle revealed that under certain conditions, as little as 5 cases of consumer fireworks (tanks, rockets, ground spinners, fountains and roman candles) produced an overwhelming fire scenario for a space equipped with a NFPA 13 wet pipe sprinkler system. Although this is only one result, it underscores the need for a more scientific basis to support criteria for exempt amounts.” (Research Foundation Report at p. 65, footnote omitted) The Council directs that the 125 lb and the 250 lb threshold limits be further investigated and adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Fire Code (NFPA 1).

2. Threshold Limits for Sprinkler Protection. Section 7.3.6 of NFPA 1124 requires that an automatic sprinkler system designed and installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, be provided throughout permanent CFRS facilities and stores in which CFRS are conducted in the following buildings: (1) new buildings greater than 6000 ft<sup>2</sup> (557.2 m<sup>2</sup>) in area; and (2) existing buildings greater than 7500 ft<sup>2</sup> (694 m<sup>2</sup>) in area. The Research Foundation Report indicates that “the basis for the limits of 6000 ft<sup>2</sup> for new buildings and 7500 ft<sup>2</sup> for existing buildings is unclear. For perspective on this issue, consider that these limits are not significantly below the floor area of the Ohio River Fireworks Store where the most relevant loss history for this commodity was established. Also, these criteria do not consider factors as significant as fuel loading within the space.” (Research Foundation Report at p. 65) The Council directs that the threshold limits of 6000 ft<sup>2</sup> and 7500 ft<sup>2</sup>, or any other similar proposed thresholds regarding the need for sprinkler protection, be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Fire Code (NFPA 1).
3. Height and Area Limitations. Section 7.2.3 of NFPA 1124 requires that any building or structure used for the retail sales of consumer fireworks, including their related storage, comply with NFPA 101, *Life Safety Code*, for mercantile occupancies, except as provided in this code. These provisions address building height and area limitations based upon occupancy type and construction type. NFPA 101 provides additional sub classification of the mercantile occupancy group in Classes A, B, and C stores distinguished on the basis of height and area.

The Research Foundation Report indicates that “this analogy [reference to NFPA 101 height and area limitations] is potentially incomplete in a fundamental way. As previously referenced in the analysis of analogous hazards in this report [Research Foundation Report], the fundamental concept of the balance between allowable height and area with type of construction is based upon fuel loading. Fuel loading is implied by the intended use of occupancy of the space in question. For hydrocarbon-based fuels, the maximum severity of an enclosure fire is limited by ventilation into the space. As a result, there is an intended balance between size of the space, type of construction, and fuel loading. This balance is disturbed when additional oxidizers are present within the enclosure. In the case of consumer fireworks, this may lead to

maximum gas temperatures within the space that exceed ventilation-limited values. This is not to say that fire protection for consumer fireworks retail sales facilities should not be similar to those of mercantile facilities; however, such specificity may be worthy of further evaluation in light of the previous discussion.” (Research Foundation Report at p. 65)

The Council directs that the limits pertaining to size of space, type of construction, and fuel loading as addressed by chapter 7 of NFPA 1124 and as represented by the Mercantile Occupancy classification be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Building Construction (NFPA 5000).

4. Means of Egress Provisions. Section 6.8 and paragraphs 7.3.14 and 7.4.8 of NFPA 1124 address means of egress provisions.

With regard to storage facilities (chapter 6 provisions), the Research Foundation Report indicates that “coordination with the Life Safety Code requires identification of an occupancy type as well as the relative hazard level of contents. Specific guidance on this issue is sparse. As a result, there is a certain level of ambiguity associated with judging compliance with NFPA 101. Requirements are provided in NFPA 1124 with respect to doors, aisles, egress travel distance, exit signs and emergency lighting; however, the basis for these requirements (particularly aisles and travel distance) is unclear.

With regard to retail sales facilities (chapter 7 provisions), the Research Foundation Report indicates that “means of egress requirements specific to egress travel distance and capacity of egress components are essentially based on a simplified evacuation model where flow to and through exits is simply a product of exiting speed and capacity. In reality, the exiting speed will be governed largely by awareness of the rate of hazard development. The speed of hazard development is a key issue with respect to consumer fireworks and existing research yields conflicting results. Experiments conducted by Wyle Laboratories, CHAF and the State of Washington all suggest a relatively slow developing hazard with ample time provided for egress for a light occupant load within a small facility. However, results of the Battelle test series illustrated severe conditions occurring over a significantly more condensed timeframe. Such an occurrence could conceivably result in an overloading of exit capacity due to a corresponding increase in crowd speed. In other words, analysis of the speed of hazard development is essential to deriving appropriate means of egress requirements. To date, no experiments specific to egress from consumer fireworks retail sales facilities have been conducted. Furthermore, only 2 full-scale test efforts specific to retail sales facilities are known (Washington and Battelle). The conflicting nature of their results necessitates more focused research in this area.” (Research Foundation Report at p. 65, footnotes omitted)

The Council directs that the means of egress provisions of chapters 6 and 7 be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Means of Egress (NFPA 101, NFPA 5000).

5. Smoke and Heat Venting. Paragraph 7.3.10.1 of NFPA 1124 requires that smoke and heat vents designed and installed in accordance with NFPA 204, *Standard for Smoke*

*and Heat Venting*, be provided in the CFRS area of new permanent CFRS facilities or stores where the ceiling height is less than 10 ft (3.05 m) and the travel distance to reach an exit is greater than 25 ft (7.6 m). Similarly, paragraph 6.5.3 requires smoke and heat vents designed and installed in accordance with NFPA 204 to be provided in consumer fireworks storage buildings exceeding 50,000 ft<sup>2</sup> (4644 m<sup>2</sup>) in undivided area.

With regard to retail sales (chapter 7 provisions), the Research Foundation Report indicates that “conceptually, this criterion is based on the idea of the total duration of egress occurring prior to deterioration of tenability within the space due to a descending smoke layer. However, smoke and heat venting was not a strategy employed in any of the known experimental efforts involving fire in consumer fireworks facilities. The only known experimental data with regard to smoke control for such facilities is in reference to the Battelle experiments in Ohio where forced ventilation was used and failed to achieve its objective of maintaining a clear tenable layer of air for egress purposes. Furthermore, given that the results of this particular testing program suggest the implementation of ESFR automatic sprinkler protection, the compatibility of smoke and heat vents with this technology must be questioned as the standard is developed.” (Research Foundation Report at p. 66) With regard to storage facilities (chapter 6 provisions), the Research Foundation Report indicates that “the author of this review [Research Foundation Report] was unable to locate any data for consumer fireworks fire related hazards in the built environment in spaces of this size. Additionally, smoke and heat venting was not a strategy employed in any of the known experimental efforts involving fire in consumer fireworks storage facilities.”

The Council directs that the application and use of smoke vents as currently required by chapters 6 and 7 of NFPA 1124 be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Smoke Management Systems (NFPA 204).

6. Flame Breaks. Paragraphs 7.3.15.3, 7.3.15.4, and 7.3.15.5 of NFPA 1124 address flame breaks and packaging of fireworks. The Research Foundation Report indicates that:

A potentially promising method for achieving fire control is provided in the form of requirements for flame breaks in Section 7.3.15.3. Conceptually, flame breaks are designed to limit fire area. Toward this objective, they should be designed as noncombustible thermally robust barriers allowing minimal heat conduction to the unexposed side and extending beyond the shelving to limit potential convective and/or radiant heat exposure. Minimizing heat conduction may be accomplished by selecting a material either with the appropriate balance between thermal conductivity, thermal diffusivity and thickness. Requirements for flame breaks in the current standard are geared more toward slowing flame spread than halting it altogether. A total of 11 materials and associated thicknesses are specified in Section A.7.3.15.3 of the standard as being acceptable for use as flame breaks. It should be noted that materials such as 0.25 mm thick sheet aluminum would likely behave as thermally thin solids thereby offering little thermal protection to the unexposed side.

The approach of incorporating more mass into the overall storage arrangement is certainly effective in slowing the propagation of an accelerating reaction (i.e.,

high energy explosives); however, objectives for fire protection of consumer fireworks facilities are fundamentally different. If consumer fireworks retail sales facilities are to be treated as traditional mercantile occupancies with respect to NFPA 101 (which is thus far an incomplete analogy), fire protection objectives in these spaces must necessarily be consistent with either fire suppression or fire control as defined in NFPA 13. Fire control as defined in NFPA 13 is intended to correspond with confining flame spread to a design area (i.e., halting growth rather than simply slowing it). This may be accomplished with the use of thermally thick barriers within a shelving unit. It is important to recognize that thermally thin materials will not truly halt fire growth, but rather slow its spread over a relatively short time frame. Depending on the design, this time frame may not be sufficient to make an appreciable difference in prolonging tenable conditions within the space as currently asserted by the standard.

Consider also that the interior of the shelving unit will likely be partially shielded from automatic sprinkler protection at the ceiling level. Therefore, flame breaks will be exposed to a significant heat load, which may locally resemble an unsprinklered fire. For perspective, recall that the heat load produced by the 150 case full scale test conducted by Battelle severely deformed the gondola shelving and even melted smoke detectors prior to sprinkler intervention. All things considered, selection and design of flame break materials should be a major focus of future research as certain methods potentially offer a very practical means for achieving fire control.

Tests conducted by Wyle Labs and the State of Washington reveal that the final packaging of consumer fireworks may play an important role in slowing fire growth beyond its incipient stage. In part, it is this observation that may lead to the hypothesis that thermally thin flame breaks will be particularly effective in slowing fire growth. However, there are a few important issues with respect to the global fire dynamics that must be considered. During the incipient stage, the total heat flux to exposed materials is quite low, thereby maximizing the insulating quality of relatively thin packaging. As illustrated in the Washington test, if the enclosure fire fails to grow beyond its incipient stage prior to utilizing the available ventilation within the space, the duration of the fire event will be significantly prolonged. In this case, the burning packaging requires ventilation to sustain combustion. As a result, with limited or no ventilation, the heat load generated by the smoldering packaging will remain low thereby minimizing the involvement of fireworks. However, for a case where fire progresses to a more robust stage of growth, as observed eventually in the Washington test and immediately in the Battelle tests, the insulating quality of thermally thin solids (i.e., packaging and thin flame breaks) becomes far less important.

To date, there is no known research focusing on designing flame breaks for maximum efficiency for fires in consumer fireworks retail sales applications. Nonetheless, very specific design criteria are provided in NFPA 1124. The scientific basis for these criteria, whether theoretical or experimental, should be referenced in the appendix of the standard. (Research Foundation Report at pp. 66-67, footnotes omitted)

The Council directs that the provisions for flame breaks in chapter 7 of NFPA 1124 be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and associated substantiation must be obtained by the Technical Committee on Fire Code (NFPA 1).

7. Separation Distances. Paragraphs 6.4.7 and 7.4.7 of NFPA 1124 address separation distances. The Foundation Report indicates that “minimum separation distances for temporary consumer fireworks retail sales facilities include distances to nearby buildings, combustibles, other tents, vehicle parking, other stands and storage of consumer fireworks. Minimum distances range from 5-20 feet depending upon the application. The basis for this range of distances is unclear, particularly given the results of the Washington test which officially concluded a minimum separation distance on the order of 40 feet would be appropriate for many of the listed applications, despite projectiles traveling greater distances during the test. Providing a discussion of the rationale behind specific separation distance requirements in the appendix of the standard may alleviate such apparent discrepancies between existing provisions and known experimental results.” (Research Foundation Report at p. 67, footnote omitted)

The Council directs that the separation distances be adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and the associated substantiation must be obtained by the Technical Committee on Building Construction (NFPA 5000).

8. Construction Materials. Paragraphs 6.4.2 and 7.4.3 (1) indicate that buildings having an area up to and including 8000 ft<sup>2</sup> (743 m<sup>2</sup>) are permitted to be constructed of any approved construction materials. The Research Foundation Report indicates that “the basis for selecting this critical area is unclear” and that “further research regarding the balance between fuel loading, sprinkler protection and structural protection is necessary before such a specific criteria can be reasonably implemented.” (Research Foundation Report at pp. 63-64)

The Council directs that further research be conducted in this regard and that the 8000 ft<sup>2</sup> or any other similar proposed threshold regarding construction materials be adequately substantiated. Supporting testing, data, and other relevant studies are to be submitted and referenced. Approval of these provisions and the associated substantiation must be obtained by the Technical Committee on Building Construction (NFPA 5000).

9. Sprinkler Design Criteria. Paragraph 6.5.1.1 requires that an automatic sprinkler system be designed using the following criteria for the areas in which the consumer fireworks are stored in DOT-approved packaging:

- (1) Consumer fireworks stored in DOT-approved packaging shall be considered as a Class IV commodity.

- (2) Consumer fireworks stored to a height not greater than 10 ft (3 m) in racks or 12 ft (3.7 m) otherwise shall be classified as an Ordinary Hazard (Group 2) occupancy.

- (3) Consumer fireworks stored to a height not greater than 12 ft (3.7 m) in racks but greater than 10 ft (3 m) shall be classified as an Extra Hazard (Group 1) occupancy.

- (4) Consumer fireworks stored to a height greater than 12 ft (3.7 m) shall be protected by an automatic sprinkler system designed using a fire control approach or a special design approach in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

The Research Foundation Report indicates that “based upon the research explored in this literature review, there appears to be no basis for any of these very specific design requirements. If data exists which suggests that consumer fireworks stored in DOT-approved packaging exhibit similar burning behavior to a Class IV commodity, then it should be referenced in the standard so that the basis for this requirement is clear. Similarly, the rationale for using requirements related to occupancy classification on the basis of storage height should be detailed in the appendix of the standard. If further testing is necessary for such justification, this testing should be performed or the specific requirements removed from the standard. Currently, it appears that sprinkler protection is provided based solely upon the hazard posed by packaging; however, supporting data for this strategy is inadequate at best.” (Research Foundation Report at p. 64)

In this regard the Council further notes that subsection 6.5.1, subsection 7.3.6 and paragraph A.7.5.1.1 of NFPA 1124 require sprinkler systems to be designed and installed in accordance with NFPA 13. However, NFPA 13 contains no design or installation provisions that address consumer fireworks.

The Council directs that sprinkler system design and installation provisions for both the storage and retail sale of consumer pyrotechnics be developed and adequately substantiated and that supporting testing, data, and other relevant studies be submitted and referenced. Approval of these provisions and the associated substantiation must be obtained by the Technical Committee on Sprinkler System Discharge Criteria (NFPA 13).

#### IV. Conclusion

In concluding that the 2006 edition of NFPA 1124 should remain in place for the present, as issued, and that standards development for the storage and retail sale of consumer fireworks should continue for the period designated and in the manner prescribed in this decision, the Council has been greatly influenced by the powerful presentation of the enforcement community urging NFPA to retain and continue to improve the existing storage and retail sales standards. The Council also believes that, with the establishment of clear guidelines made possible by the Research Foundation Report and discussed in this decision, the industry and other participants now have clear and specific guidance as to the questions that need to be answered. In addition, marshaling the full capabilities of the NFPA standards development process, through procedures outlined herein, can improve the quality of and confidence in the storage and retail sales provisions. In this regard, the effectiveness of NFPA’s standards development efforts in this area can be maximized by utilizing other technical committee projects with clear interest and expertise in areas critically related to storage and retail sales facilities. Ultimately, of course, producing acceptable standards within the time framework set forth in this decision will require a concerted commitment of the industry or others to fund and implement reliable and reviewable research and testing. It is hoped that such a commitment together with the energy and dedication of the participants in the NFPA standards development process will result in enhanced standards in the interests of public safety.