# Standards Council Meeting
## Supplemental Agenda
### March 5-6, 2012

**San Juan Marriott and Resort**  
and Stellaris Casino  
1309 Ashford Avenue  
San Juan, PR 00907  
787-722-7000

| 12-3-1 | Review of the Product Development Process by Paul Crossman, Vice President, Business Group. No Attachment |
| 12-3-2 | Review of the Process of Standards Council Decision Making by Maureen Brodoff, Vice President and General Council. No Attachment |
| 12-3-3 | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Section 6.3.4 of the 2010 and proposed 2013 edition of NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, (TIA No. 1041). Comment closing date was January 13, 2012.  
**STAFF NOTE:** Please note that TIA No. 1041 on NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, is being proposed for the 2010 and the 2013 editions. In the Regulations Governing Committee Projects (*Regs*) at Section 5.9, TIAs shall apply to the document existing at the time of issuance, except in the case of a document undergoing revisions where a TIA can apply to the existing and proposed editions. NFPA 13D is expected to be an A2012 consent document. The NITMAM Closing Date for A2012 consent documents is April 6, 2012. If this TIA on the 2010 edition is issued by the Standards Council, this TIA will be placed on a future Council agenda for consideration of issuance concurrently with the 2013 edition of NFPA 13D.  
| 12-3-3-a | Text of proposed TIA No. 1041. See Attachment 12-3-3-a |
| 12-3-3-b | Ballot results of TIA No. 1041 Passed TCC ballot on both correlation and emergency nature; Passed TC ballot on both technical merit and emergency nature. See Attachment 12-3-3-b |
| 12-3-3-c | One public comment was received. See Attachment 12-3-3-c |
| 12-3-4 | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Section 2.3.2, 6.1.1, 6.2.1.1, A.6.2.1.1(c), A.6.2.1.1(d), and 6.2.2 of the 2011 edition of NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*, (TIA No. 1043). Comment closing date was January 13, 2012.  
| 12-3-4-a | Text of proposed TIA No. 1043. See Attachment 12-3-4-a |
| 12-3-4-b | Ballot results of TIA No. 1043 Passed TC ballot on both technical merit and emergency nature. See Attachment 12-3-4-b |
| 12-3-4-c | Two public comments were received. See Attachment 12-3-4-c |
| 12-3-5 | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Section 3.3 (New), 10.6, 11.2.1.3, and B.1.2.1 of the 2012 edition of NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*, (TIA No. 1036). This TIA was administratively withdrawn from the October, 2011 Council Meeting so that proposed text changes to the sprinklers in the TIA could be reviewed by other NFPA Technical Committees. Comment closing date was September 9, 2011. |
| 12-3-5-a | Text of proposed TIA No. 1036. See Attachment 12-3-5-a See SA 12-3-5-a |
| 12-3-5-b | Ballot results of TIA No. 1036 **Passed** TC ballot on both technical merit and emergency nature. See Attachment 12-3-5-b See SA 12-3-5-b |
| 12-3-5-c | One public comment was received. See Attachment 12-3-5-c |
| 12-3-6 | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Section 10.4.4 and A.10.4.4 of the 2009 edition of NFPA 75, *Standard for the Protection of Information Technology Equipment*, (TIA No. 1042). Comment closing date was January 13, 2012. |
| 12-3-6-a | Text of proposed TIA No. 1042. See Attachment 12-3-6-a |
| 12-3-6-b | Ballot results of TIA No. 1042 **Passed** TC ballot on both technical merit and emergency nature. See Attachment 12-3-6-b |
| 12-3-6-c | Two public comments were received. See Attachment 12-3-6-c |
| 12-3-7 | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Section 6.3.1.7.1 of the 2010 and Proposed 2013 edition of NFPA 80, *Standard for Fire Door and other Opening Protectives*, (TIA No. 1039). Comment closing date was January 13, 2012. **STAFF NOTE:** Please note that TIA No. 1039 on NFPA 80, *Standard for Fire Doors and other Opening Protectives*, is being proposed for the 2010 and the 2013 editions. In the Regulations Governing Committee Projects (Regs) at Section 5.9, TIAs shall apply to the document existing at the time of issuance, except in the case of a document undergoing revisions where a TIA can apply to the existing and proposed editions. NFPA 80 is expected to be an A2012 consent document. The NITMAM Closing Date for A2012 consent documents is April 6, 2012. If this TIA on the 2010 edition is issued by the Standards Council, this TIA will be placed on a future Council agenda for consideration of issuance concurrently with the 2013 edition of NFPA 80. |
| 12-3-7-a | Text of proposed TIA No. 1039. See Attachment 12-3-7-a |
| 12-3-7-b | Ballot results of TIA No. 1039. **Passed** TC ballot on technical merit but **Failed** ballot on emergency nature. See Attachment 12-3-7-b |
| 12-3-7-c | No public comments received. No Attachment |
| 12-3-7-d | APPEAL Consider an appeal of Tim Klotz of Kelley Brothers requesting that the Council not issue proposed Tentative Interim Amendment to Section 6.3.1.7 of the 2010 and proposed 2013 edition of NFPA 80, *Standard for Fire Doors and other Opening Protectives*, (TIA No. 1039). See Attachment 12-3-7-d |
| 12-3-7-e | Three comments received on the appeal filed by T. Klotz requesting that the Council issue proposed Tentative Interim Amendment (TIA) to NFPA 80 (TIA No. 1039). See Attachment 12-3-7-e See SA 12-3-7-e |
| 12-3-8 | Hear an update on the testing done on antifreeze in standard sprinkler sprays. See SA 12-3-8 |
The 2011 Revision Cycle Consent Documents were letter balloted by the Council with an issuance date of December 13, 2011 and an effective date of January 2, 2012, as shown below: No action necessary.

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td>Standard for the Fire Protection of Telecommunications Facilities</td>
</tr>
<tr>
<td>115</td>
<td>Standard for Laser Fire Protection</td>
</tr>
<tr>
<td>170</td>
<td>Standard for Fire Safety and Emergency Symbols</td>
</tr>
<tr>
<td>252</td>
<td>Standard Methods of Fire Tests of Door Assemblies</td>
</tr>
<tr>
<td>257</td>
<td>Standard on Fire Test for Window and Glass Block Assemblies</td>
</tr>
<tr>
<td>269</td>
<td>Standard Test Method for Developing Toxic Potency Data for Use in Fire Hazard Modeling</td>
</tr>
<tr>
<td>271</td>
<td>Standard Method of Test for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter (withdrawn)</td>
</tr>
<tr>
<td>288</td>
<td>Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies</td>
</tr>
<tr>
<td>385</td>
<td>Standard for Tank Vehicles for Flammable and Combustible Liquids</td>
</tr>
<tr>
<td>497</td>
<td>Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas</td>
</tr>
<tr>
<td>550</td>
<td>Guide to the Fire Safety Concepts Tree</td>
</tr>
<tr>
<td>557</td>
<td>Standard for Determination of Fire Loads for Use in Structural Fire Protection Design</td>
</tr>
<tr>
<td>560</td>
<td>Standard for the Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigation (withdrawn)</td>
</tr>
<tr>
<td>655</td>
<td>Standard for Prevention of Sulfur Fires and Explosions</td>
</tr>
<tr>
<td>1037</td>
<td>Standard for Professional Qualifications for Fire Marshal</td>
</tr>
<tr>
<td>1041</td>
<td>Standard for Fire Service Instructor Professional Qualifications</td>
</tr>
<tr>
<td>1051</td>
<td>Standard for Wildland Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>1401</td>
<td>Recommended Practice for Fire Service Training Reports and Records</td>
</tr>
<tr>
<td>1402</td>
<td>Guide to Building Fire Service Training Centers</td>
</tr>
<tr>
<td>1403</td>
<td>Standard on Live Fire Training Evolutions</td>
</tr>
<tr>
<td>1906</td>
<td>Standard for Wildland Fire Apparatus</td>
</tr>
<tr>
<td>1911</td>
<td>Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus</td>
</tr>
<tr>
<td>1983</td>
<td>Standard on Life Safety Rope and Equipment for Emergency Services</td>
</tr>
</tbody>
</table>
**Proposed Document Scope:**

1.1 **Scope.** 1.1.1* The standard shall provide the minimum requirements for testing of integrated fire protection and life safety systems where such systems are involved in emergency response operations that do not involve structural firefighting.
testing is required by governing laws, codes, regulations, or standards.

1.1.2* This standard shall not provide requirements for testing of individual systems.

1.1.3 The requirements of this standard shall apply to new and existing systems.

See Attachment 12-3-17  See SA 12-3-17

12-3-18 Consider a request from NFPA Staff to disband the Physical and Chemical Data Consistency (PCDCA) Advisory Committee.  See Attachment 12-3-18  See SA 12-3-18

12-3-19 Act on the National Electrical Code schedule for the Annual 2016 Revision Cycle.  See Attachment 12-3-19

12-3-20 Consider two requests for a revision cycle change for NFPA 70, National Electrical Code.  See Attachment 12-3-20

12-3-20-a One comment received on the NEC® revision cycle change.  See SA 12-3-20-a

ADDITION

12-3-21 Consider requests from NFPA Committees to change revision cycles for the following documents:

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<thead>
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<tr>
<td>33</td>
<td>2011 A2013</td>
<td>A2013 to F2014</td>
<td>one time move</td>
<td>3 to 4 ½ year revision cycle</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>2011 A2013</td>
<td>A2013 to F2014</td>
<td>one time move</td>
<td>3 to 4 ½ year revision cycle</td>
<td></td>
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<tr>
<td>75</td>
<td>2009 A2012</td>
<td>A2016 to F2015</td>
<td>one time move</td>
<td>4 to 3½ year revision cycle</td>
<td></td>
</tr>
<tr>
<td>415</td>
<td>2008 A2012</td>
<td>A2017 to A2015</td>
<td>one time move</td>
<td>5 to 3 year revision cycle</td>
<td></td>
</tr>
<tr>
<td>423</td>
<td>2010 F2014</td>
<td>F2014 to A2015</td>
<td>one time move</td>
<td>5 to 5½ year revision cycle</td>
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<tr>
<td>556</td>
<td>2011 A2014</td>
<td>A2014 to A2015</td>
<td>one time move</td>
<td>4 to 5 year revision cycle</td>
<td></td>
</tr>
<tr>
<td>1901</td>
<td>2009 A2013</td>
<td>A2013 to A2015</td>
<td>one time move</td>
<td>5 to 7 year revision cycle</td>
<td></td>
</tr>
<tr>
<td>1906</td>
<td>2012 F2016</td>
<td>F2016 to A2015</td>
<td>one time move</td>
<td>5 to 3 ½ year revision cycle</td>
<td></td>
</tr>
</tbody>
</table>

See Attachment 12-3-21  See SA 12-3-21

12-3-22 Report of the Awards Task Group (J. Pauley, Chair).

12-3-23 Report of the Policy and Procedures Task Group. (J. Milke, Chair).

12-3-24 Report of the Membership Task Group (K. Bell, Chair).

12-3-25 Dates and places of upcoming meetings:

August 6-9, 2012
(TG Meeting 12:00 PM on August 6)  Quincy, MA

October 29-30, 2012
(TG Meeting 8:00 AM on October 29)  Santa Fe, NM

12-3-26 Hear a report on the Minutes of the October 2011 meeting.  No Attachment
1. Move 6.5.3 to 6.3.4 as follows:

6.5.3.4 A warning sign, with minimum 1/4 in. letters, shall be affixed adjacent to the main shutoff valve and shall state the following:

   **WARNING:** The water system for this home supplies fire sprinklers that require certain flows and pressures to fight a fire. Devices that restrict the flow or decrease the pressure or automatically shut off the water to the fire sprinkler system, such as water softeners, filtration systems, and automatic shutoff valves, shall not be added to this system without a review of the fire sprinkler system by a fire protection specialist. Do not remove this sign.

**Submitter’s Substantiation:** This proposed language is currently located within the “Common Supply Pipes” section of Chapter 6. This sign is not appropriate for this section and is only needed for multipurpose piping systems. This section should be moved to 6.3.4 so that it falls under the “Multipurpose Piping” heading.

**Emergency Nature:** This was a mistake that the committee made between the ROP and ROC. Originally wording was in 6.3(5), 2007 Edition. Originally proposed as 6.3.4 during ROP and then moved for some reason to 6.5.3. This sign is not necessary on stand-alone systems. Because of construction practices in California the sign must be places at the meter by the street or on the outside of the home sometimes by the front door. This is a major problem for the builders, their marketing departments and their sales personnel.
TIA FINAL TCC BALLOT RESULTS

According to 5.4 in the NFPA (RGCP), the final results show this TIA HAS achieved the necessary votes on both Question 1 (Correlation Issues) and Question 2 (Emergency Nature).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 14.

\[19 \text{ (eligible to vote)} - 1 \text{ (not returned)} - 0 \text{ (abstention)} = 18 \times 0.75 = 13.5\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[19 \text{ eligible} \div 2 = 9.5 = 10\] (this is the simple majority)

---

19 Eligible to Vote
1 Not Returned (Palenski)

TCC FINAL Ballot results for Correlation Issues are as follows:
18 Agree
0 Disagree
0 Abstentions

FINAL ACTION: PASSED

TCC FINAL Ballot results for Emergency Nature are as follows:
14 Agree (Grill w/comment)
4 Disagree (Hilton, Stultz, Thompson, Underwood)
0 Abstentions

FINAL ACTION: PASSED

Final AUT-RES Ballots are on the next page
According to 5.4 in the NFPA (RGCP), the final results show this TIA **HAS** achieved the necessary votes on both Question 1 (**Technical Merit**) and Question 2 (**Emergency Nature**).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is **20**.

\[
31 \text{ (eligible to vote)} - 5 \text{ (not returned)} - 0 \text{ (abstentions)} = 26 \times 0.75 = 19.5
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
31 \text{ eligible} \div 2 = 15.5 = 16 \text{ (this is the simple majority)}
\]

**31 Eligible to Vote**  
**5 Not Returned (Haagensen, Hopkins, Ketner, O’Brien, Shaw)**

**TC FINAL** Ballot results for **Technical Merit** are as follows:  
25 Agree  
1 Disagree (Skare)  
0 Abstentions

**FINAL ACTION: PASSED**

The number of affirmative votes needed to obtain a recommendation to issue the TIA is **19**.

\[
31 \text{ (eligible to vote)} - 5 \text{ (not returned)} - 1 \text{ (abstention)} = 25 \times 0.75 = 18.75
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
31 \text{ eligible} \div 2 = 15.5 = 16 \text{ (this is the simple majority)}
\]

**TC FINAL** Ballot results for **Emergency Nature** are as follows:  
22 Agree (Pugsley w/comment)  
3 Disagree (Brown, Rians, Skare)  
1 Abstention (Flancher)

**FINAL ACTION: PASSED**
TECHNICAL CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1 I agree with the TECHNICAL MERITS of the Proposed TIA to Move 6.5.3 to 6.3.4

☐ AGREE  ☐ DISAGREE*  ☐ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. If disagreeing, cite relevant section(s)/paragraph(s) of the correlation issue and describe.

Question 2: I agree that the subject of this TIA is of an EMERGENCY NATURE.

☐ AGREE  ☐ DISAGREE*  ☐ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a negative/disagreement or abstaining position.

NOT NEW LANGUAGE - CURRENTLY NOT "COMMON SUPPLY PIPES" SECTION.

Signature

Luke Hixon

Name (Please Print)

1/3/2012

Date

Please return the ballot on or before January 6, 2012

PLEASE RETURN TO:
Stacey Van Zandt, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7056

E-mail: svanzandt@nfpa.org
TECHNICAL CORRELATING COMMITTEE
LETTER BALLOT

PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 19D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Move 6.5.3 to 6.3.4

X AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. If disagreeing, cite relevant section(s)/paragraph(s) of the correlation issue and describe.

____________________________________________________________________________________________________

Question 2: I agree that the subject of this TIA is of an EMERGENCY NATURE.

_________ AGREE X DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a negative/disagreement or abstaining position.

____________________________________________________________________________________________________

I do not see this issue as being "of an emergency nature"

____________________________________________________________________________________________________

Signature  Douglas P. Stultz
Name (Please Print)  03 JAN 2012
Date

Please return the ballot on or before January 6, 2012

PLEASE RETURN TO:
Stacey Van Zandt, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7056  E-mail: svanzandt@nfpa.org
TECHNICAL CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Move 6.5.3 to 6.3.4

<table>
<thead>
<tr>
<th>Agree</th>
<th>Disagree*</th>
<th>Abstain*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. If disagreeing, cite relevant section(s)/paragraph(s) of the correlation issue and describe.

______________________________________________________________

Question 2: I agree that the subject of this TIA is of an EMERGENCY NATURE.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Disagree*</th>
<th>Abstain*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td></td>
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</tbody>
</table>

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a negative/disagreement or abstaining position.

I do not believe that the submitter has documented the emergency nature of the TIA on its technical merits.

______________________________________________________________

Signature
I. Michael Thompson (alternate)
Name (Please Print)
January 6, 2012
Date

Please return the ballot on or before January 6, 2012

PLEASE RETURN TO:
Stacey Van Zandt, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7056
E-mail: svanzandt@nfpa.org
TECHNICAL CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the proposed TIA to Move 6.5.3 to 6.3.4

[ ] AGREE    [ ] DISAGREE*   [ ] ABSTAIN*

EXPLANATION OF VOTE: Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. If disagreeing, cite relevant section(s)/paragraph(s) of the correlation issue and describe.

Question 2: I agree that the subject of this TIA is of an EMERGENCY NATURE.

[ ] AGREE    [ ] DISAGREE*   [ ] ABSTAIN*

EXPLANATION OF VOTE: Please type or print your comments:

*An explanation must accompany a negative disagreement or abstaining position.

This does not meet the “emergency nature” requirements of 5.2.

__________________________
Signature
Lynn K. Underwood
January 3, 2010

Please return the ballot on or before January 6, 2012

PLEASE RETURN TO:
Seyra Yen Zandi, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7056  E-mail: syenzandi@nfpa.org
TECHNICAL CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1 I agree with the TECHNICAL MERITS of the Proposed TIA to Move 6.5.3 to 6.3.4

X______ AGREE _________ DISAGREE* _________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. If disagreeing, cite relevant section(s)/paragraph(s) of the correlation issue and describe.

Question 2: I agree that the subject of this TIA is of an EMERGENCY NATURE.

X*______ AGREE _________ DISAGREE* _________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a negative/disagreement or abstaining position.

I think it is difficult to classify this issue to be of an emergency nature under the definitions of NFPA. However, there isn't any other way of handling the issue.

Signature
Raymond A. Grill
Name (Please Print)
12/27/2011
Date

Please return the ballot on or before January 6, 2012

PLEASE RETURN TO:
Stacey Van Zandt, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169       FAX: (617) 984-7056     E-mail: svanzandt@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Move 6.5.3 to 6.3.4

X AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

________________________________________________________________________

Question 2: I agree that the subject is of an EMERGENCY NATURE.

__________ AGREE X DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I DON'T FEEL THAT THIS ISSUE WARRANTS AN EMERGENCY NATURE.

________________________________________________________________________

Signature

PHILLIP A. BROWN
Name (Please Print)

12-16-2011
Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7110

E-mail: ecarroll@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Move 6.5.3 to 6.3.4

[ ] AGREE [ ] DISAGREE* [ ] ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

[ ] AGREE [X] DISAGREE* [ ] ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

This is not a threat to life safety, only an economic concern.

Signature

Steven R. Riens
CEO

Name (Please Print)

11/21/2011

Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7110 E-mail: ecarroll@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Move 6.5.3 to 6.3.4

_________ AGREE       ______ DISAGREE*       ______ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I do not agree that the warning sign is appropriate for only multipurpose systems. I believe any incoming supply that serves fire sprinklers should have a warning sign alerting the homeowner and warning that modifications could have an impact on the performance of the fire sprinkler system.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

_________ AGREE       ______ DISAGREE*       ______ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I also do not believe that this is of an emergency nature. Based on the ROC justification text, it doesn't appear that the change was made in error as stated in the justification. The ultimate location of this warning sign may be unfortunate based on certain construction practices, and although I would like to minimize any resistance to residential sprinkler systems, I don't believe this meets the emergency nature criteria.

Signature

ERIC SKARE

Name (Please Print)

12/5/2011

Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7110       E-mail: ecarroll@nfpa.org
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Move 6.5.3 to 6.3.4

[ ] AGREE [ ] DISAGREE* [ ] ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

[ ] AGREE [ ] DISAGREE* [ ] X ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

The AWWA Fire Protection Committee did not provide a response to Question #2. I therefore abstain from voting.

Signature

Dawn Flancher
Name (Please Print)

12/16/2011
Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7110

E-mail: ecarroll@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1041
To Move 6.5.3 to 6.3.4 of the 2010 and Proposed 2013 Editions of NFPA 13D,
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Move 6.5.3 to 6.3.4

____X____ AGREE

____ _____ DISAGREE*

____ _____ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

____X____ AGREE

____ _____ DISAGREE*

____ _____ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

This proposed TIA matches the definition of 5.2 (a) however it's presentation as an "Emergency" is distorted. Action under earlier revisions seem a more reasonable course for matters like this.

Scott Pugsley
Signature
Scott Pugsley

Name (Please Print)

_12-16-2011 ____________________________
Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110
E-mail: ecarroll@nfpa.org

February 29, 2012
Supplemental Agenda, March 5-6, 2012
NFPA 13D-2010 and Proposed 2013 Edition
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes
TIA Log No.: 1041
Reference: 6.5.3
Comment Closing Date: January 13, 2012
Submitter: Fred Benn, Advanced Automatic Sprinkler, Inc.

I would have to disagree with the submitter on this proposal, the section this is currently in and the section 6.5.3 is appropriate to cover the main valve at the water meter when the system is installed per the standard. Obviously depending on jurisdictional variance that there may be different arrangements supplying the residential and domestic systems, but the valve at the street or curb or meter box is where the system will be shut the majority of the time. Since the code does not require any other shut off provisions and discourages the act it is appropriate to have the requirement stated in the current section. I would like to see a requirement thought that the sign be made of materials that will not disintegrate due to moisture intrusion within the meter box.

Best regards

Todd Letterman
Fire Prevention Engineer CFPS
Riverside County Fire Department  "Fire never sleeps"
(951) 955-5273 FAX (951) 955-4886
todd.letterman@fire.ca.gov
Item 12-3-4
1. Add the ASTM D 92 reference into 2.3.2 to read as follows:


2. Modify Section 6.1.1 as follows:

6.1.1 The protection criteria in this chapter are for metal containers only. Protection criteria for glass or plastic containers greater than 118 ml (4 fl oz) is beyond the scope of this chapter, with the exception of the maximum allowable quantities (MAQ) and those aerosol products covered by Section 6.2.1.1.

3. Add a new subsection to read as follows:

6.2.1.1 Aerosol products in plastic containers larger than 118 ml (4 fl. oz.) shall be considered to be equivalent to Class III commodities, as defined in NFPA 13, Standard for the Installation of Sprinkler Systems, where any of the following conditions are met:

(a) Base product has no fire point when tested in accordance with ASTM D 92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester, and nonflammable propellant.

(b) Base product has no sustained combustion as tested in accordance with “Method of Testing for Sustained combustibility”, Title 49 Code of Federal Regulations, Part 173, Appendix H, or the UN publication Recommendation on the Transport of Dangerous Goods, and nonflammable propellant.

(c)* Base product contains up to 20% by volume (15.8% by weight) of ethanol and/or isopropyl alcohol in an aqueous mix and nonflammable propellant.

(d)* Base product contains 4% by weight or less of an emulsified flammable liquefied gas propellant within an aqueous base. The propellant shall remain emulsified for the life of the product. Where such propellant is not permanently emulsified then the propellant shall be nonflammable.

A.6.2.1.1(c) Fire testing with alcohol and water at this percentage in plastic bottles has been successful. Small-scale burn tests of aerosol products in plastic containers have shown the aerosol with a nonflammable propellant to behave the same as the aerosol with no propellant.

A.6.2.1.1(d) A fire test with a formula of this type using liquefied petroleum gas was successful. An emulsion, in an aerosol product, would be a mixture of two or more liquids in which one is present as droplets, of microscopic or ultramicroscopic size, distributed throughout the other. Emulsions are formed from the component liquids either spontaneously or, more often, by mechanical means, such as agitation, provided that the liquids that are mixed have no (or a very limited) mutual solubility. Emulsions are stabilized by agents that form films at the surface of the droplets (e.g., soap molecules) or that impart to them a mechanical stability (e.g., colloidal carbon or bentonite). Colloidal distributions or suspension of one or more liquid(s) with another will have a shelf life that varies with the efficiency of the recipe used.

4. Modify 6.2.2 as follows:

6.2.2 In cases where the storage of Level 1 aerosol products or aerosol products in plastic containers as meeting the requirements of paragraph 6.2.1.1 is required to be protected, such storage shall be protected in accordance with the requirements for Class III commodities set forth in NFPA 13, Standard for the Installation of Sprinkler Systems.

Submitter’s Substantiation: At the close of the 2011 revision cycle, only preliminary fire testing had been completed on aerosol products in plastic containers. The testing clearly demonstrated the severe fire hazard created by one product type and hinted that a significantly lower fire hazard may be created by another. It did not provide any guidance on how to protect the lower hazard products. The US DOT has allowed the transport of aerosol products in plastic containers however, the guidance provided in the 2011 edition of NFPA 30B limits a manufacturer’s ability to develop and sell low hazard versions of this product. Since the release of the...
2011 edition, a significant amount of new research has been completed on aerosol products in plastic containers that clearly defines a “low hazard” version of the product that can be stored in general purpose warehouses without significantly increasing the fire hazard. The following discussion provides an overview of the work that was done and the conclusions from the effort.

1) Aerosol Products in Plastic Containers – Propellant: Nonflammable; Base: Liquid Content that Does not Support Combustion

The fire hazard created by aerosol products in metal containers is driven by their propellant and the liquid content. An aerosol product that contains a nonflammable propellant and a liquid content that does not support combustion would have a Chemical Heat of Combustion of 0 kJ/g and be classified as a Level 1 aerosol product. Level 1 aerosols are protected using the same protection criteria needed for Class III commodities provided by NFPA 13.

The fire hazard of an aerosol product in a plastic container cannot be directly compared to aerosol products in metal containers. However, using commodity classification information for plastic containers filled with liquids that do not burn supports proposing a protection level for equivalent aerosol products. In this case, the content of the aerosol would not contribute to a fire. Only the primary (plastic container) and secondary (carton) packaging would contribute. If the aerosol was not pressurized, it would directly compare to products listed in NFPA 13 Annex A and FM Global Property Loss Prevention Data Sheet 8-1 as shown below.

**NFPA 13 Annex A**
Table A.5.6.3
- Milk in Plastic – Class I
- Bottles, Jars / Filled noncombustible liquids / Plastic, PET – Class I

**FM Global Property Loss Prevention Data Sheet 8-1**
2.2.2.2 Examples of Class I Commodities
- 4. Other – Noncombustible liquids in 5 gal (19 l) or smaller plastic containers

Both standards treat a plastic container filled with a liquid that does not burn as a Class I commodity. The addition of a nonflammable propellant to a plastic container will not change the burning properties of the commodity (it may result in a violent rupture with no change in burning rates or severity). The above discussion would point to classifying the aerosol products in plastic containers charged with a nonflammable propellant and liquid that does not burn as a Class I commodity. However, in an effort to provide consistency in the protection of aerosols, the protection proposal targets using the same protection currently recommended for Level 1 aerosols.

2) Aerosol Products in Plastic Containers – Propellant: Nonflammable; Base: Liquid Content Consists of up to 20% Ethanol or Isopropyl Alcohol in Aqueous Solution

An aerosol product in a plastic container that contains a liquid that burns will create a fire hazard at least as severe as the same liquid in an unpressurized plastic container. The fire hazard may increase because the container is pressurized and will definitely increase if it is pressurized with a flammable propellant. As the fire hazard of the aerosol’s content increases, the fire hazard of the actual aerosol will increase as well. If on the other hand, the aerosol product in a plastic container was charged with liquid components that can easily be protected in an unpressurized plastic container, similar to the discussion under item 1, there is a good chance that the aerosol products in plastic containers can be protected with a similar level of protection. The only question might be the impact of adding nonflammable propellant.

FM Global has developed protection criteria for several alcohol water mixtures in plastic bottles. The alcohols used in the testing are ethanol and isopropyl alcohol. The mixtures ranged from 100% alcohol (approximate) down to 20% by volume alcohol/80% by volume water. The 20% alcohol/80% water mixture in a plastic bottle in cartons was tested in a full-scale array with the overview of the test presented in Table 1. This alcohol/water mixture does have a definable fire point; however, it produces unstable burning.
<table>
<thead>
<tr>
<th>Test Parameters</th>
<th>Fire Test Summary – Diluted Alcohol Test Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Number</td>
<td>5</td>
</tr>
<tr>
<td>Test Date</td>
<td>1-19-99</td>
</tr>
<tr>
<td>Commodity</td>
<td>20% isopropyl alcohol / 80% water in a 1 pint [470 ml] plastic container in cartons</td>
</tr>
<tr>
<td>Storage Arrangement</td>
<td>Rack</td>
</tr>
<tr>
<td>Storage Height (ft) [m]</td>
<td>Nominal 20 [6.1]</td>
</tr>
<tr>
<td>No. Tiers</td>
<td>4</td>
</tr>
<tr>
<td>Ceiling Height (ft) [m]</td>
<td>30 [9.1]</td>
</tr>
<tr>
<td>Aisle Width (ft) [m]</td>
<td>8 [2.4]</td>
</tr>
<tr>
<td>Sprinkler Type (K factor gpm/psi^{0.5} [L/min/bar^{0.5}], Temperature Rating)</td>
<td>K 5.6 [81]/ 286°F [140°C] / Standard Response</td>
</tr>
<tr>
<td>Sprinkler Spacing (ft x ft) [m x m]</td>
<td>10 x 10 [3.0 x 3.0]</td>
</tr>
<tr>
<td>Discharge Density (gpm/ft^2) [mm/min]</td>
<td>0.30 [12]</td>
</tr>
<tr>
<td>First Sprinkler Operated (min:sec)</td>
<td>21:56</td>
</tr>
<tr>
<td>Total Sprinklers Operated</td>
<td>2</td>
</tr>
<tr>
<td>Peak Gas Temperature (°F) [°C]</td>
<td>585°F [307]</td>
</tr>
<tr>
<td>Peak Steel Temperature (°F) [°C]</td>
<td>189°F [87.2]</td>
</tr>
<tr>
<td>Test Concluded (min:sec)</td>
<td>30:00</td>
</tr>
</tbody>
</table>

Based on the results of this test, FM Global has recommended protecting 20%vol alcohol/80%vol water mixtures in plastic bottles with the same protection recommended for liquids that do not burn in plastic containers, i.e., Class I commodity. A final question is does pressurizing a plastic container filled with a 20%vol alcohol/80%vol water mixture with nonflammable propellant change the burning properties of the product.

Since the propellant will not burn, the only real opportunity to change the burning behavior would be to cause the alcohol/water mixture to burn more severely (e.g., maybe produce fireballs when the mixture is ejected from the container under pressure). To evaluate this potential, a small-scale test series was contracted with Underwriters Laboratories to investigate the impact of pressurizing aerosol products in plastic containers, filled with a 20%vol alcohol/80%vol water mixture, with nonflammable propellants. A summary of 5 tests that were run is provided in Table 2. Two filling methods were investigated, direct fill (liquid and propellant in same space) and bag-on-valve (liquid in one compartment, propellant in outer compartment). UL reported the number of container failures. The overall fire behavior was provided through direct observation. The tests looked at two cases of six containers arranged with a 6 in. (15 cm) flue between them and a point igniter in the flue space. The cases were in a small pan.
Table 2 UL Testing Summary

<table>
<thead>
<tr>
<th>Test #</th>
<th>Description</th>
<th>Fill Type</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15% ethanol and 85% water</td>
<td>Direct Fill</td>
<td>12 containers ruptured but burned in place</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No fire balls during rupture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No pool fire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bottom of boxes unburned after 6 min</td>
</tr>
<tr>
<td>2</td>
<td>15% ethanol and 85% water</td>
<td>Bag on Valve</td>
<td>12 containers ruptured with some ejected away from case</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50% of one carton unburned after 4 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No fire balls during rupture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No pool fire</td>
</tr>
<tr>
<td>3</td>
<td>20% ethanol and 80% water</td>
<td>Direct Fill</td>
<td>12 containers ruptured but burned in place</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No fire balls during rupture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No pool fire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bottom of boxes unburned after 5 min</td>
</tr>
<tr>
<td>4</td>
<td>20% ethanol and 80% water</td>
<td>Direct Fill</td>
<td>12 containers ruptured but burned in place</td>
</tr>
<tr>
<td></td>
<td>Unpressurized Containers</td>
<td></td>
<td>No fire balls during rupture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No pool fire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bottom of boxes unburned after 10 min</td>
</tr>
<tr>
<td>5</td>
<td>20% ethanol and 80% water</td>
<td>Bag on Valve</td>
<td>5 containers ruptured</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fire extinguished by rupturing containers</td>
</tr>
</tbody>
</table>

None of the tests produced a pool fire or fireball. In all five tests, portions of the aerosol products in plastic containers and cardboard cases remained unburned. Based on these tests, it appears that the fire properties of alcohol/water mixture remained unchanged when pressurized and that using Class III commodity protection will provide fully adequate protection for the aerosol products in plastic containers.

3) Aerosol Products in Plastic Containers – Propellant: 4% by Weight Nonflammable Propellant or Flammable Propellant that is Emulsified in Liquid Base; Base: Aqueous Base with no Fire Point.

An emulsion, in an aerosol product, would be a mixture of two or more liquids in which one is present as droplets, of microscopic or ultramicroscopic size, distributed throughout the other. Emulsions are formed from the component liquids either spontaneously or, more often, by mechanical means, such as agitation, provided that the liquids that are mixed have no (or a very limited) mutual solubility. Emulsions are stabilized by agents that form films at the surface of the droplets (e.g., soap molecules) or that impart to them a mechanical stability (e.g., colloidal carbon or bentonite). Colloidal distributions or suspension of one or more liquid(s) with another will have a shelf life that varies with the efficiency of the recipe used.

A Level 1 aerosol (metal can) was defined by the fire performance of shave cream. This product had limited amounts of flammable liquefied gas propellant to eject the mixture and to cause foaming of the mixture. In a fire, the hydrocarbon propellant would be ejected and burn, but the large quantities of foam mix and water tended to produce a very limited fire severity. A similar product was evaluated when placed in a plastic aerosol container.

The product consisted of several liquid components that do not support combustion mixed with water and a maximum of 4% by weight flammable liquefied gas propellant. The liquefied gas was held within the liquid mixture as an emulsion. The gas would eject the liquid product and cause the liquid mixture to foam. Since the liquid components do not burn, the main concern centers around the flammable liquefied gas propellant. The evaluation used small, intermediate, and full-scale fire testing to evaluate the fire hazard created by this product. All of the testing was completed at Underwriters Laboratories.

The intermediate and large-scale testing are summarized in Table 3. The large-scale test used the 12-Pallet Aerosol Classification Test protocol. This methodology only applies to metal aerosol products but, lacking any test data, it was considered a good starting point. The 12 pallet load palletized array operated 4 sprinklers in 10 seconds at around a minute and a half after ignition. The fire was quickly knocked down. The test was run for 32 minutes. The liquid product was released during the test and did not contribute. The flammable liquefied gas did create brief flare-ups of the fire when released and continued to create small fireballs throughout the test. The high sprinkler discharge density (0.79 gpm/ft²) (32 mm/min) easily extinguished the majority of the array and limited the fire spread to the ignition flue located in the center of the array. The fire test seemed to demonstrate that the limited amount of flammable liquefied gas in the product would not produce a severe fire; however, the high water density does not permit easy comparison to a Class III commodity fire.
An intermediate-scale test was run under the calorimeter at UL to evaluate the effect of a significantly lower water density (0.25 gpm/ft²) (10 mm/min) on this product. The product was placed in a double row rack with a storage height of 15 ft (4.6 m). Four open sprinklers were located 10 ft (3 m) above the top of the array and arranged to deliver a 0.25 gpm/ft² (10 mm/min). The sprinklers were activated at approximately one minute after ignition. The test was terminated at 4 minutes since the fire was extinguished. The percent damage was not provided in the UL report; however, the pictures indicate that the fire was again confined to the ignition flue.

NFPA 13 requires a 0.25 gpm/ft² (10 mm/min) to protect 15 ft (4.6 m) high double row rack storage of Class III commodity in a 25 ft (7.6 m) high building using low temperature ceiling sprinklers [NFPA 13, Table 16.2.1.3.2, Figure 16.2.1.3.2(c) curves E & F, Figure 16.2.1.3.4.1]. The intermediate-scale test indicates that this same protection level easily controlled/extinguished a fire involving the foam shave cream in a plastic aerosol container.

<table>
<thead>
<tr>
<th>Table 3 UL Test Summary</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Test Number</th>
<th>1 (Intermediate-Scale)</th>
<th>1 (Large-Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Date</td>
<td>12/31/09</td>
<td>10/26/09</td>
</tr>
<tr>
<td>Commodity</td>
<td>Shave Foam in 11 oz (330 ml) Plastic Aerosol</td>
<td>Shave Foam in 11 oz (330 ml) Plastic Aerosol</td>
</tr>
<tr>
<td>Storage Arrangement (pallet loads)</td>
<td>Rack Array under Calorimeter 2 x 2 x 3 high</td>
<td>Palletized Array 2 x 2 x 3 high</td>
</tr>
<tr>
<td>Storage Height (ft) [m]</td>
<td>15 [4.6]</td>
<td>14 [4.3]</td>
</tr>
<tr>
<td>No. Tiers</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ceiling Height (ft) [m]</td>
<td>Sprinklers at 25 [7.6] above floor</td>
<td>25 [7.6]</td>
</tr>
<tr>
<td>Aisle Width (ft)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Sprinkler Type (K factor gpm/psi⁰.⁵ [L/min/bar⁰.⁵], Temperature Rating)</td>
<td>K = 8.0 [120] / Open</td>
<td>11.2 [161] / 155°F [68°C]</td>
</tr>
<tr>
<td>Sprinkler Spacing (ft x ft) [m x m]</td>
<td>10 x 10 [3 x 3]</td>
<td>10 x 10 [3 x 3]</td>
</tr>
<tr>
<td>Discharge Density (gpm/ft²) [mm/min]</td>
<td>0.25 [10]</td>
<td>0.79 [32]</td>
</tr>
<tr>
<td>First Sprinkler Operated (min:sec)</td>
<td>1:07 water on</td>
<td>1:23</td>
</tr>
<tr>
<td>Total Sprinklers Operated</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Peak Gas Temperature (°F) [°C]</td>
<td>3000 kW peak heat release rate</td>
<td>1242 [672]</td>
</tr>
<tr>
<td>Peak Steel Temperature (°F) [°C]</td>
<td>None recorded</td>
<td>165 [74]</td>
</tr>
<tr>
<td>Test Concluded (min:sec)</td>
<td>4:00</td>
<td>32:00</td>
</tr>
</tbody>
</table>

In addition to the intermediate and large-scale fire test, a number of small-scale tests were also done to provide a visual documentation on how a plastic aerosol container with a shave foam type product behaves when exposed to fire without sprinkler protection. These tests consisted of placing two cases of six containers on each side of a standard igniter. The containers were contained in a cardboard box. A shave cream and a hair mousse were tested. A general description of the test results is provided in Table 4. Test 9 used a product that was very similar to what was tested in the intermediate and large-scale testing. It was a shave cream product that had a small percentage of a flammable liquefied gas that was in a stable emulsion with a multi-component liquid mixture. The liquid mixture did not support combustion. The product in Test 10 had a higher weight percent flammable liquefied gas that did not form a stable emulsion in the bottle. A liquefied gas layer formed in the container. It was not clear what the liquid mixture was made up of. In both products, the flammable liquefied gas was used to eject the liquid mixture out of the container and cause the liquid product to create foam.
In Test 9, all but two of the containers failed. The shave foam covered the cases, containers and pan after the test. The product burned weakly and extinguished the igniter used in the test. The product used in Test 10 did appear to burn more vigorously. Container failure produced momentary fireballs. While this limited-scale test cannot predict the behavior of a product in a full-scale arrangement, it did demonstrate that there were differences between the shave cream and the hair mousse, and that the hair mousse produced a more vigorous fire.

<table>
<thead>
<tr>
<th>Test #</th>
<th>Description</th>
<th>Fill Type</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Shave Cream Emulsion (4% by weight hydrocarbon propellant – the emulsion was stable, no propellant layer was noticeable in container)</td>
<td>Direct Fill</td>
<td>Initially flames are about 3 to 4 ft (0.9 to 1.2 m) high. First container ruptures at :50 seconds. Multiple container ruptures follow. The igniter is extinguished by a container rupture at approximately 1:15. The fire goes out at approximately 6 minutes. The two cases are covered in foam shave cream and two containers did not fail. There was no pool fire. The ruptures did not produce noticeable fireballs or increased burning.</td>
</tr>
<tr>
<td>10</td>
<td>Mousse and conditioner (6% by weight hydrocarbon propellant – the emulsion was not stable and a propellant layer formed in container)</td>
<td>Direct Fill</td>
<td>Initially flames are about 3 to 4 ft (0.9 to 1.2 m) high. First container ruptures at :48 seconds. Multiple container ruptures follow. The flames increase in intensity with the container ruptures. Eventually all of the containers are breached. A small pool of burning liquid formed but went out quickly. An increase in burning was noticeable with each container failure.</td>
</tr>
</tbody>
</table>

The results of the intermediate-scale testing, the full-scale testing, and the small-scale testing, indicate that an aerosol product in a plastic container filled with a liquid mixture that does not support combustion and no more than 4% by weight flammable liquefied gas in a stable emulsion with the liquid mixture can be protected using criteria recommended for a Class III commodity.

**Emergency Nature:** This issue meets two of the factors used by the NFPA in Section 5.3 of the Regulations Governing Committee Projects the define “Emergency Nature” (e and f), which are discussed below:

e) The proposed TIA intends to accomplish a recognition of an advance in the art of safeguarding property or life where an alternative method is not in current use or is unavailable to the public.

The current version of NFPA 30B (2011) recognizes the existence of aerosol products in plastic containers; however, it does not provide any specific fire protection options for these products. Unfortunately, the US DOT recognizes and allows aerosol products in plastic containers to be transported which will result in these products being stored in warehouses without clearly defined protection options. The research that has been completed has defined a low fire hazard aerosol product in a plastic container that can be stored in general purpose warehouses without significantly increasing the overall fire hazard. This information will help code officials and warehouse owners identify what aerosol products in plastic containers can be safely stored in their buildings.

f) The proposed TIA will correct a circumstance in which the revised document has resulted in an adverse impact on a product or method that was without adequate technical justification.

Many aerosol manufacturers feel they cannot begin producing aerosol products in plastic containers until clear protection criteria is available in NFPA 30B and the data needed to define protection criteria was not available to the NFPA 30B Committee before the previous revision cycle was completed. The first step of a larger test program for aerosol products in plastic containers has been completed. A low hazard category of aerosol products in plastic containers has been developed. The information in this TIA releases this information to manufacturers so they can begin producing low hazard aerosol products in plastic containers. This code change is required to properly allow the products covered by this TIA to be stored and handled in the normal channels of commerce moving products from the manufacturer to the consumer. The technical justification was not available to the Technical Committee during the revision process.
According to 5.4 in the NFPA (RGCP), the final results show this TIA **HAS** achieved the necessary votes on both Question 1 (**Technical Merit**) and Question 2 (**Emergency Nature**).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is **17**.

\[
[24 \text{ (eligible to vote)} - 1 \text{ (not returned)} - 1 \text{ (abstention)}] = 22 \times 0.75 = 16.50
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
24 \text{ eligible} \div 2 = 12 + 1 = 13 \text{ (this is the simple majority)}
\]

TC FINAL Ballot results for **Technical Merit** are as follows:

- 22 Agree
- 0 Disagree
- 1 Abstention (Tabar)

**FINAL ACTION: PASSED**

The number of affirmative votes needed to obtain a recommendation to issue the TIA is **18**.

\[
[24 \text{ (eligible to vote)} - 1 \text{ (not returned)} - 0 \text{ (abstentions)}] = 23 \times 0.75 = 17.25
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
24 \text{ eligible} \div 2 = 12 + 1 = 13 \text{ (this is the simple majority)}
\]

TC FINAL Ballot results for **Emergency Nature** are as follows:

- 22 Agree
- 1 Disagree (Thacker)
- 0 Abstentions

**FINAL ACTION: PASSED**
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1043
To Add the reference to Section 2.3.2 and Modify 6.1.1, 6.2.1, and 6.2.2 of the 2011 Edition of NFPA 30B
Code for the Manufacture and Storage of Aerosol Products

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Add reference to Section 2.3.2, and Modify 6.1.1, 6.2.1, and 6.2.2.

_________ AGREE _________ DISAGREE* _________ ABSTAIN* .

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

In 6.2.11(c) the second sentence should be corrected as follows:

"Where such propellant is not permanently emulsified for the life of the product than the propellant shall be non-flammable." This assures consistency

with the 1st sentence. Also, A.6.2.11(c) needs to clarify the "alcohol" as to the specific type of alcohol used in the fire test program.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

_________ AGREE _________ DISAGREE* _________ ABSTAIN* .

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________

Signature

______________________________

DAVID C. TABAR

Name (Please Print)

1-28-2012

Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 984-7110

E-mail: jgovette@nfpa.org

February 29, 2012
TECHNICAL COMMITTEE LETTER BALLOT  
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1043  
To Add the reference to Section 2.3.2 and Modify 6.1.1, 6.2.1, and 6.2.2 of the 2011 Edition of NFPA 30B  
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Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Add reference to Section 2.3.2, and Modify 6.1.1, 6.2.1, and 6.2.2.

✓ _____XX_____ AGREE ___________ DISAGREE* ___________ ABSTAIN*  

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

________________________________________________________________________
________________________________________________________________________

Question 2: I agree that the subject is of an EMERGENCY NATURE.

✓ __________ AGREE ___XXX____ DISAGREE* ___________ ABSTAIN*  

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

The addition of this information is a big change that has not gone through the NFPA ROP and ROC process which allows for public review and comment. This proposal is only being reviewed by the Technical committee. This proposal does not fix and existing error.

Signature

Jack Thacker __________________________
Name (Please Print)

12/16/11 __________________________
Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:  
Joanne Goyette, Administrator, Technical Projects  
NFPA   
1 Batterymarch Park   
Quincy, MA 02169 FAX: (617) 984-7950 E-mail: jgoyette@nfpa.org
Thanks Rich. Bigger picture, I agree as well.
Chris LaFleur
Fire Protection Engineer
Sandia National Laboratory

From: Richard Pehrson [mailto:pehrson@mninter.net]  
Sent: Monday, January 09, 2012 01:35 PM  
To: isman@nfsa.org <isman@nfsa.org>; LaFleur, Angela Christine; 'Klaus, Matthew' <MKlaus@NFPA.org>; 'Tracey Bellamy' <tbellamy@telgian.com>; 'Curtis, Martha' <mcurtis@NFPA.org>; 'Carroll, Elena' <ecarroll@NFPA.org>; 'Goyette, Joanne' <jgoyette@NFPA.org>  
Subject: RE: [EXTERNAL] NFPA 30B TIA Review

Ken and Chris,

You didn't get copied on my response to John LeBlanc (the original submitter). Ken - I agree with everything you said. On the fire protection side, I would vote yes for the TIA.

Here is what I sent:

Martha,

I've looked at John's comments below and he is correct - why is the NFPA 13 subcommittee commenting on non-sprinkler related items? I should give you some background on my comments.

First, I didn't see any issues with the sprinkler side of the TIA, so from my standpoint there isn't anything to discuss.

My two comments were simply observations I made dealing with the new text and were not considered problems with the level of protection. The first comment simply deals with wordsmithing some of the new language. The way I read the proposed language, it would appear mixtures with more than 20% flammable liquids could be possible, but if the 30B committee feels the language is adequate to keep that from happening, I would certainly defer to them.

Likewise with the second comment, I was just making sure that there is an upper size on the containers to make sure this is addressed given the testing involves containers of only a certain size. John appears to have answered that question.

In summary then, my only comment was just dealing with the limits on container contents and so from my standpoint if the 30B committee is happy with their language for the TIA, then go with that. If my comment does bring up the issue of a potential ambiguity in the language, then maybe this is something to fix in the next edition, without holding up the TIA...

I'm still available on Wednesday if the conference call is warranted (afternoon is best) - I'm not seeing much to talk about, however.
I appreciate the opportunity to provide input on this issue.
Rich Pehrson
While I understand Christine’s and Rich’s concerns, the problem here is that we don’t get to edit TIA’s. We can only vote them up or down on the language they propose.

Knowing what the industry was trying to do and hoping that it won’t be abused by the relatively small number of aerosol manufacturers, I was okay with what they had proposed as a TIA and would hope that the changes could be made next cycle as the standard goes through a regular revision.

Or should we vote “no” and force the users to come back with a different TIA?

Ken

---

From: LaFleur, Angela Christine [mailto:acalfe@sandia.gov]
Sent: Monday, January 09, 2012 2:50 PM
To: Klaus, Matthew; Kenneth Isman (isman@nfpa.org); Tracey Bellamy (tbellamy@telgian.com); Richard Pehrson (pehrson@mninter.net); Curtis, Martha; Carroll, Elena; Goyette, Joanne
Subject: RE: [EXTERNAL] NFPA 30B TIA Review

Hi Matt,

I agree with Rich’s comment on 6.2.1.1(c).

Also have the following proposed edits:

(d)* Base product contains 4% by weight or less of an emulsified flammable liquefied petroleum (consistency, since A6.2.1.1(d) indicates liquefied petroleum gas) gas propellant within an aqueous base. The propellant shall remain be permanently (consistent with the next sentence) emulsified for the life of the product. Where such propellant is not permanently emulsified then the propellant shall be nonflammable.

A.6.2.1.1(c) Fire testing with alcohol (which ones? Ethanol? IPA? “Alcohol” seems too general, since specific alcohols are indicated in (c) and water at this percentage in plastic bottles has been successful. Small-scale burn tests of aerosol products in plastic containers have shown the aerosol with a nonflammable propellant to behave the same as the aerosol with no propellant.

There are several different "alcohols" (IPA, ethanol, methanol, butyl alcohol, pentanol, cetyl alcohol, ethylene glycol, glycerin, erythritol, manitol, sorbitol, xylitol, to name way too many...) If this only applies to the ones tested, the text should be specific.

Thanks,
Chris

---

From: Klaus, Matthew [mailto:Mklaus@nfpa.org]
Sent: Tuesday, December 20, 2011 6:39 AM
To: Kenneth Isman (isman@nfpa.org); LaFleur, Angela Christine; Tracey Bellamy (tbellamy@telgian.com); Richard Pehrson (pehrson@mninter.net); Curtis, Martha; Carroll, Elena; Goyette, Joanne
Subject: [EXTERNAL] NFPA 30B TIA Review

Dear Task Group Members--
Please find attached a proposed TIA from the NFPA 30B Technical Committee. This TIA includes modifications to sprinkler related requirements and therefore the NFPA 13 TC (TCC) is included in the review of this language.

Please review the language and reply to the group if you have any issues with the proposed TIA language. If need be, we will hold a conference call early next year to discuss any potential modifications to the language. If everyone is satisfied with the language as proposed, a conference call will not be necessary and cam make a recommendation to the Standards Council to proceed with the language as provided.

Regards,

Matt Klaus
Senior Fire Protection Engineer
NFPA

Important Notice: This correspondence is not a Formal Interpretation issued pursuant to NFPA Regulations. Any opinion expressed is the personal opinion of the author, and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should be relied upon, to provide consultation or services.

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www.nfpa.org/blogs
Curtis, Martha

From: Richard Pehrson [pehrson@minter.net]
Sent: Thursday, December 29, 2011 2:49 PM
To: Klaus, Matthew; 'Kenneth Isman'; 'A. LaFleur'; 'Tracey Bellamy'; Curtis, Martha; Carroll, Elena; Goyette, Joanne
Cc: 'Richard Pehrson'
Subject: RE: NFPA 30B TIA Review

Matt,

I have two comments on the TIA:

6.2.1.1 (c): It appears the proposed language is intended to limit the base product to 20% ignitable liquid in an aqueous mix. As written, the language doesn't expressly prohibit sneaking in an additional ignitable component (that isn't ethanol or IPA), and then making an aqueous mixture out of what remains. To prevent such a thing, may I propose something like this:

(c)* Base product contains up to 20% by volume (15.8% by weight) of ethanol and/or isopropyl alcohol in an aqueous mix (a minimum of 80% by volume/84.2% by weight of the base product must have no fire point), and a nonflammable propellant.

Also, is there an upper limit on container size? The tests and justification appear to be for smaller containers, yet I don't see anything preventing a large container size, if such a thing can be manufactured...

Rich Pehrson

From: Klaus, Matthew [mailto:MKlaus@nfpa.org]
Sent: Tuesday, December 20, 2011 7:39 AM
To: Kenneth Isman (isman@nfpa.org); A. LaFleur (alaufle@sandia.gov); Tracey Bellamy (tbellamy@telgian.com); Richard Pehrson (pehrson@minter.net); Curtis, Martha; Carroll, Elena; Goyette, Joanne
Subject: NFPA 30B TIA Review

Dear Task Group Members-

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Please review the language and reply to the group if you have any issues with the proposed TIA language. If need be, we will hold a conference call early next year to discuss any potential modifications to the language. If everyone is satisfied with the language as proposed, a conference call will not be necessary and can make a recommendation to the Standards Council to proceed with the language as provided.

Regards,

Matt Klaus
Senior Fire Protection Engineer
NFPA

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Item 12-3-5
1. Add the following new definitions to Section 3.3 as follows:

**3.3.xx Fast Acting Detection System.** A Detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

**3.3.xx Fill Valve.** A shutoff valve on the charging system for charging MATS where the acetylene supply first enters the charging connection.

**3.3.xx MATS Building.** A single-story detached building, without an attic, basement, crawl space or false ceiling, used for acetylene trailer(s) or mobile acetylene trailer system (MATS) operations located indoors and the balance of the building is used exclusively for acetylene operations including storage and use of hazardous materials.

**3.3.xx MATS Fire Area.** The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the source valve for MATS being discharged or to the point of the fill valve for MATS being charged.

**3.3.xx Source Valve.** A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user’s supply line.

**A.3.xx Fast Acting Detection System.** Examples for outdoor installations are optical (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations examples include high sensitivity smoke detection (HSSD), optical (UV/IR) or other early detection systems.

2. Modify Section 10.6 as follows:

**10.6* Mobile Acetylene Trailer Systems (MATS).** In addition to the general requirements of NFPA 51A, MATS charging and discharge stations located at acetylene charging plants shall be in accordance with 10.6.

**10.6.1 General.** MATS fire areas used for charging or discharging operations shall be separated from each other by not less than 30 ft. or by fire barriers or fire walls:

**10.6.1.1** When fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire resistive construction and shall separate individual fire areas by line of sight.

**10.6.1.2** When fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, the fire barriers shall be full height walls without openings extending from the foundation to the roof constructed of not less than 2-hour fire resistive construction. The allowable area occupied by weather protection shall be in accordance with the requirements of the building code.

**10.6.1.3** When MATS are installed indoors in a MATS building, fire walls, fire barriers or 2-hour fire rated exterior walls are permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.

**10.6.12 MATS Filling Charging Stations.**
10.6.2.1 Location. The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

1. Not less than 25 ft (7.6 m) from property lines.
2. Not less than 50 feet (15.2 m) from buildings of combustible construction.
3. Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the charging or discharging of the mobile acetylene trailer.
4. Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines.
5. Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, flammable gases or oxidizing materials.
6. Not less than 50 ft (15.2 m) from air intakes.

10.6.2.1.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.6.2.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water run-off.

10.6.2.3 Protection from vehicular damage shall be provided in accordance with NFPA 55 *Compressed Gases and Cryogenic Fluids Code*.

10.6.2.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst pressure of 10,000 psig (69,000 kPa).

10.6.2.5 The charging site shall be posted with a sign with the following or equivalent wording:
ACETYLENE – FLAMMABLE GAS – NO SMOKING – NO OPEN FLAMES

10.6.2.6 Electrical equipment shall be in accordance with NFPA 70

10.6.2.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with NFPA 70, *National Electrical Code*.

10.6.2.6.2 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.6.23 MATS Discharge Stations

10.6.23.1 The MATS discharge station shall be in accordance with 10.6.2 except that 10.6.2.2 shall not apply.

10.6.23.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed 15 psig (103 kPa).

10.6.23.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:

1. For pressures greater than 15 psig hoses shall have a minimum burst pressure of 10,000 psig (69,000 kPa).
2. For pressures of 15 psig (103 kPa) or less hoses shall be rated for a minimum working pressure of 125 psig (860 kPa) and a minimum burst pressure of 500 psig (3450 kPa).

10.6.4 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.

A.10.6.23.3 (1) A 10,000 psi burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.
11.2.1.3 Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants a fire sprinkler system in accordance with NFPA 13, extra hazard group 1 shall be installed in the areas occupied by trailers in charging or discharging stations. A deluge or water spray fixed system shall be provided for mobile acetylene trailer fire areas used as indoor and outdoor charging and discharging stations.

11.2.1.3.1 The system shall be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, Standard for Portable Fire Extinguishers, at not less than 20 B:C shall be mounted on each trailer.

11.2.1.3.2 Deluge or water spray fixed systems shall provide a minimum design density in accordance with the design documents for the MATS fire area being protected.

11.2.1.3.3 The deluge or water spray fixed system shall be able to be activated automatically by a fast acting detection system and also by a manual actuator.

11.2.1.3.3.1 Manual activation controls shall be identified and marked with a sign and shall be positioned for use in an emergency.

11.2.1.3.3.2 Fire protection equipment and manual activation controls shall not be blocked or obstructed.

11.2.1.3.4 Existing acetylene charging and discharging stations shall be protected by an automatic deluge or water spray fixed system meeting the above requirements not later than January 1, 2015. See also Section 1.4.

11.2.1.3.4.1 The above requirements for deluge or water spray fixed systems shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this standard providing the MATS are protected with an automatic sprinkler system with a minimum design density of not less than 0.25 gpm per square foot.

11.2.1.3.5 At least one UL listed fire extinguisher with a rating of not less than 20 B:C shall be mounted on the mobile acetylene trailer.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

A.11.2.1.3.2 For additional information on mobile acetylene trailer systems, see CGA G-1.6, Standard for Mobile Acetylene Trailer Systems.

4. Revise the title of CGA G-1.6 to read as follows:


Submitter’s Substantiation: The TIA contains compromise language that could not be achieved in the revision cycle. The three CAMs submitted by the Compressed Gas Association were withdrawn in favor of a TIA as a TIA was viewed as a viable approach for the committee. The language in the TIA is more technically complete and is believed to be acceptable to all interested parties.

The provisions included in the 2011 Edition for sprinkler systems for Mobile Acetylene Trailer Systems (MATS) as incorporated into Section 11.3.1.3 have been recognized as being inadequate and incomplete as a means to address the unusual hazards of fire in systems of this nature. Acceptance of this change will resolve the technical problem by providing a fire protection system that has been designed to address the special hazards identified with systems of this
nature. The work product is the result of a joint effort between members of the IMG-AAA TC and CGA technical committees involved with CGA Standards designed to address the charging of Mobile Acetylene Trailers (MATS). The IMG-AAA TC is seeking to establish a requirement for deluge sprinkler systems as recommended by the National Transportation Safety Board (NTSB) subsequent to incidents which resulted in substantial damage to acetylene discharge stations using Mobile Acetylene Trailer Systems (MATS). The incidents were the subject of a report from the NTSB which was brought to the attention of the IMG-AAA Technical Committee.

The requirements of Section 11.2.1.3 for a sprinkler system as shown in the 2011 Edition of NFPA 51A may in fact be suitable for filling of individual cylinders for indoor use where closed head systems can be activated. They are not suitable for sprinkler systems installed outdoors where ambient conditions can negatively influence performance, and for other reasons detailed below. A clear requirement should be established to require a deluge or water spray fixed system when MATS are charged or discharged either indoors or outdoors. The requirement to do so must be in the body of the standard so that users, designers and AHJs are clear with respect to the fact that NFPA 13 or 15 systems can be used at discretion of the designer and approval of the AHJ.

REASONS WHY OPEN SYSTEMS SHOULD BE REQUIRED

Closed head sprinkler systems do not provide the same level of protection as a deluge system. During a fire inside a building, the ceiling forces the hot combustion products to travel outward ahead of the fire. These hot combustion products activate the closed head sprinklers allowing sprinklers not directly above the fire to activate and help keep the adjacent areas cool helping to prevent the spread of the fire.

MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. When located outdoors there is no means provided to allow the collection of the hot combustion products in order to activate a sprinkler system and therefore these sprinkler heads may not open. Depending on ambient conditions such as wind speed, the heat from a fire may only activate sprinkler heads downwind of the fire thus allowing the fire to rapidly spread to cylinders upwind allowing the incident to escalate instead of immediately containing the situation like an open head deluge system could have. In addition wind can blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature.

Acetylene cylinders have a thermally activated fusible metal plug located near the valve or on the top of the cylinder that melts at approximately 212°F. The plug is designed to release the gas as it expands in order to prevent rupture of the container. When this plug melts acetylene vents directly to atmosphere in effect making a large torch (with temperatures greater than 5700°F). On a Mobile Acetylene Trailer (MAT) the cylinders are nested closely together with the typical cylinder diameters generally 12 inches or less. The result is that the fusible metal plugs are typically only 10 to 12 inches apart. (See Figure 1 below) In the event of a fire if adjacent cylinders are not quickly cooled, the fusible metal plugs will continue to melt allowing the fire to quickly spread from cylinder to cylinder throughout the array. (See Figure 2).
Figure 1. Distance between cylinder fusible metal plugs that are located on the head of the cylinder near the base of the cylinder shutoff valve

Figure 2 – Large quantity of cylinders nested on a trailer
Acetylene Specific Hazards

Acetylene (stabilized) is a flammable gas and also an unstable reactive gas that can decompose and generate heat without the presence of oxygen. Cylinders on a trailer are connected through a common manifold that allows the gas to be transported into or out of the containers in the process of being charged or discharged (See Figure 2). In a fire acetylene can decompose inside the piping system which can lead to further decomposition of acetylene inside of cylinders as heat is transmitted through the manifold. The heat from the decomposition of acetylene is sufficient to melt the fusible metal plugs installed to prevent cylinder rupture. If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly. In the absence of fire it is also possible, based on the increased pressures (greater than 15 psig), for decomposition to occur inside the piping due to mechanical shock or adiabatic compression with insufficient heat to initially melt a fusible metal plug. Until a fire occurs there will be no external heat available that would activate a closed head sprinkler system. In that particular situation the operator will most likely identify the event when it occurs by either an audible or visual cue before a fire occurs. Having a deluge system available that can be manually activated provides the operator with a system that can be used to cool the cylinders and piping before an external fire, mass release from multiple fusible metal plugs, or potential cylinder rupture occurs.

Activation

Outdoors deluge systems can either be activated manually from a remote point or by automatic means using optical flame detectors such as UV/IR or other approved early warning detection systems. Indoors deluge systems can also be activated manually or activated by automatic means by using optical flame detection or a high sensitivity smoke detection system. Flame detectors have the advantage of being used to detect small flames where open headed deluge systems can quickly be effective. By contrast there is no way to manually or automatically activate a closed head system.

Water Density

Acetylene trailers vary in size. Typical trailers are approximately 8 feet wide ranging in length from 15 to 50 feet although longer and shorter trailers may exist. The maximum trailer dimensions allowed under DOT regulations are 8.5 ft wide by 65 ft long. The 1984 Edition of NFPA 51A contained the first reference to MATS in Section 8-6.1, requiring that the MATS be in compliance with the 1981 Edition of CGA Pamphlet G-1.6. The G-1.6 publication required fire protection to be provided in the form of fire hoses or fixed spray systems. In 1996 the requirements for MATS in 51A Section 8-6 were deleted as an “editorial change”…”to make the standard more useable, adoptable and enforceable.” A reference to CGA G-1.6 was included as an informational note. Within the regulatory scheme described by NFPA 51A the need for fire protection systems was to be determined by an analysis of local conditions of hazard within the plant, exposure to other properties, water supplies and the probable effectiveness of plant fire brigades to include the time of response and probable effectiveness of fire departments. Where automatic water spray systems were installed NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection were installed water coverage was to be not less than a minimum of 0.25 gpm per sq ft of floor area directly wetted by the stream. An NFPA 13 extra hazard open or closed head sprinkler system was allowed to be used as an acceptable alternate; however, the provisions were general requirements for fire protection including general use and the use of MATS was not mentioned.

There is a concern that limited water supplies may prevent being able to deluge a large area. In these instances it is possible to reduce the total water flow required by constructing fire barrier walls to divide the trailers into groups or compartments. Each area so divided can be equipped with separately controlled deluge systems provided for each area bounded by the fire barriers. Alternatively, an increased spacing between MAT systems can be provided to limit the exposure accordingly.

OTHER CONCERNS

Applicability to Cylinder Charging Facilities
The valves on cylinders in storage are closed as compared to valves on a MAT system which are normally open when the MAT is being charged or discharged. Cylinders on a MAT are manifolded together as compared with typical cylinders in storage. Therefore, stored cylinders are less likely to be involved in an event where heat can spread internally from cylinder to cylinder through a common manifold system. This primary difference requires that a distinction be made between the fire protection systems provided for a MAT system versus the typical arrangement where cylinders are simply stored.

Freezing Conditions

Due to the possibility of freezing (< 40°F) ambient conditions in outdoor locations a wet pipe closed head sprinkler system is not acceptable in many locations. A dry pipe closed head system can be used but it will be much slower to react.

Hot Conditions

When closed head fire sprinkler systems are used NFPA 13 7.7.1.3.1.3 requires the use of intermediate or high temperature-rated sprinklers when the water temperature of the fire protection water being used exceeds 100°F. This is not an uncommon occurrence in areas of the southwestern United States where fire protection water is stored in aboveground tanks and day time temperatures exceed 100°F. NFPA 13: Table 6.2.5.1 lists the following temperature ratings or operating ranges.

- Ordinary temperature-rated sprinklers operate between 135 and 170°F.
- Intermediate temperature-rated sprinklers operate between 175 and 225°F.
- High temperature-rated sprinklers operate between 250 and 300°F.

During the winter season the length of time it takes to achieve a temperature above 175°F at the sprinkler head could allow a fire to become larger than what might otherwise occur in a system protected by an open head deluge system.

EMERGENCY NATURE

- The document contains an error or an omission that was overlooked during a regular revision process.
- The proposed TIA intends to correct a previously unknown existing hazard.
- The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing dangerous condition or situation.

When the IMG-AAA TC considered this issue in the ROC phase of the revision cycle the unstable nature of acetylene, particularly when Mobile Acetylene Trailer Systems (MATS) were being charged or discharged was not the focus of the group. The unstable nature of acetylene must be addressed by providing a means to cool cylinders rapidly in the event of a fire. The risk for conflagration for cylinders arranged on a MATS, particularly MATS located outdoors is significantly increased through the use of closed head sprinkler systems. The IMG-AAA TC recognized that a fire sprinkler system was necessary to address the risks of a system of this nature but the focus of discussion resulted in requiring an NFPA 13 closed head system. As a result the ROC version contains provisions which could result in the use of a closed head NFPA 13 sprinkler system being installed and the protection provided for MATS in a charging or discharging mode typically found outdoors would be unresponsive within the time frame needed to prevent a major conflagration from occurring. The manufacturing members of the Compressed Gas Association (CGA) have provided additional information to substantiate the use of an open headed deluge system based on response time and coverage required to protect these systems in the early stages of fire thereby avoiding conflagration. The provisions have been expanded to provide a limitation of MATS fire areas and to recognize the use of fire barrier walls as a means to limit exposure.

CGA’s standard addressing MATS G-1.6 has been substantially revised and a joint task group was formed between CGA’s technical committee and principal members (fire protection engineers) of NFPA’s IMG-AAA TC to determine a protection strategy suitable for systems of this nature recognizing the need for fire protection for these systems whether used indoors or outdoors. Past editions of NFPA 51A were reviewed and the specialized needs of MATS systems were recognized. The methodology now proposed revisions integral to the TIA have been accepted by CGA’s Standards Council to be published in the CGA G-1.6 standard. These changes represent a reduction of risk to the public and are in
keeping with the recommendations of the National Transportation Safety Board (NTSB) and the Department of Transportation.

The document contains a conflict within the document or with another NFPA document.

Since completing the work on NFPA 51A the IMG-AAA TC has held its ROP meeting for the revision of NFPA 55 which will be used to integrate NFPA 51A into NFPA 55 and NFPA 51A will be withdrawn. Recognizing the special needs of the fire sprinkler system to be provided the TC has approved a proposal to require deluge sprinkler protection for MATS as the requirements for MATS have been expanded and are to be included in NFPA 55. Publication of a revised NFPA 55 will present a conflict in approach with NFPA 51A as the IMG-AAA TC has recognized the need for deluge sprinkler protection. The TIA will serve as an amendment to NFPA 51A that will avoid confusing designers, users and AHJs as the technical provisions for fire protection evolve within the new venue for requirements which will now be found in NFPA 55.
From: Larry Fluer [mailto:larryfluer@att.net]
Sent: Friday, January 27, 2012 1:17 PM
To: May, Paul
Cc: Goyette, Joanne; Rich Craig
Subject: RE: NFPA 51A TIA

Paul: This email will confirm our conversation which occurred at just before 1 PM your time today. I am enclosing (or better said – returning) a copy of the document that you had sent to Joanne so that we don’t get mixed up on this. All I did was save the version that you sent me with your message and added a date of 1_27_12 so that it would be clear as to the point of agreement, and Rich would have the opportunity of seeing the document as it moves toward ballot. I was pleased to see that the G-1.6 update to the 2011 edition was included. CGA went to a significant effort, as did the members of the IMG TC (Gresho and Namyst) to fulfill a practical commitment which has been registered with the NTSB and DOT. Having NFPA lag behind the Fed in this regard is not something that should be encouraged, so the update solves that problem. Thank you for the calls and we will look forward to the balloting process.

Larry Fluer
Technical Consultant
Fluer, Inc.
Tel: (805) 238 7896
larryfluer@att.net

From: May, Paul [mailto:pm@NFPA.org]
Sent: Friday, January 27, 2012 6:07 AM
To: Larry Fluer
Cc: Goyette, Joanne
Subject: NFPA 51A TIA
Importance: High

Hi Larry,

Just to recap, this is what I have assembled at this point. I have included the most recent version of the TIA that has the revisions made to update the Annex B reference. Please review that and the memo notes that will go out for the committee to consider. We need your approval to move forward on this today.
The TIA No. 1036 on NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*, 2012 Edition, as approved by the Technical Committee on Industrial and Medical Gases, has been revised with the following editorial changes:

The text in 11.2.1.3, 11.2.1.3.2, 11.2.1.3.3, and 11.2.1.3.4 as well as throughout the substantiation were editorially changed to remove the term “sprinkler” and add “water spray fixed system.” The intent is to allow the designer to be able to use either an NFPA 13 or NFPA 15 type suppression system.

The substantiating language was revised to clarify that either NFPA 13 or NFPA 15 may be utilized by the designer. This eliminated any phraseology that implied one system to be used in place of the other by applying more general terms to the overall explanation.

An annex note to Section 11.2.1.3.2 has been added as an informational note to direct the user to CGA G-1.6 for additional information on MATS. The reference to G-1.6 was updated to refer to the most recent CGA publication.

Thank You,

Paul E. May
NFPA Staff Liaison
Fire Protection Engineer
1. Add the following new definitions to Section 3.3 as follows:

**3.3.xx* Fast Acting Detection System.** A detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

**3.3.xx Fill Valve.** A shutoff valve on the charging system for charging MATS where the acetylene supply first enters the charging connection.

**3.3.xx MATS Building.** A single-story detached building, without an attic, basement, crawl space or false ceiling, used for acetylene trailer(s) or mobile acetylene trailer system (MATS) operations located indoors and the balance of the building is used exclusively for acetylene operations including storage and use of hazardous materials.

**3.3.xx MATS Fire Area.** The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the source valve for MATS being discharged or to the point of the fill valve for MATS being charged.

**3.3.xx Source Valve.** A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user’s supply line.

**A.3.xx Fast Acting Detection System.** Examples for outdoor installations are optical (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations, examples include high sensitivity smoke detection (HSSD), optical (UV/IR), or other early detection systems.

2. Revise Section 10.6 as follows:

**10.6* Mobile Acetylene Trailer Systems (MATS).** In addition to the general requirements of NFPA 51A, MATS charging and discharge stations located at acetylene charging plants shall be in accordance with Section 10.6.

**10.6.1 General.** MATS fire areas used for charging or discharging operations shall be separated from each other by not less than 30 ft (9.1 m) or by fire barriers or fire walls.

**10.6.1.1** Where fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire resistive construction and shall separate individual fire areas by line of sight.

**10.6.1.2** Where fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of NFPA 55, Compressed Gases and Cryogenic Fluids Code, the fire barriers shall be full height walls without openings extending from the foundation to the roof constructed of not less than 2-hour fire-resistive construction. The allowable area occupied by weather protection shall be in accordance with the requirements of the building code.

**10.6.1.3** Where MATS are installed indoors in a MATS building, fire walls, fire barriers or 2-hour fire-rated exterior walls are permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.

**10.6.42 MATS Filling Charging Stations.**
10.6.1.2.1 Location. The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

(1) Not less than 25 ft (7.6 m) from property lines.

(2) Not less than 50 feet (15.2 m) from buildings of combustible construction.

(3) Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the charging filling or discharging of the mobile acetylene trailer.

(4) Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines.

(5) Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, flammable gases or oxidizing materials.

(6) Not less than 50 ft (15.2 m) from air intakes.

10.6.1.2.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.6.1.2.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water run-off.

10.6.1.2.3 Protection from vehicular damage shall be provided in accordance with NFPA 55, Compressed Gases and Cryogenic Fluids Code.

10.6.1.2.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst pressure of 10,000 psig (69,000 kPa).

10.6.1.2.5 The charging site shall be posted with a sign with the following or equivalent wording:

ACETYLENE – FLAMMABLE GAS – NO SMOKING – NO OPEN FLAMES

10.6.1.2.6 Electrical equipment shall be in accordance with NFPA 70®, National Electrical Code®.

10.6.1.2.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with NFPA 70, National Electrical Code.

10.6.1.2.6.2 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.6.2 MATS Discharge Stations.

10.6.2.1 The MATS discharge station shall be in accordance with 10.6.2 except that 10.6.2.2 shall not apply.

10.6.2.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed 15 psig (103 kPa).

10.6.2.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:

(1)* For pressures greater than 15 psig (103 kPa) hoses shall have a minimum burst pressure of 10,000 psig (69,000 kPa).
(2) For pressures of 15 psig (103 kPa) or less, hoses shall be rated for a minimum working pressure of 125 psig (860 kPa) and a minimum burst pressure of 500 psig (3450 kPa).

A.10.6.23.3(1) A 10,000 psi (69,000 kPa) burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.

10.6.4 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.

3. Revise Section 11.2.1.3 and delete existing Sections 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3 in accordance with the following:

11.2.1.3 Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants a fire sprinkler system in accordance with NFPA 13, extra hazard group 1 shall be installed in the areas occupied by trailers in charging or discharging stations. A deluge sprinkler system shall be provided for mobile acetylene trailer fire areas used as indoor and outdoor charging and discharging stations. The system shall be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, Standard for Portable Fire Extinguishers, at not less than 20 B:C shall be mounted on each trailer.

11.2.1.3.1 Deluge sprinkler systems shall provide a minimum design density of 0.3 gpm per square foot over the MATS fire area being protected.

11.2.1.3.2 The deluge sprinkler system shall be able to be activated automatically by a fast acting detection system and also by a manual actuator.

11.2.1.3.2.1 Manual activation controls shall be identified and marked with a sign and shall be positioned for use in an emergency.

11.2.1.3.2.2 Fire protection equipment and manual activation controls shall not be blocked or obstructed.

11.2.1.3.3 Existing acetylene charging and discharging stations shall be protected by an automatic deluge sprinkler system meeting the above requirements not later than January 1, 2015. See also Section 1.4.

11.2.1.3.3.1 The above requirements for deluge sprinkler systems shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this standard providing the MATS are protected with an automatic sprinkler system with a minimum design density of not less than 0.25 gpm per square foot (10.1 L/min per square meter).

11.2.1.3.4 At least one UL listed fire extinguisher with a rating of not less than 20 B:C shall be mounted on the mobile acetylene trailer.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

Submitter’s Substantiation: The TIA contains compromise language that could not be achieved in the revision cycle. The three CAMs submitted by the Compressed Gas Association were withdrawn in favor of a TIA as a TIA was viewed as a viable approach for the committee. The language in the TIA is more technically complete and is believed to be acceptable to all interested parties.

The provisions included in the 2011 Edition for sprinkler systems for Mobile Acetylene Trailer Systems (MATS) as incorporated into Section 11.3.1.3 have been recognized as being inadequate and incomplete as a means to address the
unusual hazards of fire in systems of this nature. Acceptance of this change will resolve the technical problem by providing a fire protection system that has been designed to address the special hazards identified with systems of this nature. The work product is the result of a joint effort between members of the IMG-AAA TC and CGA technical committees involved with CGA Standards designed to address the charging of Mobile Acetylene Trailers (MATS).

The IMG-AAA TC is seeking to establish a requirement for deluge sprinkler systems as recommended by the National Transportation Safety Board (NTSB) subsequent to incidents which resulted in substantial damage to acetylene discharge stations using Mobile Acetylene Trailer Systems (MATS). The incidents were the subject of a report from the NTSB which was brought to the attention of the IMG-AAA Technical Committee.

The requirements of Section 11.2.1.3 for a sprinkler system as shown in the 2011 Edition of NFPA 51A may in fact be suitable for filling of individual cylinders for indoor use where closed head systems can be activated. They are not suitable for sprinkler systems installed outdoors where ambient conditions can negatively influence performance, and for other reasons detailed below. A clear requirement should be established to require a deluge sprinkler system when MATS are charged or discharged either indoors or outdoors. The requirement to do so must be in the body of the standard so that users, designers and AHJs are clear with respect to the requirements.

**REASONS WHY OPEN HEAD DELUGE SYSTEM SHOULD BE REQUIRED**

**Cooling of adjacent cylinders**

Closed head sprinkler systems do not provided the same level of protection as a deluge system. During a fire inside a building, the ceiling forces the hot combustion products to travel outward ahead of the fire. These hot combustion products activate the closed head sprinklers allowing sprinklers not directly above the fire to activate and help keep the adjacent areas cool helping to prevent the spread of the fire.

MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. When located outdoors there is no means provided to allow the collection of the hot combustion products in order to activate a sprinkler system and therefore these sprinkler heads may not open. Depending on ambient conditions such as wind speed, the heat from a fire may only activate sprinkler heads downwind of the fire thus allowing the fire to rapidly spread to cylinders upwind allowing the incident to escalate instead of immediately containing the situation like an open head deluge system could have. In addition wind can blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature.

Acetylene cylinders have a thermally activated fusible metal plug located near the valve or on the top of the cylinder that melts at approximately 212°F. The plug is designed to release the gas as it expands in order to prevent rupture of the container. When this plug melts acetylene vents directly to atmosphere in effect making a large torch (with temperatures greater than 5700°F). On a Mobile Acetylene Trailer (MAT) the cylinders are nested closely together with the typical cylinder diameters generally 12 inches or less. The result is that the fusible metal plugs are typically only 10 to 12 inches apart. (See Figure 1 below) In the event of a fire if adjacent cylinders are not quickly cooled, the fusible metal plugs will continue to melt allowing the fire to quickly spread from cylinder to cylinder throughout the array. (See Figure 2).
Figure 1. Distance between cylinder fusible metal plugs that are located on the head of the cylinder near the base of the cylinder shutoff valve

Figure 2 – Large quantity of cylinders nested on a trailer
Acetylene Specific Hazards

Acetylene (stabilized) is a flammable gas and also an unstable reactive gas that can decompose and generate heat without the presence of oxygen. Cylinders on a trailer are connected through a common manifold that allows the gas to be transported into or out of the containers in the process of being charged or discharged (See Figure 2). In a fire acetylene can decompose inside the piping system which can lead to further decomposition of acetylene inside of cylinders as heat is transmitted through the manifold. The heat from the decomposition of acetylene is sufficient to melt the fusible metal plugs installed to prevent cylinder rupture. If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly.

In the absence of fire it is also possible, based on the increased pressures (greater than 15 psig), for decomposition to occur inside the piping due to mechanical shock or adiabatic compression with insufficient heat to initially melt a fusible metal plug. Until a fire occurs there will be no external heat available that would activate a closed head sprinkler system. In that particular situation the operator will most likely identify the event when it occurs by either an audible or visual cue before a fire occurs. Having a deluge system available that can be manually activated provides the operator with a system that can be used to cool the cylinders and piping before an external fire, mass release from multiple fusible metal plugs, or potential cylinder rupture occurs.

Activation

Outdoors deluge systems can either be activated manually from a remote point or by automatic means using optical flame detectors such as UV/IR or other approved early warning detection systems. Indoors deluge systems can also be activated manually or activated by automatic means by using optical flame detection or a high sensitivity smoke detection system. Flame detectors have the advantage of being used to detect small flames where open headed deluge systems can quickly be effective. By contrast there is no way to manually or automatically activate a closed head system.

Water Density

Acetylene trailers vary in size. Typical trailers are approximately 8 feet wide ranging in length from 15 to 50 feet although longer and shorter trailers may exist. The maximum trailer dimensions allowed under DOT regulations are 8.5 ft wide by 65 ft long. The 1984 Edition of NFPA 51A contained the first reference to MATS in Section 8-6.1, requiring that the MATS be in compliance with the 1981 Edition of CGA Pamphlet G-1.6. The G-1.6 publication required fire protection to be provided in the form of fire hoses or fixed spray systems. In 1996 the requirements for MATS in 51A Section 8-6 were deleted as an “editorial change”…”to make the standard more useable, adoptable and enforceable.” A reference to CGA G-1.6 was included as an informational note. Within the regulatory scheme described by NFPA 51A the need for fire protection systems was to be determined by an analysis of local conditions of hazard within the plant, exposure to other properties, water supplies and the probable effectiveness of plant fire brigades to include the time of response and probable effectiveness of fire departments. Where automatic water spray systems were installed NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection were installed water coverage was to be not less than a minimum of 0.25 gpm per sq ft of floor area directly wetted by the stream. An NFPA 13 extra hazard open or closed head sprinkler system was allowed to be used as an acceptable alternate; however, the provisions were general requirements for fire protection including general use and the use of MATS was not mentioned.

There is a concern that limited water supplies may prevent being able to deluge a large area. In these instances it is possible to reduce the total water flow required by constructing fire barrier walls to divide the trailers into groups or compartments. Each area so divided can be equipped with separately controlled deluge systems provided for each area bounded by the fire barriers. Alternatively, an increased spacing between MAT systems can be provided to limit the exposure accordingly.

OTHER CONCERNS

Applicability to Cylinder Charging Facilities
The valves on cylinders in storage are closed as compared to valves on a MAT system which are normally open when the MAT is being charged or discharged. Cylinders on a MAT are manifolded together as compared with typical cylinders in storage. Therefore, stored cylinders are less likely to be involved in an event where heat can spread internally from cylinder to cylinder through a common manifold system. This primary difference requires that a distinction be made between the fire protection systems provided for a MAT system versus the typical arrangement where cylinders are simply stored.

**Freezing Conditions**

Due to the possibility of freezing (< 40°F) ambient conditions in outdoor locations a wet pipe closed head sprinkler system is not acceptable in many locations. A dry pipe closed head system can be used but it will be much slower to react.

**Hot Conditions**

When closed head fire sprinkler systems are used NFPA 13 7.7.1.3.1.3 requires the use of intermediate or high temperature-rated sprinklers when the water temperature of the fire protection water being used exceeds 100°F. This is not an uncommon occurrence in areas of the southwestern United States where fire protection water is stored in aboveground tanks and day time temperatures exceed 100°F. NFPA 13: Table 6.2.5.1 lists the following temperature ratings or operating ranges.

- Ordinary temperature-rated sprinklers operate between 135 and 170°F.
- Intermediate temperature-rated sprinklers operate between 175 and 225°F.
- High temperature-rated sprinklers operate between 250 and 300°F.

During the winter season the length of time it takes to achieve a temperature above 175°F at the sprinkler head could allow a fire to become larger than what might otherwise occur in a system protected by an open head deluge system.

**Emergency Nature**: The document contains an error or an omission that was overlooked during a regular revision process. The proposed TIA intends to correct a previously unknown existing hazard. The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing dangerous condition or situation.

When the IMG-AAA TC considered this issue in the ROC phase of the revision cycle the unstable nature of acetylene, particularly when Mobile Acetylene Trailer Systems (MATS) were being charged or discharged was not the focus of the group. The unstable nature of acetylene must be addressed by providing a means to cool cylinders rapidly in the event of a fire. The risk for conflagration for cylinders arranged on a MATS, particularly MATS located outdoors is significantly increased through the use of closed head sprinkler systems. The IMG-AAA TC recognized that a fire sprinkler system was necessary to address the risks of a system of this nature but the focus of discussion resulted in requiring an NFPA 13 closed head system. As a result the ROC version contains provisions which could result in the use of a closed head NFPA 13 sprinkler system being installed and the protection provided for MATS in a charging or discharging mode typically found outdoors would be unresponsive within the time frame needed to prevent a major conflagration from occurring. The manufacturing members of the Compressed Gas Association (CGA) have provided additional information to substantiate the use of an open headed deluge system based on response time and coverage required to protect these systems in the early stages of fire thereby avoiding conflagration. The provisions have been expanded to provide a limitation of MATS fire areas and to recognize the use of fire barrier walls as a means to limit exposure.

CGA’s standard addressing MATS G-1.6 has been substantially revised and a joint task group was formed between CGA’s technical committee and principal members (fire protection engineers) of NFPA’s IMG-AAA TC to determine a protection strategy suitable for systems of this nature recognizing the need for fire protection for these systems whether used indoors or outdoors. Past editions of NFPA 51A were reviewed and the specialized needs of MATS systems were recognized. The methodology now proposed revisions integral to the TIA have been accepted by CGA’s Standards Council to be published in the CGA G-1.6 standard. These changes represent a reduction of risk to the public and are in keeping with the recommendations of the National Transportation Safety Board (NTSB) and the Department of Transportation.
Since completing the work on NFPA 51A the IMG-AAA TC has held its ROP meeting for the revision of NFPA 55 which will be used to integrate NFPA 51A into NFPA 55 and NFPA 51A will be withdrawn. Recognizing the special needs of the fire sprinkler system to be provided the TC has approved a proposal to require deluge sprinkler protection for MATS as the requirements for MATS have been expanded and are to be included in NFPA 55. Publication of a revised NFPA 55 will present a conflict in approach with NFPA 51A as the IMG-AAA TC has recognized the need for deluge sprinkler protection. The TIA will serve as an amendment to NFPA 51A that will avoid confusing designers, users and AHJs as the technical provisions for fire protection evolve within the new venue for requirements which will now be found in NFPA 55.
1. Add the following definitions to Section 3.3 of Chapter 3:

**3.3.xx Fast Acting Detection System.** A Detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

**A.3.xx Fast Acting Detection System.** Examples for outdoor installations are optical (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations examples include high sensitivity smoke detection (HSSD), optical (UV/IR) or other early detection systems.

**3.3.xx Fill Valve.** A shutoff valve on the charging system for charging MATS where the acetylene supply first enters the charging connection.

**3.3.xx MATS Building.** A single-story detached building, without an attic, basement, crawl space or false ceiling, used for acetylene trailer(s) or mobile acetylene trailer system (MATS) operations located indoors and the balance of the building is used exclusively for acetylene operations including storage and use of hazardous materials.

**3.3.xx MATS Fire Area.** The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the source valve for MATS being discharged or to the point of the fill valve for MATS being charged.

**3.3.xx Source Valve.** A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user’s supply line.

2. Modify Section 10.6 as follows:

**10.6* Mobile Acetylene Trailer Systems (MATS).** In addition to the general requirements of NFPA 51A, MATS charging and discharge stations located at acetylene charging plants shall be in accordance with 10.6.

**10.6.1 General.** MATS fire areas used for charging or discharging operations shall be separated from each other by not less than 30 ft. or by fire barriers or fire walls:

**10.6.1.1** When fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire resistive construction and shall separate individual fire areas by line of sight.

**10.6.1.2** When fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* the fire barriers shall be full height walls without openings extending from the foundation to the roof constructed of not less than 2-hour fire resistive construction. The allowable area occupied by weather protection shall be in accordance with the requirements of the building code.

**10.6.1.3** When MATS are installed indoors in a MATS building, fire walls, fire barriers or 2-hour fire rated exterior walls are permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.

**10.6.2 MATS Filling Charging Stations**

**10.6.2.1 Location.** The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

(1) Not less than 25 ft (7.6 m) from property lines.
(2) Not less than 50 feet (15.2 m) from buildings of combustible construction.
(3) Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the charging, filling or discharging of the mobile acetylene trailer.
(4) Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines.
(5) Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, flammable gases or oxidizing materials.
(6) Not less than 50 ft (15.2 m) from air intakes.

10.6.12.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.6.12.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water run-off.

10.6.12.3 Protection from vehicular damage shall be provided in accordance with NFPA 55 Compressed Gases and Cryogenic Fluids Code.

10.6.12.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst pressure of 10,000 psig (69,000 kPa).

10.6.12.5 The charging site shall be posted with a sign with the following or equivalent wording:
ACETYLENE – FLAMMABLE GAS – NO SMOKING – NO OPEN FLAMES

10.6.12.6 Electrical equipment shall be in accordance with NFPA 70

10.6.12.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with NFPA 70, National Electrical Code.

10.6.12.6.2 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.6.23 MATS Discharge Stations

10.6.23.1 The MATS discharge station shall be in accordance with 10.6.2 except that 10.6.2.2 shall not apply.

10.6.23.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed 15 psig (103 kPa).

10.6.23.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:
(1)* For pressures greater than 15 psig hoses shall have a minimum burst pressure of 10,000 psig (69,000 kPa).
(2) For pressures of 15 psig (103 kPa) or less hoses shall be rated for a minimum working pressure of 125 psig (860 kPa) and a minimum burst pressure of 500 psig (3450 kPa).

A.10.6.23.3 (1) A 10,000 psi burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.

10.6.4 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.
3. Modify Section 11.2.1.3 and delete existing Sections A.11.2.1.3, 11.2.3.1, and 11.2.1.3.2 in accordance with the following:

11.2.1.3 Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants a fire sprinkler system in accordance with NFPA 13, extra hazard group 1 shall be installed in the areas occupied by trailers in charging or discharging stations. A deluge sprinkler or water spray fixed system shall be provided for mobile acetylene trailer fire areas used as indoor and, or outdoor charging and, or discharging stations.
11.2.1.3.1 The system shall be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, at not less than 20 B:C shall be mounted on each trailer.

11.2.1.3.3 Deluge sprinkler or water spray fixed systems shall provide a minimum design density of 0.3 gpm per square foot over in accordance with the design documents for the MATS fire area being protected. For additional information on mobile acetylene trailer systems, see CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*.

11.2.1.3.2 The deluge sprinkler or water spray fixed system shall be able to be activated automatically by a fast acting detection system and also by a manual actuator.

11.2.1.3.2.1 Manual activation controls shall be identified and marked with a sign and shall be positioned for use in an emergency.

11.2.1.3.2.2 Fire protection equipment and manual activation controls shall not be blocked or obstructed.

11.2.1.3.3 Existing acetylene charging and discharging stations shall be protected by an automatic deluge sprinkler or water spray fixed system meeting the above requirements not later than January 1, 2015. See also Section 1.4.

11.2.1.3.4 The above requirements for deluge sprinkler or water spray fixed systems shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this standard providing the MATS are protected with an automatic sprinkler system with a minimum design density of not less than 0.25 gpm per square foot.

11.2.1.3.5 At least one UL listed fire extinguisher with a rating of not less than 20 B:C shall be mounted on the mobile acetylene trailer.


Substantiation:

The TIA contains compromise language that could not be achieved in the revision cycle. The three CAMs submitted by the Compressed Gas Association were withdrawn in favor of a TIA as a TIA was viewed as a viable approach for the committee. The language in the TIA is more technically complete and is believed to be acceptable to all interested parties.

The provisions included in the 2011 Edition for sprinkler systems for Mobile Acetylene Trailer Systems (MATS) as incorporated into Section 11.3.1.3 have been recognized as being inadequate and incomplete as a means to address the unusual hazards of fire in systems of this nature. Acceptance of this change will resolve the technical problem by providing a fire protection system that has been designed to address the special hazards identified with systems of this nature. The work product is the result of a joint effort between members of the IMG-AAA TC and CGA technical committees involved with CGA Standards designed to address the charging of Mobile Acetylene Trailers (MATS).

The IMG-AAA TC is seeking to establish a requirement for deluge sprinkler systems as recommended by the National Transportation Safety Board (NTSB) subsequent to incidents which resulted in substantial damage to acetylene discharge stations using Mobile Acetylene Trailer Systems (MATS). The incidents were the subject of a report from the NTSB which was brought to the attention of the IMG-AAA Technical Committee.
The requirements of Section 11.2.1.3 for a sprinkler system as shown in the 2011 Edition of NFPA 51A may in fact be suitable for filling of individual cylinders for indoor use where closed head systems can be activated. They are not suitable for sprinkler systems installed outdoors where ambient conditions can negatively influence performance, and for other reasons detailed below. A clear requirement should be established to require a deluge sprinkler or water spray fixed system when MATS are charged or discharged either indoors or outdoors. The requirement to do so must be in the body of the standard so that users, designers and AHJs are clear with respect to the fact that NFPA 13 or 15 systems can be used at discretion of the designer and approval of the AHJ.

**REASONS WHY OPEN HEAD DELUGE SYSTEMS SHOULD BE REQUIRED**

**Cooling of adjacent cylinders**

Closed head sprinkler systems do not provide the same level of protection as a deluge system. During a fire inside a building, the ceiling forces the hot combustion products to travel outward ahead of the fire. These hot combustion products activate the closed head sprinklers allowing sprinklers not directly above the fire to activate and help keep the adjacent areas cool helping to prevent the spread of the fire. MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. When located outdoors there is no means provided to allow the collection of the hot combustion products in order to activate a sprinkler system and therefore these sprinkler heads may not open. Depending on ambient conditions such as wind speed, the heat from a fire may only activate sprinkler heads downwind of the fire thus allowing the fire to rapidly spread to cylinders upwind allowing the incident to escalate instead of immediately containing the situation like an open head deluge system could have. In addition wind can blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature.

Acetylene cylinders have a thermally activated fusible metal plug located near the valve or on the top of the cylinder that melts at approximately 212°F. The plug is designed to release the gas as it expands in order to prevent rupture of the container. When this plug melts acetylene vents directly to atmosphere in effect making a large torch (with temperatures greater than 5700°F). On a Mobile Acetylene Trailer (MAT) the cylinders are nested closely together with the typical cylinder diameters generally 12 inches or less. The result is that the fusible metal plugs are typically only 10 to 12 inches apart. (See Figure 1 below) In the event of a fire if adjacent cylinders are not quickly cooled, the fusible metal plugs will continue to melt allowing the fire to quickly spread from cylinder to cylinder throughout the array. (See Figure 2).

![Figure 1. Distance between cylinder fusible metal plugs that are located on the head of the cylinder near the base of the cylinder shutoff valve](image-url)
Acetylene Specific Hazards
Acetylene (stabilized) is a flammable gas and also an unstable reactive gas that can decompose and generate heat without the presence of oxygen. Cylinders on a trailer are connected through a common manifold that allows the gas to be transported into or out of the containers in the process of being charged or discharged (See Figure 2). In a fire acetylene can decompose inside the piping system which can lead to further decomposition of acetylene inside of cylinders as heat is transmitted through the manifold. The heat from the decomposition of acetylene is sufficient to melt the fusible metal plugs installed to prevent cylinder rupture. If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly.

In the absence of fire it is also possible, based on the increased pressures (greater than 15 psig), for decomposition to occur inside the piping due to mechanical shock or adiabatic compression with insufficient heat to initially melt a fusible metal plug. Until a fire occurs there will be no external heat available that would activate a closed head sprinkler system. In that particular situation the operator will most likely identify the event when it occurs by either an audible or visual cue before a fire occurs. Having a deluge system available that can be manually activated provides the operator with a system that can be used to cool the cylinders and piping before an external fire, mass release from multiple fusible metal plugs, or potential cylinder rupture occurs.

Activation
Outdoors deluge systems can either be activated manually from a remote point or by automatic means using optical flame detectors such as UV/IR or other approved early warning detection systems. Indoors deluge systems can also be activated manually or activated by automatic means by using optical flame detection or a high sensitivity smoke detection system. Flame detectors have the advantage of being used to detect small flames where open headed deluge systems can quickly be effective. By contrast there is no way to manually or automatically activate a closed head system.

Water Density
Acetylene trailers vary in size. Typical trailers are approximately 8 feet wide ranging in length from 15 to 50 feet although longer and shorter trailers may exist. The maximum trailer dimensions allowed under DOT regulations are 8.5 ft wide by 65 ft long. The 1984 Edition of NFPA 51A contained the first reference to MATS in Section 8-6.1, requiring that the MATS be in compliance with the 1981 Edition of CGA Pamphlet G-1.6. The G-1.6 publication required fire protection to be provided in the form of fire hoses or fixed spray systems. In 1996 the requirements for MATS in 51A Section 8-6 were deleted as an “editorial change”…to make the standard
more useable, adoptable and enforceable.” A reference to CGA G-1.6 was included as an informational note. Within the regulatory scheme described by NFPA 51A the need for fire protection systems was to be determined by an analysis of local conditions of hazard within the plant, exposure to other properties, water supplies and the probable effectiveness of plant fire brigades to include the time of response and probable effectiveness of fire departments. Where automatic water spray systems were installed NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection were installed water coverage was to be not less than a minimum of 0.25 gpm per sq ft of floor area directly wetted by the stream. An NFPA 13 extra hazard open or closed head sprinkler system was allowed to be used as an acceptable alternate; however, the provisions were general requirements for fire protection including general use and the use of MATS was not mentioned.

There is a concern that limited water supplies may prevent being able to deluge a large area. In these instances it is possible to reduce the total water flow required by constructing fire barrier walls to divide the trailers into groups or compartments. Each area so divided can be equipped with separately controlled deluge systems provided for each area bounded by the fire barriers. Alternatively, an increased spacing between MAT systems can be provided to limit the exposure accordingly.

OTHER CONCERNS

Applicability to Cylinder Charging Facilities
The valves on cylinders in storage are closed as compared to valves on a MAT system which are normally open when the MAT is being charged or discharged. Cylinders on a MAT are manifolded together as compared with typical cylinders in storage. Therefore, stored cylinders are less likely to be involved in an event where heat can spread internally from cylinder to cylinder through a common manifold system. This primary difference requires that a distinction be made between the fire protection systems provided for a MAT system versus the typical arrangement where cylinders are simply stored.

Freezing Conditions
Due to the possibility of freezing (< 40°F) ambient conditions in outdoor locations a wet pipe closed head sprinkler system is not acceptable in many locations. A dry pipe closed head system can be used but it will be much slower to react.

Hot Conditions
When closed head fire sprinkler systems are used NFPA 13 7.7.1.3.1.3 requires the use of intermediate or high temperature-rated sprinklers when the water temperature of the fire protection water being used exceeds 100°F. This is not an uncommon occurrence in areas of the southwestern United States where fire protection water is stored in aboveground tanks and day time temperatures exceed 100°F. NFPA 13: Table 6.2.5.1 lists the following temperature ratings or operating ranges.

- Ordinary temperature-rated sprinklers operate between 135 and 170°F.
- Intermediate temperature-rated sprinklers operate between 175 and 225°F.
- High temperature-rated sprinklers operate between 250 and 300°F.

During the winter season the length of time it takes to achieve a temperature above 175°F at the sprinkler head could allow a fire to become larger than what might otherwise occur in a system protected by an open head deluge system.

EMERGENCY NATURE

- The document contains an error or an omission that was overlooked during a regular revision process.
- The proposed TIA intends to correct a previously unknown existing hazard.
- The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing dangerous condition or situation.

When the IMG-AAA TC considered this issue in the ROC phase of the revision cycle the unstable nature of acetylene, particularly when Mobile Acetylene Trailer Systems (MATS) were being charged or discharged was not the focus of the group. The unstable nature of acetylene must be addressed by providing a means to cool cylinders rapidly in the event of a fire. The risk for conflagration for cylinders arranged on a MATS, particularly MATS located outdoors is significantly increased through the use of closed head sprinkler systems. The IMG-AAA TC recognized that a fire sprinkler system
was necessary to address the risks of a system of this nature but the result of this decision resulted in requiring an NFPA 13 closed head system. As a result the ROC version contains provisions which could result in the use of a closed head NFPA 13 sprinkler system being installed and the protection provided for MATS in a charging or discharging mode typically found outdoors would be unresponsive within the time frame needed to prevent a major conflagration from occurring.

The manufacturing members of the Compressed Gas Association (CGA) have provided additional information to substantiate the use of an open headed deluge system based on response time and coverage required to protect these systems in the early stages of fire thereby avoiding conflagration. The provisions have been expanded to provide a limitation of MATS fire areas and to recognize the use of fire barrier walls as a means to limit exposure.

CGA’s standard addressing MATS G-1.6 has been substantially revised and a joint task group was formed between CGA’s technical committee and principal members (fire protection engineers) of NFPA’s IMG-AAA TC to determine a protection strategy suitable for systems of this nature recognizing the need for fire protection for these systems whether used indoors or outdoors. Past editions of NFPA 51A were reviewed and the specialized needs of MATS systems were recognized. The methodology now proposed revisions integral to the TIA have been accepted by CGA’s Standards Council to be published in the CGA G-1.6 standard. These changes represent a reduction of risk to the public and are in keeping with the recommendations of the National Transportation Safety Board (NTSB) and the Department of Transportation.

The document contains a conflict within the document or with another NFPA document.

Since completing the work on NFPA 51A the IMG-AAA TC has held its ROP meeting for the revision of NFPA 55 which will be used to integrate NFPA 51A into NFPA 55 and NFPA 51A will be withdrawn. Recognizing the special needs of the fire sprinkler system to be provided the TC has approved a proposal to require deluge sprinkler protection for MATS as the requirements for MATS have been expanded and are to be included in NFPA 55. Publication of a revised NFPA 55 will present a conflict in approach with NFPA 51A as the IMG-AAA TC has recognized the need for deluge sprinkler protection. The TIA will serve as an amendment to NFPA 51A that will avoid confusing designers, users and AHJs as the technical provisions for fire protection evolve within the new venue for requirements which will now be found in NFPA 55.
Hi Linda:

I’m not sure if you need this for your records, but I thought you might like to see Larry’s confirmation. I will print his email and keep it in the file.

Thanks for your continued help,
Joanne

From: Larry Fluer [mailto:larryfluer@att.net]
Sent: Friday, January 27, 2012 1:17 PM
To: May, Paul
Cc: Goyette, Joanne; Rich Craig
Subject: RE: NFPA 51A TIA

Paul: This email will confirm our conversation which occurred at just before 1 PM your time today. I am enclosing (or better said – returning) a copy of the document that you had sent to Joanne so that we don’t get mixed up on this. All I did was save the version that you sent me with your message and added a date of 1_27_12 so that it would be clear as to the point of agreement, and Rich would have the opportunity of seeing the document as it moves toward ballot. I was pleased to see that the G-1.6 update to the 2011 edition was included. CGA went to a significant effort, as did the members of the IMG TC (Gresho and Namyst) to fulfill a practical commitment which has been registered with the NTSB and DOT. Having NFPA lag behind the Fed in this regard is not something that should be encouraged, so the update solves that problem. Thank you for the calls and we will look forward to the balloting process.

Larry Fluer
Technical Consultant
Fluer, Inc.
Tel: (805) 238 7896
larryfluer@att.net

Hi Larry,

Just to recap, this is what I have assembled at this point. I have included the most recent version of the TIA that has the revisions made to update the Annex B reference. Please review that and the memo notes that will go out for the committee to consider. We need your approval to move forward on this today.
The TIA No. 1036 on NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*, 2012 Edition, as approved by the Technical Committee on Industrial and Medical Gases, has been revised with the following editorial changes:

The text in 11.2.1.3, 11.2.1.3.2, 11.2.1.3.3, and 11.2.1.3.4 as well as throughout the substantiation were editorially changed to remove the term “sprinkler” and add “water spray fixed system.” The intent is to allow the designer to be able to use either an NFPA 13 or NFPA 15 type suppression system.

The substantiating language was revised to clarify that either NFPA 13 or NFPA 15 may be utilized by the designer. This eliminated any phraseology that implied one system to be used in place of the other by applying more general terms to the overall explanation.

An annex note to Section 11.2.1.3.2 has been added as an informational note to direct the user to CGA G-1.6 for additional information on MATS. The reference to G-1.6 was updated to refer to the most recent CGA publication.

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Thank You,
Paul E. May
NFPA Staff Liaison
Fire Protection Engineer
1. Add the following new definitions to Section 3.3 as follows:

**3.3.xx Fast Acting Detection System.** A Detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

**3.3.xx Fill Valve.** A shutoff valve on the charging system for charging MATS where the acetylene supply first enters the charging connection.

**3.3.xx MATS Building.** A single-story detached building, without an attic, basement, crawl space or false ceiling, used for acetylene trailer(s) or mobile acetylene trailer system (MATS) operations located indoors and the balance of the building is used exclusively for acetylene operations including storage and use of hazardous materials.

**3.3.xx MATS Fire Area.** The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the source valve for MATS being discharged or to the point of the fill valve for MATS being charged.

**3.3.xx Source Valve.** A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user’s supply line.

**A.3.xx Fast Acting Detection System.** Examples for outdoor installations are optical (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations examples include high sensitivity smoke detection (HSSD), optical (UV/IR) or other early detection systems.

2. Modify Section 10.6 as follows:

**10.6* Mobile Acetylene Trailer Systems (MATS).** In addition to the general requirements of NFPA 51A, MATS charging and discharge stations located at acetylene charging plants shall be in accordance with 10.6.

**10.6.1 General.** MATS fire areas used for charging or discharging operations shall be separated from each other by not less than 30 ft. or by fire barriers or fire walls;

**10.6.1.1 When fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire resistive construction and shall separate individual fire areas by line of sight.**

**10.6.1.2 When fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of NFPA 55, Compressed Gases and Cryogenic Fluids Code, the fire barriers shall be full height walls without openings extending from the foundation to the roof constructed of not less than 2-hour fire resistive construction. The allowable area occupied by weather protection shall be in accordance with the requirements of the building code.**

**10.6.1.3 When MATS are installed indoors in a MATS building, fire walls, fire barriers or 2-hour fire rated exterior walls are permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.**

**10.6.12 MATS Filling Charging Stations.**
10.6.2.1 Location. The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

(1) Not less than 25 ft (7.6 m) from property lines.
(2) Not less than 50 feet (15.2 m) from buildings of combustible construction.
(3) Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the charging filling or discharging of the mobile acetylene trailer.
(4) Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines.
(5) Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, flammable gases or oxidizing materials.
(6) Not less than 50 ft (15.2 m) from air intakes.

10.6.2.1.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.6.2.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water run-off.

10.6.2.3 Protection from vehicular damage shall be provided in accordance with NFPA 55 *Compressed Gases and Cryogenic Fluids Code*.

10.6.2.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst pressure of 10,000 psig (69,000 kPa).

10.6.2.5 The charging site shall be posted with a sign with the following or equivalent wording:

ACETYLENE – FLAMMABLE GAS – NO SMOKING – NO OPEN FLAMES

10.6.2.6 Electrical equipment shall be in accordance with NFPA 70

10.6.2.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with NFPA 70, *National Electrical Code*.

10.6.2.6.2 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.6.23 MATS Discharge Stations

10.6.23.1 The MATS discharge station shall be in accordance with 10.6.2 except that 10.6.2.2 shall not apply.

10.6.23.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed 15 psig (103 kPa).

10.6.23.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:

(1)* For pressures greater than 15 psig hoses shall have a minimum burst pressure of 10,000 psig (69,000 kPa).
(2) For pressures of 15 psig (103 kPa) or less hoses shall be rated for a minimum working pressure of 125 psig (860 kPa) and a minimum burst pressure of 500 psig (3450 kPa).

10.6.4 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.

A.10.6.23.3 (1) A 10,000 psi burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.

3. Modify Section 11.2.1.3 and delete existing Sections A.11.2.1.3, 11.2.3.1, and 11.2.1.3.2 in accordance with the
11.2.1.3 Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants a fire sprinkler system in accordance with NFPA 13, extra hazard group 1 shall be installed in the areas occupied by trailers in charging or discharging stations. A deluge or water spray fixed system shall be provided for mobile acetylene trailer fire areas used as indoor and/or outdoor charging and/or discharging stations.

11.2.1.3.1 The system shall be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, at not less than 20 B:C shall be mounted on each trailer.

11.2.1.3.2 Deluge or water spray fixed systems shall provide a minimum design density in accordance with the design documents for the MATS fire area being protected.

11.2.1.3.3 The deluge or water spray fixed system shall be able to be activated automatically by a fast acting detection system and also by a manual actuator.

11.2.1.3.3.1 Manual activation controls shall be identified and marked with a sign and shall be positioned for use in an emergency.

11.2.1.3.3.2 Fire protection equipment and manual activation controls shall not be blocked or obstructed.

11.2.1.3.4 Existing acetylene charging and discharging stations shall be protected by an automatic deluge or water spray fixed system meeting the above requirements not later than January 1, 2015. See also Section 1.4.

11.2.1.3.4.1 The above requirements for deluge or water spray fixed systems shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this standard providing the MATS are protected with an automatic sprinkler system with a minimum design density of not less than 0.25 gpm per square foot.

11.2.1.3.5 At least one UL listed fire extinguisher with a rating of not less than 20 B:C shall be mounted on the mobile acetylene trailer.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

A.11.2.1.3.2 For additional information on mobile acetylene trailer systems, see CGA G-1.6, *Standard for Mobile Acetylene Trailer Systems*.

4. Revise the title of CGA G-1.6 to read as follows:


Submitter’s Substantiation: The TIA contains compromise language that could not be achieved in the revision cycle. The three CAMs submitted by the Compressed Gas Association were withdrawn in favor of a TIA as a TIA was viewed as a viable approach for the committee. The language in the TIA is more technically complete and is believed to be acceptable to all interested parties.

The provisions included in the 2011 Edition for sprinkler systems for Mobile Acetylene Trailer Systems (MATS) as incorporated into Section 11.3.1.3 have been recognized as being inadequate and incomplete as a means to address the unusual hazards of fire in systems of this nature. Acceptance of this change will resolve the technical problem by providing a fire protection system that has been designed to address the special hazards identified with systems of this
nature. The work product is the result of a joint effort between members of the IMG-AAA TC and CGA technical committees involved with CGA Standards designed to address the charging of Mobile Acetylene Trailers (MATS). The IMG-AAA TC is seeking to establish a requirement for deluge sprinkler systems as recommended by the National Transportation Safety Board (NTSB) subsequent to incidents which resulted in substantial damage to acetylene discharge stations using Mobile Acetylene Trailer Systems (MATS). The incidents were the subject of a report from the NTSB which was brought to the attention of the IMG-AAA Technical Committee.

The requirements of Section 11.2.1.3 for a sprinkler system as shown in the 2011 Edition of NFPA 51A may in fact be suitable for filling of individual cylinders for indoor use where closed head systems can be activated. They are not suitable for sprinkler systems installed outdoors where ambient conditions can negatively influence performance, and for other reasons detailed below. A clear requirement should be established to require a deluge or water spray fixed system when MATS are charged or discharged either indoors or outdoors. The requirement to do so must be in the body of the standard so that users, designers and AHJs are clear with respect to the fact that NFPA 13 or 15 systems can be used at discretion of the designer and approval of the AHJ.

**REASONS WHY OPEN SYSTEMS SHOULD BE REQUIRED**

Closed head sprinkler systems do not provided the same level of protection as a deluge system. During a fire inside a building, the ceiling forces the hot combustion products to travel outward ahead of the fire. These hot combustion products activate the closed head sprinklers allowing sprinklers not directly above the fire to activate and help keep the adjacent areas cool helping to prevent the spread of the fire.

MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. When located outdoors there is no means provided to allow the collection of the hot combustion products in order to activate a sprinkler system and therefore these sprinkler heads may not open. Depending on ambient conditions such as wind speed, the heat from a fire may only activate sprinkler heads downwind of the fire thus allowing the fire to rapidly spread to cylinders upwind allowing the incident to escalate instead of immediately containing the situation like an open head deluge system could have. In addition wind can blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature.

Acetylene cylinders have a thermally activated fusible metal plug located near the valve or on the top of the cylinder that melts at approximately 212°F. The plug is designed to release the gas as it expands in order to prevent rupture of the container. When this plug melts acetylene vents directly to atmosphere in effect making a large torch (with temperatures greater than 5700°F). On a Mobile Acetylene Trailer (MAT) the cylinders are nested closely together with the typical cylinder diameters generally 12 inches or less. The result is that the fusible metal plugs are typically only 10 to 12 inches apart. (See Figure 1 below) In the event of a fire if adjacent cylinders are not quickly cooled, the fusible metal plugs will continue to melt allowing the fire to quickly spread from cylinder to cylinder throughout the array. (See Figure 2).
Figure 1. Distance between cylinder fusible metal plugs that are located on the head of the cylinder near the base of the cylinder shutoff valve

Figure 2 – Large quantity of cylinders nested on a trailer
Acetylene Specific Hazards

Acetylene (stabilized) is a flammable gas and also an unstable reactive gas that can decompose and generate heat without the presence of oxygen. Cylinders on a trailer are connected through a common manifold that allows the gas to be transported into or out of the containers in the process of being charged or discharged (See Figure 2). In a fire acetylene can decompose inside the piping system which can lead to further decomposition of acetylene inside of cylinders as heat is transmitted through the manifold. The heat from the decomposition of acetylene is sufficient to melt the fusible metal plugs installed to prevent cylinder rupture. If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly.

In the absence of fire it is also possible, based on the increased pressures (greater than 15 psig), for decomposition to occur inside the piping due to mechanical shock or adiabatic compression with insufficient heat to initially melt a fusible metal plug. Until a fire occurs there will be no external heat available that would activate a closed head sprinkler system. In that particular situation the operator will most likely identify the event when it occurs by either an audible or visual cue before a fire occurs. Having a deluge system available that can be manually activated provides the operator with a system that can be used to cool the cylinders and piping before an external fire, mass release from multiple fusible metal plugs, or potential cylinder rupture occurs.

Activation

Outdoors deluge systems can either be activated manually from a remote point or by automatic means using optical flame detectors such as UV/IR or other approved early warning detection systems. Indoors deluge systems can also be activated manually or activated by automatic means by using optical flame detection or a high sensitivity smoke detection system. Flame detectors have the advantage of being used to detect small flames where open headed deluge systems can quickly be effective. By contrast there is no way to manually or automatically activate a closed head system.

Water Density

Acetylene trailers vary in size. Typical trailers are approximately 8 feet wide ranging in length from 15 to 50 feet although longer and shorter trailers may exist. The maximum trailer dimensions allowed under DOT regulations are 8.5 ft wide by 65 ft long. The 1984 Edition of NFPA 51A contained the first reference to MATS in Section 8-6.1, requiring that the MATS be in compliance with the 1981 Edition of CGA Pamphlet G-1.6. The G-1.6 publication required fire protection to be provided in the form of fire hoses or fixed spray systems.

In 1996 the requirements for MATS in 51A Section 8-6 were deleted as an “editorial change”…”to make the standard more useable, adoptable and enforceable.” A reference to CGA G-1.6 was included as an informational note. Within the regulatory scheme described by NFPA 51A the need for fire protection systems was to be determined by an analysis of local conditions of hazard within the plant, exposure to other properties, water supplies and the probable effectiveness of plant fire brigades to include the time of response and probable effectiveness of fire departments. Where automatic water spray systems were installed NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection were installed water coverage was to be not less than a minimum of 0.25 gpm per sq ft of floor area directly wetted by the stream. An NFPA 13 extra hazard open or closed head sprinkler system was allowed to be used as an acceptable alternate; however, the provisions were general requirements for fire protection including general use and the use of MATS was not mentioned.

There is a concern that limited water supplies may prevent being able to deluge a large area. In these instances it is possible to reduce the total water flow required by constructing fire barrier walls to divide the trailers into groups or compartments. Each area so divided can be equipped with separately controlled deluge systems provided for each area bounded by the fire barriers. Alternatively, an increased spacing between MAT systems can be provided to limit the exposure accordingly.

OTHER CONCERNS

Applicability to Cylinder Charging Facilities
The valves on cylinders in storage are closed as compared to valves on a MAT system which are normally open when
the MAT is being charged or discharged. Cylinders on a MAT are manifolded together as compared with typical
cylinders in storage. Therefore, stored cylinders are less likely to be involved in an event where heat can spread
internally from cylinder to cylinder through a common manifold system. This primary difference requires that a
distinction be made between the fire protection systems provided for a MAT system versus the typical arrangement
where cylinders are simply stored.

**Freezing Conditions**

Due to the possibility of freezing (< 40°F) ambient conditions in outdoor locations a wet pipe closed head sprinkler
system is not acceptable in many locations. A dry pipe closed head system can be used but it will be much slower to
react.

**Hot Conditions**

When closed head fire sprinkler systems are used NFPA 13 7.7.1.3.1.3 requires the use of intermediate or high
temperature-rated sprinklers when the water temperature of the fire protection water being used exceeds 100°F. This is
not an uncommon occurrence in areas of the southwestern United States where fire protection water is stored in
aboveground tanks and day time temperatures exceed 100°F. NFPA 13: Table 6.2.5.1 lists the following temperature
ratings or operating ranges.

- Ordinary temperature-rated sprinklers operate between 135 and 170°F.
- Intermediate temperature-rated sprinklers operate between 175 and 225°F.
- High temperature-rated sprinklers operate between 250 and 300°F.

During the winter season the length of time it takes to achieve a temperature above 175°F at the sprinkler head could
allow a fire to become larger than what might otherwise occur in a system protected by an open head deluge system.

**EMERGENCY NATURE**

- The document contains an error or an omission that was overlooked during a regular revision process.
- The proposed TIA intends to correct a previously unknown existing hazard.
- The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or
  ameliorate a continuing dangerous condition or situation.

When the IMG-AAA TC considered this issue in the ROC phase of the revision cycle the unstable nature of acetylene,
particularly when Mobile Acetylene Trailer Systems (MATS) were being charged or discharged was not the focus of the
group. The unstable nature of acetylene must be addressed by providing a means to cool cylinders rapidly in the event of
a fire. The risk for conflagration for cylinders arranged on a MATS, particularly MATS located outdoors is significantly
increased through the use of closed head sprinkler systems. The IMG-AAA TC recognized that a fire sprinkler system
was necessary to address the risks of a system of this nature but the focus of discussion resulted in requiring an NFPA 13
closed head system. As a result the ROC version contains provisions which could result in the use of a closed head NFPA
13 sprinkler system being installed and the protection provided for MATS in a charging or discharging mode typically
found outdoors would be unresponsive within the time frame needed to prevent a major conflagration from occurring.
The manufacturing members of the Compressed Gas Association (CGA) have provided additional information to
substantiate the use of an open headed deluge system based on response time and coverage required to protect these
systems in the early stages of fire thereby avoiding conflagration. The provisions have been expanded to provide a
limitation of MATS fire areas and to recognize the use of fire barrier walls as a means to limit exposure.
CGA’s standard addressing MATS G-1.6 has been substantially revised and a joint task group was formed between
CGA’s technical committee and principal members (fire protection engineers) of NFPA’s IMG-AAA TC to determine a
protection strategy suitable for systems of this nature recognizing the need for fire protection for these systems whether
used indoors or outdoors. Past editions of NFPA 51A were reviewed and the specialized needs of MATS systems were
recognized. The methodology now proposed revisions integral to the TIA have been accepted by CGA’s Standards
Council to be published in the CGA G-1.6 standard. These changes represent a reduction of risk to the public and are in
keeping with the recommendations of the National Transportation Safety Board (NTSB) and the Department of Transportation.

The document contains a conflict within the document or with another NFPA document.

Since completing the work on NFPA 51A the IMG-AAA TC has held its ROP meeting for the revision of NFPA 55 which will be used to integrate NFPA 51A into NFPA 55 and NFPA 51A will be withdrawn. Recognizing the special needs of the fire sprinkler system to be provided the TC has approved a proposal to require deluge sprinkler protection for MATS as the requirements for MATS have been expanded and are to be included in NFPA 55. Publication of a revised NFPA 55 will present a conflict in approach with NFPA 51A as the IMG-AAA TC has recognized the need for deluge sprinkler protection. The TIA will serve as an amendment to NFPA 51A that will avoid confusing designers, users and AHJs as the technical provisions for fire protection evolve within the new venue for requirements which will now be found in NFPA 55.
1. Add the following new definitions to Section 3.3 as follows:

3.3.xx* Fast Acting Detection System. A detection system designed to detect a fire more rapidly than standard smoke or heat detectors.

3.3.xx Fill Valve. A shutoff valve on the charging system for charging MATS where the acetylene supply first enters the charging connection.

3.3.xx MATS Building. A single-story detached building, without an attic, basement, crawl space or false ceiling, used for acetylene trailer(s) or mobile acetylene trailer system (MATS) operations located indoors and the balance of the building is used exclusively for acetylene operations including storage and use of hazardous materials.

3.3.xx MATS Fire Area. The area or footprint occupied by the individual mobile acetylene trailer(s) to include the control system up to the point of the source valve for MATS being discharged or to the point of the fill valve for MATS being charged.

3.3.xx Source Valve. A shutoff valve on the piping system serving MATS where the acetylene supply first enters the user’s supply line.

A.3.xx Fast Acting Detection System. Examples for outdoor installations are optical (UV/IR) systems that detect visible flames and do not rely on products of combustion to be transported by the energy of the heat plume to the location of the detector. For indoor installations, examples include high sensitivity smoke detection (HSSD), optical (UV/IR), or other early detection systems.

2. Revise Section 10.6 as follows:

10.6* Mobile Acetylene Trailer Systems (MATS). In addition to the general requirements of NFPA 51A, MATS charging and discharge stations located at acetylene charging plants shall be in accordance with Section 10.6.

10.6.1 General. MATS fire areas used for charging or discharging operations shall be separated from each other by not less than 30 ft (9.1 m) or by fire barriers or fire walls.

10.6.1.1 Where fire barriers are used to separate outdoor MATS fire areas without weather protection, the fire barriers shall be not less than 2-hour fire resistive construction and shall separate individual fire areas by line of sight.

10.6.1.2 Where fire barriers are used to separate outdoor MATS fire areas covered by weather protection constructed in accordance with the requirements of NFPA 55, Compressed Gases and Cryogenic Fluids Code, the fire barriers shall be full height walls without openings extending from the foundation to the roof constructed of not less than 2-hour fire-resistive construction. The allowable area occupied by weather protection shall be in accordance with the requirements of the building code.

10.6.1.3 Where MATS are installed indoors in a MATS building, fire walls, fire barriers or 2-hour fire-rated exterior walls are permitted to be used to separate MATS fire areas. Walls shall be constructed in accordance with the requirements of the building code.

10.6.42 MATS Filling Charging Stations.
10.6.2.1 Location. The mobile acetylene trailer, including fill connections, shall be located in accordance with the following criteria:

(1) Not less than 25 ft (7.6 m) from property lines.

(2) Not less than 50 feet (15.2 m) from buildings of combustible construction.

(3) Not less than 15 ft (4.6 m) from buildings of noncombustible construction not associated with the charging filling or discharging of the mobile acetylene trailer.

(4) Not less than 15 ft (7.6 m) horizontal distance from the vertical plane below the nearest overhead electrical utility power lines.

(5) Not less than 15 ft (4.6 m) horizontal distance from the vertical plane below overhead piping containing flammable liquids, flammable gases or oxidizing materials.

(6) Not less than 50 ft (15.2 m) from air intakes.

10.6.2.1 The minimum required distances, except for air intake openings, shall not apply when fire barriers without openings or penetrations having a minimum fire resistance rating of 2 hours interrupt the line of sight between the discharge and the exposure.

10.6.2.2 Where process needs require removing the heat of solution of acetylene as determined by ambient temperature and cylinder charging rates, provisions shall be made for a cylinder cooling process water spray system and water run-off.

10.6.2.3 Protection from vehicular damage shall be provided in accordance with NFPA 55, Compressed Gases and Cryogenic Fluids Code.

10.6.2.4 Flexible transfer hoses used for charging of MATS shall have a minimum burst pressure of 10,000 psig (69,000 kPa).

10.6.2.5 The charging site shall be posted with a sign with the following or equivalent wording:

ACETYLENE – FLAMMABLE GAS – NO SMOKING – NO OPEN FLAMES

10.6.2.6 Electrical equipment shall be in accordance with NFPA 70®, National Electrical Code®.

10.6.2.6.1 An electrical grounding system for the acetylene piping shall be provided in accordance with NFPA 70, National Electrical Code.

10.6.2.6.2 The trailer chassis shall be connected to the grounding system before connections are made to the piping system.

10.6.23 MATS Discharge Stations.

10.6.23.1 The MATS discharge station shall be in accordance with 10.6.2 except that 10.6.2.2 shall not apply.

10.6.23.2 Acetylene meters, where used, shall be designed for acetylene service and shall operate at a pressure not to exceed 15 psig (103 kPa).

10.6.23.3 Flexible transfer hoses used for withdrawal of acetylene shall be pressure rated as follows:

(1)* For pressures greater than 15 psig (103 kPa) hoses shall have a minimum burst pressure of 10,000 psig (69,000 kPa).
For pressures of 15 psig (103 kPa) or less, hoses shall be rated for a minimum working pressure of 125 psig (860 kPa) and a minimum burst pressure of 500 psig (3450 kPa).

A.10.6.23.3(1) A 10,000 psi (69,000 kPa) burst pressure for charging leads integral to 10.6.2.3 has been used to withstand a decomposition reaction of acetylene in the charging lead.

10.6.4 Fire Protection. Fire protection systems shall be provided in accordance with 11.2.1.3.

3. Revise Section 11.2.1.3 and delete existing Sections 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3 in accordance with the following:

11.2.1.3 Mobile Acetylene Trailer Systems (MATS). At mobile acetylene charging plants a fire sprinkler system in accordance with NFPA 13, extra hazard group 1 shall be installed in the areas occupied by trailers in charging or discharging stations. A deluge sprinkler system shall be provided for mobile acetylene trailer fire areas used as indoor and outdoor charging and discharging stations. The system shall be designed to provide water as a means of cooling the containers located on the trailer that are potentially exposed to fire.

11.2.1.3.1 Where the public water is not sufficient to meet the requirements for water flow or capacity, the supply shall be subject to approval by the authority having jurisdiction.

11.2.1.3.2 At least one portable fire extinguisher rated in accordance with NFPA 10, Standard for Portable Fire Extinguishers, at not less than 20 B:C shall be mounted on each trailer.

11.2.1.3.1 Deluge sprinkler systems shall provide a minimum design density of 0.3 gpm per square foot over the MATS fire area being protected.

11.2.1.3.2 The deluge sprinkler system shall be able to be activated automatically by a fast acting detection system and also by a manual actuator.

11.2.1.3.2.1 Manual activation controls shall be identified and marked with a sign and shall be positioned for use in an emergency.

11.2.1.3.2.2 Fire protection equipment and manual activation controls shall not be blocked or obstructed.

11.2.1.3.3 Existing acetylene charging and discharging stations shall be protected by an automatic deluge sprinkler system meeting the above requirements not later than January 1, 2015. See also Section 1.4.

11.2.1.3.3.1 The above requirements for deluge sprinkler systems shall not apply to existing indoor or outdoor facilities, equipment, structures, or other installations where MATS are charged or discharged that existed or were approved for construction or installation prior to the effective date of this standard providing the MATS are protected with an automatic sprinkler system with a minimum design density of not less than 0.25 gpm per square foot (10.1 L/min per square meter).

11.2.1.3.4 At least one UL listed fire extinguisher with a rating of not less than 20 B:C shall be mounted on the mobile acetylene trailer.

A.11.2.1.3 MATS fire protection requirements apply to charging or discharging stations located indoors or outdoors.

Submitter’s Substantiation: The TIA contains compromise language that could not be achieved in the revision cycle. The three CAMs submitted by the Compressed Gas Association were withdrawn in favor of a TIA as a TIA was viewed as a viable approach for the committee. The language in the TIA is more technically complete and is believed to be acceptable to all interested parties.

The provisions included in the 2011 Edition for sprinkler systems for Mobile Acetylene Trailer Systems (MATS) as incorporated into Section 11.3.1.3 have been recognized as being inadequate and incomplete as a means to address the
unusual hazards of fire in systems of this nature. Acceptance of this change will resolve the technical problem by providing a fire protection system that has been designed to address the special hazards identified with systems of this nature. The work product is the result of a joint effort between members of the IMG-AAA TC and CGA technical committees involved with CGA Standards designed to address the charging of Mobile Acetylene Trailers (MATS).

The IMG-AAA TC is seeking to establish a requirement for deluge sprinkler systems as recommended by the National Transportation Safety Board (NTSB) subsequent to incidents which resulted in substantial damage to acetylene discharge stations using Mobile Acetylene Trailer Systems (MATS). The incidents were the subject of a report from the NTSB which was brought to the attention of the IMG-AAA Technical Committee.

The requirements of Section 11.2.1.3 for a sprinkler system as shown in the 2011 Edition of NFPA 51A may in fact be suitable for filling of individual cylinders for indoor use where closed head systems can be activated. They are not suitable for sprinkler systems installed outdoors where ambient conditions can negatively influence performance, and for other reasons detailed below. A clear requirement should be established to require a deluge sprinkler system when MATS are charged or discharged either indoors or outdoors. The requirement to do so must be in the body of the standard so that users, designers and AHJs are clear with respect to the requirements.

REASONS WHY OPEN HEAD DELUGE SYSTEM SHOULD BE REQUIRED

Cooling of adjacent cylinders

Closed head sprinkler systems do not provided the same level of protection as a deluge system. During a fire inside a building, the ceiling forces the hot combustion products to travel outward ahead of the fire. These hot combustion products activate the closed head sprinklers allowing sprinklers not directly above the fire to activate and help keep the adjacent areas cool helping to prevent the spread of the fire.

MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. When located outdoors there is no means provided to allow the collection of the hot combustion products in order to activate a sprinkler system and therefore these sprinkler heads may not open. Depending on ambient conditions such as wind speed, the heat from a fire may only activate sprinkler heads downwind of the fire thus allowing the fire to rapidly spread to cylinders upwind allowing the incident to escalate instead of immediately containing the situation like an open head deluge system could have. In addition wind can blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature.

Acetylene cylinders have a thermally activated fusible metal plug located near the valve or on the top of the cylinder that melts at approximately 212°F. The plug is designed to release the gas as it expands in order to prevent rupture of the container. When this plug melts acetylene vents directly to atmosphere in effect making a large torch (with temperatures greater than 5700°F). On a Mobile Acetylene Trailer (MAT) the cylinders are nested closely together with the typical cylinder diameters generally 12 inches or less. The result is that the fusible metal plugs are typically only 10 to 12 inches apart. (See Figure 1 below) In the event of a fire if adjacent cylinders are not quickly cooled, the fusible metal plugs will continue to melt allowing the fire to quickly spread from cylinder to cylinder throughout the array. (See Figure 2).
Figure 1. Distance between cylinder fusible metal plugs that are located on the head of the cylinder near the base of the cylinder shutoff valve

Figure 2 – Large quantity of cylinders nested on a trailer
**Acetylene Specific Hazards**

Acetylene (stabilized) is a flammable gas and also an unstable reactive gas that can decompose and generate heat without the presence of oxygen. Cylinders on a trailer are connected through a common manifold that allows the gas to be transported into or out of the containers in the process of being charged or discharged (See Figure 2). In a fire acetylene can decompose inside the piping system which can lead to further decomposition of acetylene inside of cylinders as heat is transmitted through the manifold. The heat from the decomposition of acetylene is sufficient to melt the fusible metal plugs installed to prevent cylinder rupture. If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly.

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CGA’s standard addressing MATS G-1.6 has been substantially revised and a joint task group was formed between CGA’s technical committee and principal members (fire protection engineers) of NFPA’s IMG-AAA TC to determine a protection strategy suitable for systems of this nature recognizing the need for fire protection for these systems whether used indoors or outdoors. Past editions of NFPA 51A were reviewed and the specialized needs of MATS systems were recognized. The methodology now proposed revisions integral to the TIA have been accepted by CGA’s Standards Council to be published in the CGA G-1.6 standard. These changes represent a reduction of risk to the public and are in keeping with the recommendations of the National Transportation Safety Board (NTSB) and the Department of Transportation.
Since completing the work on NFPA 51A the IMG-AAA TC has held its ROP meeting for the revision of NFPA 55 which will be used to integrate NFPA 51A into NFPA 55 and NFPA 51A will be withdrawn. Recognizing the special needs of the fire sprinkler system to be provided the TC has approved a proposal to require deluge sprinkler protection for MATS as the requirements for MATS have been expanded and are to be included in NFPA 55. Publication of a revised NFPA 55 will present a conflict in approach with NFPA 51A as the IMG-AAA TC has recognized the need for deluge sprinkler protection. The TIA will serve as an amendment to NFPA 51A that will avoid confusing designers, users and AHJs as the technical provisions for fire protection evolve within the new venue for requirements which will now be found in NFPA 55.
According to 5.4 in the NFPA (RGCP), the final results show this TIA HAS achieved the necessary votes on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 18.

\[
[28 \text{ (eligible to vote)} - 5 \text{ (not returned)} - 0 \text{ (abstentions)} = 23 \times 0.75 = 17.25]
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
[28 \text{ eligible} ÷ 2 = 14 + 1 = 15 \text{ (this is the simple majority)}]
\]

TC FINAL Ballot results for Technical Merit are as follows:

- 22 Agree
- 1 Disagree (Mahnken)
- 0 Abstentions

FINAL ACTION: PASSED

TC FINAL Ballot results for Emergency Nature are as follows:

- 23 Agree
- 0 Disagree
- 0 Abstentions

FINAL ACTION: PASSED
TECHNICAL COMMITTEE LETTER BALLOT  
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1036  
To Add New Definitions to Section 3.3, Revise Sections 10.6 and 11.2.1.3, and to Delete Sections 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3 to the 2012 Edition of NFPA 51A, Standard for Acetylene Cylinder Charging Plants  

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to add a New 3.3, revise 10.6 and 11.2.1.3, and delete 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3.  

____________ AGREE _______X_____ DISAGREE* ____________ ABSTAIN*  

EXPLANATION OF VOTE - Please type or print your comments:  
*An explanation must accompany a disagreement or abstaining position.  

3.3. xx The term ‘MATS Fire Area’ is a misnomer. The concern is the design operating area for the deluge or water spray system. If two MATS are separated by a ‘line of sight’ fire barrier, but only 10 ft apart, they would be separate ‘fire areas’ based on the definition, but should both be included in the design operating area. The design operating area will be site specific and should be left up to the designer subject to approval by the AHJ.  

The new 11.2.1.3 should refer to NFPA 13 (for deluge) and NFPA 15 (for water spray) for design of the respective systems.  

The new 11.2.1.3.2 has been modified and no longer provides a design density. The currently required design density (0.30 gpm per square foot) over the design operating area will be adequate for cooling via water spray or deluge and should be specified in this document. A specific design density is needed!  

Question 2: I agree that the subject is of an EMERGENCY NATURE.  

________X____ AGREE ____________ DISAGREE* ____________ ABSTAIN*  

EXPLANATION OF VOTE - Please type or print your comments:  
*An explanation must accompany a disagreement or abstaining position.  

Signature  

Name (Please Print) Glenn Mahnken  

Date Feb 2, 2012  

Please return the ballot on or before Thursday, August 18, 2011.  

PLEASE RETURN TO:  
Joanne Goyette, Administrator, Technical Projects  
NFPA  
1 Batterymarch Park  
Quincy, MA 02169  
FAX: (617) 984-7110 E-mail: jgoyette@nfpa.org
TIA FINAL TC BALLOT RESULTS

According to 5.4 in the NFPA (RGCP), the final results show this TIA HAS achieved the necessary votes on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 18.

\[28 \text{ (eligible to vote)} - 5 \text{ (not returned)} - 0 \text{ (abstentions)} = 23 \times 0.75 = 17.25\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[28 \text{ eligible} \div 2 = 14 + 1 = 15 \text{ (this is the simple majority)}\]

28 \hspace{1em} \text{Eligible to Vote}
5 \hspace{1em} \text{Not Returned (Barnes, Fast, Harris, Mills, Younis)}

TC FINAL Ballot results for Technical Merit are as follows:
23 \hspace{1em} \text{Agree}
0 \hspace{1em} \text{Disagree}
0 \hspace{1em} \text{Abstentions}

\text{FINAL ACTION: PASSED}

TC FINAL Ballot results for Emergency Nature are as follows:
23 \hspace{1em} \text{Agree}
0 \hspace{1em} \text{Disagree}
0 \hspace{1em} \text{Abstentions}

\text{FINAL ACTION: PASSED}
Agenda Item: TIA 51A-2012

Document: NFPA 51A, Standard for Acetylene Cylinder Charging Plants

Reference: 3.3 (New), 10.6, and 11.2.1.3
(TIA Log 1036)

Comment Closing: 9/9/2011
1 Public Comment Received

TIA FINAL TC BALLOT RESULTS

According to 5.4 in the NFPA (RGCP), the final results show this TIA HAS achieved the necessary votes on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 18.

\[
[28 \text{ (eligible to vote)} - 5 \text{ (not returned)} - 0 \text{ (abstentions)} = 23 \times 0.75 = 17.25]
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
[28 \text{ eligible} \div 2 = 14 + 1 = 15 \text{ (this is the simple majority)}]
\]

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<td>5</td>
</tr>
</tbody>
</table>

TC FINAL Ballot results for **Technical Merit** are as follows:

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<tr>
<th>Agree</th>
<th>Disagree (Mahnken)</th>
<th>Abstentions</th>
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<tr>
<td>22</td>
<td>1</td>
<td>0</td>
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**FINAL ACTION: PASSED**

TC FINAL Ballot results for **Emergency Nature** are as follows:

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<tr>
<th>Agree</th>
<th>Disagree</th>
<th>Abstentions</th>
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<tbody>
<tr>
<td>23</td>
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**FINAL ACTION: PASSED**
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1036
To Add New Definitions to Section 3.3, Revise Sections 10.6 and 11.2.1.3, and to Delete Sections 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3 to the 2012 Edition of NFPA 51A, Standard for Acetylene Cylinder Charging Plants

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to add a New 3.3, revise 10.6 and 11.2.1.3, and delete 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3.

_________ AGREE _______X_____ DISAGREE* ____________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

3.3. xx The term ‘MATS Fire Area’ is a misnomer. The concern is the design operating area for the deluge or water spray system. If two MATS are separated by a ‘line of sight’ fire barrier, but only 10 ft apart, they would be separate ‘fire areas’ based on the definition, but should both be included in the design operating area. The design operating area will be site specific and should be left up to the designer subject to approval by the AHJ.

The new 11.2.1.3 should refer to NFPA 13 (for deluge) and NFPA 15 (for water spray) for design of the respective systems.

The new 11.2.1.3.2 has been modified and no longer provides a design density. The currently required design density (0.30 gpm per square foot) over the design operating area will be adequate for cooling via water spray or deluge and should be specified in this document. A specific design density is needed!

Question 2: I agree that the subject is of an EMERGENCY NATURE.

_________X____ AGREE ____________ DISAGREE* ____________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

Name (Please Print) Glenn Mahnken
Date Feb 2, 2012

February 29, 2012 Supplemental Agenda, March 5-6, 2012 Page 83 of 830
According to 5.4 in the NFPA (RGCP), the final results show this TIA **HAS** achieved the necessary votes on both Question 1 (**Technical Merit**) and Question 2 (**Emergency Nature**).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 18.

\[
[28 \text{ eligible to vote} - 5 \text{ not returned} - 0 \text{ abstentions}] = 23 \times 0.75 = 17.25
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
[28 \text{ eligible} \div 2 = 14 + 1 = 15 \text{ (this is the simple majority)}]
\]

---

**TC FINAL Ballot results for Technical Merit** are as follows:

- 22 Agree
- 1 Disagree (Mahnken)
- 0 Abstentions

**FINAL ACTION: PASSED**

**TC FINAL Ballot results for Emergency Nature** are as follows:

- 23 Agree
- 0 Disagree
- 0 Abstentions

**FINAL ACTION: PASSED**
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1036
To Add New Definitions to Section 3.3, Revise Sections 10.6 and 11.2.1.3, and to Delete Sections 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3 to the 2012 Edition of NFPA 51A, Standard for Acetylene Cylinder Charging Plants

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to add a New 3.3, revise 10.6 and 11.2.1.3, and delete 11.2.1.3.1, 11.2.1.3.2, and A.11.2.1.3.

____________ AGREE _______X_____ DISAGREE* ____________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

3.3. xx The term ‘MATS Fire Area’ is a misnomer. The concern is the design operating area for the deluge or water spray system. If two MATS are separated by a ‘line of sight’ fire barrier, but only 10 ft apart, they would be separate ‘fire areas’ based on the definition, but should both be included in the design operating area. The design operating area will be site specific and should be left up to the designer subject to approval by the AHJ.

The new 11.2.1.3 should refer to NFPA 13 (for deluge) and NFPA 15 (for water spray) for design of the respective systems.

The new 11.2.1.3.2 has been modified and no longer provides a design density. The currently required design density (0.30 gpm per square foot) over the design operating area will be adequate for cooling via water spray or deluge and should be specified in this document. A specific design density is needed!

Question 2: I agree that the subject is of an EMERGENCY NATURE.

________X____ AGREE ____________ DISAGREE* ____________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

________________________________
Signature

Name (Please Print) Glenn Mahnken

Date Feb 2, 2012

Please return the ballot on or before Thursday, August 18, 2011.

PLEASE RETURN TO:
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169 FAX: (617) 984-7110 E-mail: jgoyette@nfpa.org
TIA FINAL TC BALLOT RESULTS

According to 5.4 in the NFPA (RGCP), the final results show this TIA **HAS** achieved the necessary votes on both Question 1 (**Technical Merit**) and Question 2 (**Emergency Nature**).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is **18**.
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[28 \text{ eligible} ÷ 2 = 14 + 1 = 15 \text{ (this is the simple majority)}]
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<tr>
<td>5</td>
<td>Not Returned (Barnes, Fast, Harris, Mills, Younis)</td>
</tr>
</tbody>
</table>

**TC FINAL** Ballot results for **Technical Merit** are as follows:

- 23 Agree
- 0 Disagree
- 0 Abstentions

**FINAL ACTION: PASSED**

**TC FINAL** Ballot results for **Emergency Nature** are as follows:

- 23 Agree
- 0 Disagree
- 0 Abstentions

**FINAL ACTION: PASSED**

Formerly SC Item 11-10-2-b
Administratively Withdrawn
I concur with Terry and Rich... Does not belong in 13.

Steven Scandaliato, SET CFPS

Principal

SDG, LLC.
Life Safety & Fire Protection
Consulting & Design
1330 W. Roller Coaster Rd.
Suite 100
Tucson, Arizona 85704
520.887.2818 Tucson Office
403.385.2048 Calgary Office
520.971.2322 cell
www.scandaliato.com

February 29, 2012

Supplemental Agenda, March 5-6, 2012
Page 87 of 830

From: Victor, Terry [mailto:TVictor@simplexgrinnell.com]
Sent: Wednesday, January 11, 2012 10:50 AM
To: Klaus, Matthew; sscandaliato@qwestoffice.net; Golinveaux, James; pehrson@mninter.net; david.hague@libertymutual.com; jeff.sutton@globalriskconsultants.com; Duffy, Chad
Subject: RE: NFPA 51A Task Group

Matt & fellow TG members,

I can see the rationale of trying to allow a NFPA 13 deluge system installation because of the area coverage normally desired for this hazard, but I can’t agree on the NFPA 13 reference in this TIA for numerous reasons.

First, I encourage all to read the substantiation for the TIA very carefully. There are several key statements made that support my argument for a NFPA 15 reference only:

1. These MATS are either outside or under a roof with at least three sides open and they are worried about wind cold soldering adjacent sprinklers if there are closed heads. That same wind will affect the area protection from open standard spray sprinklers, especially on the windward side of the systems, due to the low velocity of the water coming from a standard spray sprinkler. Water spray nozzles used per NFPA 15 are designed to discharge with a higher velocity to account for the wind especially in outdoor applications.

   Cooling of adjacent cylinders

   "..... MATS (especially discharge stations) are typically located outdoors or under an area of overhead cover that is open on three or more sides constructed as weather protection in accordance with the requirements and limitations of the building code. .... In addition wind can
blow the spray from the activated sprinklers to downwind sprinklers cooling the downwind sprinklers below their activation temperature. ......”

2. Cooling of adjacent cylinders and the common manifold is one of the objectives of the fire protection system:

   **Acetylene Specific Hazards**
   “..... If cylinders are not cooled immediately the release of gas from melted fusible metal plugs will likely result in initiating a fire at a different location on the trailer, or even on adjacent trailers. Immediate cooling of all cylinders on the trailer reduces the possibility of a flashover fire and prevents a decomposition reaction and potential mass release of gas thereby limiting the size of the incident accordingly. ......”

3. The substantiation states that NFPA 51A installations are normally required to be in accordance with NFPA 15. However, in some cases NFPA 13 was allowed, except for the use of MATS as shown bolded and underlined below:

   **Water Density**
   “..... Where automatic water spray systems were installed NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection were installed water coverage was to be not less than a minimum of 0.25 gpm per sq ft of floor area directly wetted by the stream. An NFPA 13 extra hazard open or closed head sprinkler system was allowed to be used as an acceptable alternate; however, the provisions were general requirements for fire protection including general use and **the use of MATS was not mentioned**.”

The more I read about this hazard the more I’m convinced that a NFPA 15 water spray system using directional spray nozzles providing area protection is the appropriate design.

If someone told me to design a deluge system using open standard spray sprinklers for this hazard in accordance with NFPA 13, I wouldn’t know where to start. To the best of my knowledge NFPA 13 doesn’t address any hazards that involve gaseous flammable materials, except in chapter 21 where there are special occupancies that allow deluge systems but they give the specific design criteria for each occupancy such as in the following sections:

21.4 Spray Application Using Flammable or Combustible Materials.
21.16 Standard for Ovens and Furnaces.
21.17 Class A Hyperbaric Chambers.
21.21 Water Cooling Towers.
21.27 Advanced Light Water Reactor Electric Generating Plants.
21.35 Class E Hypobaric Facilities.
21.36 Coal Mines.

Most of these are straight extracts from other NFPA standards.

The only other references in NFPA 13 to a deluge system is for stages where prosenium openings require protection, and in high expansion foam systems. If the NFPA 51A committee wants MATS protection in NFPA 13 they have to first put the specific design criteria in NFPA 51A which can then be extracted into NFPA 13, as is the case for the acetylene cylinder charging plants themselves:

21.10 Acetylene Cylinder Charging Plants.

On the other hand, NFPA 15 specifically states that it is intended for use for gaseous flammable materials:
1.3.2 Water spray protection is acceptable for the protection of hazards involving each of the following groups:
(1) Gaseous and liquid flammable materials

NFPA 15 also has provisions for including side by side systems discharging simultaneously if the possibility exists that the fire could involve more than one system (7.1.10.2). NFPA 13 has no provision for this that I’m aware of.

In conclusion, the reference to NFPA 13 is inappropriate for this application.

Terry Victor | National Manager – Sprinkler Business Processes
SimplexGrinnell, A Tyco International Company
9585 Snowden River Parkway, Columbia, MD 21046 United States

Tel: +1-443-896-1053 | Mobile: +1-443-286-4038
tvictor@simplexgrinnell.com | Linkedin
www.simplexgrinnell.com

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From: Sutton, Jeff [mailto:jeff.sutton@globalriskconsultants.com]
Sent: Wednesday, January 11, 2012 10:50 AM
To: Hague, David; Klaus, Matthew; Steven Scandaliato (sscandaliato@qwestoffice.net); James Goliveauaux (james.goliveauaux@tycofp.com); Richard Pehrson (pehrson@mninter.net); Terry Victor (tvictor@simplexgrinnell.com); Duffy, Chad
Subject: RE: NFPA 51A Task Group

I have no issues with either revised language below.

A NFPA 13 deluge system will do the job intended just fine as will a NFPA 15 deluge system designed for area protection.

Jeff Sutton
Global Risk Consultants / ARISE
5775 Wayzata Blvd, Suite 600
Minneapolis, MN 55416-2648
Ph: 952-544-4449 x330
Fax: 952-544-0417
tvictor@simplexgrinnell.com

NOTE: Please do not send any attachments >18 MB as our email system will not receive anything greater.

From: Hague, David [mailto:David.Hague@LibertyMutual.com]
Sent: Tuesday, January 10, 2012 1:00 PM
To: Klaus, Matthew; Steven Scandaliato (sscandaliato@qwestoffice.net); James Goliveauaux (james.goliveauaux@tycofp.com); Richard Pehrson (pehrson@mninter.net); Terry Victor
I would like to suggest the following:

11.2.1.3 A deluge system designed and installed in accordance with NFPA 13 or fixed water spray system designed and installed in accordance with NFPA 15 shall be provided for mobile acetylene trailer fire areas used as indoor or outdoor charging or discharging stations.

In my opinion, NFPA 13 deals with deluge sprinkler systems (area protection) and any design should be referenced to that document. NFPA 15 deals with fixed water spray systems (equipment surface protection) and does not address or define deluge systems or sprinklers (other than pilot sprinklers) only directional water spray nozzles. This should be done unless the committee scope of NFPA 15 is modified to include deluge systems thus removing it from NFPA 13.

Just my humble opinion.

Thanks,
Dave

David R. Hague, P.E., CFPS, CET
Manager, Technical Engineering

Liberty Mutual Commercial Markets
Property Risk Engineering
20 Riverside Road MS: 02BN
Weston, MA 02493-2231
PH: 781-891-0230 x0212
SDN 8-4620212
FAX: 781-891-4378
David.Hague@LibertyMutual.com

From: James Golinveaux [mailto:James.Golinveaux@tycofp.com]
Sent: Wednesday, January 11, 2012 11:05 AM
To: Klaus, Matthew; sscandalli@qwestoffice.net; pehrson@mninter.net; Victor, Terry; david.hague@libertymutual.com; jeff.sutton@globalriskconsultants.com; Duffy, Chad
Subject: RE: NFPA 51A Task Group

My problem with 13 is where to find the design protocol in 13?

Thank You

James Golinveaux | General Manager, Water Fire Suppression Products | Tyco Fire Protection Products
1467 Elmwood Ave, Cranston, RI 02910 USA
Tel: +1-401-781-8220 x60413 | Mobile: +1-401-225-8828 | Fax: +1-401-467-4415
james.golinveaux@tycofp.com

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February 29, 2012

Supplemental Agenda, March 5-6, 2012
Page 91 of 830

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From: Richard Pehrson [mailto:pehrson@mninter.net]
Sent: Wednesday, January 11, 2012 12:01 PM
To: Klaus, Matthew; 'Steven Scandaliato'; 'James Golinveaux'; 'Terry Victor'; 'David Hague';
jeff.sutton@globalriskconsultants.com; Duffy, Chad
Subject: RE: NFPA 51A Task Group

Matt, et. al.,

To answer this question we first need to look at why the system is necessary. Is it to suppress or control a fire in ordinary combustibles, if so, then an NFPA 13 system would do the trick. If the need for the system is something else, such as cooling of vessels or exposure protection, then NFPA 13 is silent on how to do this, and you must look to NFPA 15 for guidance.

Based on my reading of the TIA, it appears the problem that has been identified is premature cylinder failure due to an exposure fire from an adjacent tank that has had the relief valve/plug open up. This is clearly an exposure type fire with different design needs than simply putting sprinklers up at the ceiling. We are not expecting the fire protection system to suppress a gas jet fire, instead the system is intended to keep adjacent cylinders cool long enough for the first cylinder to finish what it's going to do, without additional cylinders opening. That's clearly in the "cooling of vessels and exposure protection" world and not something even remotely covered by an NFPA 13 deluge system. The only valid design protocol that I've come across is in NFPA 15 for exposure protection of vessels (i.e. density per square foot of vessel surface - not floor area as used in NFPA 13). A 0.3 gpm/ft2 density from the ceiling (NFPA 13 design) is not the same as a 0.3 gpm/ft2 of protected vessel area applied with directional nozzles selected for their ability to cool all threatened surfaces (NFPA 15 design).

I don't agree with the reference to NFPA 13 - it is outside the scope of the standard.

Rich

From: Klaus, Matthew [mailto:MKlaus@nfpa.org]
Sent: Tuesday, January 10, 2012 1:27 PM
To: Steven Scandaliato (sscandaliato@qwestoffice.net); James Golinveaux (james.golinveaux@tycofp.com); Richard Pehrson (pehrson@mninter.net); Terry Victor (tvictor@simplexgrinnell.com); Hague, David; jeff.sutton@globalriskconsultants.com; Duffy, Chad
Subject: NFPA 51A Task Group

Task Group Members-

At present, the revised TIA language requires the system to be designed and installed to NFPA 15 (excluding NFPA 13 deluge system designs). I want to gauge this group on the concept of including a design reference to allow either NFPA 13 deluge systems or NFPA 15 systems to be used to protect these occupancies. The language would read as follows:
11.2.1.3 A deluge system designed and installed in accordance with NFPA 13 or NFPA 15 shall be provided for mobile acetylene trailer fire areas used as indoor or outdoor charging or discharging stations.

I know how some of you feel on this issue and it seems like we are right in the middle, a few for and a few against this concept. We need to ballot the TC's on this and I want to make sure we have don't put ourselves in a pickle by having one TC in favor of revised language and another TC opposing it. Please feel free to reply-to-all and offer your two cents.

Regards,

Matt Klaus
Senior Fire Protection Engineer
NFPA

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Delete subsection 10.4.4 and Annex A.10.4.4.

Submitter's Substantiation: NFPA 75 sets forth the minimum requirements for the protection of information technology equipment and information technology equipment areas from damage by fire or its associated effects — namely, smoke, corrosion, heat, and water.

NFPA 75 TC Considerations During preparation of the 2009 edition of NFPA 75, Section 10.4.4 which is referenced as an extraction from NFPA 70 Article 645 was updated per the NFPA extraction policy to include a provision from NEC Article 645 that under raised floors “The ventilation system shall be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.”

A problem with this is that in preparation of the 2003 edition of NFPA 75 while developing CP46, the Technical Committee specifically considered and rejected this sentence requiring cessation of air flow upon detection of fire or products of combustion. The meeting minutes from January 24 & 25, 2001 note the discussion and rejection of the subject sentence. The subject paragraph in the 2003 edition of NFPA 75 reads: “(3) Ventilation in the underfloor area is used for the information technology equipment room only.”

The 2003 action of the NFPA 75 technical committee to omit the NEC requirement was purposeful and intended by the NFPA 75 Technical Committee. The addition of the sentence in the 2009 edition was not intended by the NFPA 75 Technical Committee and is an undesired consequence of the application of the NFPA extraction policy. The requirement which this sentence adds can, if enforced, have serious negative consequences.

In order to remove this requirement from NFPA 75 the entire NEC extraction of Section 10.4.4 must be deleted. This will not cause any unintended consequences as the desired provisions for wiring under the raised floor of an IT facility contained in 10.4.4 as extracted from NFPA 70 Article 645 are covered in section 10.3.1 of NFPA 75 2009 Edition.

Consequences of the Unwanted Requirement

Today's IT servers run applications that are critical to business continuity and frequently have life safety implications. Unplanned shutdown of the IT equipment can cause loss of control over life support systems, emergency response systems, security systems and loss of essential data in process. Therefore, it may be undesirable – or even dangerous - to automatically shut down equipment that is not directly involved in a fire.

Modern server racks contain multiple processing units which can create a large amount of heat. If air conditioning equipment used to cool the servers is shut down, temperatures can increase by as much as 40 degrees in a matter of minutes, potentially causing more damage than the heat of a small electronic fire. Therefore, it is desirable to maintain cooling air flow for as long as possible.

Thermal overheat devices are built in to servers to immediately depower components in an attempt to prevent permanent equipment damage. But permanent equipment damage from complete cessation of cooling air flow to operating IT equipment is nonetheless possible. Plus, the sudden loss of function due to equipment shutdown from thermal overheat can have serious consequences.

Relation to Fire Suppression Fire suppression systems used in IT facilities are often designed to detect and extinguish fire in its incipient stage while cooling air flow through the facility is maintained and servers remain running. If depowering of equipment is required as part of the fire protection, such depowering is generally done in a planned, programmed sequence to minimize loss of data. When an IT facility is providing support or control related to life safety or security, the depowering sequence typically includes provision to transfer support or control functions to a backup IT
Determination of when it is safe to shut off ventilation to the IT equipment is part of the planned depowering sequence.

**Air Flow Affects Detection** In IT facilities protected by automatic gaseous extinguishing systems, the activation of more than one detector is usually required to confirm existence of fire and thereby release the fire extinguishing gas. Air flow is taken into account in locating smoke detectors. Cessation of normal air flow upon activation of a single smoke detector can delay the activation of additional smoke detectors in the IT facility and thereby delay release of automatic gaseous extinguishing agent in facilities equipped with such systems.

**Summary of Technical Merit** The NFPA 75 technical committee understood the risks of automatically stopping the flow of cooling air under a raised floor upon first detection of fire or products of combustion under the raised floor when they declined to add the sentence to the 2003 edition of the standard.

Due to ever increasing heat loads in modern data centers, these risks are more serious today than they were when the 2003 edition of NFPA 75 was developed. NFPA 75 edition 2009 contains other requirements and guidance for proper control of air handling systems in IT facilities. These requirements should remain. But the unwanted requirement for shut down of air flow through the underfloor space upon detection of smoke or fire must be deleted from the 2009 edition of the standard. Because the NFPA extraction policy directs that editing of extracted text be confined to making style consistent with that of the document containing the extract, it is necessary to remove the entire 10.4.4 in order to delete this unwanted requirement.

The decision on how and when to shut down air flow should be left to the facility design engineer and operations management using the guidance given in NFPA Standard 75 and guidance given in standards covering the specific fire suppression system employed in the facility.

**Emergency Nature:** Removal of this sentence from NFPA 75 edition 2009 is an urgent matter requiring the emergency action of a TIA because:

1) NFPA 75 Edition 2009 is currently being enforced in many jurisdictions. End users are being forced by some AHJs to shutdown cooling airflow under the raised floor and into the IT equipment upon first detection of fire or products of combustion under the raised floor or be refused an occupancy permit. The choice is between operating the facility and risking unnecessary damage to equipment and/or loss of IT function or not operating the facility.

2) In facilities protected by gaseous extinguishing systems, the release of the gaseous extinguishing system may be delayed if air flow through space under the raised floor ceases upon activation of a single smoke detector. Such delay in the release of gaseous agent can unnecessarily increase the amount of fire damage before the extinguishing system is activated.

3) Many IT facilities utilize very early warning smoke detection capable of detecting minute quantities of smoke thus permitting effective programmatic intervention before fire poses serious risk of equipment damage or interruption of functionality. Requiring shut down of cooling air flow upon detection of smoke under such conditions defeats this very efficacious response to fire.

4) Since NFPA 75 edition 2009 has already been processed, the TIA is the only means available to remove the unwanted sentence.

Members of the ELT technical committee responsible for NFPA 75 have submitted a proposal to the NEC code making panel to delete the same sentence, a performance requirement, from Article 645. The proposal was approved by vote of the ELT Technical Committee by a vote of 18 affirmative 1 negative.
According to 5.4 in the NFPA (RGCP), the final results show this TIA HAS achieved the necessary votes on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 14.

[28 (eligible to vote) – 10 (not returned) – 0 (abstentions) = 18 × 0.75 = 13.5]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

[28 eligible ÷ 2 = 14 + 1 = 15 (this is the simple majority)]

TC FINAL Ballot results for Technical Merit are as follows:
18 Agree (Langer w/comment)
0 Disagree
0 Abstentions

FINAL ACTION: PASSED

TC FINAL Ballot results for Emergency Nature are as follows:
18 Agree (Langer w/comment)
0 Disagree
0 Abstentions

FINAL ACTION: PASSED
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to delete subsection 10.4.4 and Annex A.10.4.4.

___ X ___ AGREE  ________ DISAGREE*  ________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:  See Attached

*An explanation must accompany a disagreement or abstaining position.

________________________________________________________________________

________________________________________________________________________

Question 2: I agree that the subject is of an EMERGENCY NATURE.

___ X ___ AGREE  ________ DISAGREE*  ________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:  See Attached

*An explanation must accompany a disagreement or abstaining position.

________________________________________________________________________

________________________________________________________________________

                                        ____________________________
                                        Signature

                                        Robert Langer
                                        Name (Please Print)

                                        December 16, 2011
                                        Date

Please return the ballot on or before December 16, 2011.

PLEASE RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110 E-mail: ecarroll@nfpa.org
The following sentence in subsection 10.4.4 will create unsafe conditions in IT facilities: “The ventilation system shall be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.”

There is a need to issue this TIA based on the emergency nature of the request. Specifically, there is a potential negative impact to the overall safety of a facility and its occupants if the underfloor ventilation system is prematurely shut down. The current verbiage in NFPA 70, which was extracted and placed in NFPA 75, is out of date and doesn’t contemplate current fire protection technology. Please consider the following:

Many IT facilities are protected by automatic gaseous extinguishing systems. These fire suppression systems are installed with detection systems to detect a fire during its incipient stage. The detection systems serve two functions. The first function is to notify people of a potential emergency fire situation while allowing cooling air to continues to flow through the facility and the IT servers remain operating. The second purpose of the smoke detection system is to automatically actuate the gaseous agent system.

The actuation of the gaseous agent system is accomplished with a second detector located remotely from the one the signals an emergency fire situation. These detectors are typically spaced at one half of the permitted coverage area, providing a higher level of confidence that the system accurately reports the fire/smoke condition. Some jurisdictions are interpreting the requirement to mean that ventilation systems must be shut down upon initial detector activation, which defeats the overall purpose of cross-zoned systems, air aspirating systems, and other technologically advanced detection schemes.

Many, if not most buildings depend upon servers to operate building systems, including smoke control systems, evacuation alarms, ventilation systems, security systems, and other building components that provide for the safety of occupants. Shutting down the ventilation system for the servers may create a greater hazard to building occupants than leaving them running.

These facilities need a higher level of flexibility than is permitted by the arbitrary requirement to shut down the ventilation system upon activation of a smoke alarm. A nominal risk assessment will provide all of the information necessary to determine the safest and most appropriate response to a detection system’s readings.

Although there were good intentions for the editorial update of the extracted material, the potential negative impact to life safety and business continuity outweigh the need to conform to an update policy. I strongly urge the Standards Council to issue this TIA based on the emergency nature of the request and the concerns outlined above.
Subject: FW: Comment on Proposed TIA No 1042

NFPA 75

From: Johnston, Christopher M [mailto:cjohnston@syska.com]
Sent: Friday, December 02, 2011 11:26 AM
To: TIAs
Cc: Ramu, Venkata; Eagar, John
Subject: Comment on Proposed TIA No 1042

I am the Chief Engineer for our Critical Facilities practice, the largest in the US, and I agree with this TIA. With average load densities in IT data halls exceeding 500 watts per square foot and spot densities exceeding 1000 watts per square foot, maintaining proper airflow for cooling is of utmost importance. Loss of airflow for a few seconds can cause loss of IT function and substantial damage to IT equipment.

NFPA 70 is enforced across the US while NFPA 75 is not enforced across the US. NFPA 70 will govern in every jurisdiction, regardless of whether NFPA 75 is enforced or not. NFPA should ensure that the two panels immediately coordinate this matter, perhaps by issuing coordinated TIAs for both NFPA 70 and 75.

Regards,

Christopher M. Johnston, P.E.
Senior Vice President
Syska Hennessy Group, Inc.
A member company of SH Group, Inc.

900 Circle 75 Parkway,
Suite 400
Atlanta, GA 30339 USA
Tel: +1 770.563.1567
Cell: +1 770.846.6443
Fax: +1 678.401.0205
Email: cjohnston@syska.com
http://www.syska.com

Please consider the environment before printing this e-mail

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January 12, 2012

Secretary of the Standards Council
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

via fax: 617-770-3500

To whom it may concern:

I am writing on behalf of the Fire Suppression Systems Association (FSSA), a not for profit trade association comprised of manufacturers and installers of detection and fire extinguishing systems for special hazards. Our members frequently supply detection and fire suppression for data centers covered by NFPA 75. In the course of supplying such fire protection, FSSA members have become well versed in the characteristics of modern data centers. The FSSA is in full agreement with the proposed TIA to NFPA 75. The requirement in 10.4.4(4) of the 2009 edition of NFPA 75 which states: “The ventilation system shall be so arranged, with approved smoke detection devices, that upon the detection of fire or products of combustion in the underfloor space, the circulation of air will cease.” should be rescinded immediately. If enforced, this requirement can have serious negative consequences for the owner and for suppression control sequencing when protecting sensitive electronic equipment.

The verbiage in 10.4.4(4) was extracted from NFPA 70 during final processing of the 2009 edition of NFPA 75. The requirement does not recognize the operational characteristics of the most current fire protection systems used in data centers. Nor does the requirement recognize the frequent need for continued operation of IT equipment even in case of a fire event.

EFFECT ON FIRE PROTECTION Data centers are often protected by gaseous fire extinguishing systems. These fire extinguishing systems are typically controlled by detection systems capable of sensing fire in its incipient stage. The detection system serves the functions of 1) providing an alarm to alert personnel of a potential fire emergency and 2) activating the gaseous extinguishing system.

Personnel are alerted of the potential fire emergency upon operation of a single fire detector. This is an early warning that something may be amiss. The actuation of the gaseous fire extinguishing system occurs after a confirmatory signal of fire is received by the system controls from a second detection device. Detectors are located taking into account the airflow through the facility. Shutting down airflow upon activation of a single smoke detector may delay operation of the second detection device required to activate the gaseous detection system.
EFFECT ON PERSONNEL SAFETY

In addition to the traditional handling of data, modern IT facilities often control building systems including smoke control, evacuation alarms, ventilation, security, and other building components all of which provide for safety of building occupants. If cooling airflow in a data center is shutdown as required by the subject 10.4.4(4), IT equipment can shutdown on thermal overload devices or be destroyed by the heat in a matter of minutes. Essential building services can cease, endangering occupants.

SUMMARY

The scope of functions which IT equipment provides is broad – traditional mathematical calculations, handling and storing financial data, control of life support systems in medical facilities, dispatch and routing of emergency response vehicles, control of building systems, air traffic control, control of infrastructure, national security and defense functions – the list goes on. IT equipment cannot survive very long without cooling – and airflow provides that cooling in a great many IT facilities.

The sequencing of fire suppression system operation and the control of airflow and IT functions has traditionally been handled by design features and operating procedures. If the requirement to shutdown cooling airflow upon detection of products of combustion in an IT facility is enforced, it can have serious negative effects on life safety, essential services as well as business continuity. These negative effects far outweigh the need to apply the extraction policy in NFPA 75. Therefore we urge the Standards Council to issue the TIA based on the above technical concerns and its emergency nature.

Respectfully submitted,

FIRE SUPPRESSION SYSTEMS ASSOCIATION

Crista LeGrand
Executive Director
(crista@fssa.net)
Item 12-3-7
1. Revise 6.3.1.7.1 to read as follows

6.3.1.7.1 The clearances between the top and vertical edges of the door and the frame, and the meeting edges of doors swinging in pairs, shall be 1/8 in. ± 1/16 in. (3.18 mm ± 1.59 mm) for steel doors and shall not exceed 1/8 in. (3.18 mm) and for wood doors.

Submitter’s Substantiation: The statement “shall not exceed 1/8 in. (3.18 mm) for wood doors” in the current edition does not take into account any of the allowable industry standard manufacturing and installation tolerances.

ANSI, NAAMM (National Association of Architectural Metal Manufactures), SDI (Steel Door Institute), and WDMA (Window and Door Manufactures Association) all allow for acceptable tolerances in the manufacturing and installation processes. A steel frame manufactured and installed to industry standards, along with a wood door manufactured to industry standards can exceed the allowable 1/8 in. (3.18 mm) clearance. An example is that typically a single swing fire door would be pre-fit to include 1/8 in. clearance at the top and each vertical edge. In an ideal situation, the door and frame manufactured and installed to exact dimensions with no tolerances, 1/8 in. clearance would be maintained at the top and vertical edges. If either the door or frame is not exact but manufactured with acceptable tolerances the clearance at top or vertical edges can slightly exceed 1/8 in. In order to take these tolerances into account and not exceed the 1/8 in. clearance the wood doors would have to be pre-fit for less than 1/8 clearance on the top and vertical edge. This often leads to other issues such as binding due to frame manufacturing and installation tolerances, binding due to changes in humidity levels, and conflicts with hardware items such as edge or top of door mounted door position switches.

Additionally, the adoption of the UBC-7-2-97 Code and UL-10C positive pressure test requirements provides additional edge sealing protection for wood doors in the event of a fire. The concealed intumescent (Category A door) or the surface applied intumescent (Category B door) expand once they reach a specific temperature and seal the gap between the top and vertical edges of the door and frame. The expansion capability of this intumescent is more than sufficient to seal a gap that is 3/16 in. which meets the proposed new text in this TIA. Steel doors are currently allowed the additional (+,-) 1/16” in. clearance due to the fact that during a fire and high temperature a steel door will expand taking up the additional clearance allowed. The same principal seems to apply to positive pressure tested wood doors.

The stated NFPA 80 clearances are used by Authorities Having Jurisdiction to determine if an opening is compliant. If the clearances are greater than 1/8 in. the opening is not in compliance and can be subject to rejection and replacement. Although many AHJ’s would be practical and allow doors to be slightly over the stated 1/8 in. some do not waive at all and anything over 1/8 in. is not in compliance. There have been situations where doors have been rejected because the gap was .015 in. over the stated 1/8 in. This situation required replacement doors to be provided although the assembly would have performed its intended purpose as a fire door assembly. The wood door manufacture, steel frame manufacture, and frame installer are not responsible for non-compliance as they performed their task within their acceptable tolerances. The responsibility to bring opening into compliance rests directly on the distributor of these products which can only hold a manufacture or installer liable if they do not meet their industry tolerances.

As long as the fire protection ability is not compromised by the additional clearance of (+,-) 1/16 in. wood doors should be allowed the same clearances as steel doors currently have. The clearances stated in NFPA 80 should take into account positive pressure tested wood doors and the acceptable manufacturing and installation tolerances of steel frames and wood doors. This would help avoid costly replacements of doors or frames which slightly exceed the 1/8 in. clearance but would perform as required in the event of a fire.
TIA FINAL BALLOT RESULTS

According to 5.4 in the NFPA (RGCP), the final results show this TIA **HAS** achieved the necessary votes on Question 1 **(Technical Merit)** and **HAS NOT** on Question 2 **(Emergency Nature)**.

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 18.

\[
[27 \text{ (eligible to vote)} - 3 \text{ (not returned)} - 1 \text{ (abstention)} = 23 \times 0.75 = 17.25]
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
[27 \text{ eligible} \div 2 = 13.5 = 14 \text{ (this is the simple majority)}]
\]

<table>
<thead>
<tr>
<th>27</th>
<th>Eligible to Vote</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Not Returned (Beebe, Koffel, Patton)</td>
</tr>
</tbody>
</table>

**TC FINAL** Ballot results for **Technical Merit** are as follows:

- 21 Agree
- 2 Disagree (Hicks, Savage)
- 1 Abstention (Hahn)

**FINAL ACTION: PASSED**

The number of affirmative votes needed to obtain a recommendation to issue the TIA is 17.

\[
[27 \text{ (eligible to vote)} - 3 \text{ (not returned)} - 2 \text{ (abstentions)} = 22 \times 0.75 = 16.5]
\]

In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.

\[
[27 \text{ eligible} \div 2 = 13.5 = 14 \text{ (this is the simple majority)}]
\]

**TC FINAL** Ballot results for **Emergency Nature** are as follows:

- 15 Agree
- 7 Disagree (Coleman, Conner, Hicks, Reynolds, Rubright, Savage, Van Becelaere)
- 2 Abstentions (Hahn, Yuen)

**FINAL ACTION: FAILED**
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1639
To Revise 6.3.1.7.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire
Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.7.1.

AGREE    DISAGREE    ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

AGREE    DISAGREE    ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

I have not seen or heard an issue or cogent reason to
make this an emergency.

Paul R. Coleman
Signature
Paul R. Coleman
Name (Please Print)
12-10-11
Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110
E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.71.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.71.1.

______ AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

______ AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Upon reading the other ballots, I concur that this is not rise to a change of an emergency nature.

William Conner
Signature

Name (Please Print)

Date

19 December 2011

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110
E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.7.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.7.1.
AGREE XXXXX DISAGREE* ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

The proponent of this TIA advocates that changes need to be made for wood doors installed in metal frames. However, all of the supporting documentation appears to support the committee's position concerning acceptable clearances for steel doors in steel frames. I will need to see some supporting documentation for wood doors before accepting the change. Thermal bow is a real concern for metal doors. Does this same thermal bow appear in wood doors?

Question 2: I agree that the subject is of an EMERGENCY NATURE.
AGREE XXXXX DISAGREE* ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

This provision of the code has been standing for many editions and has not previously been noted as being a problem by wood door manufacturers.

Signature

Harold D. Hicks
Name (Please Print)

December 12, 2011
Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169    FAX: (617) 984-7110     E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.71.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire
Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.71.1.

AGREE DISAGREE* ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

AGREE DISAGREE* ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Current language is not a burden as nor'
does it represent a lower level of safety

Signature
Steven Reynolds
Name (Please Print)

Date
16 DEC 11

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169 FAX: (617) 984-7110 E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.71.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.71.1.

X AGREE    DISAGREE*    ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

AGREE    X DISAGREE*    ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

SEE ATTACHED LETTER

[Signature]

THOMAS RUBRIGHT
Name (Please Print)

[Date]

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110  E-mail: awoodberry@nfpa.org
To: NFPA Technical Committee on Fire Doors and Windows (FDW-AAA)

From: Thomas Rubright, Alternate to Keith Pardoe, Door and Hardware Institute

Date: December 9, 2011

Re: NFPA 80 Proposed Tentative Interim Amendment (TIA) No. 1039

Explanation of Negative Vote on Emergency Nature of TIA 1039

Technical Merits
I agree with the technical merits and the supporting data sent to the Committee to review prior to the vote on this matter. I agree that this change will solve a multitude of field inspection issues and give the building officials more latitude in determining acceptable field installations. I also feel that the addition of intumescent material (if required) and its expansion capabilities would more than fill an additional clearance of 1/16".

Emergence Nature
However, I feel that the Committee should not act in haste on this matter. I feel strongly that additional discussion needs to happen. I have many questions and not very many answers but feel that some of our membership could address these concerns in further discussions on this matter.

Most of the supporting data submitted on the TIA addressed "acceptable tolerances in the manufacture and installation processes" of metal frame and metal and wood door construction and installation. The submitter allows that "As long as the fire protection ability is not compromised by the additional clearance of +,- 1/16 in, wood doors should be allowed the same clearances as steel doors currently have."

Who decides that the fire protection ability is not compromised? The testing lab, the manufacturer, the installer, the building official or others? When is this decided?

In researching the clearance issue, I reviewed what several "Fire Door Test Standards" have to say on the matter. Both UL 10C and NFPA 252 (2008), para 5.3.1, reference "testing" clearances as being 1/8", + 0", - 1/16".

If we allow the TIA to proceed, are we establishing field clearances greater than the test standards currently allow? The obvious answer is yes. It also seems obvious that
the "Fire Door Test Standards" would also have to be changed to reflect the new clearances.

If we change the clearances, what happens to all the doors tested with the above noted clearances? Do we suddenly allow installations in the field to have greater clearances than they had when tested?

What about wood doors tested and listed without intumescent material? (And there are several of them.) Would the additional clearance (if tested that way) cause these doors to fail?

Do the "Fire Door Test Standards" use clearances noted in NFPA 80 or do they establish these clearances through engineering studies? In the "Fire Door Test Standards", why are there no differences in clearance requirements noted between wood and hollow metal doors yet we allow differences?

How are test standard requirements changed? Do the testing labs reflect industry practices, do they test whatever a client brings for testing, or are there committees responsible for periodic review of the test requirements?

As you can see, I have a lot of questions without many answers. I feel that we should address the same concern that the submitter expressed in the last paragraph of Submitter's Substantiation. (Concern that a wood fire door's fire protection ability with additional clearances is not compromised.)
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.71.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.71.1.

AGREE  DISAGREE*  ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

No information was submitted to support the TIA with regards to installation issues.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

AGREE  DISAGREE*  ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.

I do not believe there is an emergency nature per the evaluation items listed under 5.2 of TIA's

Michael L. Savage, Sr
Name (Please Print)
11-21-11
Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110
E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.7.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.7.1.

☐ AGREE ☐ DISAGREE* ☐ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

☐ AGREE ☐ DISAGREE* ☐ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I THOUGHT IT CAN BE PUT IN THE NEXT CYCLE

Signature

Robert Van Becelaar

Name (Please Print)

20 NOV 2011

Date

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 934-7110
E-mail: awoodberry@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1039
To Revise 6.3.1.7.1 in the 2010 and the Proposed 2013 Edition of NFPA 80, Standard for Fire
Doors and Other Opening Protectives

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.7.1.

□ AGREE  □ DISAGREE*  □ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.
While I do not necessarily object to the proposal, I do not have the required expertise to judge the technical merits of the proposal

Question 2: I do not agree that the subject is of an EMERGENCY NATURE.

□ AGREE  □ DISAGREE*  □ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a disagreement or abstaining position.
I don't think it's appropriate to judge its emergency

Signature

Steve Poli
Name (Please Print)

12-22-11
Date

Please return the ballot or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: awoodberry@nfpa.org

February 29, 2012  Supplemental Agenda, March 5-6, 2012  Page 114 of 830
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 109
To Revise 6.3.1.7.1 to the 2010 and the Proposed 2012 Edition of NFPA 30, Standard for Fire
Doors and Other Opening Protectives.

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to Revise 6.3.1.7.1.

AGREE   DISAGREE   ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement of abstaining position.

Question 2: I agree that the subject is of an EMERGENCY NATURE.

AGREE   DISAGREE   ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

Signature

[Signature]

Name (Please Print)

[Name]

Date

[Date]

Please return the ballot on or before Friday, December 16, 2011.

PLEASE RETURN TO:
Alma Woodberry, Administrator, Technical Projects.
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110
E-mail: awoodberry@nfpa.org
February 1, 2012

Tim Klotz
Kelley Bros. LLC
1220 S. Main St
Elmira, NY 14904

Appeal to the Technical Committee

Dear Technical Committee Members,

Please accept this document as an appeal to the failed ballot of the Technical Committee on Emergency Nature for proposed TIA 1039. Per Section 5.3 Regulations Governing Committee Projects; the determination of Emergency Nature for proposed TIA’s must include one or more factors. I kindly ask that you review the following information and reconsider the previous failed ballot on Emergency Nature

- There seems to be a conflict between the current text of NFPA 80 6.3.1.7.1 and other requirements included within NFPA 80. The current text states that for fire rated assemblies the clearances “shall not exceed 1/8 in. (3.18mm) for wood doors”. The fire door assembly consists of a labeled frame, a labeled door (wood or hollow metal), and approved hardware. A labeled frame, as described in Section 6.3.1 Door Frames, must be installed in accordance with the manufactures instructions. The majority of hollow metal frame manufacturer’s instructions refer to ANSI A250.11 and SDI 117 for acceptable installation practices and tolerances of their labeled frames. These publications allow for a certain amount of tolerances when installing a labeled frame. The acceptable frame installation tolerances of 1/16” for frame twist, out-of-square, and out-of-plumb conditions can lead to the final assembly not meeting the 1/8” wood door clearance requirements of NFPA 80. Acceptable tolerances for a labeled frame, a base component of a fire rated assembly, make if difficult to have a final assembly that is not allowed any tolerance. The balance of the components in the assembly, a wood door and builders hardware, all have acceptable manufacturing tolerances leading to final assemblies which can slightly exceed the 1/8” allowable clearance.

- Additionally the current text does not seem to incorporate the additional edge sealing properties of positive pressure tested (UL 10C) wood doors. The expansion properties of the intumescent material used throughout the industry is more than sufficient to fill the additional 1/16” of clearance as proposed in TIA 1039. With the additional edge sealing properties of positive pressure tested wood doors it would seem as if more clearance would be allowed than the previous neutral pressure tested (UL 10B) doors. Taking into account tolerances and real world field conditions, positive pressure tested doors offer a greater amount of protection than neutral pressure tested doors. Having the ability to
expand and seal the edge of an assembly with clearances slightly greater than 1/8” allows the positive pressure tested wood door to overcome certain field conditions and tolerance issues and still perform as required. This is a benefit of the positive pressure tested wood door that the neutral pressure tested door did not offer.

I ask that you take into account the above information and reconsider the previous failed ballot on Emergency Nature for TIA 1039.

Thank you for your time regarding this matter.

Sincerely,

Tim Klotz
Annex A

Tolerances

The detailed descriptions of frame installation techniques that follow refer to plumbing, squaring and aligning the frame. The details in figure A1 indicate the maximum allowable tolerances in this area.

Note: Annex A is excerpted from ANSI/DHI A115.IG, “Installation Guide for Doors & Hardware” in order to define installation tolerances that should not be exceeded in order to maintain the operative integrity of the assembly.

Figure A1 – Installation tolerances
1. REFERENCED DOCUMENTS

Note: The publications listed in this section form a part of this standard to the extent referenced. The publications are referenced in the text by basic designation only. When a more recent standard is available, the specifier shall verify its applicability to this standard prior to its inclusion.

A. ANSI A250.11 Recommended Erection Instructions for Steel Frames
C. NAAMM HMMA-810 TN01-03 Technical Note, "Defining Undercuts."
D. NAAMM HMMA-840-99 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames

ANSI American National Standards Institute, Inc.
25 W. 43rd Street
New York, New York 10036
(212) 642-4900 www.ansi.org

NAAMM National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Bldg C, Suite 312
Glen Ellyn, Illinois 60137
(630) 942-6591 www.naamm.org

NFPA National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, Massachusetts 02269
(617) 770-3000 www.nfpa.org

2. MANUFACTURING TOLERANCES

A. Manufacturing tolerances shall be maintained within the following limits:

1. Frame product for singles or pairs of doors (See Figure 1)
   a. Width, measured between rabbets at the head:
      nominal opening width + 1/16 in. (+1.5 mm), - 1/32 in. (- 0.8 mm)
   b. Height (total length of jamb rabbet):
      nominal opening height + 1/16 in. (+1.5 mm), - 1/32 in. (- 0.8 mm)

2. Frame for glazing materials or panels, height and width of each opening ± 1/16 in. (1.5 mm)

3. Surface flatness of factory assembled frame product (measured in any direction with straight edge placed on face of frame product)............ Max. 1/8 in (3.1 mm)

4. Cross sectional profile dimensions (See Figure 2)
   a. Face .........................................................± 1/32 in. (0.8 mm)
   b. Stop ......................................................± 1/32 in. (0.8 mm)
   c. Rabbet for door/glass/panel..............................± 1/32 in. (0.8 mm)
   d. Depth .....................................................± 1/16 in. (1.5 mm)
   e. Throat ....................................................± 3/32 in. (2.4 mm)

Frames overlapping walls (except slip-on construction) to have throat dimension 1/8 in. (3.1 mm) greater than dimensioned wall thickness to accommodate irregularities in wall construction.
5. Doors; Tolerances for actual hollow metal door sizes are as follows (See Figure 3):
   a. Width ...........................................................± 3/64 in. (1.2 mm)
   b. Height ..........................................................± 3/64 in. (1.2 mm)
   c. Thickness ....................................................± 1/16 in. (1.5 mm)
   d. Perimeter flatness ..........................................1/16 in. (1.5 mm) maximum
   e. Surface flatness .............................................1/8 in. (3.1 mm) maximum
   f. Twist ...........................................................1/16 in. (1.5 mm) maximum
   g. Squareness ..................................................1/16 in. (1.5 mm) maximum

6. Hardware (See figure 1 & 3):
   a. Cutouts ..........................................................Template dimensions + 1/64 in. (0.4 mm), - 0
   b. Location ..........................................................± 1/32 in. (0.8 mm)
   c. Between hinge centerlines ................................± 1/64 in. (0.4 mm)
   d. Face cutout for hinge .......................................+ 1/16 in. (1.5 mm), -0
   e. Mortise depth of reinforcement ..........................± 1/64 in. (0.4 mm)

   These tolerances provide a reasonable guideline for manufacturing of hollow metal products. However, it should be noted that the cumulative effect of manufacturing tolerances at or near their maximum levels could have an effect on operating clearances. Tolerance buildup occurs when several tolerances are at or near their maximums. Care should be taken to keep each of these tolerances as close to zero as possible.

3. INSTALLATION TOLERANCES

   A. The installer shall perform the following:

   1. Prior to installation, the area of floor on which the frame is to be installed, and within the path of door swing, shall be checked for flatness and levelness. Permissible tolerance is +/- 1/16" (1.5 mm). If the floor exceeds this, it is the general contractor’s responsibility to correct the area that is out of tolerance before the frame is installed.

   2. During the setting of the frame check and correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Permissible frame product installation tolerances shall be maintained within the following limits: (see Figure 4)

   a. Opening width ..........measured from rabbet to rabbet at top, middle and bottom of frame; + 1/16 in. (1.5 mm), - 1/32 in. (0.8 mm)

   b. Opening height ..........measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and across the head; ± 3/64 in. (1.2 mm)

   c. Squareness .............measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 1/16 in. (1.5 mm)

   d. Alignment ...............measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 1/16 in. (1.5 mm)

   e. Twist .......................measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 1/16 in. (1.5 mm)

   f. Plumbness ...............measured at jambs on a perpendicular line from the head to the floor; not to exceed 1/16 in. (1.5 mm)
Prior to installation, doors and frame shall be checked for correct size, swing, fire rating and opening number.

Brace, level and square frame as specified in HMMA 840 and ANSI A250.11

Hardware shall be applied in accordance with hardware manufacturers’ templates and instructions.

These tolerances provide a reasonable guideline for proper installation of hollow metal frame product. However, it should be noted that the cumulative effect of the installation tolerances at or near their maximum levels could result in sufficient misalignment to prevent the door from functioning properly. Installers should be careful not to create a tolerance buildup. Tolerance buildup occurs when several tolerances are at or near their maximums. Care should be taken to keep each of these tolerances as close to zero as possible.

3. Proper door edge clearances shall be maintained in accordance with Section 4 except for special conditions otherwise noted. Where necessary, steel hinge shims, furnished by the installer, shall be used to maintain clearances.

Installers and end users must be aware of thermal bow which can affect edge clearances. Thermal bow is a temporary condition that occurs when opposing sides of a door are exposed to extreme temperature differences. The effects of thermal bow depend upon the color of the door, door construction, ambient temperatures on each side of door (extreme hot or cold climates), and direct sunlight. An example of a door susceptible to this condition would be an exterior door on the southern side of a building exposed to direct sunlight. A door exposed to direct sunlight may bow and appear to be warped during part of the day and then straighten as the direct sun passes over it. The effects of thermal bow can be reduced by painting the exposed surface of the door a lighter color.

4. OPERATING CLEARANCES

A. Edge clearance for swinging hollow metal doors and as specified in ANSI/NFPA 80, shall be provided for the functional operation of the assembly and shall not exceed the following (for all door heights):

1. Between doors and frame at head and jambs ........ 1/8 in. (3.1 mm) ± 1/16 in. (1.5 mm)
2. Between meeting edges of pairs of doors ............... 1/8 in. (3.1 mm) ± 1/16 in. (1.5 mm)

B. Floor clearance for fire rated swinging hollow metal doors shall not exceed 3/4" (19.0 mm). Floor clearance shall be provided for the functional operation of all swinging hollow metal doors and shall not be less than 1/8" (3.1 mm)

The Architect must define the distance from the top of the floor/finished floor to top of floor covering so appropriate undercuts can be provided. Floor/Finish Floor is defined as the top of the concrete or structural slab. HMMA uses the term ‘top of floor covering’ to describe the NFPA term ‘nominal surface of floor covering’. Please refer to HMMA-810 TN01-03 Tech Note, “Defining Undercuts.”
FIGURE 1
FRAME TOLERANCES

- Height: +1/16 IN. (1.5mm) - 1/32 IN. (0.8mm)
- Width: +1/16 IN. (1.5mm) - 1/32 IN. (0.8mm)
- Face Cutout for Hinge: +1/16 IN. (1.5mm) - 0 IN.
- Mortise Depth of Reinforcement: +/- 1/64 IN. (0.4mm)
- Hinge Cutout: +1/64 IN. (0.4mm) - 0 IN.

See insert below for hardware cutout and reinforcement detail.
3.3 Factory Applied Coatings
Since factory applied coatings (primer, finish paint, etc.) are subject to performance standards rather than thickness, the dry film thickness is irrelevant. Such coatings must comply with performance criteria of:

ANSI/SDI A250.3 – Test Procedure and Acceptance Criteria for Factory Applied Finished Painted Steel Surfaces for Steel Doors and Frames

OR

ANSI/SDI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

4 Frame Tolerances

4.1 Frame Cross Section Profile
Permissible tolerances in frame profile surfaces are as shown below:

4.2 Frame Opening & Vertical Locations

4.3 Bow or Twist of Jambs or Header
Realizing that frames are somewhat “pliable,” and require bracing and alignment during installation, allowable deformation (bow, twist, etc.) of jambs or header of frame prior to installation shall not result in a reduction of opening sizes more than ±1/16” beyond those shown in Figure “B” when measured at any point.

4.4 Horizontal Alignment of Door Within Rabbet
Hinge and strike backsets shall allow the horizontal centerline of the door to be in line with the horizontal centerline of the frame rabbet ± 1/32” prior to installation. Figure “C” is an example based on a 1 3/4” door in a 1 13/16” rabbet.
7.1.2 Figure “K” shows how to relocate the pivot point away from the jamb.

- Using shim "C" only, door will be relocated in direction of Arrow "Y".
- Using "D" only, both door and centerline of hinge barrel will move in the direction of Arrow "F".
- Using both shims "C" and "D" will relocate the door in direction of Arrow "F" by a greater amount than by using either "C" or "D" alone. The centerline of hinge barrel will be relocated the same as by using shim "D" alone.

**Figure K – Hinge Bind, Shims C and D**

7.2 Frame Installation Tolerances

While this document is mainly concerned with tolerances relating to the manufacturing process, openings will not function properly if the frame is not installed within recognized tolerances.

Figures "L-M-N-O" show examples of the accuracy to be maintained while setting frames. Instructions for installation may be found in ANSI A250.11.

**Figure L – Squareness**

**Figure M – Plumbness**
7.3 Troubleshooting

Further information regarding corrective actions for door & frame openings may be found in SDI-122.
P-2: Suggested Installation Chart

**Extra Heavy Duty:** This duty level typically involves doors where use is considered heavy and frequent, and requires the highest minimum performance standards.

**Heavy Duty:** This duty level typically involves doors where usage is moderate, and requires intermediate minimum performance standards.

**Standard Duty:** This duty level typically involves doors where frequency of use is low, and requires the lowest minimum performance standards.

<table>
<thead>
<tr>
<th>Extra Heavy Duty</th>
<th>Heavy Duty</th>
<th>Standard Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>Assisted Living Room Entry</td>
<td>Closet</td>
</tr>
<tr>
<td>Patient Rooms</td>
<td>Office - Interior Passage</td>
<td>Wardrobe</td>
</tr>
<tr>
<td>Bathroom - Public</td>
<td>Stairwell</td>
<td>Bathroom - Private</td>
</tr>
<tr>
<td>Dorm Room</td>
<td>Mechanical Service</td>
<td>Small, low usage Office</td>
</tr>
<tr>
<td>Assembly areas</td>
<td>Hallway</td>
<td></td>
</tr>
<tr>
<td>Auditorium Entry</td>
<td>Hotel/Motel Room Entry</td>
<td></td>
</tr>
<tr>
<td>Detention/Correctional</td>
<td>Storage</td>
<td></td>
</tr>
<tr>
<td>Bullet Resistant</td>
<td>Apartment/Condo Entry</td>
<td></td>
</tr>
<tr>
<td>Gymnasium/Locker Room</td>
<td>X-Ray</td>
<td></td>
</tr>
<tr>
<td>Surgical Entry</td>
<td>Acoustic</td>
<td></td>
</tr>
<tr>
<td>Trauma Centers</td>
<td>Medical Examination Room</td>
<td></td>
</tr>
</tbody>
</table>

P-3: Dimensional Tolerances

**Doors**

<table>
<thead>
<tr>
<th>Width</th>
<th>±1/16 in. (±1.6 mm) not prefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>±1/32 in. (±0.8 mm) factory prefit</td>
</tr>
<tr>
<td>Thickness</td>
<td>±1/16 in. (±1.6 mm)</td>
</tr>
</tbody>
</table>

**Hardware Machining**

**Hinge Mortises**

<table>
<thead>
<tr>
<th>Location</th>
<th>±1/32 in. (±0.8 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>+1/32 in., -0 in. (+0.8 mm, -0 mm)</td>
</tr>
<tr>
<td>Depth</td>
<td>+.025 in., -0 in. (+0.6 mm, -0 mm)</td>
</tr>
<tr>
<td>Backset</td>
<td>+0 in., -1/32 in. (+0 mm, -0.8 mm)</td>
</tr>
</tbody>
</table>

**Lock Fronts**

<table>
<thead>
<tr>
<th>Location</th>
<th>±1/32 in. (±0.8 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>+1/32 in., -0 in. (+0.8 mm, -0 mm)</td>
</tr>
<tr>
<td>Width</td>
<td>+1/32 in., -0 in. (+0.8 mm, -0 mm)</td>
</tr>
<tr>
<td>Depth</td>
<td>+.025 in., -0 in. (+0.6 mm, -0 mm)</td>
</tr>
</tbody>
</table>

P-4: Flame Spread Smoke Development

Doors covered by this standard are exempt per NFPA 101.
Maynard, Mary

Subject: FW: Appeal to Standards Council - Failed TIA ballot (Log #1039)

From: William Koffel [mailto:wkoffel@koffel.com]
Sent: Monday, February 13, 2012 4:50 PM
To: Maynard, Mary; Fuller, Linda
Cc: Bigda, Kristin
Subject: RE: Appeal to Standards Council - Failed TIA ballot (Log #1039)

I am submitting this information for consideration by the Council since my ballot was not received by NFPA in time for inclusion in the Final Ballot results. An attempt was made to fax the ballot to NFPA on December 20th but unfortunately my office did not notice that the transmission did not go through. Obviously, the failure to submit the ballot in a timely manner was our fault and this material is in no way a complaint about the manner in which the ballot was processed. Again, I am providing this information since it is not included in the Ballot results.

With respect to the Technical Merit of the proposed TIA, I disagree with the technical merit of the Proposed TIA. The following statement was intended to be included in my ballot:

I have been trying to confirm that wood doors would pass the fire test with an increased clearance and have been unable to do so. The supporting information is based on steel doors.

With respect to the subject of the TIA being of an Emergency Nature, I disagree that the TIA is of an Emergency Nature. The following statement was intended to be included in my ballot:

This has been in NFPA 80 for a long time without any previous proposals or concerns.

Although I did not submit my ballot in a timely manner, I appreciate the Council’s consideration of my responses to the original Technical Committee Letter Ballot.

Bill

William E. Koffel P.E., FSFPE
President
Licensed in DC, MD, NY, OH, PA, VA, WA
KOFFEL ASSOCIATES, INC.
8815 Centre Park Drive / Suite 200 / Columbia, MD 21045–2107
wkoffel@koffel.com
www.koffel.com
Fire Protection Engineers: Expertly Engineering Safety From Fire

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Subject: FW: upcoming TIA appeal

Kristin:

Not sure if this is what you need, but see how this works (if you need further details or information, just let me know):

TIA 1039 involved a concern with the clearance between the top and vertical edges of a wooden fire door and frame, and the meeting edges of doors swinging in pairs. The TIA submitter requested that the tolerance of not exceeding 1/8-inch be struck for wooden doors and left in place for steel doors. The author stated that the 1/8-inch tolerance does not take into account any allowable industry standard manufacturing and installation tolerances. The author then cited and attached information from ANSI, NAAMA (National Association of Architectural Metal Manufacturers), SDI (Steel Door Institute), and WDMA (Window and Door Manufacturers Association).

The committee voted on the TIA through the normal voting process. On Technical Merit the TIA needed 18 to pass and the affirmative votes were 21. On Emergency Nature the TIA needed 17 to pass and the affirmative votes were 15, thus the emergency nature failed and consequently the TIA failed

On the technical merit, specific committee issues included:
- Insufficient information was provided supporting the documentation for wood doors and thermal bow is a concern with metal doors and wanted to know if it was the same for wood doors

On emergency nature, specific issues included:
- “The provision of the code has been standing for many editions and has not previously been noted as being a problem by the wood door manufacturers”
- “Current language is not a burden nor does it represent a lower level of safety”
- “I feel strongly that additional discussion needs to happen. I have many questions and not very many answers but feel that some of our membership could address these concerns in further discussions on this matter”
- “I think it can be put in the next cycle”

I support the committee actions. I have also asked the NFPA 80/105 NFPA Staff Liaison to add this to the list for discussion at our next cycle.

Yours respectively,

Bruce Campbell
Chair NFPA 80/105
Hi Kristin,

Earlier this week DHI was contacted regarding an appeal that is going to be (or has been) filed with NFPA regarding the TIA 1039 ballot from late last year.

In the interest of full disclosure, the initial proposal and subsequent appeal is from one of DHI’s members. This member has requested DHI’s assistance in supporting the appeal, but we are not able to support his position for the reasons stated below.

I thought I should forward the results of my research to you since I would expect you to be involved with the TIA 1039 appeal process. I am cc’ing Tom Rubright since he is my alternate on this committee and he and I are of the same opinion.

Thanks.

Regards,

Keith

My response to the DHI CEO regarding the TIA1039 appeal:

NFPA has added digital copies of technical committee reports to their online archives that are free to anyone who as an interest in researching them. The earliest archive file for NFPA 80 that is posted online is dated 1966. In the 1966 edition of NFPA 80, paragraph 503.C is titled “Clearances” and it states, “The clearance between the door and frame and between meeting edges of doors swinging in pairs shall not exceed 1/8-inch. The clearance between the door and the floor with either flush or raised sill shall not be more than 3/4-inch.”
I suspect that the clearance requirements existed in NFPA 80 prior to the 1966 edition, but the online archive does not go back any farther and I cannot verify if my suspicion.

In 1989, the NFPA 80 committee “accepted in principle” a proposal (Log #18 in TCRF-1989-80) submitted by the Steel Door Institute that resulted in the current requirement for clearances in 2010 edition of NFPA 80 (and the soon to be released 2013 edition). SDI proposed adopting a standard plus or minus tolerance of 1/16-inch for all clearance dimensions from the nominal clearance dimension specified in NFPA 80.

The NFPA 80 committee statement regarding this proposal records that the committee thought that the plus or minus tolerance of 1/16-inch from the nominal clearance dimension was too broad to be permitted throughout the standard.

The record does not show the NFPA 80 committee’s reasoning for specifically for changing the clearance dimensions for steel doors, but my suspicion is that they recognized that steel doors will expand significantly when exposed to intense heat of a fire and in so doing reduce the clearance between the doors and frames. Accordingly, the NFPA committee added the plus or minus 1/16-inch tolerance to steel doors, but retained the original not-to-exceed-1/8-inch clearance (with no plus tolerance) for wood fire doors.

The approved language in 1989 was, “The clearance dimension between the door and the frame and between meeting edges of doors swinging in pairs shall be 1/8-inch (plus/minus 1/16-inch) for steel doors and shall not exceed 1/8-inch for wood doors.”

For comparison, the 2007 and 2010 (and the soon to be released 2013 edition) contain the current language: “6.3.1.7* Clearances. 6.3.1.7.1 The clearances between the top and vertical edges of the door and the frame, and the meeting edges of doors swinging in pairs, shall be 1/8-inch (plus or minus 1/16-inch) for steel doors and shall not exceed 1/8-inch for wood doors.”

The appeal is based on the 2011 committee decision that recognized the disparity between the clearances for steel and wood fire doors, but that rejected the issue since the technical committee did not agree with that the issue is needs to be addressed as an emergency.

To recap, the clearance dimension for wood fire doors of 1/8-inch (with no plus tolerance) has been a requirement in NFPA 80 since 1966.

Throughout the years, DHI, NWWDA, WDMA, and other door and hardware industry experts have sat on the NFPA 80 technical committee and have not deemed it necessary to change the clearance requirement for wood doors. For the record, I am neither for or against changing the requirement. Tom’s letter recommends that a change such as this be made with thorough discussion, careful deliberation, and research – not something to be rushed into. And, I agree completely with him.
Now the overarching caveat to all of NFPA 80’s requirements for fire doors is that if a manufacturer’s product listing allows for variances from the requirements of NFPA 80, the products should be allowed since they have been tested and listed with those variances. In this case, if the wood door manufacturer in question has successfully passed a fire door test with clearances greater than that allowed in NFPA 80, the fire-rating of the wood door is valid – provided the AHJ accepts that variance from NFPA 80’s requirements.
Item SA 12-3-8
Antifreeze Solutions Supplied through Spray Sprinklers

Interim Report

Prepared by:

Code Consultants, Inc.

The Fire Protection Research Foundation
One Batterymarch Park
Quincy, MA, USA 02169-7471
Email: foundation@nfpa.org
http://www.nfpa.org/foundation

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February 2012
FOREWORD

This Interim Report provides information on a fire test program recently completed by the Foundation to investigate antifreeze solutions supplied through spray sprinklers. Previous research by the Foundation investigated the use of antifreeze solutions only in residential sprinkler systems. As specifically requested by the NFPA Standards Council, the Foundation has completed this additional research to address a gap in the existing data by extending the data set to include spray (commercial) sprinklers. The current research was developed to investigate the potential for ignition of antifreeze supplied through non-residential, spray sprinklers. The scope of the project does not include investigating the effectiveness of the antifreeze sprays in controlling a fire condition.

The content, opinions and conclusions contained in this report are solely those of the authors.
Antifreeze Solutions Supplied through Spray Sprinklers

Technical Panel
Magnus Arvidson, SP (Sweden)
Kerry Bell, Underwriters Laboratories Inc.
Elizabeth Buc, Fire and Materials Research Lab, LLC
Scott Futrell, Futrell Fire Consult & Design, Inc.
Sherry Habon, CAL FIRE
Tonya Hoover, CAL FIRE
Roland Huggins, American Fire Sprinkler Association
Garner Palenske, Aon Fire Protection Engineering Corporation
Maurice Pilette, Mechanical Designs Ltd.
Noah Ryder, δQ Fire & Explosion Consultants, Inc.
Joseph Senecal, Kidde-Fenwal, Inc.
Matt Klaus, NFPA staff liaison

Sponsor representatives
Scott Franson, The Viking Corporation
Peter Willse, XL Global Asset Protection Services

Project Contractor
Steven Wolin, Code Consultants, Inc.
Interim Report
Antifreeze Solutions Supplied through Spray Sprinklers

Prepared for:
The Fire Protection Research Foundation
1 Batterymarch Park
Quincy, MA 02169

Prepared by:
CODE CONSULTANTS, INC.
2043 Woodland Pkwy, Suite 300
Saint Louis, MO 63146

CCI Project No. 100138.04.003

February 21, 2012

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Interim Report
Antifreeze Solutions Supplied through Spray Sprinklers

This Interim Report provides information on a fire test program recently completed by the Fire Protection Research Foundation to investigate antifreeze solutions supplied through spray sprinklers. Previous research by the Foundation investigated the use of antifreeze solutions only in residential sprinkler systems. As specifically requested by the NFPA Standards Council, the Foundation has completed this additional research to address a gap in the existing data by extending the data set to include spray (commercial) sprinklers.

A. Prior Foundation Research

In 2010 the Foundation completed a research project to investigate the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. [1] [2] Testing was conducted in two parts. Scope A consisted of fire tests using six (6) models of residential sprinklers at elevations of 8 ft and 20 ft to investigate the potential for large-scale ignition of antifreeze sprays at pressures ranging from 10 psi to 150 psi. Scope B consisted of room fire tests, similar to UL 1626, that were designed to investigate the effectiveness of sprinklers discharging antifreeze solutions and their ability to maintain tenable conditions in a sample residential fire scenario.

Results of the Scope A testing indicated that concentrations of propylene glycol exceeding 40% by volume and concentrations of glycerin exceeding 50% by volume had the potential to ignite when discharged through residential sprinklers. The potential for ignition depended on several factors including the antifreeze solution, ignition source, sprinkler model, sprinkler elevation, discharge pressure, and the location of the sprinkler with respect to the ignition source.

Results of the Scope B testing indicated that concentrations of propylene glycol not exceeding 40% by volume and concentrations of glycerin not exceeding 50% by volume have similar performance to water when compared using the UL 1626 fire control criteria. Both the 40% propylene glycol and 50% glycerin solutions met the UL 1626 fire control criteria and demonstrated similar performance to that of water alone throughout the series of tests.

The results of the research suggested that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume were not appropriate for use in home fire sprinkler systems. It was recommended that consideration be given to an appropriate safety factor for concentrations of these antifreeze solutions permitted by future editions of NFPA 13, as well as warnings and limitations outlined in antifreeze product literature.
The report included the following recommendations for further research:

- Investigate antifreeze solutions supplied through non-residential sprinklers.
- Characterize droplet distributions produced by sprinklers.
- Investigate small or medium scale tests for the ignition of liquid sprays.
- Develop a listing standard for antifreeze solutions used in sprinkler systems to encourage the development of alternative solutions.

The first recommendation was identified as particularly important to developing requirements for antifreeze solutions used in non-residential sprinkler systems.

B. Test Plan

The current research was developed to investigate the potential for ignition of antifreeze supplied through non-residential, spray sprinklers. The scope of the project does not include investigating the effectiveness of the antifreeze sprays in controlling a fire condition.

The test plan was similar to Scope A of the Foundation’s prior research on residential sprinkler systems. The test configuration consisted of a heptane spray burner positioned below a sprinkler. The operating mechanism was removed from the sprinkler prior to the test and the operating pressure was incrementally increased during each test to investigate a range typically from 20 psi to 150 psi. The basic test configuration is illustrated in Figure 1, below, and is similar to the test configuration used for the prior research on residential sprinklers.
Prior research suggested that solutions of 50% glycerin and 40% propylene glycol have similar performance in the ignition test configuration. [2] Thus, all tests were conducted with a solution of 50% glycerin by volume based on the results also being applicable to a solution of 40% propylene glycol by volume.

The ignition source used in the tests is intended to provide a conservative representation of the potential fire conditions that a sprinkler system may be designed to control or suppress. The Foundation's prior work investigated a variety of ignition sources and used a nominal ignition source heat release rate of 1.4 MW for the majority of the tests. The ignition source heat release rate was based in part on an analysis of the estimated fire size at sprinkler activation for a residential sprinkler. The analysis was based on the typical ceiling heights in residential occupancies and the response characteristics of residential sprinklers.

Residential sprinklers use a fast-response operating element to achieve relatively quick activation and limit the size of a fire condition. Spray sprinklers are available and have been produced with a variety of operating elements and activation temperatures that may allow for a fire size greater than 1.4 MW to occur prior to sprinkler activation. In addition, spray sprinklers are installed in spaces with ceiling heights greater than those typically found in residential occupancies which may allow for a further increase in fire size prior to sprinkler activation. Thus, this test program investigated the impact of increasing the nominal heat release of the ignition source from 1.4 MW to 3.0 MW. The current testing used same heptane spray burner ignition
source that was used for the prior research on residential sprinklers. The heptane spray burner provided a substantial ignition source that was difficult to extinguish.

Tests were conducted with seven (7) commercially available spray sprinklers. The sprinklers included nominal k-factors ranging from 2.8 gpm/psi\(^{1/2}\) to 8.0 gpm/psi\(^{1/2}\). In addition to standard spray sprinklers, an extended coverage sprinkler was also tested. Four sprinklers with k-factors of 5.6 gpm/psi\(^{1/2}\) were tested to investigate the impact of variables other than the nominal k-factor of the sprinkler on the potential for ignition of the spray.

Table 1, below, summarizes the various tests that were conducted.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Sprinkler</th>
<th>Height (ft)</th>
<th>Ignition Source HRR (MW)</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>residential k3.1</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
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</tbody>
</table>

Table 1. Test Matrix

C. Results

The results indicate that the heat release rate of the ignition source can have a substantial impact on the ignition of the antifreeze spray. Figure 2, below, compares the results of tests using a 1.4 MW ignition source with otherwise identical tests using a 3.0 MW ignition source.
As indicated in Figure 2, above, substantial increases in heat release rate were measured for solutions of 50% glycerin supplied through several sprinklers using the 3.0 MW ignition source. The measured increase in heat release rate is due to ignition of the antifreeze. The increase in heat release rate does not occur or is substantially less with the 1.4 MW ignition source.

Results with the sprinkler positioned at 8 ft above the floor showed a significant variation in the increase in heat release rate depending on the sprinkler and the operating pressure. Results for the 8 ft tests are illustrated in Figure 3, below.
Of the tests at 8 ft, the greatest increase in heat release rate occurred with the k2.8 sprinkler where the heat release rate increased by approximately 135% due to ignition of the antifreeze spray. A similar increase in heat release rate was also measured during the test with the k5.6 concealed sprinkler. In contrast, a maximum increase of 40% was measured in the test with the k8.0 sprinkler.

The maximum increase in heat release rate varied from approximately 1,500 kW to more than 3,700 kW in the various tests with k5.6 sprinklers. Thus, factors other than the nominal k-factor of the sprinkler, such as deflector design and configuration, influence the droplet distribution and the potential for ignition of the antifreeze.

Substantial ignition of the antifreeze spray and flames extending away from the ignition source were observed during two of the tests with the sprinkler positioned at 20 ft above the floor. Results for the 20 ft tests are illustrated in Figure 4, below.
In contrast to the results at 8 ft, only a minor increase in heat release rate was measured during the test with the k2.8 sprinkler at 20 ft. However, a substantial ignition of the antifreeze spray and increase in heat release rate occurred during tests with the k4.2 and k8.0 sprinklers at 20 ft. In both tests flames were observed away from the ignition source.

The interaction between the ignition source and the antifreeze spray appears to have a significant role in the potential for ignition of the antifreeze. Because results with the k8.0 sprinkler differed substantially between the test at 8 ft and the test at 20 ft, an additional test was conducted with the k8.0 sprinkler positioned at 15 ft above the floor. The results are illustrated in Figure 5, below.

Figure 4. Increase in heat release rate during tests at 20 ft.
The potential for ignition of the antifreeze spray depends not only on the droplet distribution from the sprinklers, but also on the presence of a suitable ignition source. In the test at 8 ft, the spray from the k8.0 sprinkler has significant density and momentum when it reaches the ignition source. The spray has a notable impact on the ignition source as it would be expected to have on many fire conditions.

In contrast, the antifreeze spray from the same sprinkler at 20 ft has significantly less momentum when it reaches the ignition source. The spray appears to have little impact on the ignition source.

The test at 15 ft showed a combination of the two conditions. At the beginning of the test at 15 ft, when the operating pressure was in the range of 80 psi to 90 psi, an increase in heat release rate of more than 100% was measured and flames were observed to extend away from the ignition source. As the operating pressure increased the spray from the sprinkler had significant momentum when it reached the fire and there was little, if any, increase in heat release rate.
The results demonstrate a complicated interaction between the sprinkler spray and the ignition source that appears to influence the potential for ignition of the antifreeze spray.

D. Summary

The Foundation has completed a test program to investigate the potential for ignition of antifreeze solutions of 50% glycerin supplied through spray sprinklers. Based on prior research, similar results would also be expected with solutions of 40% propylene glycol. The current research did not investigate the effectiveness of antifreeze sprays in controlling a fire condition.

The current test program investigated nominal ignition source heat release rates of 1.4 MW and 3.0 MW. The 1.4 MW ignition source is the same ignition source used for the Foundation’s prior research on residential sprinklers and was used to provided comparable data between the two test programs. The 3.0 MW ignition source was used to better characterize the fire size at sprinkler activation for certain non-residential fire conditions.

Increasing the ignition source heat release rate was found to significantly increase the ignition of the antifreeze spray in some tests. Results of tests with spray sprinklers and the 1.4 MW ignition source were consistent with the results of the Foundation’s prior research program on residential sprinklers using the same 1.4 MW ignition source. The 1.4 MW ignition source was not able to ignite a substantial portion of the antifreeze spray. In contrast, some tests with the 3.0 MW ignition source resulted in an increase in heat release rate of more than 200% with flames extending away from the ignition source.

The test program used seven (7) commercially available spray sprinklers with nominal k-factors ranging from 2.8 gpm/psi$^{1/2}$ to 8.0 gpm/psi$^{1/2}$. The sprinklers were selected to include a range of deflector configurations, which was found to impact the potential for ignition of the antifreeze spray. The nominal k-factor of the sprinkler was not found to determine the potential for ignition of the antifreeze spray. Further testing is anticipated as part of this project to characterize the droplet distribution from several of the sprinklers included in this test program.

In tests with the sprinklers positioned at 8 ft above the floor, a maximum increase in heat release rate of more than 4,000 kW or approximately 135% was measured with the k2.8 sprinkler. A similar increase in heat release rate was measured with a k5.6 concealed sprinkler. The maximum increase in heat release rate varied by more than a factor of two between the different k5.6 sprinklers tested. Antifreeze solutions supplied through other sprinklers showed varying increases in heat release rate, with the k8.0 sprinkler having the lowest maximum increase in heat release rate of approximately 40%.

In contrast, results at 20 ft showed an increase in heat release rate of more than 200% for both the k4.2 and the k8.0 sprinklers at certain operating pressures. Ignition of the antifreeze spray away from the ignition source was observed in tests with both the k4.2 and k8.0 sprinkler at 20
An additional test was conducted with the k8.0 sprinkler at 15 ft that showed that the potential for ignition of the spray can depend on a complex interaction between the spray distribution from the sprinkler and the ignition source.

The final report on this test program is anticipated to include additional analysis of several of the factors that affect the potential for ignition of the antifreeze spray. In addition to the antifreeze solution, these factors include:

- the ignition source (fuel package);
- the configuration of the sprinkler with respect to the ignition source; and
- the sprinkler model and operating pressure along with the resulting droplet distribution.

The results of this test program indicate that limitations should be considered on the use of 50% glycerin or 40% propylene glycol antifreeze solutions in non-residential sprinkler systems. Ignition of substantial portions of the antifreeze spray was observed in several of the tested configurations. In addition, testing has not been conducted to investigate the effectiveness of antifreeze solutions in controlling non-residential fire conditions. The additional analysis and droplet distribution testing that will be documented in the final report may provide information that could assist in developing future requirements for the use of glycerin and propylene glycol antifreeze solutions in non-residential sprinkler systems.

E. References


TO: Technical Committees on Automatic Sprinkler Systems

FROM: Linda Fuller

DATE: September 13, 2011

SUBJECT: Antifreeze

I am transmitting to you herewith the following action of the Standards Council (August 8-11, 2011):

At its March 2011 meeting, the standards Council issued several TIAs relating to ongoing review of the use of antifreeze in sprinkler systems. The extensive background and activities leading up to the development and issuance of these TIAs is set forth in the Council’s decision issuing the TIAs and in decisions and minute items cited in that decision. See Standards Council Decision 11-5 (SC #11-3-3-e, 11-3-4-e and 11-3-5-d, March 1, 2011). The TIAs were developed by the responsible technical committees and the Council emphasized in its decision issuing the TIAs that, while the Council had initially taken action to address the antifreeze questions pending further technical committee consideration, the technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus-based technical committees to determine.

In issuing the TIAs, the Council stressed, in the following terms, that the sprinkler committees’ consideration of issues related to antifreeze was not an end:

In voting to issue these TIAs, the Council stresses that the sprinkler committees’ consideration of issues related to antifreeze is not at an end. The sprinkler standards are in the Annual 2012 revision cycle, and that the content of the new TIAs will be considered as Proposals during the process. The Fire Protection Research Foundation report discussed areas where future research might be needed, as, for example, in the area of commercial applications. It is anticipated that further research will be conducted and information developed that will aid the sprinkler committees in their continuing consideration of issues raised by the use of antifreeze in sprinkler systems.

To aid the work of the sprinkler committees, and for its own information, the Council requested the sprinkler committees, representatives of the relevant sprinkler industries, the Fire Protection Research Foundation and others with relevant information to provide reports to the Council at its August 2011 meeting "identifying research needs, planned or ongoing research, and any other activities or developments related to the use of antifreeze in sprinkler systems."

In response to the Council's request, the Council has received a single report from the Chair of the Technical Correlating Committee (TCC) on Sprinklers on potential research paths that may need to be taken as it pertains to antifreeze usage in sprinkler systems. The Council also heard an oral presentation from Executive Director of the Fire Protection Research Foundation on her efforts to explore potential research paths with potential funders. Disappointingly, the Council received no submissions from other interested parties. Nevertheless, it was never the Council’s intention to itself evaluate or analyze the information that it was seeking. Rather it was attempting to assist the
interested parties in maintaining their focus on and commitment to the ongoing task of providing the responsible NFPA technical committees with research and data to support effective standards development. While no action of the Council is required at this time, the Council expects the interested parties will continue investigation and research aimed at ensuring the safety of freeze protection in sprinkler systems and the incorporation of such new information as may be developed into subsequent editions of the sprinkler standards.

As suggested above, it is not the Council’s role to identify all of the gaps in research that may exist and it has not undertaken to evaluate or analyze all the information presented or to construct any research plan. While some of the research being discussed may be aimed at showing that the antifreeze limits are more stringent than necessary, attention should also be maintained on identifying any additional research needed to ensure the adequacy of all the current antifreeze limits. In this regard, and without suggesting that other avenues of research may also be advisable, the Council notes that the TCC Chair’s report and from the previously submitted research reports prepared for the Fire Protection Research Foundation point to at least one gap that needs to be filled. Specifically, it appears that the data that has been generated in the recent research on residential sprinklers has been extrapolated to standard spray sprinklers (i.e., commercial sprinklers). Standard spray sprinklers have different characteristics than residential sprinklers and research appears to be necessary to verify that the extrapolation of the data obtained on residential sprinklers is either valid for standard spray sprinklers or needs adjustment.

The Council is requesting that interested parties report back to the Council on or about March, 2012. Council meeting on plans and progress toward filling the gap identified above as well as on other research activities that are being considered, planned or undertaken.

Council Member Roland Huggins recused himself from the vote on this issue.

c:  D. Berry, M. Brodoff, A. Cronin, M. Klaus, P. Foley, J. Goyette, E. Carroll
TCC on Automatic Sprinkler Systems AUT-AAC
TC on Residential Sprinkler Systems (AUT-RSS)
TC on Sprinkler System Installation Criteria (AUT-SSI)
TC on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)
NFPA Standards Council
Interested parties (individuals providing comments)

11-8-48
Standards Council Decision (Final): D#11-5
Standards Council Agenda Item: SC#11-3-3-e, 11-3-4-d and 11-3-5-d
Date of Decision: 1 March 2011
TIA Nos. 1015, 1012 and 1013 on NFPA 13, 13D and 13R, all 2010 editions

**SUMMARY ACTION:** The Standards Council voted to deny the appeal and issue TIA Nos. 1015, 1012 and 1013 on NFPA 13, NFPA 13D and NFPA 13R, respectively. In addition, the Council directed further activities as set forth in the decision.

In August of 2010, the Standards Council voted to issue three Tentative Interim Amendments (TIAs), the effect of which, pending further technical committee consideration, was to prohibit the use of antifreeze within the dwelling unit portions of sprinkler systems. In doing so, the Council took the unusual step of issuing TIAs without the full support of the responsible sprinkler committees. This was because the Council was presented with an unusual and compelling situation in which the status quo in the existing sprinkler documents was no longer tenable, and in which the circumstances required emergency action. (See Standards Council Decision #10-10 [August 5, 2010]). In its decision, the Council stressed that its action was strictly an interim measure that would remain in place "unless and until the responsible technical committees, after due consideration and any correlation by the [Technical Correlating Committee], reach consensus on a different approach." The Council, moreover, stressed that "it is not undertaking to make any final technical determination about the correct course of action that may eventually emerge. The technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus-based technical committees to determine, and the same should be true in this case." In turning the matter back to the sprinkler committees, the Council noted that the TIAs all involved standards that address the design and installation of new sprinkler systems. It asked the technical committees to examine the important question of what should be done to address antifreeze in existing residential sprinkler systems. Finally, the Council noted that the TIAs did not address antifreeze in nonresidential commercial applications and suggested the need for further research and consideration of the treatment of nonresidential commercial applications as well. (See Standards Council Decision #10-10).

The sprinkler committees have now completed the review and consideration of the antifreeze issues as anticipated in Standards Council Decision #10-10. The technical committees have developed and reached consensus on three new TIAs related to the use of antifreeze in sprinkler systems that proposed to supersede the TIAs previously issued on an interim basis by the Council.
The new TIAs, which were presented to the Council at its meeting of February 28 – March 1, 2011 are: TIA Nos. 1015, 1012 and 1013 on the 2010 editions, respectively, of NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes, and NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height. Also considered by the Council at the meeting was an appeal relating to the TIAs from Dana Haagensen, Massachusetts Department of Fire Services. The appeal requested that the Council not issue the new TIAs and that the three existing TIAs issued in Standards Council Decision D#10-10, and which would be superseded by the new TIAs, remain in place. The existing TIAs, for new installations, prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R sprinkler systems.

As suggested above, the new TIAs replace the complete prohibition on the use of antifreeze in the dwelling unit portions of new sprinkler systems. Described in general terms, TIA Nos. 1015, 1012 and 1013, taken together: limit the antifreeze solutions used in sprinkler systems to manufacturer premixed antifreeze solutions only; limit the use of antifreeze in sprinkler systems to specified volume concentrations based on one of the types of permitted solutions; provide additional provisions based on the type of sprinkler for NFPA 13 sprinkler systems; and provide additional requirements for NFPA 13D systems including provisions for annual testing and provisions based on whether the NFPA 13D system is new or existing. The TIAs do not address existing systems designed to NFPA 13 or 13R, however, another TIA on NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, that is being issued concurrently with these TIAs and that has not been the subject of an appeal, does address antifreeze concentrations for these systems. (See Minute Item 11-3-6, Standards Council Meeting of February 28-March 1, 2011; see also Minute Item 11-3-7, for another TIA on NFPA 25, which did not pass ballot and has not been appealed.) The individual TIAs must, of course, be consulted for the precise terms of the provisions they contain.

The three new TIAs were balloted through the responsible Technical Committees (TC) – the Technical Committee on Sprinkler System Installation Criteria for NFPA 13, and the Technical Committee on Residential Sprinklers for NFPA 13D and NFPA 13R – as well as the Technical Correlating Committee on Automatic Sprinkler Systems (the TCC). Balloting was completed in accordance with the NFPA Regulations Governing Committee Projects, to determine if it had the necessary three-fourths majority support on technical merit and emergency nature in favor of issuance. All three TIAs passed the ballots of the TCs and the TCC on both technical merit and emergency nature. One public comment was received.

The appeal requests that the Council overturn the action recommended by the NFPA codes and standards development process and not issue the TIAs. On appeal, the Standards Council accords great respect and deference to the codes and standards development process. In conducting its review, the Council will overturn the result recommended through that process, only where a clear and substantial basis for doing so is demonstrated. The Council has reviewed the entire record concerning this matter and
has considered all the arguments raised in this appeal. In the view of the Council, this appeal does not present any clear and substantial basis on which to overturn the result recommended by the NFPA codes and standards development process. Accordingly, the Council has voted to deny the appeal and issue TIA Nos. 1015, 1012 and 1013.

As indicated above, the Council's previous action in limiting the use of antifreeze in sprinkler systems was intended as an interim measure to allow the sprinkler committees the time and opportunity to review the available information and research and make the final consensus determination about what should or should not be contained in the sprinkler standards concerning the antifreeze issues. The sprinkler committees have now processed the issues and reached a consensus, meeting in each case the demanding three-quarter majority vote. The committees have reviewed and considered the available information, including the research presented in the Fire Protection Research Foundation report, "Antifreeze Solutions in Home Fire Sprinkler Systems, Phase II Research Final Report" issued in 2010. Moreover, and importantly, the TIAs address the use of antifreeze in nonresidential commercial applications and in existing installations, subjects that were not able to be addressed in the previous TIAs. The committees have arrived at reasonable conclusions based on the available information and the many considerations that must be weighed in arriving at consensus judgments. Since absent compelling circumstances were not presented here, the Council must defer to the consensus judgments of the committees.

In voting to issue these TIAs, the Council stresses that the sprinkler committees’ consideration of issues related to antifreeze is not at an end. The sprinkler standards are in the Annual 2012 revision cycle, and that the content of the new TIAs will be considered as Proposals during the process. The Fire Protection Research Foundation report discussed areas where future research might be needed, as, for example, in the area of commercial applications. It is anticipated that further research will be conducted and information developed that will aid the sprinkler committees in their continuing consideration of issues raised by the use of antifreeze in sprinkler systems. In the meantime, the Council is requesting, both in aid of the committees’ work and for the Council’s information, that the sprinkler committees, representatives of the relevant sprinkler industries, the Fire Protection Research Foundation, and any other parties with relevant information provide reports to the Council at its next meeting identifying research needs, planned or ongoing research, and any other activities or developments related to the use of antifreeze in sprinkler systems.

Council Member Roland Huggins recused himself during the deliberation and vote on the issue.
Tentative Interim Amendment

NFPA 13
Standard for the Installation of Sprinkler Systems

2010 Edition

Reference: 3.4.1.1 Premixed Antifreeze Solution, 7.6.1.5, 7.6.2, and A.7.6
TIA 10-2
(3C 11-3-3/TIA Log #1015)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13, Standard for the Installation of Sprinkler Systems, 2010 edition. The TIA was processed by the Technical Committee on Sprinkler System Installation Criteria and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new definition as 3.4.1.1 to read as follows:

3.4.1.1 Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

2. Remove the new section 7.6.1 that was added by issuance of TIA No. 10-1 (Log #1000) and renumber sections.

3. Revise 7.6.1.5 to read as follows:

7.6.1.5 A placard shall be placed on the antifreeze system main valve that indicates the manufacture type and brand of the antifreeze solution, the concentration by volume of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

4. Revise 7.6.2.1 to read as follows:

7.6.2.1* Antifreeze solutions shall be limited to premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume, or propylene glycol at a maximum concentration of 38% by volume.

5. Add a new 7.6.2.1.1 to read:

7.6.2.1.1 Premixed antifreeze solutions of propylene glycol exceeding 40% concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

6. Add new 7.6.2.1.2 to read as follows:

7.6.2.1.2 Premixed antifreeze solutions other than those described in 7.6.2.1 that are listed for use in sprinkler systems shall be permitted to be used.

7. Add a new 7.6.2.1.3 to read as follows:
7.6.2.1.3 All premixed antifreeze solutions shall be provided with a certificate of origin from the manufacturer indicating the type of antifreeze, concentration by volume, and freezing point.

8. Delete current Table 7.6.2.2 and replace it with the following table in the annex renumbered as Table A.7.6.2.1

A.7.6.2.1 See Table A.7.6.2.1.

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<td>1.114</td>
<td>-2</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td>1.130</td>
<td>-11</td>
</tr>
<tr>
<td>50%</td>
<td></td>
<td>1.141</td>
<td>-19</td>
</tr>
</tbody>
</table>

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

- | Propylene glycol | Solution (by volume) | Specific Gravity at 77°F (25°C) | Freezing Point |
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td>1.000</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
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<td>-3</td>
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<tr>
<td>10</td>
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<td>1.008</td>
<td>25</td>
<td>-4</td>
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<td>1.020</td>
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<td>-10</td>
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<tr>
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<td>-12</td>
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<td>1.028</td>
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<td>-17</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>1.032</td>
<td>-6</td>
<td>-21</td>
</tr>
</tbody>
</table>

8. Delete 7.6.2.3 and Table 7.6.2.3.

9. Revise 7.6.2.4 to read as follows:

7.6.2.4 A premix antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be provided.

10. Delete existing 7.6.2.5 as well as the Figures 7.6.2.5(a), 7.6.2.5(b), and 7.6.2.5(c) and Annex A.7.6.2.5.

11. Delete 7.6.2.6.

12. Add an asterisk to Section 7.6 and a new Annex A.7.6 to read as follows:

A.7.6 In cold climates and areas where the potential for freezing of pipes is a concern, options other than antifreeze are available. Such options include installing the pipe in warm spaces, tenting insulation over the piping (as illustrated in NFPA 13D), listed heat tracing, and the use of dry pipe systems and preaction systems.

13. In A.7.6.2, delete the second paragraph.
A.7.6.2 Listed CPVC sprinkler pipe and fittings should be protected from freezing by glycerine only. The use of diethylene, ethylene, or propylene glycols is specifically prohibited. Laboratory testing shows that glycol-based antifreeze solutions present a chemical environment detrimental to CPVC.

14. Delete existing A.7.6.2.4 and Figure A.7.6.2.4.
Tentative Interim Amendment

NFPA 13D
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

2010 Edition

Reference: 3.3.9.1 Premixed Antifreeze Solution (New), 4.1.4, 5.2.7, 8.3.2, 8.3.3, and A.4.1.4
TIA 10-2
(SC 11-3-4/TIA Log #1012)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Undo all of the changes made by TIA No. 10-1 (Log #994) to sections 3.3.9.1, 4.1.4, 5.2.7, 8.3.2 and 8.3.3 returning NFPA 13D to the text of the published 2010 edition with the following changes:

2. Add a new definition as 3.3.9.1.1 and related annex note to read as follows:

3.3.9.1.1* Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared and factory-mixed by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

A.3.3.9.1.1 Where a tank is used as the water supply for the sprinkler system, the tank is not permitted to be filled with antifreeze.

3. Revise 4.1.4 and related annex note to read as follows:

4.1.4* Antifreeze Systems.

A.4.1.4 Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portions of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

On an annual basis, test samples should be drawn from test valve B as shown in Figure 8.3.3.2.1(1), especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops that are less than 36 inches in length. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For long drops with significant volume, consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.
When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

4.1.4.1 Annual Antifreeze Solution Test and Replacement Procedure.

4.1.4.1.1 Samples of antifreeze solution shall be collected by qualified individuals in accordance with 4.1.4.1.1.1 or 4.1.4.1.1.2 on an annual basis.

4.1.4.1.1.1 The system shall be drained to verify that (a) the solution is in compliance with 8.3.3, and (b) the solution provides the necessary freeze protection. Solution samples shall be taken near the beginning and near the end of the draining process.

4.1.4.1.1.2* Solution samples shall be taken at the highest practical elevation and the lowest practical elevation of the system.

A.4.1.4.1.1.2 If not already present, test connections (valves) for collection of solution samples should be installed at the highest and lowest practical locations of the system or portion of the system containing antifreeze solution.

4.1.4.1.2 The two samples collected in accordance with the procedures specified in 4.1.4.1.1.1 or 4.1.4.1.1.2 shall be tested to verify that the specific gravity of both samples is similar and that the solution is in compliance with 8.3.3. The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.

4.1.4.1.3* If concentrations of the two samples collected in accordance with the procedures above are similar and in compliance with 8.3.3, then (a) the solution drained in accordance with 4.1.4.1.1.1 can be used to refill the system, or (b) the existing undrained solution tested in accordance with 4.1.4.1.1.2 shall be permitted to continue to be used. If the two samples are not similar and not in compliance with 8.3.3, then a solution in compliance with 8.3.3 shall be used to refill the system.

A.4.1.4.1.3 In the past, for some existing systems subject to extremely low temperatures, antifreeze solutions with concentrations greater than what is now permitted by NFPA 13D were used. Such high concentrations of antifreeze are no longer permitted. In situations where extremely low temperatures are anticipated, refilling the fire sprinkler system with a concentration of antifreeze solution currently permitted by the standard might not provide sufficient freeze protection without additional measures. Such measures might include converting the antifreeze system to another type of sprinkler system.

4.1.4.1.4 A tag shall be attached to the riser indicating the date the antifreeze solution was tested. The tag shall also indicate the type and concentration of antifreeze solution (by volume) with which the system is filled, the date the antifreeze was replaced (if applicable), the name of the contractor that tested and/or replaced the antifreeze solution, the contractor’s license number, a statement indicating if the entire system was drained and replaced with antifreeze, and a warning to test the concentration of the antifreeze solutions at yearly intervals per NFPA 13D.

4. Add an asterisk to 8.3.3 and add a new A.8.3.3 to read as follows:

8.3.3* Antifreeze Systems.

A.8.3.3 Where protection of pipes from freezing is a concern, options other than antifreeze are available. Such alternatives include running the piping in warm spaces, tenting insulation over pipe, dry-pipe systems, and preaction systems.

5. Revise 8.3.3.2.1 to read as follows:

8.3.3.2.1* Unless permitted by 8.3.3.2.1.1, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume, propylene glycol at a maximum concentration of 38% by volume, or other solutions listed specifically for use in fire protection systems.

6. Add a new 8.3.3.2.1.1 to read as follows:

8.3.3.2.1.1. For existing systems, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 50% by volume, propylene glycol at a maximum concentration of 40% by volume, or other solutions listed specifically for use in fire protection systems.

7. Delete 8.3.3.2.2 and 8.3.3.2.3 and related Annex material A.8.3.3.2.3.

8. Move Table 8.3.3.2.3 to the annex and renumber as Table A.8.3.3.2.1 while deleting the rows in the table dealing with glycerine and 40% water, glycerine and 30% water, propylene glycol and 50% water and propylene glycol and 40% water. Add an annex note so that the annex and Table would appear as follows:

A.8.3.3.2.1 See Table A.8.3.3.2.1.
Table A.8.3.3.2.1 Properties of Glycerine and Propylene Glycol

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution (by volume)</th>
<th>Specific Gravity at 60ºF (15.6ºC)</th>
<th>Freezing Point ºF</th>
<th>ºC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerine (C.P. or U.S.P. grade)</td>
<td>50% water</td>
<td>1.145</td>
<td>-20.9</td>
<td>-29.4</td>
</tr>
<tr>
<td>Hydrometer scale 1.000 to 1.200</td>
<td>Propylene glycol</td>
<td>60% water</td>
<td>1.034</td>
<td>-6</td>
</tr>
<tr>
<td>Hydrometer scale 1.000 to 1.200 (subdivisions 0.002)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

9. Renumber 8.3.3.2.3.1 to 8.3.3.2.2.

8.3.3.2.2 The concentration of antifreeze solutions shall be limited to the minimum necessary for the anticipated minimum temperature.

10. Delete 8.3.3.2.4, 8.3.3.2.5 and Table 8.3.3.2.5.

11. Renumber 8.3.3.2.6 as 8.3.3.2.3 and renumber A.8.3.3.2.6 as A.8.3.3.2.3. Also renumber Figure A.8.3.3.2.6 as Figure A.8.3.3.2.3.

8.3.3.2.3* An antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be installed.

A.8.3.3.2.3 Beyond certain limits, an increased proportion of antifreeze does not lower the freezing point of the solution (see Figure A.8.3.3.2.3). Glycerine, diethylene glycol, ethylene glycol, and propylene glycol never should be used without mixing with water in the proper proportions, because these materials tend to thicken near 32ºF (0ºC).

12. Renumber 8.3.3.2.7 as 8.3.3.2.4 and revise to read as follows:

8.3.3.2.4 The specific gravity of the antifreeze shall be checked by a hydrometer with a scale having 0.002 subdivisions in accordance with Figure 8.3.3.2.4(a) and 8.3.3.2.4(b).

13. Renumber Figure 8.3.3.2.3(a) as Figure 8.3.3.2.4(a) and delete the 50% curve.

14. Renumber Figure 8.3.3.2.3(b) as Figure 8.3.3.2.4(b) and delete the 60% and 70% curves.

Issue Date: March 1, 2011

Effective Date: March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
Tentative Interim Amendment

NFPA 13R
Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height
2010 Edition

Reference: 4.7 and 5.4.3
TIA 10-2
(SC 11-3-5/TIA Log #1013)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Delete Section 4.7, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010.
2. Delete new 5.4.3, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010.
3. Revise 5.4.4 to 5.4.3, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010 to read as follows:

5.4.3 Where antifreeze systems, dry pipe systems, and preaction systems are installed, they shall be installed in accordance with NFPA 13.

Issue Date: March 1, 2011
Effective Date: March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)

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NATIONAL FIRE PROTECTION ASSOCIATION
The Standards Council voted to issue TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, which, for new installations, prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R sprinkler systems. In addition, the Council directed that the responsible technical committees conduct further activities as set forth in the decision.

At its meeting of August 3-5, 2010, the Standards Council considered six proposed Tentative Interim Amendments (TIAs), together with related appeals, regarding antifreeze in new residential fire sprinkler installations. Two TIAs were submitted on each of the following documents: NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, and NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height. Of the TIAs, one group of three (TIAs 1000, 995, and 994) sought collectively to prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “No Antifreeze” TIAs). The other group of three (TIAs 996, 997, and 998) sought collectively to prohibit the use of antifreeze solutions in excess of 50% by volume within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “50% Antifreeze” TIAs). These latter TIAs permitted only the use of factory premixed antifreeze solutions.

The six proposed TIAs were balloted through the responsible Technical Committees – the Technical Committee on Sprinkler System Installation Criteria for NFPA 13, and the Technical Committee on Residential Sprinklers for NFPA 13D and NFPA 13R – as well as the Technical Correlating Committee on Automatic Sprinkler Systems (the TCC). Balloting was completed in accordance with the NFPA Regulations Governing Committee Projects, but, as detailed further in this decision, the ballot results are of limited significance because of new technical data and information that has recently become available. The TIAs, ballot results, and several related appeals have nevertheless been forwarded to the Council for consideration. In this unusual and compelling situation, in which the status quo in the existing sprinkler documents is no longer tenable, and in which circumstances require emergency action, the Council has voted to issue three TIAs, the effect of which, pending further technical committee consideration, will be to prohibit the use of antifreeze within the dwelling unit portions of sprinkler systems.
BACKGROUND

Antifreeze solutions have long been used in sprinkler systems to protect piping in unheated areas subject to freezing temperatures. Since at least 1940, NFPA standards have included guidance on the use of antifreeze solutions in sprinkler systems. The events that led to the development of the proposed TIAs to limit or prohibit the use of antifreeze solutions in residential sprinkler applications began when the NFPA became aware of a fire incident in Truckee, California, which took place in August of 2009. Emerging information concerning this incident raised concern surrounding the combustibility of antifreeze solutions in residential sprinkler systems. The incident reportedly involved a grease fire in a kitchen where a sprinkler system with a reportedly high - possibly in excess of 70% - concentration of antifreeze deployed. The fire resulted in a single fatality and serious injury to another person, and the possibility was raised that the antifreeze solution discharging from the sprinkler intensified the fire and resulting harm.

In response to these reports, several activities were initiated within the NFPA and the NFPA-affiliated Fire Protection Research Foundation (the Research Foundation). These activities and especially the resulting reports of the Research Foundation will be described here only in brief, and the reader is urged to consult the Research Foundation reports available at www.nfpa.org/antifreeze for the presentation of the available research and analysis. With this caveat, it suffices to say, in outline, that the NFPA, in response to reports of the Truckee incident, commissioned the Research Foundation to conduct a literature review and develop a research plan on antifreeze solutions and residential fire sprinkler systems. A report on this project was published by the Research Foundation as "Literature Review and Research Plan Antifreeze Solutions in Home Fire Sprinkler Systems," (prepared for the Fire Protection Research Foundation by Code Consultants, Inc., May 28, 2010) (the First Research Foundation Report). Meetings of the NFPA Technical Correlating Committee on Sprinkler Systems (the TCC) were also convened to review available information. During this period, Underwriters Laboratories (UL) conducted a series of tests in an effort to begin exploring the effect of antifreeze solutions in certain residential sprinkler configurations (the Phase I tests). The Phase I tests were not conducted as part of the Research Foundation activities, but several of the tests were witnessed by researchers working on behalf of the Research Foundation and are summarized in the First Research Foundation Report. The results of these Phase I tests were also presented at a meeting of the TCC. The results of these limited Phase I tests could not provide answers to all questions concerning the safe use of antifreeze solutions in residential sprinkler systems. They did point to serious concerns with the use of higher concentrations of antifreeze and were inconclusive as to the safety of antifreeze in lower concentrations of 50% by volume or less.

With the Phase I tests, the First Research Foundation Report and other available information, two sets of competing TIAs on antifreeze in residential sprinkler systems were developed and submitted by several parties. As summarized more fully above, the three No Antifreeze TIAs, prohibited the use of antifreeze solutions and the 50% Antifreeze TIAs prohibited the use of antifreeze solutions in excess of 50% by volume and required that only factory premixed solutions be used. The TIAs were submitted to the ballot of the responsible technical committees and the TCC. Five of the TIAs failed letter ballot of the technical committees. The No Antifreeze TIAs showed considerable support, including one TIA which failed by only a single vote. One of the TIAs, the 50% Antifreeze TIA on NFPA 13 did pass ballot. Unlike the balloting on the TIAs for NFPA 13D and NFPA 13R, however, the 50% Antifreeze TIA on NFPA 13 was balloted separately from the No Antifreeze option for NFPA 13, and it is not clear what effect the sequencing of the balloting on NFPA 13 may have had on the outcome.

The confusing and inconclusive ballot results may have stemmed from the limited nature of the data then available to the technical committees. The Council, however, need not undertake to
analyze these TIA results in any depth because events have largely superseded them. Specifically, the First Research Foundation Report had concluded that "the existing research as well as the recent near-term [Phase I] testing conducted by UL indicate the urgent need for further research into the effectiveness of currently permitted antifreeze solutions." This conclusion led to the development of a Phase II test plan to investigate in greater depth the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. With great rapidity, the Research Foundation mounted a project to fund and conduct the Phase II testing, with UL and Code Consultants, Inc. under contract to do the testing and to develop a report. However, even under the aggressive testing schedule, the test results did not become available until after the close of balloting on the TIAs. Indeed, the Phase II tests were completed just prior to the commencement of the Standards Council's August meeting and have now been published as “Interim Report: Phase II Research Antifreeze Solutions in Home Fire Sprinkler Systems, (Prepared for the Fire Protection Research Foundation by Code Consultants, Inc., August 11, 2010) (www.nfpa.org/antifreeze) (the Second Research Foundation Report).

At the Standards Council meeting, Steve Wolin, of Code Consultants, Inc., presented the Research Foundation reports, including the results of the Phase I and II tests. A hearing then proceeded to consider appeals and arguments as to what course of action the Council should pursue with respect to the TIAs. Rather than focus on the various arguments presented on the TIAs, the Council for purposes of this decision, focuses on some undisputed conclusions of the Phase II testing, namely that the existing provisions in NFPA 13, NFPA 13R and NFPA 13D, relating to antifreeze are no longer supportable as written. Specifically, current standards recommend the use of the antifreeze solutions, depending on the chemical being used and level of freeze protection being sought, to exceed 50% concentration, by volume, up to, in some cases, as much as 70%. See, e.g., NFPA 13, Table 7.6.2.2. The conclusions of the Research Foundation report, however, were clear this was no longer acceptable. Specifically, the new research from the Phase II testing clearly indicates that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in residential sprinkler systems, and the fire size increased (to some extent) for all the antifreeze solutions tested under certain sprinkler discharge and fire test conditions. Moreover, although these concentrations met UL 1626 fire control criteria and exhibited similar performance to that of water alone, consideration must also be given to adding appropriate safety factors for concentrations of these antifreeze solutions in the relevant standards. See Second Research Foundation Report at Executive Summary, pp. 1-2.

Given these conclusions, the Council must now determine how to proceed. At the hearing to consider the TIAs, several alternatives were suggested and advocated to varying degrees, including: take no action and refer the matter back to the responsible technical committees to review the new technical data from the Phase II testing and consider further appropriate action; issue the 50% Antifreeze TIAs; issue the No Antifreeze TIAs; or issue modified TIAs taking into account the test results reported by the Research Foundation.

In normal circumstances, the Council might well have delayed taking any action in order to give time to the responsible technical committees to review and take action based on the technical issues and new data presented by the Research Foundation reports. It is clear, however, from the discussion at the hearing, and from the complicated nature of the technical information that will need to be reviewed that consideration by the technical committees will require some time. Given the serious nature of the safety concerns related to the current concentrations of antifreeze permitted in existing NFPA standards, the Council believes that immediate action needs to be taken.
As to the actions that have been proposed, issuing TIAs that would merely limit antifreeze solutions to 50% by volume is not an adequate step. The Phase II test results showed that a 50% by volume limitation for propylene glycol is not appropriate, and, depending on what safety factors may be needed, may not be appropriate for glycerin either. The 50% Antifreeze TIAs, moreover, would allow 50% solutions of other antifreeze compounds including diethylene glycol and ethylene glycol, which have not been tested and may well require different limits. Given the circumstances, the Council does not believe it would be appropriate for the Council to issue the 50% Antifreeze TIAs.

Nor is it appropriate for the Council itself to craft and issue new TIAs that fully consider and address the technical issues raised by the Research Foundation data and other information now available. Crafting new TIAs is the province of the technical committees. In the interim, however, emergency action needs to be taken. This is not in dispute as the balloting on all the TIAs confirmed the emergency nature of addressing the existing antifreeze provisions concerning residential applications.

Considering the entire record before it, the Council has concluded that the most prudent course of action at this time must be the most conservative approach to assuring safety in new residential sprinkler installations. That course of action is to prohibit the use of antifreeze in new residential sprinkler systems unless and until the responsible technical committees, after due consideration and any correlation by the TCC, reach consensus on a different approach. Accordingly, the Council has voted to issue the three TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, that prohibit the use of antifreeze solutions in new residential sprinkler applications.

In reaching this decision, the Council wishes to make several points. First, the Council's action follows on previous action already taken by the NFPA. On July 6, 2010, the NFPA, separate from its standards development process, and acting in its role as a safety advocate, issued a Safety Alert responding to developing concerns about the use of antifreeze solutions in residential applications. The Safety Alert urged that, until further information was available, new residential sprinkler systems should be designed and installed so as not to require the use of antifreeze solutions. The TIAs now being issued merely extend this recommendation, pending any further consideration and action by the responsible technical committees.

Second, it should be noted that for 13R and 13D residential systems, sprinklers are not required to be installed in unheated areas. At any rate, the use of antifreeze should be avoidable in most if not all residential installations through alternative design approaches including the use of insulation and other means.

Third, the Council wishes to emphasize that in issuing the TIAs, it is not undertaking to make any final technical determination about the correct course of action that may eventually emerge. The technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus based technical committees to determine, and the same should be true in this case. The Council’s action is an emergency action only, and is not intended to prejudge the merits of any further revisions that the responsible technical committees may propose. As to the technical committees’ further consideration of the technical issues, the record suggests that the Research Foundation reports and other information now available will require careful and considered review. This, of course, may take some time, but it is also possible that the technical committees may be able to act quickly to bring new recommendations to the Council. The Council urges the committees to address this matter with reasonable speed and provide clear technical substantiation for any further actions that are proposed. Should the committees do so...
prior to the Council's next scheduled meeting, the Council will make every effort to expedite its consideration of the matter through a special meeting or letter ballot.

The Council wishes to address two additional important matters beyond the scope of the present TIAs. First, the TIAs that were presented to the Council all involve standards that address the design and installation of new sprinkler systems. The important question of what should be done to address antifreeze in existing residential sprinkler systems is, therefore, not addressed by these TIAs. Fortunately, the NFPA in its July 6, 2010 Safety Alert has addressed existing systems. Specifically, the Safety Alert stresses that fire sprinklers are extremely effective protection devices, significantly reducing deaths, injuries and property loss from fire. It urges that these systems should not be disconnected and it recommends that the following actions be taken:

- If you have, or are responsible for, a residential occupancy with a fire sprinkler system, contact a sprinkler contractor to check and see if there is antifreeze solution in the system.

- If there is antifreeze solution in the system, as an interim measure, drain the system and replace it with water only. Problems associated with freezing of sprinkler pipes can be mitigated by alternative measures such as insulation. NFPA hopes to provide further guidance based on additional testing before the winter freezing months.

These recommendations and any updates that the NFPA may provide as a result of the Phase II testing (see www.nfpa.org/antifreeze for any updates as they may become available) provide important guidance on the handling of antifreeze in existing residential sprinkler systems. The responsible technical committees within the NFPA consensus codes and standards development process, however, should now review where and how relevant NFPA standards might be made to address antifreeze in existing systems. Relevant committees, including the Technical Committee on Sprinkler System Installation Criteria, the Technical Committee on Residential Sprinkler Systems, the Technical Correlating Committee on Automatic Sprinkler Systems, and the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems, should consider this question in a coordinated manner and report back to the Council no later than its October 2010 meeting with any proposed actions or recommendations.

Finally, the actions taken in this decision do not address antifreeze in non-residential commercial applications. As the Research Foundation reports suggests, commercial sprinklers and occupancies present quite different characteristics than residential sprinklers and occupancies and, as the First Research Foundation Report suggests, any analysis of antifreeze in sprinkler systems is highly dependent on the specific characteristics of the sprinkler design and setting. The current activities, driven by clear concerns identified in residential sprinkler systems, have been a necessary response to an emerging problem. Further research will likely be necessary to better understand and address the use of antifreeze in various non-residential commercial settings. The role of the relevant committees in considering further standards development activities in this area and in recommending needed research is clear, and the Council is, therefore, requesting that they begin to review and consider the use of antifreeze in non-residential contexts and report back to the Council by its October 2010 meeting with any proposed actions or recommendations.

In conclusion, the Council wishes stress the importance of fire sprinklers in safeguarding lives and property. The home in particular is the place where most fire fatalities occur, and when home sprinklers are present, the risk of dying in a home fire decreases by 83%. It is hoped that the actions of the Standards Council, the valuable contributions of the NFPA and the Research Foundation, (including the project contractors, technical panel and sponsors), and the continuing
activities of the sprinkler related NFPA technical committees will all combine to help ensure the continued effectiveness and wide use of these important safety devices.

Council Member Roland Huggins recused himself during the hearings, deliberations and vote on the issue. Council Members Shane Clary and Ralph Gerdes wished to be recorded as voting negatively.
Tentative Interim Amendment

NFPA 13
Standard for the Installation of Sprinkler Systems

2010 Edition

Reference: 7.6.1
TIA 10-1
(SC 10-8-16/TIA Log #1000)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13, Standard for the Installation of Sprinkler Systems, 2010 edition. The TIA was processed by the Technical Committee on Sprinkler System Installation Criteria and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new section 7.6.1 as follows:

7.6.1 Dwelling Units. Antifreeze shall not be permitted to be used within the dwelling unit portions of sprinkler systems.

2. Renumber the remainder of the section accordingly.

Issue Date: August 5, 2010
Effective Date: August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)

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NATIONAL FIRE PROTECTION ASSOCIATION
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Delete 3.3.9.1 and renumber remainder of subsection 3.3.9.
2. Delete entire subsection 4.1.4, Antifreeze Systems.
3. Revise 5.2.7 to read as follows:
   “Joints for the connection of copper tube for wet type systems shall be soldered joints or be brazed.” (delete the words “and antifreeze systems”).
4. Delete Item (2) of subsection 8.3.2 and renumber (3) as (2).
5. Revise section 8.3.3.1 to read:
   8.3.3.1 Antifreeze shall not be permitted in sprinkler systems.
6. Delete A.8.3.3.1.
7. Delete all subsections and accompanying Annex A paragraphs commencing with 8.3.3.2 and ending with 8.3.3.5.

Issue Date: August 5, 2010
Effective Date: August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
Tentative Interim Amendment

NFPA 13R
Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

2010 Edition

Reference: 4.7 and 5.4.3
TIA 10-1
(SC 10-8-19/TIA Log #995)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add new sections as follows:

4.7 Antifreeze Systems. Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

5.4.3 Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

2. Renumber 5.4.3 as 5.4.4.

Issue Date: August 5, 2010
Effective Date: August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
March 14, 2011

Mr. Russell P. Fleming
National Fire Sprinkler Association, Inc.
40 Jon Barrett Road
Patterson, NY  12563

Dear Mr. Fleming:

I am pleased to notify you that the Standards Council, at its meeting on March 1, 2011, voted to issue the TIA on NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2011 edition, with an effective date of March 21, 2011.

NFPA will be publishing the Tentative Interim Amendment in the April 2011 issue of NFPA News and it will be included in any further distribution of the document. I have enclosed a copy of the TIA.

Very truly yours,

Linda Fuller
Manager, Codes and Standards Administration

LF/nmw

Enclosure: [TIA 11-1 (SC-11-3-6 Log #1014)]

cc:  D. Berry, M. Brodoff, L. Fuller, M. Klaus, J. Goyette
    Members, TC on Foam-Water Sprinklers (AUT-FOW)
    Members, TC on Hanging and Bracing of Water-Based Fire Protection Systems (AUT-HBS)
    Members, TC on Private Water Supply Piping Systems (AUT-PRI)
    Members, TC on Residential Sprinkler Systems (AUT-RSS)
    Members, TC on Sprinkler System Discharge Criteria (AUT-SSD)
    Members, TC on Sprinkler System Installation Criteria (AUT-SSI)
    Members, TCC on Automatic Sprinkler System (AUT-AAC)
    Members, TC on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)
    Members, NFPA Standards Council (AAD-AAA)
    Individuals Providing Public Comment and Appeal Commentary
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2011 edition. The TIA was processed by the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new definition as 3.6.4.1.1 to read as follows:

3.6.4.1.1 Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared by the manufacturer at a factory with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

2. Revise 5.3.4 to read as follows:

5.3.4* Antifreeze Systems. Annually, before the onset of freezing weather, the antifreeze solution shall be tested using the following procedure:

(1) Using installation records, maintenance records, information from the owner, chemical tests, or other reliable sources of information, the type of antifreeze in the system shall be determined.

   a) If the type of antifreeze is found to be a type that is no longer permitted, the system shall be drained completely and replaced with an acceptable solution.

   b) If the type of antifreeze cannot be reliably determined, then the system shall be drained completely and replaced with an acceptable solution.

(2) If the antifreeze is not replaced in accordance with step 1, test samples shall be taken at the top of each system and at the bottom of each system.

   a) If the most remote portion of the system is not near the top or the bottom of the system, an additional sample shall be taken at the most remote portion.

   b) If the connection to the water supply piping is not near the top or the bottom of the system, an additional sample shall be taken at the connection to the water supply.

(3) The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.
(4) If any of the samples exhibits a concentration in excess of what is permitted by NFPA 25, the system shall be emptied and refilled with a new acceptable solution. If a concentration greater than what is currently permitted by NFPA 25 was necessary to keep the fluid from freezing, alternate methods of preventing the pipe from freezing shall be employed.

(5) If any of the samples exhibits a concentration lower than what is necessary to keep the fluid from freezing, the system shall be emptied and refilled with a new acceptable solution.

5.3.4.1 The use of antifreeze solutions shall be in conformity with state and local health regulations.

5.3.4.1.1* Listed CPVC sprinkler pipe and fittings shall be protected from freezing with glycerin only. The use of diethylene, ethylene, or propylene glycols shall be specifically prohibited.

5.3.4.2* Antifreeze solutions shall comply with one of the following:

(1) The concentration of a glycerin solution measured in an existing system shall be limited to 50% by volume.

(2) Newly introduced solutions shall be factory premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume.

(3) The concentration of a propylene glycol solution measured in an existing system shall be limited to 40% by volume.

(4) Newly introduced solutions shall be factory premixed antifreeze solutions of propylene glycol (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 38% by volume.

(5) Other solutions listed specifically for use in fire protection systems.

5.3.4.3 The antifreeze solution shall be tested at its most remote portion and where it interfaces with the wet pipe system.

5.3.4.4 Where antifreeze systems have a capacity larger than 150 gal (568 L), tests at one additional point for every 100 gal (379 L) shall be made.

5.3.4.4.1 If the results indicate an incorrect freeze point at any point in the system, the system shall be drained and refilled with new premixed antifreeze.

5.3.4.4.2 For premixed solutions, the manufacturer’s instructions shall be permitted to be used with regard to the number of test points and refill procedure.

4. Remove Table 5.3.4.1(a) and 5.3.4.1(b) and add Table 5.3.4.1 as follows:

**Table 5.3.4.1- Properties of Glycerin and Propylene Glycol**

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution (% by volume)</th>
<th>Specific Gravity at 77°F (25°C)</th>
<th>Freezing Point °F</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin (C.P. or U.S.P. grade)</td>
<td>0</td>
<td>1.000</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.014</td>
<td>31</td>
<td>-0.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>1.029</td>
<td>28</td>
<td>-2.2</td>
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<td>15</td>
<td>1.043</td>
<td>25</td>
<td>-3.9</td>
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<td></td>
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<td>1.059</td>
<td>20</td>
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<td>1.087</td>
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<td>-12</td>
</tr>
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<td>4</td>
<td>-15.5</td>
</tr>
<tr>
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<td>1.114</td>
<td>-2</td>
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<td></td>
<td>45</td>
<td>1.130</td>
<td>-11</td>
<td>-24</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>1.141</td>
<td>-19</td>
<td>-28</td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>0</td>
<td>1.000</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>------------------</td>
<td>----</td>
<td>-------</td>
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<td>--</td>
</tr>
<tr>
<td>5</td>
<td>1.004</td>
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<td>35</td>
<td>1.028</td>
<td>2</td>
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<td></td>
</tr>
<tr>
<td>40</td>
<td>1.032</td>
<td>-6</td>
<td>-21</td>
<td></td>
</tr>
</tbody>
</table>

5. Revise A.5.3.4 to read as follows:

A.5.3.4 Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portion of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

Two or three times during the freezing season, test samples can be drawn from test valve B as shown in Figure 7.6.2.1(1) of NFPA 13, especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

See Figure A.5.3.4 for expected minimum air temperatures in 48 of the United States and parts of Canada where the lowest one-day mean temperature can be used as one method of determining the minimum reasonable air temperature. In situations where the piping containing the antifreeze solution is protected in some way from exposure to the outside air, higher minimum temperatures can be anticipated.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For drops in excess of 36 in., consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.

When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.
6. Add a new A.5.3.4.2 to read as follows:

**A.5.3.4.2** The use of factory premixed solutions is required because solutions that are not mixed properly have a possibility of separating from the water, allowing the pure concentrate (which is heavier than water) to drop out of solution and collect in drops or low points of the system. Such concentrations are combustible and could present problems during fires. The properties of glycerin are shown in Table A.5.3.4.2.

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution (% by volume)</th>
<th>Specific Gravity at 60°F (15.6°C)</th>
<th>Freezing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin (C.P. or U.S.P. grade)</td>
<td>50 water</td>
<td>1.145</td>
<td>-20.9</td>
</tr>
<tr>
<td>Hydrometer scale 1,000 to 1,200</td>
<td>Propylene glycol</td>
<td>60 water</td>
<td>1.034</td>
</tr>
</tbody>
</table>

C.P.: chemically pure; U.S.P.: United States Pharmacopoeia 96.5%.

**Issue Date:** March 1, 2011

**Effective Date:** March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
TO: Richard Bielen

FROM: Linda Fuller

DATE: November 3, 2010

SUBJECT: Status Report re: Relevant NFPA Standards to Address Antifreeze in both New and Existing Systems

I am transmitting to you herewith the following action of the Standards Council (October 19-20, 2010):

The Council heard a status report from NFPA Staff on behalf of the Technical Correlating Committee on Automatic Sprinkler Systems (TCC), the Technical Committee (TC) on Sprinkler System Installation Criteria, the TC on Residential Sprinkler Systems, and the TC on Inspection, Testing, and Maintenance of Water-Based Systems responsible for NFPA 25. The report provided the progress to date about how the relevant NFPA standards could address antifreeze in both new and existing systems. The report indicated that the TCC and TCs have reviewed the Fire Protection Research Foundation test reports and have begun work on potential TIAs for NFPA 13, 13R, 13D and 25. The Council acknowledged the ongoing work of the Sprinkler Project. Further, the Council notes that the report has identified some potential future research needs. The Council directs NFPA Staff to forward this information to the Fire Protection Research Foundation for its consideration in determining the feasibility and scope of future research projects that it might undertake.

c: M. Klaus, C. Grant, K. Almand
Technical Correlating Committee on Automatic Sprinkler Systems (AUT-AAC)
Technical Committee on Sprinkler System Installation Criteria (AUT-SSI)
Technical Committee on Residential Sprinkler Systems (AUT-RSS)
Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)

10-10-21
Antifreeze Solutions in Home Fire Sprinkler Systems

Phase II Research Final Report

Prepared by:
Code Consultants, Inc.
FOREWORD

NFPA 13, *Standard for the Installation of Sprinkler Systems*, has included guidance on the use of antifreeze solutions in fire sprinkler systems since the 1940 edition. Recent fire incidents, analysis of available literature, and preliminary testing have identified concerns with the use of certain antifreeze solutions. Under certain conditions, solutions of glycerin and propylene glycol antifreeze have been found to ignite when discharged from automatic sprinkler systems. A literature review, preliminary testing, and a long term research plan were developed as part of Phase I of this project. This Final Report includes the results of a comprehensive test program (also outlined in the Interim Report on the project) on a range of propylene glycol and glycerin antifreeze solutions challenged in a range of fire scenarios, as well as additional analysis and recommendations for further study.

The content, opinions and conclusions contained in this report are solely those of the author.
Project Technical Panel

Home Fire Sprinklers and Antifreeze Solutions

Phase II

Magnus Arvidson  Swedish Testing and Research Center
Elizabeth Buc   Fire and Materials LLC
Scott Futrell   Futrell Fire Design and Consult
Tonya Hoover   CAL FIRE – Office of the State Fire Marshal
Garner Palenske  Schirmer Engineering
Maurice Pilette Mechanical Designs Inc (chair of NFPA 13D)
Noah Ryder   Packer Engineering
Joe Senecal Kidde Fenwal
Pete Willse   XL Insurance
Jim Lake   NFPA Staff Liaison

Contractors
Steve Wolin Code Consultants, Inc.
Kerry Bell   Underwriters Laboratories Inc.

Sponsor Representatives
Chris Dubay   NFPA
James Golinveaux Tyco Fire Suppression and Building Products
Scott Franson The Viking Corporation
Russ Fleming   NFSA
Roland Huggins AFSA
Tom Multer   Reliable Automatic Fire Sprinkler Co.
Tom Wancho and Ken Swantek Victaulic
Phase II Research
Antifreeze Solutions in Home Fire Sprinkler Systems

Prepared for:
The Fire Protection Research Foundation
1 Batterymarch Park
Quincy, MA 02169

Prepared by:
CODE CONSULTANTS, INC.
1804 Borman Circle Drive
Saint Louis, MO 63146

CCI Project No. 100138.04.001

December 3, 2010

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Executive Summary

NFPA 13, Standard for the Installation of Sprinkler Systems, has included guidance on the use of antifreeze solutions in fire sprinkler systems since the 1940 edition. [1] Antifreeze solutions may be used in fire sprinkler systems where the piping system, or portions of the piping system, may be subject to freezing temperatures. [2] Antifreeze solutions permitted for use in sprinkler systems connected to potable water supplies include propylene glycol and glycerin.

Recent fire incidents, analysis of available literature, and preliminary testing have identified concerns with the use of certain antifreeze solutions. Under certain conditions, solutions of glycerin and propylene glycol antifreeze have been found to ignite when discharged from automatic sprinkler systems. A literature review, preliminary testing, and a long term research plan were developed as part of Phase I of this project. This Report outlines the results of Phase II of the project, which includes further testing of propylene glycol and glycerin antifreeze solutions for a range of concentrations and operating conditions. The testing and analysis were limited to antifreeze solutions discharged through residential sprinklers and did not investigate other types of sprinklers.

A test plan was developed for Phase II to investigate the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. Testing was conducted in two parts. Scope A consisted of fire tests using six (6) models of sprinklers at elevations of 8 ft and 20 ft to investigate the potential for large-scale ignition of antifreeze sprays at pressures ranging from 10 psi to 150 psi. Scope B consisted of room fire tests, similar to UL 1626, that were designed to investigate the effective of sprinklers discharging antifreeze solutions and their ability to maintain tenable conditions.

Results of the Scope A testing indicate that concentrations of propylene glycol exceeding 40% by volume and concentrations of glycerin exceeding 50% by volume have the potential to ignite when discharged through residential sprinklers. The potential for ignition depends on several factors including the ignition source, sprinkler model, sprinkler elevation, discharge pressure, and the location of the sprinkler with respect to the ignition source. Ignition of antifreeze spray increased the measured heat release rate in certain tests with 50% propylene glycol and 55% glycerin by more than 300%. For certain test conditions, the increase in heat release rate resulting from the application of 55% glycerin solution exceeded the increase in heat release rate from the application of 50% glycerin solution by a factor of 10. A similar level of sensitivity was observed between 40% and 50% propylene glycol solutions, but not between 40% and 45% propylene glycol solutions.
The results of the Scope B testing indicated that concentrations of propylene glycol not exceeding 40% by volume and concentrations of glycerin not exceeding 50% by volume have similar performance to water as compared to the UL 1626 fire control criteria. Both the 40% propylene glycol and 50% glycerin solutions met the UL 1626 fire control criteria and demonstrated similar performance to that of water alone throughout the series of tests.

The results of this research suggest that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in home fire sprinkler systems. Consideration should be given to an appropriate safety factor for concentrations of these antifreeze solutions that are permitted by future editions of NFPA 13, as well as warnings and limitations outlined in antifreeze product literature.

Based on the flammability properties outlined in Table 4, the use of solutions of diethylene glycol and ethylene glycol in home fire sprinkler systems should also be limited unless testing is conducted to establish that they are appropriate for use in home fire sprinkler systems. The results of this analysis are limited to residential sprinklers; the flammability of antifreeze solutions discharged through other types of sprinklers has not been investigated.

Recommendations are provided for further research in the following areas:

- Investigate the use of Antifreeze Solutions in Sprinkler Systems with Non-Residential Sprinklers
- Characterize Droplet Size Distributions from Sprinklers
- Develop a Small or Medium Scale Screening Test of Antifreeze Solutions
- Develop a Listing Standard for Solutions introduced into Sprinkler Systems
I. Introduction

Recent fire incidents raised questions regarding the effectiveness of antifreeze sprinkler systems in controlling residential fire conditions. As a result, the Fire Protection Research Foundation retained Code Consultants, Inc. (CCI) to perform a literature search and develop a research plan to investigate the impact of antifreeze solutions on the effectiveness of home fire sprinkler systems. [3] The literature review included the following subjects:

1. Antifreeze sprinkler system requirements
2. Mixing and separation of antifreeze compounds commonly used in sprinkler systems
3. Flammability of antifreeze solutions commonly used in sprinkler systems
4. Factors influencing the flammability of liquids, such as dispersion in droplets
5. Characterization of residential sprinkler sprays
6. Factors influencing the potential for flash fires or explosions from liquid sprays
7. Existing fire test data on the effectiveness of antifreeze solutions at controlling fire conditions
8. Fire incident reports involving antifreeze sprinkler systems

A research plan was developed to supplement the literature review in areas where existing information was limited. In addition, CCI observed a series of preliminary fire tests (Phase I) conducted by Underwriters Laboratories, Inc. (UL) to investigate the effectiveness of antifreeze sprinkler systems in controlling certain home fire scenarios. A summary of data from the preliminary testing was also provided by UL. [4] CCI provided suggestions for further research to provide a more complete analysis of currently permitted antifreeze solutions as well as to investigate other antifreeze solutions that could be used in sprinkler systems.

The Phase I testing identified the need for additional research regarding the potential for antifreeze solutions to create a large-scale ignition of spray when discharged through automatic sprinklers onto a fire. Additional research was also needed to further investigate the impact of antifreeze solutions on a sprinkler system’s ability to control a fire condition and maintain tenable conditions. As such, a Phase II test plan was created based on the Phase I information.
The Phase II test plan was separated into two scopes (A and B) which were intended to investigate additional research identified in Phase I. Scope A tested antifreeze solutions for the potential to create a large-scale ignition of the spray when discharged through sprinklers onto a fire. Scope B tested antifreeze solutions for its impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.
II. Background

Recent fire tests have indicated the potential for ignition of certain antifreeze solutions discharged from automatic sprinkler systems. [4] The potential for ignition of an antifreeze spray and the influence of antifreeze solutions on sprinkler effectiveness involves several complex and contemporary research topics. This section provides a basic summary of relevant background information; a more complete discussion can be found in the report from Phase I of this project. [3]

A. Antifreeze Solutions

NFPA 13 [5], 13D [6], and 13R [7] each include substantially similar requirements for antifreeze solutions used in sprinkler systems. Antifreeze solutions of propylene glycol and glycerin with water are each permitted in sprinkler systems connected to potable water supplies. The antifreeze solutions are intended to protect sprinkler piping that passes through areas that could be exposed to freezing temperatures. Freezing point data for propylene glycol and glycerin solutions provided in NFPA 13 is summarized in the following table.

<table>
<thead>
<tr>
<th>Material (C.P. or U.S.P grade)</th>
<th>Solution with Water (by Volume)</th>
<th>Specific Gravity at 60 °F (15.6 °C)</th>
<th>Freezing Point °F</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin</td>
<td>50% glycerin</td>
<td>1.145</td>
<td>-20.9</td>
<td>-29.4</td>
</tr>
<tr>
<td></td>
<td>60% glycerin</td>
<td>1.171</td>
<td>-47.3</td>
<td>-44.1</td>
</tr>
<tr>
<td></td>
<td>70% glycerin</td>
<td>1.197</td>
<td>-22.2</td>
<td>-30.1</td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>40% propylene glycol</td>
<td>1.034</td>
<td>-6</td>
<td>-21.1</td>
</tr>
<tr>
<td></td>
<td>50% propylene glycol</td>
<td>1.041</td>
<td>-26</td>
<td>-32.2</td>
</tr>
<tr>
<td></td>
<td>60% propylene glycol</td>
<td>1.045</td>
<td>-60</td>
<td>-51.1</td>
</tr>
</tbody>
</table>

C.P.: Chemically pure. U.S.P.: United States Pharmacopoeia 96.5%

Table 1: Adapted from NFPA 13 Table 7.6.2.2 Antifreeze Solution to be Used if Potable Water is Connected to Sprinklers

Antifreeze solutions of ethylene glycol and diethylene glycol are also permitted, but only in sprinkler systems that are connected to non-potable water supplies. This research focuses on propylene glycol and glycerin antifreeze solutions, because they are believed to be much more commonly used in home fire sprinkler systems.

Antifreeze solutions of glycerin, diethylene glycol, and ethylene glycol were included in NFPA 13 starting in the Appendix of the 1940 edition, known at the time as National Board of Fire Underwriters Pamphlet No. 13. [1] The 1953 edition of NFPA 13 included requirements for
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December 3, 2010

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antifreeze sprinkler systems in the body of the standard and permitted the use of propylene glycol or calcium chloride solutions as well as glycerin, diethylene glycol, and ethylene glycol. [8] The antifreeze solutions and concentrations permitted by the 1953 edition of NFPA 13 are the same as those permitted by the current (2010) edition of NFPA 13, with the exception that calcium chloride is no longer permitted. [2]

Table 2, below, illustrates the freezing point and the specific gravity values (at 25°C) for a propylene glycol-water mixture in addition to the corresponding percent volume and percent weight of propylene glycol. The difference in percent volume and percent weight of propylene glycol solutions is minimal, because its density is only slightly higher than the density of water.

Table 2: Propylene Glycol Properties

<table>
<thead>
<tr>
<th>% Vol.</th>
<th>% Wt.*</th>
<th>Freezing Point (°F)</th>
<th>Specific Gravity at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>32</td>
<td>1.000</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
<td>26</td>
<td>1.004</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>25</td>
<td>1.008</td>
</tr>
<tr>
<td>15%</td>
<td>15%</td>
<td>22</td>
<td>1.012</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
<td>19</td>
<td>1.016</td>
</tr>
<tr>
<td>25%</td>
<td>25%</td>
<td>15</td>
<td>1.020</td>
</tr>
<tr>
<td>30%</td>
<td>30%</td>
<td>11</td>
<td>1.024</td>
</tr>
<tr>
<td>35%</td>
<td>35%</td>
<td>2</td>
<td>1.028</td>
</tr>
<tr>
<td>40%</td>
<td>40%</td>
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<td>1.032</td>
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<tr>
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<td>45%</td>
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<td>50%</td>
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<td>-45</td>
<td>1.040</td>
</tr>
<tr>
<td>60%</td>
<td>60%</td>
<td>-60</td>
<td>1.041</td>
</tr>
</tbody>
</table>

*% Vol. to % wt. conversion is at 25°C

Similar to Table 2 (above), Table 3 (below) depicts the freezing point and specific gravity values (at 25°C) for a glycerin-water mixture in addition to the corresponding percent volume and percent weight of glycerin. Unlike the propylene glycol properties, the values for percent volume and percent weight vary significantly, because the density of glycerin is approximately 26% higher than the density of water.

Table 3: Glycerin Properties
As illustrated by the v-shaped curve in Figure 1, below, glycerin-water solutions reach their maximum freeze protection at a concentration of approximately 60% glycerin by volume. A glycerin-water solution that contains more than approximately 60% by volume glycerin will provide the same freeze protection as a less concentrated mixture. From a freeze protection standpoint, there is no reason to use a glycerin-water solution that contains more than 60% glycerin by volume.

Table 3: Glycerin Properties [10] (Portions of data are calculated or interpolated)

<table>
<thead>
<tr>
<th>% Vol.</th>
<th>% Wt.*</th>
<th>Freezing Point (°F)</th>
<th>Specific Gravity at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>32</td>
<td>1.000</td>
</tr>
<tr>
<td>5%</td>
<td>6%</td>
<td>31</td>
<td>1.014</td>
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<tr>
<td>10%</td>
<td>12%</td>
<td>28</td>
<td>1.029</td>
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<td>15%</td>
<td>18%</td>
<td>25</td>
<td>1.043</td>
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<td>20%</td>
<td>24%</td>
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<td>25%</td>
<td>29%</td>
<td>16</td>
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<td>30%</td>
<td>35%</td>
<td>10</td>
<td>1.087</td>
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<td>35%</td>
<td>40%</td>
<td>4</td>
<td>1.100</td>
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<td>40%</td>
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<td>1.114</td>
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<td>51%</td>
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<td>1.141</td>
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<td>60%</td>
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<td>1.155</td>
</tr>
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<td>65%</td>
<td>-46</td>
<td>1.168</td>
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<td>65%</td>
<td>69%</td>
<td>-40</td>
<td>1.179</td>
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<td>70%</td>
<td>74%</td>
<td>-25</td>
<td>1.193</td>
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<td>75%</td>
<td>79%</td>
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<td>1.207</td>
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<tr>
<td>80%</td>
<td>83%</td>
<td>6</td>
<td>1.217</td>
</tr>
<tr>
<td>85%</td>
<td>87%</td>
<td>19</td>
<td>1.228</td>
</tr>
<tr>
<td>90%</td>
<td>92%</td>
<td>36</td>
<td>1.241</td>
</tr>
<tr>
<td>95%</td>
<td>96%</td>
<td>49</td>
<td>1.252</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td>63</td>
<td>1.262</td>
</tr>
</tbody>
</table>

*% Vol. to % wt. conversion is at 25°C
B. Flammability of Liquids

Liquids have many quantifiable flammability properties that vary depending on the type of liquid and the surrounding environment. The flash point is the temperature at which a liquid must be raised in order to produce sufficient vapors for flash ignition under specified test conditions. The flash point can be measured by one of many standardized test apparatus. Figure 2, below, illustrates an example of a closed-cup tester (ASTM D 93). The tester utilizes a heated stirrer (intended to maintain temperature uniformity) inserted into the test liquid. The test liquid is heated at a rate of approximately 41°F to 43°F per minute. The tester is capable of measuring the flash point of liquids between 174°F and 750°F. [11]
Maintaining a liquid at a temperature below its measured flash point does not guarantee that ignition will be prevented. There are many factors that may influence a liquid's actual flash point. This is because the flash point of a liquid, as measured by test apparatus, is not necessarily the flash point of a liquid in its end-use environment. Liquids with flash point temperatures greater than the temperature of the environment of the liquid may sometimes be ignited by spraying, wicking or other means. Liquids that are mixtures, as opposed to pure substances, may demonstrate a tendency for vaporization of one component and not the other. The flash point of the remaining liquid may be different than that of the mixture when it was originally tested. [11]

At some temperature above a liquid’s flash point temperature, a liquid’s vapor can ignite without the presence of an ignition source. This is known as the autoignition temperature (AIT). There is no known relation between a liquid’s flash point and its AIT. The AIT is primarily determined by a liquid’s reactivity (rate of oxidation) while the flash point is determined by a liquid’s volatility (rate of evaporation). Many factors may affect a liquid’s AIT. Some known factors are the concentration of the vapor given off by the liquid, the shape and size of the container, the rate and duration of heating, and the test method. [11]

Figure 3, below, is an example of a test method used to measure the AIT of liquids (ASTM E 659). In this method, the testing vessel is a glass flask surrounded by an electrically heated oven equipped with several thermocouples. During a test, a 0.1 mL sample of liquid is injected.
into the glass flask and is heated to a constant temperature while being observed for indications of ignition. Once the AIT is observed, both larger and smaller amounts of liquid are analyzed to determine the overall lowest AIT. [11]

![Figure 3: ASTM E 659 Autoignition Test (Setchkin Flask Test)](image)

Flammable substances may also have an upper flammability limit (UFL) and lower flammability limit (LFL). The UFL is the highest concentration (or lowest in the case of LFL) of gas or vapor of the liquid in air capable of producing a flash fire in the presence of an ignition source.

The following table summarizes flammability properties of chemicals permitted for use in antifreeze solutions by NFPA 13.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Flammable Limits in Air (% by volume)</th>
<th>Flash Point (°F)</th>
<th>Autoignition Temperature (°F)</th>
<th>Boiling Point (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propylene Glycol</td>
<td>2.6 / 12.5</td>
<td>210</td>
<td>700</td>
<td>370</td>
</tr>
<tr>
<td>Glycerin</td>
<td>Not Provided / Not Provided</td>
<td>390</td>
<td>698</td>
<td>340</td>
</tr>
<tr>
<td>Diethylene Glycol</td>
<td>Not Provided / Not Provided</td>
<td>255</td>
<td>435</td>
<td>472</td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>3.2 / Not Provided</td>
<td>232</td>
<td>748</td>
<td>387</td>
</tr>
</tbody>
</table>

Table 4: Flammability Properties of Pure Antifreeze Chemicals Permitted by NFPA 13 [12]

A suspension of finely divided droplets of flammable liquid in air can yield a flammable mixture that has many of the characteristics of a flammable gas/air mixture. These droplets have the potential to burn or explode. Researchers have observed that a 10 μm diameter droplet of flammable liquid behaves like a vapor with respect to burning velocity and LFL. Droplets with diameters larger than 40 μm behave differently. [13]
Flame propagation can occur at average concentrations well below the LFL. A flammable mixture can also form at temperatures below the flash point of a combustible liquid when atomized into air. Testing shows that with fine mists and sprays (particles less than 10 μm) the combustible concentration at the lower limit is about the same as that in uniform vapor-air mixtures. However, as the droplet diameter increases, the lower limit appears to decrease. It was observed that coarse droplets tend to fall towards the flame front in an upward propagating flame, and as a result the concentration at the flame front actually approached the value found in lower limit mixtures of fine droplets and vapors. [14]

Mists made up of coarser aerosols are capable of sustaining a flame at considerably lower fuel-air ratios than fine aerosols (vapors). The reason for this lies in the ability of the droplets to move in relation to the ambient air. Mists made up of coarser aerosols prove to be more responsive to acceleration and random movement than that of finer aerosols. As such, coarser aerosols communicate flame more readily. [13]

In the case of water-glycols, flash points will not exist until the excessive water has been removed. Research indicates that a high-temperature environment is required to realize a flash point hazard with the vapors of these fluids at normal pressure conditions. [15]

In pure form, propylene glycol and glycerin are Class IIIB Combustible Liquids. As discussed above, existing research and testing suggests that the combustibility characteristics of antifreeze-water mixtures in droplet form are not completely characterized by standardized test methods for flash point or autoignition temperature. As such, these methods are not a reliable indication of the potential for ignition of a liquid dispersed into droplets. Under certain conditions, atomized antifreeze-water mixtures can combust when sprayed onto an ignition source. Increasing the concentration of the antifreeze in the antifreeze-water solution increases the combustibility of the solution.

Antifreeze solutions of propylene glycol and water have been permitted in sprinkler systems for more than 50 years at concentrations as high as 60% by volume, which is equal to 60% by weight. However, the following disclaimer is included in the MSDS for a premix antifreeze solution specifically intended for sprinkler systems:

*Fire and Explosion Hazards – Heat from fire can generate flammable vapor. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Vapors may travel long distances along the ground before igniting and flashing back to vapor source. Fine sprays/mists may be combustible at temperatures below normal flash point. Aqueous solutions containing less than 95% propylene glycol by weight have no flash point as obtained by standard test methods. However aqueous solutions of propylene glycol greater than 22% by weight, if heated sufficiently, will produce flammable vapors. Always drain and*
flush systems containing propylene glycol with water before welding or other maintenance. [16]

The disclaimer above identifies the potential for vapors of aqueous solutions that contain certain concentrations of propylene glycol to combust. It is important to consider this potential for combustion when dealing with aqueous solutions that contain flammable liquids (e.g. propylene glycol and glycerin). Furthermore, the disclaimer identifies that fine sprays/mists may be combustible at temperatures below their normal flash point.

The discussion above describes the complexity of whether a certain antifreeze solution has the potential to ignite when supplied through automatic sprinkler systems. Existing research indicates that under certain conditions the energy released during a fire condition could increase upon interaction with certain antifreeze-water mixtures currently permitted by NFPA 13, 13D and 13R. [17] [18] Recent testing conducted by UL [4] demonstrates that, under certain conditions, a large-scale sustained ignition is possible from the discharge of certain sprinkler systems containing antifreeze solutions. The intent of the Phase II testing is to more completely investigate the potential for large-scale ignition of flash fires from antifreeze solutions and to investigate the impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.

C. Sprinkler Droplet Sizes and Distributions

Droplet sizes and distributions produced by automatic sprinklers have been studied using a variety of techniques. Measurements of the droplet sizes produced by automatic sprinklers are relatively complex because the droplet size distribution measured is expected to vary with several factors including:

- Position with respect to the sprinkler in three dimensions
- Sprinkler model
- Operating pressure/flow rate
- Liquid supplied to the sprinkler, e.g. water or antifreeze solution
- Surrounding air currents, including fire induced flows

Even with all of the variables above held constant, measurements include a range of droplet sizes and not a single uniform droplet size. Additionally, it is possible for sprinklers operating with identical k-factors and pressures to have different spray patterns. Sprinklers that have identical orifice sizes (k-factor) can have varying geometric parameters such as arms, deflectors or tines. Changes in any of these geometric parameters may substantially alter the droplet size.
and distribution. For example, the figure below illustrates sprinkler discharge from two sprinklers with the same k-factor operating under the same pressure, but with spray distribution patterns that are significantly different.

![Figure 4. Spray distribution from automatic sprinklers. (Courtesy: Prof. André Marshall, University of Maryland)](image)

Many of the existing methods are point measurement techniques that only measure data at a single point. Point measurement techniques are capable of measuring droplet size and velocity and work well for spherical droplets. However, sprinkler droplets are not always spherical.[19] In addition, point measurements must be taken at various locations in the sprinkler flow so that the results are temporally and spatially averaged. This limits measurement accuracy because fire sprinkler sprays are unsymmetrical and unsteady. Certain areas of the spray distribution are denser than others which may cause results to vary based on measurement locations. [19]

Studies of standard orifice, pendent spray fire sprinklers indicate droplet sizes between approximately 200 and 3,000 μm. [19] This approximation agreed with existing research which indicated that droplets larger than approximately 5,500 μm in diameter are unstable and break up into smaller droplets, predominantly in the range of 1,000 to 2,000 μm. [20] Previous research indicates that while a large number of very small drops are present, they comprise a small portion of the total water volume. Data indicates that 98% of the water from standard orifice fire sprinklers is contained in droplets larger than 200 μm in diameter. [19] A study of residential sprinklers measured water droplets ranging from an arithmetic mean of 200 to over
500 μm, depending on location. [21] However, droplets with diameters of less than 100 μm were measured. [21]

D. Phase I Testing

During Phase I of this project a series of preliminary tests were sponsored and conducted by Underwriters Laboratories. Tests were conducted in UL’s large-scale test facility in Northbrook, IL and several of the tests were witnessed by CCI on behalf of the Fire Protection Research Foundation.

Initial tests were conducted with a small ceiling above an elevated pan of heptane using residential pendent sprinklers with nominal k-factors of 3.1 and 4.9 gpm/psi\(^{1/2}\). The tests used premixed solutions of 70% glycerin and 60% propylene glycol with water. The tests indicated the potential for large-scale ignition of a 70% glycerin solution using a 3.1 k-factor sprinkler at an operating pressure of 100 psi. This large-scale ignition resulted in flames surrounding the majority of the sprinkler spray. A similar large-scale ignition did not occur for initial tests with 60% propylene glycol solutions or tests using a 4.9 k-factor sprinkler at an operating pressure of 50 psi.

Further tests were conducted in a three sided room measuring approximately 12 feet by 12 feet with a ceiling height of 8 feet. A single sprinkler with a k-factor of 3.1 was located in the center of the ceiling for each test. The majority of the room tests were conducted using a nominal 12-inch cast-iron pan with cooking oil as the initial fire source. An electric cooktop was used to heat the pan and ignite the cooking oil. One room test was conducted with a pan of heptane as the initial fire instead of the cooking oil. In various tests, the sprinkler was supplied with water only as well as premixed solutions of 70% glycerin, 50% glycerin, and 60% propylene glycol in water. Sprinkler operating pressures of 20, 100, and 150 psi were investigated.

Test results in the room configuration ranged from extinguishment of the fire to large-scale, sustained ignition of the antifreeze solution. Preliminary observations during the tests indicated that the results depend, at a minimum, on a combination of the following factors:

- Location of the initial fire with respect to the sprinkler
- Initial fire source
- Type of sprinkler and operating pressure
- Type and concentration of antifreeze solution
Large-scale, sustained ignition of the 70% glycerin solution supplied at 100 psi occurred when the initial fire was in close proximity to the sprinkler, but the initial fire was controlled using the same concentration of antifreeze at the same operating pressure when the initial fire was located farther from the sprinkler. Large-scale ignition of the 60% propylene glycol solution occurred in the room configuration during a cooking oil fire, but did not occur in the open configuration during a heptane fire. Large-scale ignition of the antifreeze solution did not occur in any of the tests with the 50% glycerin solution.

Preliminary observations during the UL testing indicate the following:

- Large-scale ignition of antifreeze solutions occurred in certain tests for 70% solutions of glycerin and 60% solutions of propylene glycol with water.

- Large-scale ignition of antifreeze solutions of 50% glycerin with water did not occur for any of the tested configurations.

Preliminary observations from the tests highlighted the need for further research into the effectiveness of currently permitted antifreeze solutions and consideration of their suitability for use in sprinkler systems.
III. Phase II Test Plan and Setup

The Phase II testing was intended to further study the potential for contribution of antifreeze solutions to fire conditions. The Phase II test plan was separated into two scopes. Scope A tested antifreeze solutions for the potential to create a large-scale ignition of the spray when discharged through sprinklers onto a fire. Scope B tested antifreeze solutions for their impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.

Tests were conducted with premixed solutions of propylene glycol and glycerin with water obtained from a single commercial distributor. Application of the test results is limited to the solutions tested and not to other formulations of antifreeze solutions that were not tested. Phase II tests were conducted at UL’s fire test facility in Northbrook, IL and a Summary of Fire Test Data was provided by UL in Reference [22].

A. Scope A: Fire Tests for Spray Ignition using Sprinklers

Scope A was developed to investigate the potential for ignition of antifreeze solutions supplied by automatic sprinklers. The tests were designed to use a strong, continuous ignition source to identify whether flammable mixtures of antifreeze were created by the antifreeze spray. The tests used several models of residential sprinklers to investigate their impact of the potential for ignition.

Scope A tests were conducted without an enclosure, other than the walls and roof bounding the laboratory. As discussed in the report from Phase I of this project [3], the difference between a flash fire and an explosion is the degree of confinement of the flash fire. Because an explosion could not occur in this context without a flash fire, the flash fires themselves were used as criteria for the tests without the need to evaluate a resulting, enclosure dependant, explosion. While the test setup was designed to avoid explosions within the laboratory, the confinement of flash fires can produce over-pressurizations or explosions.

The test setup for Scope A is illustrated in Figure 5, below.
Figure 5. Scope A test setup.

The test setup included a long ignition source that was designed to extend radially from the sprinkler location. The long ignition source allowed a single test to investigate the potential for ignition over a range of locations within the spray pattern. The arrangement allowed for multiple sprinkler heights to be tested and data was collected to allow for heat release rate measurements using oxygen consumption calorimetry.

Initial testing was conducted to investigate appropriate ignition sources. Ignition sources investigated included:

- 6" wide and 12" wide rectangular pans of heptane extended radially from the point directly below the sprinkler.
- 4-nozzle heptane spray burners under a metal grate (the metal grate functions as a hot surface to vaporize antifreeze solution).
- Electric range heating elements (also functioning as a hot surface to vaporize antifreeze solutions).
Figure 6, below, illustrates each of the ignition sources investigated as part of Scope A.

![Figure 6. Scope A ignition sources.](image)

The ignition sources are also shown in the photographs below.
The heat release rate of each of the ignition sources, with the exception of the electric range coils, is illustrated in the following graph. The heat release rates were measured using an oxygen consumption calorimeter. Because the electric range coils are heated by electricity and not combustion, the oxygen consumption calorimeter could not measure the heat release rate during that test. The electric range coils were tested based on the high temperature of the coils and not due to their total heat release rate.
The heat release rate of the pan fires increases for several minutes after ignition before reaching a steady heat release rate. For tests with the pan fires sprinkler flow was initiated three minutes after ignition of the pan fire to allow the pan fire to reach a nearly steady heat release rate.

The following graph shows the maximum heat release rate of various household furniture items [23] in comparison with the heat release rate of the heptane spray burner.

Figure 8. Comparison of ignition source heat release rates.
Figure 9. Heat Release Rate of Home Furnishings.

Figure 9, above, shows that the heat release rate of the ignition sources is less than the maximum heat release rates of some common household furniture items. The data above indicates heat release rates measured under the specific conditions tested without the benefit of sprinkler protection. Thus, in a residence protected by automatic sprinklers, the heat release rate at the time of sprinkler activation could be less than the heat release rates illustrated in Figure 9.

An estimate of the heat release rate at the time of sprinkler activation was calculated using the Sprinkler/Detector Response routine in the computer fire model FPETool. [24] The model was originally developed by the National Bureau of Standards, now the National Institute of Standards and Technology, as DETACT-QS. The DETACT-QS model is a basic computer fire model that calculates the temperature and velocity at a sprinkler based on correlations developed by Alpert [25] and combines them with a lumped-capacitance heat transfer model to estimate the time and heat release when sprinkler activation is calculated to occur. The model is designed to large, open spaces and does not account for the effect of the room enclosure on the temperatures at the sprinkler. Thus, for residential scale rooms the model typically over-
predicts the fire size at the time of sprinkler activation. The results below are based on the following parameters:

<table>
<thead>
<tr>
<th>INPUT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>70°F</td>
</tr>
<tr>
<td>Sprinkler activation temperature</td>
<td>155°F</td>
</tr>
<tr>
<td>Response Time Index (RTI)</td>
<td>91 (ft.s)(^{1/2})</td>
</tr>
<tr>
<td>Horizontal Distance from Fire to Sprinkler</td>
<td>10.6 ft</td>
</tr>
<tr>
<td>Fire growth rate</td>
<td>Medium t-squared (growth time of 300 s to reach 1,055 kw)</td>
</tr>
</tbody>
</table>

The following graph shows the calculated heat release rate at the time of sprinkler activation along with the heat release rate of the heptane spray burner fire used for the Scope A tests.

Figure 10. Heat release rate at sprinkler activation based on ceiling height.

The results summarized in Figure 10, above, show that the heat release rate of the ignition source used in the Scope A tests was generally conservative for spaces with ceiling heights of...
less than 20 feet. The calculated heat release rate at the time of sprinkler activation for ceiling heights of less than 20 feet are less than the heat release rate of heptane burner ignition source used in the Scope A tests. The calculated heat release rate for a ceiling height of 20 feet was within approximately 5% of the heat release rate of the heptane burner used in the Scope A tests.

Ignition sources were tested using solutions of 50% propylene glycol and 60% propylene glycol supplied from a residential pendent sprinkler with a k-factor of 3.1. Prior testing indicated that a 60% propylene glycol solution can be ignited by a kitchen grease fire when supplied from a k3.1 sprinkler. Thus, the ignition source selected should be capable of igniting the 60% propylene glycol solution supplied through a k3.1 sprinkler. It was unclear prior to the start of testing whether the 50% propylene glycol solution would be ignited.

The ignition sources selected for the Scope A testing are very unlikely to be extinguished during sprinkler activation. This is unlike most home fire conditions that would be expected to reduce in intensity upon the application of water. Some increase in heat release rate could be expected for the ignition sources, but observations of flash fires or ignition of the spray away from the fire source were considered an immediate failure. The initial testing was also intended to validate the use of a variable sprinkler operating pressure. Varying the sprinkler operating pressure allowed each test to collect data for a range of sprinkler operating pressures. This approach reduced the overall number of tests conducted and helped yield more complete results.

Following the initial testing, a series of tests was conducted to investigate the potential for ignition of select concentrations of antifreeze for the following variables:

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES TESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreeze concentration</td>
<td>• Propylene glycerol</td>
</tr>
<tr>
<td></td>
<td>o 40%, 45%, 50%, 60%</td>
</tr>
<tr>
<td></td>
<td>• Glycerin</td>
</tr>
<tr>
<td></td>
<td>o 50%, 55%</td>
</tr>
<tr>
<td>Antifreeze temperature</td>
<td>• Ambient 80-90°F</td>
</tr>
<tr>
<td></td>
<td>• Elevated 140°F</td>
</tr>
<tr>
<td>Sprinkler height</td>
<td>• 8 ft</td>
</tr>
<tr>
<td></td>
<td>• 20 ft</td>
</tr>
<tr>
<td>Horizontal position of ignition source</td>
<td>Considered through the use of a long ignition source that extended radially from the sprinkler</td>
</tr>
<tr>
<td>Sprinkler operating pressure</td>
<td>10 to 150 psi (varied in 10 psi increments)</td>
</tr>
<tr>
<td>Sprinkler type and nominal k-factor</td>
<td>• Fixed deflector residential pendent (k3.1, k4.9, k7.4)</td>
</tr>
<tr>
<td></td>
<td>• Drop-down deflector (concealed) residential</td>
</tr>
</tbody>
</table>
The majority of the testing was conducted with solutions of 40%, 50%, and 60% propylene glycol as well as 50% glycerin. Select tests of 45% propylene glycol and 55% glycerin were used to evaluate the sensitivity of the results to the antifreeze concentration.

Ceiling heights of 8 ft and 20 ft were used to evaluate a range of residential applications. The 8 ft ceiling height is typical of many residential spaces and the 20 ft ceiling height is intended to account for a tall, double-height space in a residential occupancy. It was theorized prior to the initial testing that the atomization and dispersion of the droplets in the sprinkler spray would behave differently for varying ceiling heights. The initial testing confirmed that the spray distribution reaching the fire sources changes with the height of the sprinkler.

The Phase I testing demonstrated that the position of the ignition source within the sprinkler spray significantly impacted the potential for ignition of the spray. The long ignition source extending radially from below the sprinkler was used to allow a single test to generate data for a range of ignition source locations.

Data was gathered for a wide range of sprinkler operating pressures by varying the operating pressure during each test. The low pressure (10 psi) was intended to capture data near the minimum flow rates that would be permitted for the larger orifice sprinklers in the test plan. The high pressure (150 psi) was intended as a high pressure anticipated for a typical residential occupancy. In some instances the tests were conducted starting at a higher operating pressure greater than 10 psi or were terminated prior to reaching 150 psi based on the data to be collected from that test.

Due to the complex nature of the droplet size and sprinkler spray distribution produced during sprinkler discharge, several different types of sprinklers were selected for the Scope A testing. This approach was used to develop information on how changes in sprinkler geometry (deflector, arms and tines) and orifice size impacted the results.

### B. Scope B: Room Fire Tests of Sprinkler Effectiveness

The Scope B tests were intended to investigate the effectiveness of residential sprinklers using an antifreeze solution compared with water alone. The Scope B tests were not intended to investigate the potential for large-scale ignition of the sprinkler spray.

The Scope B testing is similar to the UL 1626 fire test, with certain additional variables considered as outlined in the table below.
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES TESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreeze solutions</td>
<td>• 50% Glycerin&lt;br&gt;• 40% Propylene glycol (single test)&lt;br&gt;• Water alone</td>
</tr>
<tr>
<td>Ceiling height</td>
<td>• 8 ft</td>
</tr>
<tr>
<td>Sprinkler operating pressure/flow rate</td>
<td>• Minimum permitted flow based on NFPA 13D design criteria&lt;br&gt;  o Pendent: 18 gpm one sprinkler / 13 gpm each for two sprinklers&lt;br&gt;  o Sidewall: 24 gpm one sprinkler / 17 gpm each for two sprinklers&lt;br&gt;• 80psi&lt;br&gt;• 150 psi</td>
</tr>
<tr>
<td>Sprinkler type, temperature rating, and nominal k-factor</td>
<td>• Ordinary temperature fixed deflector residential pendent (k3.1, k4.9)&lt;br&gt;• Ordinary temperature residential sidewall (k4.2)</td>
</tr>
<tr>
<td>Fire Source</td>
<td>• UL 1626 fuel package&lt;br&gt;• Furnished living room (sofa, chair, tables)</td>
</tr>
</tbody>
</table>

The tests are designed to directly compare the performance of sprinkler systems supplied with antifreeze solutions to the performance of sprinkler systems supplied with water alone. The tests measured temperature at several locations within the room to evaluate tenability in accordance with the criteria specified in UL 1626. In addition, the test setup included sprinklers installed within the room that were designed to evaluate whether the fire condition would be expected to overwhelm the sprinkler system. Figure 11, below, illustrates the test setup for Scope B.

For the purposes of the Scope B testing, a ceiling height of 8 ft was used. This ceiling height was intended to represent that of a typical residential dwelling.

Similar to the Scope A tests, Scope B tests included multiple sprinkler operating pressures, but the pressure was not varied during each test. The low flow tests were intended to match the NFPA 13D criteria of 18 gpm for the activation of the first sprinkler and 13 gpm per sprinkler for the activation of two sprinklers. For the sidewall sprinklers a minimum flow rate of 24 gpm for the first sprinkler and 17 gpm per sprinkler for the activation of two sprinklers was required based on the listing of the sprinkler. Higher sprinkler operating pressures of 80 and 150 psi were also tested to evaluate their impact on the results.

A range of sprinkler types and models were tested in Scope B. Two sprinklers were located within the test room in accordance with UL 1626 to control the fire condition and a third sprinkler was located near the doorway to the enclosure, as illustrated in Figure 11, below, to investigate
the potential for activation of sprinklers away from the area of fire origin. The test enclosure measured 32 ft by 16 ft by 8 ft high, which was within the listed spacing of the k4.9 and sidewall sprinklers. The enclosure was somewhat larger than the 14 ft by 14 ft listed spacing of the k3.1 sprinkler, so the larger enclosure provided a severe test of the antifreeze solution.

The tests primarily used the fuel package specified in UL 1626 that consists of a wood crib ignited by a pan of heptane that is positioned adjacent to two simulated furniture ends. The potential for fire spread is evaluated by locating the fuel package in the corner of the room with walls covered with wood paneling. In addition to tests with the UL 1626 fuel package, a test was also conducted with a fuel package typical of a residential living room. The fuel package consisted of a sofa, chair, end table, and coffee table, along with a trash can filled with paper.

Failure criterion for the Scope B testing was based on the UL 1626 fire control criteria. Based on these criteria, residential sprinklers installed in a fire test enclosure with an 8-ft ceiling are required to control a fire for 10 minutes with the following limits:

1. The maximum gas or air temperature adjacent to the sprinkler 3 inches below the ceiling at two locations within the room must not exceed 600°F.
2. The maximum temperature 5 feet 3 inches above the floor at a specified location within the room must be less than 200°F during the entire test. This temperature must not exceed 130°F for more than a 2 minute period.

3. The maximum temperature ¼ inch behind the finished surface of the ceiling material directly above the test fire must not exceed 500°F.

4. No more than two residential sprinklers in the test enclosure can operate.

Any variation from the limits outlined above was considered an immediate failure. [26]
IV. Phase II Test Results

A. Scope A – Spray Ignition

Initial tests were conducted to investigate potential ignition sources. The tests used solutions of 50% and 60% propylene glycol to investigate the effectiveness of each ignition source in igniting antifreeze sprays. The following graph compares the increase in heat release rate due to ignition of 60% propylene glycol antifreeze spray for each of the ignition sources.

![Scope A Comparison of Ignition Sources with 60% Propylene Glycol](image)

Each of the ignition sources, with the exception of the electric range coils, was able to ignite the 60% propylene glycol solution. The increase in heat release rate from the spray burner assembly was somewhat higher than the other ignition sources at the same sprinkler flow rate. Note that the pan and spray burner tests were terminated early due to the size of the resulting fire condition.

Figure 13, below, shows the increase in heat release rate as a function of sprinkler flow rate for a 50% propylene glycol solution using each of the ignition sources that ignited the 60% solution.
The results with the 50% propylene glycol solution show significant differences between the ignition sources. There was very little increase in the heat release rate of the 6-inch wide heptane pan upon application of the antifreeze solution. The 12-inch wide heptanes pan had an initial increase in heat release rate, but higher sprinkler flow rates extinguished portions of the pan fire and reduced the heat release rate. The heat release rate of the spray burner increased throughout the test as the sprinkler flow rate increased.

The heptane spray burner was selected as the ignition source for the remaining tests based on its ability to efficiently ignite sprays of both the 50% and 60% propylene glycol solutions. As illustrated in Figure 13, above, the heptane spray burner represented the worst-case ignition source of those investigated, because it was not extinguished by the 50% propylene glycol solution. Additionally, the heptane spray burner produced a steady baseline fire size that increased the overall reproducibility and reliability of the ignition source.
Tests were conducted by lighting the heptane burners, adjusting the heptane flow rate, allowing for 2 minutes of heating, and flowing antifreeze solution to an open sprinkler. The sprinkler operating pressure was typically varied during each test from 10 psi to 150 psi, unless the test was terminated early due to the growth of the fire condition.

The tests investigated the impact of several variables in causing ignition of antifreeze sprays.

1. Sprinkler

Tests of 50% propylene glycol solution were conducted for the full range of sprinklers investigated. The graph that follows shows the increase in heat release rate due to an antifreeze spray of 50% propylene glycol for the range of sprinklers.

![Figure 14: Comparison of Sprinklers at 8' Above Floor with 50% Propylene Glycol](image)

The results presented in Figure 14, above, show that a 50% propylene glycol solution results in a significant increase in the size of the initial fire when supplied by certain sprinklers. Data for three of the six sprinklers tested shows an increase of more than 4,000 kW or 300% in the heat release rate due to the application of 50% propylene glycol.
antifreeze solution depending on the operating pressure. Very little ignition of the spray was observed during the test with the k7.4 pendent sprinkler. The results for the two k4.9 pendent sprinklers show that the portion of the spray that is ignited can differ for sprinklers with the same k-factor. For example, at a flow of approximately 55 gpm the increase in heat release rate during the test with the k4.9 pendent sprinkler was approximately 3,000 kW compared with more than 4,500 kW in the test with a concealed sprinkler. Further testing primarily used the k3.1 and k4.9 concealed sprinklers based on the results outlined above.

2. Antifreeze Solution

Scope A tests were conducted for solutions of 40%, 45%, and 50% propylene glycol as well as 50% and 55% glycerin. Results of the tests are summarized in Figure 15, below, which shows the increase in heat release rate due to the application of each antifreeze solution using the same sprinkler and ignition source.

![Comparison of Antifreeze Solutions](image)

**Figure 15: Increase in fire size for various antifreeze solutions.**

The results presented above show increases in heat release rate of more than 6,000 kW or 500% for the 50% propylene glycol and 55% glycerin solutions at certain flow rates. This is
due in large part to ignition of the antifreeze spray extending away from the initial fire condition. A significantly lower increase in heat release rate was measured for the 45% propylene glycol solution, which showed little ignition of the sprinkler spray away from the ignition source. The application of antifreeze solutions of 40% propylene glycol and 50% glycerin resulted in much smaller changes in heat release rate during otherwise identical test conditions. The 40% propylene glycol and 50% glycerin solutions resulted in very similar changes in the heat release rate of the fire condition. Although there was some increase in the heat release rate that was measured for both solutions at certain operating pressures, flames were not observed to extend away from the initial fire source.

Figure 16 and Figure 17, below, illustrate the maximum increase in heat release rate caused by 50% glycerin solution for tests with sprinklers at 8 ft and 20 ft above the floor, respectively. The maximum heat release rate measured for the test at 8 ft was approximately 3,300 kW and 2,800 kW for a test at 20 ft, compared with a baseline ignition source heat release rate of approximately 1,400 kW.

Figure 16. Detailed results for 50% glycerin supplied through k3.1 sprinkler at 8 ft.
Figure 17: Detailed results for 50% glycerin supplied through k3.1 sprinkler at 20 ft.

3. Sprinkler Height

Tests were conducted for solutions of 40%, 50% and 60% propylene glycol for sprinkler heights of 8 feet and 20 feet. Results of the tests are summarized in Figure 18, below, which shows the increase in heat release rate due to the change in ceiling height for each antifreeze solution using the same sprinkler and ignition source.
The results presented above show that for 40% and 60% propylene glycol solutions, the height of the sprinkler had a less significant effect on the increase in heat release rate. The 40% solution resulted in very little increase in heat release rate regardless of the sprinkler height and the 60% solution resulted in a substantial increase in the heat release rate for both sprinkler heights. However, the height of the sprinkler had a significant impact on the results with the 50% propylene glycol solution, particularly at higher flow rates. The 50% propylene glycol solution discharged at a height of 8 ft had an increase in heat release rate of approximately 5,000 kW while discharge at a height of 20 ft yielded an increase in heat release rate of approximately 1,200 kW. Thus, while the sprinkler and antifreeze concentration seem to be of primary importance in determining the potential for ignition, the change in spray distribution with height can significantly impact the results for marginal solutions.
4. Temperature of Antifreeze Solution

Tests were conducted that compared the performance of glycerin solution at ambient temperature (80°F to 90°F) and glycerin solution heated to 140°F. Results of the tests are summarized in Figure 19, below, which illustrates the increase in heat release rate for heated and unheated 50% glycerin solutions.

The results presented above show a minor difference in heat release rate during tests with ambient temperature and heated glycerin solutions. Each of the solutions produced a maximum increase in heat release rate of approximately 500 to 1,000kW. While there may be some difference based on temperature over the range investigated, it appears that the effect of temperature is minor compared with the impact of solution concentration.
B. **Scope B – Room Fire Tests**

Failure criterion for the Scope B testing was based on the UL 1626 fire control criteria. Based on these criteria, residential sprinklers were installed in a fire test enclosure with an 8-ft ceiling and are required to control a fire for 10 minutes within the limits established by the UL 1626 fire control criteria. UL 1626 includes provisions for extending the duration of the test to 30 minutes if continued burning is observed at 10 minutes, but the test duration was limited to 10 minutes for the purposes of this comparison.

1. **Temperature 3 inches Below Ceiling**

Tests were conducted to ensure that the maximum temperature adjacent to the sprinkler 3 inches below the ceiling did not exceed 600°F. Figure 20, below, illustrates the results of these tests.

![Scope B Results Temperature 3 inches Below Ceiling](image)

The results in Figure 20, above, show that water, 40% propylene glycol, and 50% glycerin demonstrate similar performance. Regardless of variation in sprinkler operating pressure...
and k-factor, both of the antifreeze solutions and water did not exceed a measured temperature of 246°F. This is well below the maximum temperature of 600°F specified in the UL 1626 fire control criteria.

2. Temperature at 5'-3" Above Floor

Temperature results at 5'-3" above the floor are illustrated in Figure 21 and Figure 22, below. Figure 21 shows the maximum temperature measured during the test, which is limited by UL 1626 to 200°F, and Figure 22 shows the temperature that is sustained for 2 minutes during the test, which must be less than 130°F based on the criteria in UL 1626.

![Figure 21: Maximum Temperature 5'-3" Above Floor](image)

Scope B Results
Maximum Temperature at 5'-3" Above Floor

<table>
<thead>
<tr>
<th>Sprinkler [Flow/Pressure]</th>
<th>Water</th>
<th>40% Propylene Glycol</th>
<th>50% Glycerin</th>
<th>UL 1626 Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Flow 80 psi k3.1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Low Flow 150 psi k4.9</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Low Flow 80 psi k4.2 Sidewall</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Low Flow 150 psi k4.2</td>
<td>175</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
</tbody>
</table>

Figure 21: Maximum Temperature 5'-3" Above Floor
All of the tests remained well below the temperature criteria specified in UL 1626. The maximum temperature for water and 50% glycerin were each slightly higher than 125°F compared with a criteria of 200°F. For the low flow condition and the 2 minute temperature criteria, the results with the 50% glycerin solution were better than water for the test with the k4.9 sprinkler, the results with water were better for the k3.1 sprinkler, and the results with the k4.2 sidewall sprinkler were nearly the same. The results for the 2 minute temperature criteria in the tests at 80 psi and 150 psi show somewhat higher temperatures with the 50% glycerin solution compared with water. This may be due in part to the flow rate of glycerin solution being lower than the flow rate of water at the same pressure, which should be accounted for in the design of a sprinkler system. Overall, the temperature results at 5'-3" above the floor were similar with water, 40% propylene glycol, and 50% glycerin.

3. Temperature ¼-inch Behind Ceiling Surface

The temperature results at ¼-inch behind the ceiling surface above the fire are illustrated in Figure 23, below.
As shown in the figure above, the majority of the tests had similar results and all of the tests remained within the criteria specified by UL 1626. In two of the configurations the test with 50% glycerin solution had significantly higher temperatures than the similar test with water and in one of the configurations the test with water had significantly higher temperatures than the similar test with glycerin solution. The highest measured temperature behind the ceiling material was during the test with the k3.1 sprinkler supplied with water at 150 psi. This result is likely due to the test room being larger than the listed protection area of the sprinkler; however, the same test configuration with 50% glycerin solution better controlled the fire condition.

4. Number of Sprinkler Activated

The UL 1626 criteria allows no more than two of the three sprinklers in the room to activate for a successful test. Figure 24, below, shows that the number of sprinklers activated met this criteria for each of the tests.
Two sprinklers were activated in the enclosure during two of the tests with glycerin solution and one of the tests with water. For the remaining tests only a single sprinkler activated. Based on the results of these tests, as illustrated above, the UL 1626 criteria was satisfied.

5. Scope B Summary

The results for Scope B are summarized in Table 5, below, along with the UL 1626 criteria.
<table>
<thead>
<tr>
<th>Sprinkler [Flow/Pressure]</th>
<th>Solution</th>
<th>Temperature 3&quot; Below Ceiling</th>
<th>Temperature 5'-3&quot; Above Floor</th>
<th>Temperature Behind Ceiling Material</th>
<th>No. of Sprinklers Activated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum (°F)</td>
<td>Maximum (°F)</td>
<td>2-Minute (°F)</td>
<td>Maximum (°F)</td>
<td></td>
</tr>
<tr>
<td>UL 1626 Criteria</td>
<td>600</td>
<td>200</td>
<td>130</td>
<td>500</td>
<td>2</td>
</tr>
<tr>
<td>k3.1 Low Flow</td>
<td>Water</td>
<td>190</td>
<td>118</td>
<td>90</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>188</td>
<td>115</td>
<td>99</td>
<td>148</td>
</tr>
<tr>
<td>k3.1 80 psi</td>
<td>Water</td>
<td>178</td>
<td>100</td>
<td>88</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>184</td>
<td>117</td>
<td>106</td>
<td>308</td>
</tr>
<tr>
<td>k3.1 150 psi</td>
<td>Water</td>
<td>190</td>
<td>102</td>
<td>91</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>186</td>
<td>113</td>
<td>102</td>
<td>190</td>
</tr>
<tr>
<td>k4.9 Low Flow</td>
<td>Water</td>
<td>241</td>
<td>122</td>
<td>107</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>40% Propylene Glycol</td>
<td>180</td>
<td>106</td>
<td>92</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>196</td>
<td>105</td>
<td>98</td>
<td>139</td>
</tr>
<tr>
<td>k4.9 80 psi</td>
<td>Water</td>
<td>189</td>
<td>115</td>
<td>91</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>172</td>
<td>107</td>
<td>97</td>
<td>117</td>
</tr>
<tr>
<td>k4.9 150 psi</td>
<td>Water</td>
<td>191</td>
<td>119</td>
<td>88</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>185</td>
<td>107</td>
<td>99</td>
<td>128</td>
</tr>
<tr>
<td>k4.2 Sidewall Low Flow</td>
<td>Water</td>
<td>200</td>
<td>127</td>
<td>109</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>223</td>
<td>115</td>
<td>110</td>
<td>319</td>
</tr>
<tr>
<td>k4.2 Sidewall 80 psi</td>
<td>Water</td>
<td>175</td>
<td>109</td>
<td>89</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>180</td>
<td>113</td>
<td>100</td>
<td>142</td>
</tr>
<tr>
<td>k4.2 Sidewall 150 psi</td>
<td>Water</td>
<td>209</td>
<td>119</td>
<td>88</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td>50% Glycerin</td>
<td>246</td>
<td>129</td>
<td>101</td>
<td>161</td>
</tr>
<tr>
<td>Furniture Fire k4.9 Low Flow</td>
<td>50% Glycerin</td>
<td>165</td>
<td>96</td>
<td>94</td>
<td>104</td>
</tr>
<tr>
<td>Without Sprinklers</td>
<td>&gt; 1,074</td>
<td>&gt; 545</td>
<td>&gt; 130</td>
<td>&gt; 571</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 5. Scope B Test Results
In addition to the results of tests with the UL 1626 fuel package, Table 5 also includes the results of a test conducted with living room furniture. The test used 50% glycerin solution supplied to a k4.9 sprinkler at 18 gpm. The fire was controlled by one sprinkler. The results of the test indicate that the UL 1626 fuel package is a more severe test of the sprinkler system than the living room furniture fuel package. The temperatures measured during the test with actual furniture were lower than any of the tests with the UL 1626 fuel package.

Table 5 also includes results of a UL 1626 type test conducted by Underwriters Laboratories without the use of sprinklers. The test without sprinklers was conducted as part of a prior research project and used a 12 ft by 24 ft enclosure meeting the requirements of UL 1626. The test was terminated after less than 4 minutes when the temperature in the room exceeded 1,000°F. While all of the Scope B tests with antifreeze solutions and water maintained temperatures within the UL 1626 criteria for a full 10 minutes, a similar test without sprinklers resulted in flashover of the enclosure in less than 4 minutes. The results demonstrate the effectiveness of water as well as solutions of 40% propylene glycol and 50% glycerin in controlling home fire conditions represented by UL 1626.
V. Analysis

The fire test program conducted as part of Phase II of this project was intended as an empirical evaluation of the potential for ignition and impact on sprinkler system effectiveness of various antifreeze solutions. The following observations and analysis provides additional insight into the fire test data discussed above.

A. Observations

The Scope A ignition tests conducted with the heptane spray burner were unique in that the ignition source had a steady heat release rate that was not significantly impacted by the antifreeze spray and the ignition source could not readily be extinguished by the antifreeze spray. This allowed the contribution of the antifreeze solution to the fire condition to be accurately measured, since the heat release rate of the ignition source itself could not be enhanced by the antifreeze spray, i.e. the fuel contributed by the spray burner was a function of the heptane flow rate and was not impacted by the antifreeze spray. In addition, it provided a conservative assessment of the potential for ignition, because many fire sources would be extinguished even by antifreeze solutions that had a significant increase in heat release rate during the tests.

Even the lowest antifreeze concentrations tested resulted in some increase in heat release rate when exposed to the heptane spray burner fire for certain test conditions. For example, Figure 15 shows that the 40% propylene glycol solutions result in some increase in the heat release rate of the initial fire at certain flow rates. The increase in heat release rate can be included in one of two categories:

1. Ignition of antifreeze spray that reaches the ignition source; or
2. Ignition of antifreeze spray extending away from the ignition source.

Based on the tests conducted, it appears that some portion of the antifreeze spray reaching the fire source will ignite even for the lowest antifreeze concentrations tested and even when the antifreeze spray could be expected to extinguish most anticipated fire sources in a residential occupancy. The potential for this relatively small increase in heat release rate to reduce the effectiveness of residential sprinklers was investigated in Scope B. Results of the Scope B tests demonstrate no significant differences in the capability of water, 50% glycerin, and 40% propylene glycol to control the tested fire condition.

Antifreeze sprays that ignite and propagate away from the initial fire source are a significant concern. In addition to being a hazard on its own, ignition of antifreeze sprays extending away from the ignition source can significantly increase the heat release rate of the fire and, if confined, may result in an overpressurization or explosion.
Following Phase I of this project, it appeared that the ignition of antifreeze sprays was likely to be either localized close to the ignition source or the ignition would be sufficient to involve nearly the entire volume of the sprinkler spray. The results were readily characterized as a relatively minor localized ignition that could still allow for fire control or an ignition of the majority of the sprinkler spray that would significantly enhance the initial fire condition.

Tests during Scope A of Phase II showed that at certain antifreeze concentrations, intermittent ignition of the antifreeze spray could occur that extended away from the ignition source without involving the majority of the sprinkler spray. This expanded the results of the Phase I tests by showing that intermittent ignition of a portion of the sprinkler spray could occur and that ignition of the antifreeze spray could not be characterized as only localized or involving the majority of the spray.

The importance of the droplet size distributions and concentrations was apparent during the Phase II tests, particularly for tests where the sprinklers were positioned at 20 ft above the floor. In certain tests, ignition of the antifreeze solution was observed to extend away from the ignition source, but only into a discrete portion of the sprinkler spray. Thus, while the droplet size distribution in a portion of the sprinkler spray was sufficient to allow ignition, the droplet size distribution in the majority of the sprinkler spray was not sufficient to allow the fire to spread within the spray.

The droplet size distribution from sprinklers is not currently regulated and is often not characterized for commercially available sprinklers. In addition, even if a standard method were developed to characterize the droplet size distribution from each sprinkler over a range of operating pressures, the distribution could be modified by the properties of the antifreeze solution, the airflows in the enclosure, or the installed configuration of the sprinkler. Thus, for most residential sprinklers it does not currently appear to be practical to rely solely on the droplet size distribution as a means of preventing significant ignition of antifreeze sprays. Thus, the analysis below focuses on the characteristics of the antifreeze solution that may impact the potential for significant ignition of the spray.

**B. Classification based on Solution Heat of Combustion**

The heat of combustion of the antifreeze solution reduced by the additional mass of the water in the solution was investigated for its ability to characterize the relative contribution of various antifreeze solutions. The parameter investigated is the heat of combustion of the antifreeze in the solution normalized by the mass of the solution.
Figure 25, above, shows that for a given solution concentration, a solution of propylene glycol will have a higher heat of combustion per unit of solution mass than a solution of glycerin.

The table below shows the solution concentration by volume of propylene glycol and glycerin as a function of the solution heat of combustion.
<table>
<thead>
<tr>
<th>Solution Heat of Combustion (MJ/kg)</th>
<th>Solution Concentration (% Vol.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Propylene Glycol</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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<tr>
<td>1</td>
<td>5</td>
</tr>
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<td>12</td>
<td>55</td>
</tr>
<tr>
<td>13</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 6. Solution Heat of Combustion

The table above indicates that a 42% solution of propylene glycol by volume has the same solution heat of combustion as a 50% solution of glycerin. Figure 26, below, compares the maximum increase in heat release rate measured in tests with k3.1, k4.9, and k7.4 pendent sprinklers as a function of the solution concentration. All data is from tests conducted with a sprinkler at 8 ft above the floor using the heptane spray burner ignition source. The k-factor of the sprinkler used in the test is indicated in the legend.
Figure 26, above, shows a strong relationship between the solution heat of combustion and the increase in heat release rate measured during tests with k3.1 and k4.9 sprinklers. Thus, analyzing the heat of combustion of the overall solution may be a useful method of comparing the potential contribution of different antifreeze solutions to a fire condition. However, Figure 14 showed that the sprinkler model also has a significant impact on the potential increase in heat release rate. Thus, the solution heat of combustion cannot, by itself, be used to determine the potential for ignition of an antifreeze spray.
VI. Future Research and Recommendations

The National Fire Protection Association has taken steps to implement changes based in part on information provided in prior versions of this report. Specific modifications to NFPA and other documents are not addressed in this report, but should instead be addressed through the appropriate standards revision processes. The following recommendations address research and technical areas where further investigation is warranted as a result of this work.

A. Investigate the use of Antifreeze Solutions in Sprinkler Systems with Non-Residential Sprinklers

The results of this project indicate that antifreeze solutions of propylene glycol or glycerin supplied through residential sprinklers at concentrations permitted by NFPA 13 can substantially increase the heat release rate of a fire condition. The same antifreeze solutions that are used in residential sprinkler systems are also used in sprinkler systems for non-residential applications.

Residential sprinklers differ from other spray sprinklers in that they have a different spray distribution pattern. Residential sprinkler also most commonly have k-factors of 4.9, while other types of sprinklers usually have k-factors of 5.6 or greater. Thus, the droplet size distributions produced by residential sprinklers may differ from the droplet size distributions produced by other types of sprinklers in a way that impacts the potential for ignition of antifreeze sprays. Further investigation is needed to evaluate the potential for ignition of antifreeze solutions supplied by sprinkler systems not using residential sprinklers.

Based on the results of this project with residential sprinklers, research should be conducted into the use of antifreeze solutions in non-residential applications.

B. Characterize Droplet Size Distributions from Sprinklers

Characterization of droplet size distributions from sprinklers is an active area of research and influences the potential for ignition of antifreeze sprays. An improved characterization of droplet size distributions from sprinklers over a range of sprinkler models and operating conditions could be helpful in limiting the potential for significant ignition of antifreeze sprays. The results summarized in Figure 14 indicate that the droplet size distributions produced by certain sprinklers are less likely to create conditions where an antifreeze solution can be ignited. Further research into the droplet size distributions created by a range of sprinkler models over a range of operating conditions could be used as a basis to allow the use of antifreeze solutions under conditions when the droplet size distribution created is not anticipated to ignite.
C. Develop a Small or Medium Scale Screening Test for Antifreeze Solutions

Full scale tests were conducted as part of this project to investigate antifreeze solutions supplied by actual residential sprinklers. The tests were conducted for a wide range of operating conditions and produced a variety of droplet size distributions. Ideally, a small scale test could be used to investigate only the worst case droplet size distribution produced by residential sprinklers.

FM Global Class Number 6930, Approval Standard for Flammability Classification of Industrial Fluids, was identified in Phase I of this project as a test method that could be adapted to investigate the potential for ignition of antifreeze solutions. A research effort would be needed to correlate the results of any such small or medium scale test with the results of this or other full scale testing. The investigation of a small or medium scale test might also provide additional insight into the droplet size distributions that increase the potential for ignition.

D. Develop a Listing Standard for Solutions introduced into Sprinkler Systems

NFPA 13 currently only permits glycerin or propylene glycol antifreeze solutions to be used in antifreeze sprinkler systems connected to potable water supplies. This report documents concerns with the use of certain concentrations of glycerin and propylene glycol antifreeze solution. Thus, there is a need to develop alternative solutions that could be used in instances where glycerin and propylene glycol are not suitable.

Issues of flammability, freeze protection, toxicity, and material compatibility would need to be addressed for any solutions that are introduced into sprinkler systems. A research effort would be needed to develop a series of tests that is sufficient to demonstrate the appropriateness of a new antifreeze solution and could be extended to cover other solutions that are used in sprinkler systems. The development of a listing standard that could be referenced by NFPA 13 may encourage development of alternative antifreeze solutions and help ensure that the solutions are appropriate for use in sprinkler systems.
VII. Summary

A test plan was developed for Phase II to investigate the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers. This test plan also explored the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress.

Testing was conducted in two parts (Scope A and B). Scope A consisted of fire tests using six (6) models of sprinklers operating at pressures of 10 psi to 150 psi at elevations of eight and twenty feet. The Scope A testing was intended to investigate the potential for large-scale ignition of antifreeze sprays at pressures ranging from 10 psi to 150 psi. Scope B consisted of room fire tests, similar to UL 1626, that were designed to investigate the effectiveness of sprinklers discharging antifreeze solutions and their ability to maintain tenable conditions.

Results of the Scope A testing indicated that concentrations of propylene glycol exceeding 40% by volume and concentrations of glycerin exceeding 50% by volume have the potential to ignite when discharged through automatic sprinklers. The potential for ignition depends on several factors including the ignition source, sprinkler model, sprinkler elevation, discharge pressure, and the location of the sprinkler with respect to the ignition source. Ignition of antifreeze spray increased the measured heat release rate in certain tests with 50% propylene glycol and 55% glycerin by more than 300%. For certain test conditions, the increase in heat release rate resulting from the application of 55% glycerin solution exceeded the increase in heat release rate from the application of 50% glycerin solution by a factor of 10. A similar level of sensitivity was observed between 40% and 50% propylene glycol solutions, but not between 40% and 45% propylene glycol solutions.

The results of the Scope B testing indicated that concentrations of propylene glycol not exceeding 40% by volume and concentrations of glycerin not exceeding 50% by volume have similar performance to water as compared to the UL 1626 fire control criteria. Tests with the 40% propylene glycol and 50% glycerin solution met the UL 1626 fire control criteria and demonstrated similar performance to water throughout many of the tests.

The results of this research suggest that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in home fire sprinkler systems. Consideration should be given to an appropriate safety factor for concentrations of antifreeze solutions that are permitted by future editions of NFPA 13, as well as warnings and limitations outlined in antifreeze product literature. In addition, based on the flammability properties outlined in Table 4, the use of solutions of diethylene glycol and ethylene glycol in home fire sprinkler systems should also be limited.
Recommendations for further research are also provided. Further research should be conducted to investigate the use of antifreeze solutions supplied through non-residential sprinklers. The results of this study are based on tests with residential sprinklers, which are not directly applicable to other types of sprinklers due to the unique spray pattern of residential sprinklers. However, the results documented in this report are sufficient to indicate that the use of antifreeze solutions with non-residential sprinklers should also be investigated.

The droplet size distributions produced by sprinklers is an ongoing area of research that is important to understanding the potential for ignition of antifreeze sprays. Further development is needed to characterize the droplet size distributions produced by a variety of sprinklers.

The development or investigation of a small or medium scale test for ignition of antifreeze sprays may contribute to understanding the droplet size distributions of antifreeze that have the potential to ignite. Finally, the results of this research indicate that certain concentrations of glycerin and propylene glycol antifreeze solutions are not appropriate for use in residential sprinkler systems. Thus, there is a need for alternative antifreeze solutions that are not currently permitted by NFPA 13. A listing standard for antifreeze solutions or other solutions that are introduced into sprinkler systems could encourage the development of alternative antifreeze solutions and help ensure that the solutions are appropriate for use in sprinkler systems.
VIII. References


and Technology, Gaithersburg, MD, 2004.


I am transmitting to you herewith the following action of the Standards Council (August 8-11, 2011):

At its March 2011 meeting, the standards Council issued several TIAs relating to ongoing review of the use of antifreeze in sprinkler systems. The extensive background and activities leading up to the development and issuance of these TIAs is set forth in the Council’s decision issuing the TIAs and in decisions and minute items cited in that decision. See Standards Council Decision 11-5 (SC #11-3-3-e, 11-3-4-e and 11-3-5-d, March 1, 2011). The TIAs were developed by the responsible technical committees and the Council emphasized in its decision issuing the TIAs that, while the Council had initially taken action to address the antifreeze questions pending further technical committee consideration, the technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus-based technical committees to determine.

In issuing the TIAs, the Council stressed, in the following terms, that the sprinkler committees’ consideration of issues related to antifreeze was not an end:

In voting to issue these TIAs, the Council stresses that the sprinkler committees’ consideration of issues related to antifreeze is not at an end. The sprinkler standards are in the Annual 2012 revision cycle, and that the content of the new TIAs will be considered as Proposals during the process. The Fire Protection Research Foundation report discussed areas where future research might be needed, as, for example, in the area of commercial applications. It is anticipated that further research will be conducted and information developed that will aid the sprinkler committees in their continuing consideration of issues raised by the use of antifreeze in sprinkler systems.

To aid the work of the sprinkler committees, and for its own information, the Council requested the sprinkler committees, representatives of the relevant sprinkler industries, the Fire Protection Research Foundation and others with relevant information to provide reports to the Council at its August 2011 meeting "identifying research needs, planned or ongoing research, and any other activities or developments related to the use of antifreeze in sprinkler systems."

In response to the Council's request, the Council has received a single report from the Chair of the Technical Correlating Committee (TCC) on Sprinklers on potential research paths that may need to be taken as it pertains to antifreeze usage in sprinkler systems. The Council also heard an oral presentation from Executive Director of the Fire Protection Research Foundation on her efforts to explore potential research paths with potential funders. Disappointingly, the Council received no submissions from other interested parties. Nevertheless, it was never the Council’s intention to itself evaluate or analyze the information that it was seeking. Rather it was attempting to assist the
interested parties in maintaining their focus on and commitment to the ongoing task of providing the responsible NFPA technical committees with research and data to support effective standards development. While no action of the Council is required at this time, the Council expects the interested parties will continue investigation and research aimed at ensuring the safety of freeze protection in sprinkler systems and the incorporation of such new information as may be developed into subsequent editions of the sprinkler standards.

As suggested above, it is not the Council’s role to identify all of the gaps in research that may exist and it has not undertaken to evaluate or analyze all the information presented or to construct any research plan. While some of the research being discussed may be aimed at showing that the antifreeze limits are more stringent than necessary, attention should also be maintained on identifying any additional research needed to ensure the adequacy of all the current antifreeze limits. In this regard, and without suggesting that other avenues of research may also be advisable, the Council notes that the TCC Chair’s report and from the previously submitted research reports prepared for the Fire Protection Research Foundation point to at least one gap that needs to be filled. Specifically, it appears that the data that has been generated in the recent research on residential sprinklers has been extrapolated to standard spray sprinklers (i.e., commercial sprinklers). Standard spray sprinklers have different characteristics than residential sprinklers and research appears to be necessary to verify that the extrapolation of the data obtained on residential sprinklers is either valid for standard spray sprinklers or needs adjustment.

The Council is requesting that interested parties report back to the Council on or about March, 2012. Council meeting on plans and progress toward filling the gap identified above as well as on other research activities that are being considered, planned or undertaken.

Council Member Roland Huggins recused himself from the vote on this issue.

c: D. Berry, M. Brodoff, A. Cronin, M. Klaus, P. Foley, J. Goyette, E. Carroll
TCC on Automatic Sprinkler Systems AUT-AAC)
TC on Residential Sprinkler Systems (AUT-RSS)
TC on Sprinkler System Installation Criteria (AUT-SSI)
TC on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)
NFPA Standards Council
Interested parties (individuals providing comments)

11-8-48
NFPA 13 TCC Antifreeze Update to NFPA Standards Council

Introduction

Submittal Date: July 21, 2011

The NFPA 13 Technical Committees (TC’s) and Technical Correlating Committee (TCC), along with the NFPA 25 Technical Committee recently passed new Tentative Interim Amendments (TIA) during the Standards Council Meeting in March 2011 (TIA’s 1012, 1013, 1014 and 1015). These TIA’s supersede the TIA language approved at the August 2010 Standards Council Meeting (TIA’s 994, 995 and 1000).

As part of the Standards Council decision(D#11-5) approving the latest TIA’s, the Standards Council concluded that the technical committees had satisfied the requests from Standards Council stemming from the initial council decision.

Excerpt from Standards Council Decision D#11-5:
The sprinkler committees have now completed the review and consideration of the antifreeze issues as anticipated in Standards Council Decision #10-10.

As part of the latest Standards Council decision (D#11-5), a request for more information on antifreeze developments, along with potential research paths were directed to the sprinkler committees:

Excerpt from Standards Council Decision D#11-5:
In voting to issue these TIAs, the Council stresses that the sprinkler committees’ consideration of issues related to antifreeze is not at an end. The sprinkler standards are in the Annual 2012 revision cycle, and that the content of the new TIAs will be considered as Proposals during the process. The Fire Protection Research Foundation report discussed areas where future research might be needed, as, for example, in the area of commercial applications. It is anticipated that further research will be conducted and information developed that will aid the sprinkler committees in their continuing consideration of issues raised by the use of antifreeze in sprinkler systems. In the meantime, the Council is requesting, both in aid of the committees’ work and for the Council’s information, that the sprinkler committees, representatives of the relevant sprinkler industries, the Fire Protection Research Foundation, and any other parties with relevant information provide reports to the Council at its next meeting identifying research needs, planned or ongoing research, and any other activities or developments related to the use of antifreeze in sprinkler systems.

This letter is intended to provide the Standards Council with a status report regarding the requested information.

Potential Research Paths

During the Technical Correlating Committee meeting, the TCC members discussed the need for additional research as it pertains to antifreeze usage in sprinkler systems. The following items were identified as being potential research paths that may aid in the development of technically substantiated antifreeze requirements.

1) Testing of Standard Spray Sprinklers (Commercial Sprinkler System Applications) – The TCC discussed the need for testing of standard spray sprinklers at various water/antifreeze ratios. To date, the testing of sprinklers with varying concentrations of antifreeze has been limited to residential sprinklers. The TCC believes that the use of standard spray sprinklers with the new antifreeze concentration limits will not be problematic and will most likely provide better results in terms of antifreeze solution ignition during discharge when compared to the residential sprinklers that have been tested. Such an effort should initially include a series of systematically designed confirmation tests in order to confirm or reject this assumption.

2) Testing Various Orifice Sizes- Droplet size was identified in previous testing as one of the variables contributing to the ignition of antifreeze solution. Droplet sizes vary greatly depending on several factors including pressure, deflector design and orifice size. As identified in the Phase II Report (Fire Protection Research Foundation
Antifreeze Solutions in Home Fire Sprinkler Systems Phase II Research Report) prepared for the Fire Protection Research Foundation, studies have shown that standard orifice, pendent spray fire sprinklers typically produce droplet sizes between approximately 200 and 3,000 μm. A study of residential sprinklers measured water droplets ranging from an arithmetic mean of 200 to over 500 μm, depending on location. It is believed that the regime of significantly smaller drop size ranges is more susceptible to ignition, but this generally has not been adequately examined. The impact of droplet size as a result of orifice size should be investigated further.

3) Examine Pressure as a Variable in Solution Ignition- The test data presented as part of the Phase II report illustrates that discharge pressure impacts the ignition of antifreeze solutions. As stated above, discharge pressure has been demonstrated to impact droplet size which has been identified as a critical variable associated with the ignition of antifreeze solutions under spray conditions. The TCC recommends that research be conducted to determine impact of pressure on antifreeze solution ignition.

4) Test Field Mixing Procedures – The TIA’s have limited the mixing of antifreeze solutions to manufacturers. This was done as a means of quality control to “guarantee” that sufficient energy has been imparted on the antifreeze solution and that it will remain homogenous. At present there is no procedure outlining how to impart sufficient energy on a solution in order to create a homogenous solution. Similarly, there is no quantifiable value to determine how much energy is sufficient so that a procedure can be developed. The TCC suggests that research be conducted to determine how much energy needs to be imparted on the solution, so that procedures can be developed for field mixing of antifreeze solutions.

**Antifreeze Developments**

Research into the use of antifreeze in sprinkler systems has continued since the Standards Council decision was released. Attached to this letter are the following documents:

   - Flammability of Antifreeze Agents for Automatic Sprinkler Systems
     Magnus Arvidson Department of Fire Technology, SP Technical Research Institute, Boros, Sweden

2. Manufacturers Cut Sheets – Illustrating Freeze Points for new Limitations
   - Noble – Firefighter PG 38
   - Noble – Firefighter GL 48

This information was made available in May and June 2011 and has not been reviewed by the TCC or TC’s. This information will be discussed during the upcoming ROC in September 2011.

**Committee Activity**

The TIA’s that were passed during this meeting have all been pulled into the proposed 2013 editions of NFPA 13, 13R and 13D via committee proposals without modification. These proposals may be modified during the ROC stage.

An additional TIA was developed for NFPA 25 to address concentrations of propylene glycol in excess of 38% by volume used in conjunction with ESFR sprinklers. This TIA was prepared by the TCC to provide consistency between NFPA 13 and NFPA 25.
SUMMARY ACTION: The Standards Council voted to deny the appeal and issue TIA Nos. 1015, 1012 and 1013 on NFPA 13, NFPA 13D and NFPA 13R, respectively. In addition, the Council directed further activities as set forth in the decision.

In August of 2010, the Standards Council voted to issue three Tentative Interim Amendments (TIAs), the effect of which, pending further technical committee consideration, was to prohibit the use of antifreeze within the dwelling unit portions of sprinkler systems. In doing so, the Council took the unusual step of issuing TIAs without the full support of the responsible sprinkler committees. This was because the Council was presented with an unusual and compelling situation in which the status quo in the existing sprinkler documents was no longer tenable, and in which the circumstances required emergency action. (See Standards Council Decision #10-10 [August 5, 2010]). In its decision, the Council stressed that its action was strictly an interim measure that would remain in place "unless and until the responsible technical committees, after due consideration and any correlation by the [Technical Correlating Committee], reach consensus on a different approach." The Council, moreover, stressed that "it is not undertaking to make any final technical determination about the correct course of action that may eventually emerge. The technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus-based technical committees to determine, and the same should be true in this case." In turning the matter back to the sprinkler committees, the Council noted that the TIAs all involved standards that address the design and installation of new sprinkler systems. It asked the technical committees to examine the important question of what should be done to address antifreeze in existing residential sprinkler systems. Finally, the Council noted that the TIAs did not address antifreeze in nonresidential commercial applications and suggested the need for further research and consideration of the treatment of nonresidential commercial applications as well. (See Standards Council Decision #10-10).

The sprinkler committees have now completed the review and consideration of the antifreeze issues as anticipated in Standards Council Decision #10-10. The technical committees have developed and reached consensus on three new TIAs related to the use of antifreeze in sprinkler systems that proposed to supersede the TIAs previously issued on an interim basis by the Council.
The new TIAs, which were presented to the Council at its meeting of February 28 – March 1, 2011 are: TIA Nos. 1015, 1012 and 1013 on the 2010 editions, respectively, of NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes, and NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height. Also considered by the Council at the meeting was an appeal relating to the TIAs from Dana Haagensen, Massachusetts Department of Fire Services. The appeal requested that the Council not issue the new TIAs and that the three existing TIAs issued in Standards Council Decision D#10-10, and which would be superseded by the new TIAs, remain in place. The existing TIAs, for new installations, prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R sprinkler systems.

As suggested above, the new TIAs replace the complete prohibition on the use of antifreeze in the dwelling unit portions of new sprinkler systems. Described in general terms, TIA Nos. 1015, 1012 and 1013, taken together: limit the antifreeze solutions used in sprinkler systems to manufacturer premixed antifreeze solutions only; limit the use of antifreeze in sprinkler systems to specified volume concentrations based on one of the types of permitted solutions; provide additional provisions based on the type of sprinkler for NFPA 13 sprinkler systems; and provide additional requirements for NFPA 13D systems including provisions for annual testing and provisions based on whether the NFPA 13D system is new or existing. The TIAs do not address existing systems designed to NFPA 13 or 13R, however, another TIA on NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, that is being issued concurrently with these TIAs and that has not been the subject of an appeal, does address antifreeze concentrations for these systems. (See Minute Item 11-3-6, Standards Council Meeting of February 28-March 1, 2011; see also Minute Item 11-3-7, for another TIA on NFPA 25, which did not pass ballot and has not been appealed.) The individual TIAs must, of course, be consulted for the precise terms of the provisions they contain.

The three new TIAs were balloted through the responsible Technical Committees (TC) – the Technical Committee on Sprinkler System Installation Criteria for NFPA 13, and the Technical Committee on Residential Sprinklers for NFPA 13D and NFPA 13R – as well as the Technical Correlating Committee on Automatic Sprinkler Systems (the TCC). Balloting was completed in accordance with the NFPA Regulations Governing Committee Projects, to determine if it had the necessary three-fourths majority support on technical merit and emergency nature in favor of issuance. All three TIAs passed the ballots of the TCs and the TCC on both technical merit and emergency nature. One public comment was received.

The appeal requests that the Council overturn the action recommended by the NFPA codes and standards development process and not issue the TIAs. On appeal, the Standards Council accords great respect and deference to the codes and standards development process. In conducting its review, the Council will overturn the result recommended through that process, only where a clear and substantial basis for doing so is demonstrated. The Council has reviewed the entire record concerning this matter and
has considered all the arguments raised in this appeal. In the view of the Council, this appeal does not present any clear and substantial basis on which to overturn the result recommended by the NFPA codes and standards development process. Accordingly, the Council has voted to deny the appeal and issue TIA Nos. 1015, 1012 and 1013.

As indicated above, the Council's previous action in limiting the use of antifreeze in sprinkler systems was intended as an interim measure to allow the sprinkler committees the time and opportunity to review the available information and research and make the final consensus determination about what should or should not be contained in the sprinkler standards concerning the antifreeze issues. The sprinkler committees have now processed the issues and reached a consensus, meeting in each case the demanding three-fourth majority vote. The committees have reviewed and considered the available information, including the research presented in the Fire Protection Research Foundation report, "Antifreeze Solutions in Home Fire Sprinkler Systems, Phase II Research Final Report" issued in 2010. Moreover, and importantly, the TIAs address the use of antifreeze in nonresidential commercial applications and in existing installations, subjects that were not able to be addressed in the previous TIAs. The committees have arrived at reasonable conclusions based on the available information and the many considerations that must be weighed in arriving at consensus judgments. Since absent compelling circumstances were not presented here, the Council must defer to the consensus judgments of the committees.

In voting to issue these TIAs, the Council stresses that the sprinkler committees’ consideration of issues related to antifreeze is not at an end. The sprinkler standards are in the Annual 2012 revision cycle, and that the content of the new TIAs will be considered as Proposals during the process. The Fire Protection Research Foundation report discussed areas where future research might be needed, as, for example, in the area of commercial applications. It is anticipated that further research will be conducted and information developed that will aid the sprinkler committees in their continuing consideration of issues raised by the use of antifreeze in sprinkler systems. In the meantime, the Council is requesting, both in aid of the committees’ work and for the Council’s information, that the sprinkler committees, representatives of the relevant sprinkler industries, the Fire Protection Research Foundation, and any other parties with relevant information provide reports to the Council at its next meeting identifying research needs, planned or ongoing research, and any other activities or developments related to the use of antifreeze in sprinkler systems.

Council Member Roland Huggins recused himself during the deliberation and vote on the issue.
Tentative Interim Amendment

NFPA 13
Standard for the Installation of Sprinkler Systems
2010 Edition

Reference: 3.4.1.1 Premixed Antifreeze Solution, 7.6.1.5, 7.6.2, and A.7.6
TIA 10-2
(SC 11-3-3/TIA Log #1015)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13, Standard for the Installation of Sprinkler Systems, 2010 edition. The TIA was processed by the Technical Committee on Sprinkler System Installation Criteria and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new definition as 3.4.1.1 to read as follows:

3.4.1.1 Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

2. Remove the new section 7.6.1 that was added by issuance of TIA No. 10-1 (Log #1000) and renumber sections.

3. Revise 7.6.1.5 to read as follows:

7.6.1.5 A placard shall be placed on the antifreeze system main valve that indicates the manufacture type and brand of the antifreeze solution, the concentration by volume of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

4. Revise 7.6.2.1 to read as follows:

7.6.2.1* Antifreeze solutions shall be limited to premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume, or propylene glycol at a maximum concentration of 38% by volume.

5. Add a new 7.6.2.1.1 to read:

7.6.2.1.1 Premixed antifreeze solutions of propylene glycol exceeding 40% concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

6. Add new 7.6.2.1.2 to read as follows:

7.6.2.1.2 Premixed antifreeze solutions other than those described in 7.6.2.1 that are listed for use in sprinkler systems shall be permitted to be used.

7. Add a new 7.6.2.1.3 to read as follows:
7.6.2.1.3 All premixed antifreeze solutions shall be provided with a certificate from the manufacturer indicating the type of antifreeze, concentration by volume, and freezing point.

8. Delete current Table 7.6.2.2 and replace it with the following table in the annex renumbered as Table A.7.6.2.1

**A.7.6.2.1** See Table A.7.6.2.1.

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<th>Solution (by volume)</th>
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<th>Freezing Point</th>
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</table>

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

8. Delete 7.6.2.3 and Table 7.6.2.3.

9. Revise 7.6.2.4 to read as follows:

7.6.2.4 A premix antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be provided.

10. Delete existing 7.6.2.5 as well as the Figures 7.6.2.5(a), 7.6.2.5(b), and 7.6.2.5(c) and Annex A.7.6.2.5.

11. Delete 7.6.2.6.

12. Add an asterisk to Section 7.6 and a new Annex A.7.6 to read as follows:

**A.7.6** In cold climates and areas where the potential for freezing of pipes is a concern, options other than antifreeze are available. Such options include installing the pipe in warm spaces, tenting insulation over the piping (as illustrated in NFPA 13D), listed heat tracing, and the use of dry pipe systems and preaction systems.

13. In A.7.6.2, delete the second paragraph.
A.7.6.2 Listed CPVC sprinkler pipe and fittings should be protected from freezing with glycerine only. The use of diethylene, ethylene, or propylene glycols is specifically prohibited. Laboratory testing shows that glycol-based antifreeze solutions present a chemical environment detrimental to CPVC.

14. Delete existing A.7.6.2.4 and Figure A.7.6.2.4.

Issue Date: March 1, 2011
Effective Date: March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
Supplemental Attachment 12-3-8
Page 110 of 196

Tentative Interim Amendment

NFPA 13D
Standard for the Installation of Sprinkler Systems in
One- and Two-Family Dwellings and Manufactured Homes

2010 Edition

Reference: 3.3.9.1 Premixed Antifreeze Solution (New), 4.1.4, 5.2.7, 8.3.2, 8.3.3, and A.4.1.4
TIA 10-2
(SC 11-3-4/TIA Log #1012)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Undo all of the changes made by TIA No. 10-1 (Log #994) to sections 3.3.9.1, 4.1.4, 5.2.7, 8.3.2 and 8.3.3 returning NFPA 13D to the text of the published 2010 edition with the following changes:

2. Add a new definition as 3.3.9.1.1 and related annex note to read as follows:

3.3.9.1.1* Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared and factory-mixed by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

A.3.3.9.1.1 Where a tank is used as the water supply for the sprinkler system, the tank is not permitted to be filled with antifreeze.

3. Revise 4.1.4 and related annex note to read as follows:

4.1.4* Antifreeze Systems.

A.4.1.4 Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portions of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

On an annual basis, test samples should be drawn from test valve B as shown in Figure 8.3.2.1(1), especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops that are less than 36 inches in length. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For long drops with significant volume, consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.
When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

4.1.4.1 Annual Antifreeze Solution Test and Replacement Procedure.

4.1.4.1.1 Samples of antifreeze solution shall be collected by qualified individuals in accordance with 4.1.4.1.1.1 or 4.1.4.1.1.2 on an annual basis.

4.1.4.1.1.1 The system shall be drained to verify that (a) the solution is in compliance with 8.3.3, and (b) the solution provides the necessary freeze protection. Solution samples shall be taken near the beginning and near the end of the draining process.

4.1.4.1.1.2 Solution samples shall be taken at the highest practical elevation and the lowest practical elevation of the system.

A.4.1.4.1.1.2 If not already present, test connections (valves) for collection of solution samples should be installed at the highest and lowest practical locations of the system or portion of the system containing antifreeze solution.

4.1.4.1.2 The two samples collected in accordance with the procedures specified in 4.1.4.1.1.1 or 4.1.4.1.1.2 shall be tested to verify that the specific gravity of both samples is similar and that the solution is in compliance with 8.3.3. The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.

4.1.4.1.3 If concentrations of the two samples collected in accordance with the procedures above are similar and in compliance with 8.3.3, then (a) the solution drained in accordance with 4.1.4.1.1.1 can be used to refill the system, or (b) the existing undrained solution tested in accordance with 4.1.4.1.1.2 shall be permitted to continue to be used. If the two samples are not similar and not in compliance with 8.3.3, then a solution in compliance with 8.3.3 shall be used to refill the system.

A.4.1.4.1.3 In the past, for some existing systems subject to extremely low temperatures, antifreeze solutions with concentrations greater than what is now permitted by NFPA 13D were used. Such high concentrations of antifreeze are no longer permitted. In situations where extremely low temperatures are anticipated, refilling the fire sprinkler system with a concentration of antifreeze solution currently permitted by the standard might not provide sufficient freeze protection without additional measures. Such measures might include converting the antifreeze system to another type of sprinkler system.

4.1.4.1.4 A tag shall be attached to the riser indicating the date the antifreeze solution was tested. The tag shall also indicate the type and concentration of antifreeze solution (by volume) with which the system is filled, the date the antifreeze was replaced (if applicable), the name of the contractor that tested and/or replaced the antifreeze solution, the contractor’s license number, a statement indicating if the entire system was drained and replaced with antifreeze, and a warning to test the concentration of the antifreeze solutions at yearly intervals per NFPA 13D.

4. Add an asterisk to 8.3.3 and add a new A.8.3.3 to read as follows:

8.3.3* Antifreeze Systems.

A.8.3.3 Where protection of pipes from freezing is a concern, options other than antifreeze are available. Such alternatives include running the piping in warm spaces, tenting insulation over pipe, dry-pipe systems, and preaction systems.

5. Revise 8.3.3.2.1 to read as follows:

8.3.3.2.1* Unless permitted by 8.3.3.2.1.1, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume, propylene glycol at a maximum concentration of 38% by volume, or other solutions listed specifically for use in fire protection systems.

6. Add a new 8.3.3.2.1.1 to read as follows:

8.3.3.2.1.1. For existing systems, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 50% by volume, propylene glycol at a maximum concentration of 40% by volume, or other solutions listed specifically for use in fire protection systems.

7. Delete 8.3.3.2.2 and 8.3.3.2.3 and related Annex material A.8.3.3.2.3.

8. Move Table 8.3.3.2.3 to the annex and renumber as Table A.8.3.3.2.1 while deleting the rows in the table dealing with glycerine and 40% water, glycerine and 30% water, propylene glycol and 50% water and propylene glycol and 40% water. Add an annex note so that the annex and Table would appear as follows:

A.8.3.3.2.1 See Table A.8.3.3.2.1.
Table A.8.3.3.2.1 Properties of Glycerine and Propylene Glycol

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</table>

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

9. Renumber 8.3.3.2.3.1 to 8.3.3.2.2.

8.3.3.2.2 The concentration of antifreeze solutions shall be limited to the minimum necessary for the anticipated minimum temperature.

10. Delete 8.3.3.2.4, 8.3.3.2.5 and Table 8.3.3.2.5.

11. Renumber 8.3.3.2.6 as 8.3.3.2.3 and renumber A.8.3.3.2.6 as A.8.3.3.2.3. Also renumber Figure A.8.3.3.2.6 as Figure A.8.3.3.2.3.

8.3.3.2.3* An antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be installed.

A.8.3.3.2.3 Beyond certain limits, an increased proportion of antifreeze does not lower the freezing point of the solution (see Figure A.8.3.3.2.3). Glycerine, diethylene glycol, ethylene glycol, and propylene glycol never should be used without mixing with water in the proper proportions, because these materials tend to thicken near 32°F (0°C).

12. Renumber 8.3.3.2.7 as 8.3.3.2.4 and revise to read as follows:

8.3.3.2.4 The specific gravity of the antifreeze shall be checked by a hydrometer with a scale having 0.002 subdivisions in accordance with Figure 8.3.3.2.4(a) and 8.3.3.2.4(b).

13. Renumber Figure 8.3.3.2.3(a) as Figure 8.3.3.2.4(a) and delete the 50% curve.

14. Renumber Figure 8.3.3.2.3(b) as Figure 8.3.3.2.4(b) and delete the 60% and 70% curves.

Issue Date: March 1, 2011

Effective Date: March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
NFPA 13R
Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

2010 Edition

Reference: 4.7 and 5.4.3
TIA 10-2
(SC 11-3-5/TIA Log #1013)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Delete Section 4.7, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010.

2. Delete new 5.4.3, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010.

3. Revise 5.4.4 to 5.4.3, that was language added by the issuance of TIA No. 10-1 (Log #995) in August of 2010 to read as follows:

5.4.3 Where antifreeze systems, dry pipe systems, and preaction systems are installed, they shall be installed in accordance with NFPA 13.

Issue Date: March 1, 2011
Effective Date: March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)

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NATIONAL FIRE PROTECTION ASSOCIATION
SUMMARY ACTION: The Standards Council voted to issue TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, which, for new installations, prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R sprinkler systems. In addition, the Council directed that the responsible technical committees conduct further activities as set forth in the decision.

At its meeting of August 3-5, 2010, the Standards Council considered six proposed Tentative Interim Amendments (TIAs), together with related appeals, regarding antifreeze in new residential fire sprinkler installations. Two TIAs were submitted on each of the following documents: NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes, and NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height. Of the TIAs, one group of three (TIAs 1000, 995, and 994) sought collectively to prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “No Antifreeze” TIAs). The other group of three (TIAs 996, 997, and 998) sought collectively to prohibit the use of antifreeze solutions in excess of 50% by volume within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “50% Antifreeze” TIAs). These latter TIAs permitted only the use of factory premixed antifreeze solutions.

The six proposed TIAs were balloted through the responsible Technical Committees – the Technical Committee on Sprinkler System Installation Criteria for NFPA 13, and the Technical Committee on Residential Sprinklers for NFPA 13D and NFPA 13R – as well as the Technical Correlating Committee on Automatic Sprinkler Systems (the TCC). Balloting was completed in accordance with the NFPA Regulations Governing Committee Projects, but, as detailed further in this decision, the ballot results are of limited significance because of new technical data and information that has recently become available. The TIAs, ballot results, and several related appeals have nevertheless been forwarded to the Council for consideration. In this unusual and compelling situation, in which the status quo in the existing sprinkler documents is no longer tenable, and in which circumstances require emergency action, the Council has voted to issue three TIAs, the effect of which, pending further technical committee consideration, will be to prohibit the use of antifreeze within the dwelling unit portions of sprinkler systems.
BACKGROUND

Antifreeze solutions have long been used in sprinkler systems to protect piping in unheated areas subject to freezing temperatures. Since at least 1940, NFPA standards have included guidance on the use of antifreeze solutions in sprinkler systems. The events that led to the development of the proposed TIAs to limit or prohibit the use of antifreeze solutions in residential sprinkler applications began when the NFPA became aware of a fire incident in Truckee, California, which took place in August of 2009. Emerging information concerning this incident raised concern surrounding the combustibility of antifreeze solutions in residential sprinkler systems. The incident reportedly involved a grease fire in a kitchen where a sprinkler system with a reportedly high - possibly in excess of 70% - concentration of antifreeze deployed. The fire resulted in a single fatality and serious injury to another person, and the possibility was raised that the antifreeze solution discharging from the sprinkler intensified the fire and resulting harm.

In response to these reports, several activities were initiated within the NFPA and the NFPA-affiliated Fire Protection Research Foundation (the Research Foundation). These activities and especially the resulting reports of the Research Foundation will be described here only in brief, and the reader is urged to consult the Research Foundation reports available at www.nfpa.org/antifreeze for the presentation of the available research and analysis. With this caveat, it suffices to say, in outline, that the NFPA, in response to reports of the Truckee incident, commissioned the Research Foundation to conduct a literature review and develop a research plan on antifreeze solutions and residential fire sprinkler systems. A report on this project was published by the Research Foundation as "Literature Review and Research Plan Antifreeze Solutions in Home Fire Sprinkler Systems," (prepared for the Fire Protection Research Foundation by Code Consultants, Inc., May 28, 2010) (the First Research Foundation Report). Meetings of the NFPA Technical Correlating Committee on Sprinkler Systems (the TCC) were also convened to review available information. During this period, Underwriters Laboratories (UL) conducted a series of tests in an effort to begin exploring the effect of antifreeze solutions in certain residential sprinkler configurations (the Phase I tests). The Phase I tests were not conducted as part of the Research Foundation activities, but several of the tests were witnessed by researchers working on behalf of the Research Foundation and are summarized in the First Research Foundation Report. The results of these Phase I tests were also presented at a meeting of the TCC. The results of these limited Phase I tests could not provide answers to all questions concerning the safe use of antifreeze solutions in residential sprinkler systems. They did point to serious concerns with the use of higher concentrations of antifreeze and were inconclusive as to the safety of antifreeze in lower concentrations of 50% by volume or less.

With the Phase I tests, the First Research Foundation Report and other available information, two sets of competing TIAs on antifreeze in residential sprinkler systems were developed and submitted by several parties. As summarized more fully above, the three No Antifreeze TIAs, prohibited the use of antifreeze solutions and the 50% Antifreeze TIAs prohibited the use of antifreeze solutions in excess of 50% by volume and required that only factory premixed solutions be used. The TIAs were submitted to the ballot of the responsible technical committees and the TCC. Five of the TIAs failed letter ballot of the technical committees. The No Antifreeze TIAs showed considerable support, including one TIA which failed by only a single vote. One of the TIAs, the 50% Antifreeze TIA on NFPA 13 did pass ballot. Unlike the balloting on the TIAs for NFPA 13D and NFPA 13R, however, the 50% Antifreeze TIA on NFPA 13 was balloted separately from the No Antifreeze option for NFPA 13, and it is not clear what effect the sequencing of the balloting on NFPA 13 may have had on the outcome.

The confusing and inconclusive ballot results may have stemmed from the limited nature of the data then available to the technical committees. The Council, however, need not undertake to
analyze these TIA results in any depth because events have largely superseded them. Specifically the First Research Foundation Report had concluded that "the existing research as well as the recent near-term [Phase I] testing conducted by UL indicate the urgent need for further research into the effectiveness of currently permitted antifreeze solutions." This conclusion led to the development of a Phase II test plan to investigate in greater depth the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. With great rapidity, the Research Foundation mounted a project to fund and conduct the Phase II testing, with UL and Code Consultants, Inc. under contract to do the testing and to develop a report. However, even under the aggressive testing schedule, the test results did not become available until after the close of balloting on the TIAs. Indeed, the Phase II tests were completed just prior to the commencement of the Standards Council's August meeting and have now been published as “Interim Report: Phase II Research Antifreeze Solutions in Home Fire Sprinkler Systems, (Prepared for the Fire Protection Research Foundation by Code Consultants, Inc., August 11, 2010) (www.nfpa.org/antifreeze) (the Second Research Foundation Report).

At the Standards Council meeting, Steve Wolin, of Code Consultants, Inc., presented the Research Foundation reports, including the results of the Phase I and II tests. A hearing then proceeded to consider appeals and arguments as to what course of action the Council should pursue with respect to the TIAs. Rather than focus on the various arguments presented on the TIAs, the Council for purposes of this decision, focuses on some undisputed conclusions of the Phase II testing, namely that the existing provisions in NFPA 13, NFPA 13R and NFPA 13D, relating to antifreeze are no longer supportable as written. Specifically, current standards recommend the use of the antifreeze solutions, depending on the chemical being used and level of freeze protection being sought, to exceed 50% concentration, by volume, up to, in some cases, as much as 70%. See, e.g., NFPA 13, Table 7.6.2.2. The conclusions of the Research Foundation report, however, were clear this was no longer acceptable. Specifically, the new research from the Phase II testing clearly indicates that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in residential sprinkler systems, and the fire size increased (to some extent) for all the antifreeze solutions tested under certain sprinkler discharge and fire test conditions. Moreover, although these concentrations met UL 1626 fire control criteria and exhibited similar performance to that of water alone, consideration must also be given to adding appropriate safety factors for concentrations of these antifreeze solutions in the relevant standards. See Second Research Foundation Report at Executive Summary, pp. 1-2.

Given these conclusions, the Council must now determine how to proceed. At the hearing to consider the TIAs, several alternatives were suggested and advocated to varying degrees, including: take no action and refer the matter back to the responsible technical committees to review the new technical data from the Phase II testing and consider further appropriate action; issue the 50% Antifreeze TIAs; issue the No Antifreeze TIAs; or issue modified TIAs taking into account the test results reported by the Research Foundation.

In normal circumstances, the Council might well have delayed taking any action in order to give time to the responsible technical committees to review and take action based on the technical issues and new data presented by the Research Foundation reports. It is clear, however, from the discussion at the hearing, and from the complicated nature of the technical information that will need to be reviewed that consideration by the technical committees will require some time. Given the serious nature of the safety concerns related to the current concentrations of antifreeze permitted in existing NFPA standards, the Council believes that immediate action needs to be taken.
As to the actions that have been proposed, issuing TIAs that would merely limit antifreeze solutions to 50% by volume is not an adequate step. The Phase II test results showed that a 50% by volume limitation for propylene glycol is not appropriate, and, depending on what safety factors may be needed, may not be appropriate for glycerin either. The 50% Antifreeze TIAs, moreover, would allow 50% solutions of other antifreeze compounds including diethylene glycol and ethylene glycol, which have not been tested and may well require different limits. Given the circumstances, the Council does not believe it would be appropriate for the Council to issue the 50% Antifreeze TIAs.

Nor is it appropriate for the Council itself to craft and issue new TIAs that fully consider and address the technical issues raised by the Research Foundation data and other information now available. Crafting new TIAs is the province of the technical committees. In the interim, however, emergency action needs to be taken. This is not in dispute as the balloting on all the TIAs confirmed the emergency nature of addressing the existing antifreeze provisions concerning residential applications.

Considering the entire record before it, the Council has concluded that the most prudent course of action at this time must be the most conservative approach to assuring safety in new residential sprinkler installations. That course of action is to prohibit the use of antifreeze in new residential sprinkler systems unless and until the responsible technical committees, after due consideration and any correlation by the TCC, reach consensus on a different approach. Accordingly, the Council has voted to issue the three TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, that prohibit the use of antifreeze solutions in new residential sprinkler applications.

In reaching this decision, the Council wishes to make several points. First, the Council's action follows on previous action already taken by the NFPA. On July 6, 2010, the NFPA, separate from its standards development process, and acting in its role as a safety advocate, issued a Safety Alert responding to developing concerns about the use of antifreeze solutions in residential applications. The Safety Alert urged that, until further information was available, new residential sprinkler systems should be designed and installed so as not to require the use of antifreeze solutions. The TIAs now being issued merely extend this recommendation, pending any further consideration and action by the responsible technical committees.

Second, it should be noted that for 13R and 13D residential systems, sprinklers are not required to be installed in unheated areas. At any rate, the use of antifreeze should be avoidable in most if not all residential installations through alternative design approaches including the use of insulation and other means.

Third, the Council wishes to emphasize that in issuing the TIAs, it is not undertaking to make any final technical determination about the correct course of action that may eventually emerge. The technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus based technical committees to determine, and the same should be true in this case. The Council's action is an emergency action only, and is not intended to prejudge the merits of any further revisions that the responsible technical committees may propose. As to the technical committees’ further consideration of the technical issues, the record suggests that the Research Foundation reports and other information now available will require careful and considered review. This, of course, may take some time, but it is also possible that the technical committees may be able to act quickly to bring new recommendations to the Council. The Council urges the committees to address this matter with reasonable speed and provide clear technical substantiation for any further actions that are proposed. Should the committees do so...
prior to the Council's next scheduled meeting, the Council will make every effort to expedite its consideration of the matter through a special meeting or letter ballot.

The Council wishes to address two additional important matters beyond the scope of the present TIAs. First, the TIAs that were presented to the Council all involve standards that address the design and installation of new sprinkler systems. The important question of what should be done to address antifreeze in existing residential sprinkler systems is, therefore, not addressed by these TIAs. Fortunately, the NFPA in its July 6, 2010 Safety Alert has addressed existing systems. Specifically, the Safety Alert stresses that fire sprinklers are extremely effective protection devices, significantly reducing deaths, injuries and property loss from fire. It urges that these systems should not be disconnected and it recommends that the following actions be taken:

- If you have, or are responsible for, a residential occupancy with a fire sprinkler system, contact a sprinkler contractor to check and see if there is antifreeze solution in the system.

- If there is antifreeze solution in the system, as an interim measure, drain the system and replace it with water only. Problems associated with freezing of sprinkler pipes can be mitigated by alternative measures such as insulation. NFPA hopes to provide further guidance based on additional testing before the winter freezing months.

These recommendations and any updates that the NFPA may provide as a result of the Phase II testing (see www.nfpa.org/antifreeze for any updates as they may become available) provide important guidance on the handling of antifreeze in existing residential sprinkler systems. The responsible technical committees within the NFPA consensus codes and standards development process, however, should now review where and how relevant NFPA standards might be made to address antifreeze in existing systems. Relevant committees, including the Technical Committee on Sprinkler System Installation Criteria, the Technical Committee on Residential Sprinkler Systems, the Technical Correlating Committee on Automatic Sprinkler Systems, and the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems, should consider this question in a coordinated manner and report back to the Council no later than its October 2010 meeting with any proposed actions or recommendations.

Finally, the actions taken in this decision do not address antifreeze in non-residential commercial applications. As the Research Foundation reports suggests, commercial sprinklers and occupancies present quite different characteristics than residential sprinklers and occupancies and, as the First Research Foundation Report suggests, any analysis of antifreeze in sprinkler systems is highly dependent on the specific characteristics of the sprinkler design and setting. The current activities, driven by clear concerns identified in residential sprinkler systems, have been a necessary response to an emerging problem. Further research will likely be necessary to better understand and address the use of antifreeze in various non-residential commercial settings. The role of the relevant committees in considering further standards development activities in this area and in recommending needed research is clear, and the Council is, therefore, requesting that they begin to review and consider the use of antifreeze in non-residential contexts and report back to the Council by its October 2010 meeting with any proposed actions or recommendations.

In conclusion, the Council wishes stress the importance of fire sprinklers in safeguarding lives and property. The home in particular is the place where most fire fatalities occur, and when home sprinklers are present, the risk of dying in a home fire decreases by 83%. It is hoped that the actions of the Standards Council, the valuable contributions of the NFPA and the Research Foundation, (including the project contractors, technical panel and sponsors), and the continuing
activities of the sprinkler related NFPA technical committees will all combine to help ensure the continued effectiveness and wide use of these important safety devices.

Council Member Roland Huggins recused himself during the hearings, deliberations and vote on the issue. Council Members Shane Clary and Ralph Gerdes wished to be recorded as voting negatively.
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13, Standard for the Installation of Sprinkler Systems, 2010 edition. The TIA was processed by the Technical Committee on Sprinkler System Installation Criteria and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. **Add a new section 7.6.1 as follows:**

   **7.6.1 Dwelling Units.** Antifreeze shall not be permitted to be used within the dwelling unit portions of sprinkler systems.

2. **Renumber the remainder of the section accordingly.**

**Issue Date:** August 5, 2010

**Effective Date:** August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see [www.nfpa.org/codelist](http://www.nfpa.org/codelist).)
Tentative Interim Amendment

NFPA 13D
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

2010 Edition

Reference: 3.3.9.1, 4.1.4, 5.2.7, 8.3.3, and A.8.3.3.1

TIA 10-1
(SC 10-8-18/TIA Log #994)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Delete 3.3.9.1 and renumber remainder of subsection 3.3.9.

2. Delete entire subsection 4.1.4, Antifreeze Systems.

3. Revise 5.2.7 to read as follows:
   “Joints for the connection of copper tube for wet type systems shall be soldered joints or be brazed.” (delete the words “and antifreeze systems”).

4. Delete Item (2) of subsection 8.3.2 and renumber (3) as (2).

5. Revise section 8.3.3.1 to read:
   **8.3.3.1** Antifreeze shall not be permitted in sprinkler systems.

6. Delete A.8.3.3.1.

7. Delete all subsections and accompanying Annex A paragraphs commencing with 8.3.3.2 and ending with 8.3.3.5.

Issue Date: August 5, 2010

Effective Date: August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see [www.nfpa.org/codelist](http://www.nfpa.org/codelist))
Tentative Interim Amendment

NFPA 13R
Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

2010 Edition

Reference: 4.7 and 5.4.3
TIA 10-1
(SC 10-8-19/TIA Log #995)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add new sections as follows:

4.7 Antifreeze Systems. Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

5.4.3 Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

2. Renumber 5.4.3 as 5.4.4.

Issue Date: August 5, 2010
Effective Date: August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)

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NATIONAL FIRE PROTECTION ASSOCIATION
March 14, 2011

Mr. Russell P. Fleming
National Fire Sprinkler Association, Inc.
40 Jon Barrett Road
Patterson, NY  12563

Dear Mr. Fleming:

I am pleased to notify you that the Standards Council, at its meeting on March 1, 2011, voted to issue the TIA on NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2011 edition, with an effective date of March 21, 2011.

NFPA will be publishing the Tentative Interim Amendment in the April 2011 issue of NFPA News and it will be included in any further distribution of the document. I have enclosed a copy of the TIA.

Very truly yours,

Linda Fuller
Manager, Codes and Standards Administration

LF/nmw

Enclosure:  [TIA 11-1 (SC-11-3-6 Log #1014)]

cc:  D. Berry, M. Brodoff, L. Fuller, M. Klaus, J. Goyette
    Members, TC on Foam-Water Sprinklers (AUT-FOW)
    Members, TC on Hanging and Bracing of Water-Based Fire Protection Systems (AUT-HBS)
    Members, TC on Private Water Supply Piping Systems (AUT-PRI)
    Members, TC on Residential Sprinkler Systems (AUT-RSS)
    Members, TC on Sprinkler System Discharge Criteria (AUT-SSD)
    Members, TC on Sprinkler System Installation Criteria (AUT-SSI)
    Members, TCC on Automatic Sprinkler System (AUT-AAC)
    Members, TC on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)
    Members, NFPA Standards Council (AAD-AAA)
    Individuals Providing Public Comment and Appeal Commentary
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2011 edition. The TIA was processed by the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems, and was issued by the Standards Council on March 1, 2011, with an effective date of March 21, 2011.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new definition as 3.6.4.1.1 to read as follows:

   **3.6.4.1.1 Premixed Antifreeze Solution.** A mixture of an antifreeze material with water that is prepared by the manufacturer at a factory with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

2. Revise 5.3.4 to read as follows:

   **5.3.4* Antifreeze Systems.** Annually, before the onset of freezing weather, the antifreeze solution shall be tested using the following procedure:

   (1) Using installation records, maintenance records, information from the owner, chemical tests, or other reliable sources of information, the type of antifreeze in the system shall be determined.

       a) If the type of antifreeze is found to be a type that is no longer permitted, the system shall be drained completely and replaced with an acceptable solution.

       b) If the type of antifreeze cannot be reliably determined, then the system shall be drained completely and replaced with an acceptable solution.

   (2) If the antifreeze is not replaced in accordance with step 1, test samples shall be taken at the top of each system and at the bottom of each system.

       a) If the most remote portion of the system is not near the top or the bottom of the system, an additional sample shall be taken at the most remote portion.

       b) If the connection to the water supply piping is not near the top or the bottom of the system, an additional sample shall be taken at the connection to the water supply.

   (3) The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.
(4) If any of the samples exhibits a concentration in excess of what is permitted by NFPA 25, the system shall be emptied and refilled with a new acceptable solution. If a concentration greater than what is currently permitted by NFPA 25 was necessary to keep the fluid from freezing, alternate methods of preventing the pipe from freezing shall be employed.

(5) If any of the samples exhibits a concentration lower than what is necessary to keep the fluid from freezing, the system shall be emptied and refilled with a new acceptable solution.

5.3.4.1 The use of antifreeze solutions shall be in conformity with state and local health regulations.

5.3.4.1.1* Listed CPVC sprinkler pipe and fittings shall be protected from freezing with glycerin only. The use of diethylene, ethylene, or propylene glycols shall be specifically prohibited.

5.3.4.2* Antifreeze solutions shall comply with one of the following:

1. The concentration of a glycerin solution measured in an existing system shall be limited to 50% by volume.

2. Newly introduced solutions shall be factory premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume.

3. The concentration of a propylene glycol solution measured in an existing system shall be limited to 40% by volume.

4. Newly introduced solutions shall be factory premixed antifreeze solutions of propylene glycol (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 38% by volume.

5. Other solutions listed specifically for use in fire protection systems.

5.3.4.3 The antifreeze solution shall be tested at its most remote portion and where it interfaces with the wet pipe system.

5.3.4.4 Where antifreeze systems have a capacity larger than 150 gal (568 L), tests at one additional point for every 100 gal (379 L) shall be made.

5.3.4.4.1 If the results indicate an incorrect freeze point at any point in the system, the system shall be drained and refilled with new premixed antifreeze.

5.3.4.4.2 For premixed solutions, the manufacturer’s instructions shall be permitted to be used with regard to the number of test points and refill procedure.

4. Remove Table 5.3.4.1(a) and 5.3.4.1(b) and add Table 5.3.4.1 as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution (% by volume)</th>
<th>Specific Gravity at 77°F (25°C)</th>
<th>freezing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin (C.P. or U.S.P. grade)</td>
<td>0</td>
<td>1.000</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.014</td>
<td>31</td>
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<tr>
<td></td>
<td>10</td>
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<td>28</td>
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<td>1.087</td>
<td>10</td>
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<td>35</td>
<td>1.100</td>
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</tr>
<tr>
<td></td>
<td>50</td>
<td>1.141</td>
<td>-19</td>
</tr>
</tbody>
</table>
5. Revise A.5.3.4 to read as follows:

**A.5.3.4** Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portion of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

Two or three times during the freezing season, test samples can be drawn from test valve B as shown in Figure 7.6.2.1(1) of NFPA 13, especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

See Figure A.5.3.4 for expected minimum air temperatures in 48 of the United States and parts of Canada where the lowest one-day mean temperature can be used as one method of determining the minimum reasonable air temperature. In situations where the piping containing the antifreeze solution is protected in some way from exposure to the outside air, higher minimum temperatures can be anticipated.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For drops in excess of 36 in., consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.

When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

| Propylene glycol | 0 | 1.000 | | Page 126 of 196 | 0 |
|------------------|---|-------||                  | 26 | -3               |
|                  | 10 | 1.008 | |                  | 25 | -4               |
|                  | 15 | 1.012 | |                  | 22 | -6               |
|                  | 20 | 1.016 | |                  | 19 | -7               |
|                  | 25 | 1.020 | |                  | 15 | -10              |
|                  | 30 | 1.024 | |                  | 11 | -12              |
|                  | 35 | 1.028 | |                  | 2  | -17              |
|                  | 40 | 1.032 | |                  | -6 | -21              |
6. Add a new A.5.3.4.2 to read as follows:

**A.5.3.4.2** The use of factory premixed solutions is required because solutions that are not mixed properly have a possibility of separating from the water, allowing the pure concentrate (which is heavier than water) to drop out of solution and collect in drops or low points of the system. Such concentrations are combustible and could present problems during fires. The properties of glycerin are shown in Table A.5.3.4.2.

### Table A.5.3.4.2 Properties of Glycerin and Propylene Glycol

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution (% by volume)</th>
<th>Specific Gravity at 60°F (15.6°C)</th>
<th>Freezing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin (C.P. or U.S.P. grade)</td>
<td>50 water</td>
<td>1.145</td>
<td>-20.9</td>
</tr>
<tr>
<td>Hydrometer scale 1.000 to 1.200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>60 water</td>
<td>1.034</td>
<td>-6</td>
</tr>
<tr>
<td>Hydrometer scale 1.000 to 1.200 (subdivisions 0.002)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C.P.: chemically pure; U.S.P.: United States Pharmacopoeia 96.5%.

**Issue Date:** March 1, 2011

**Effective Date:** March 21, 2011

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
TO: Richard Bielen
FROM: Linda Fuller
DATE: November 3, 2010
SUBJECT: Status Report re: Relevant NFPA Standards to Address Antifreeze in both New and Existing Systems

I am transmitting to you herewith the following action of the Standards Council (October 19-20, 2010):

The Council heard a status report from NFPA Staff on behalf of the Technical Correlating Committee on Automatic Sprinkler Systems (TCC), the Technical Committee (TC) on Sprinkler System Installation Criteria, the TC on Residential Sprinkler Systems, and the TC on Inspection, Testing, and Maintenance of Water-Based Systems responsible for NFPA 25. The report provided the progress to date about how the relevant NFPA standards could address antifreeze in both new and existing systems. The report indicated that the TCC and TCs have reviewed the Fire Protection Research Foundation test reports and have begun work on potential TIAs for NFPA 13, 13R, 13D and 25. The Council acknowledged the ongoing work of the Sprinkler Project. Further, the Council notes that the report has identified some potential future research needs. The Council directs NFPA Staff to forward this information to the Fire Protection Research Foundation for its consideration in determining the feasibility and scope of future research projects that it might undertake.

c: M. Klaus, C. Grant, K. Almand  
Technical Correlating Committee on Automatic Sprinkler Systems (AUT-AAC) 
Technical Committee on Sprinkler System Installation Criteria (AUT-SSI) 
Technical Committee on Residential Sprinkler Systems (AUT-RSS) 
Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)

10-10-21
Antifreeze Solutions in Home Fire Sprinkler Systems

Phase II Research Final Report

Prepared by:
Code Consultants, Inc.
NFPA 13, *Standard for the Installation of Sprinkler Systems*, has included guidance on the use of antifreeze solutions in fire sprinkler systems since the 1940 edition. Recent fire incidents, analysis of available literature, and preliminary testing have identified concerns with the use of certain antifreeze solutions. Under certain conditions, solutions of glycerin and propylene glycol antifreeze have been found to ignite when discharged from automatic sprinkler systems. A literature review, preliminary testing, and a long term research plan were developed as part of Phase I of this project. This Final Report includes the results of a comprehensive test program (also outlined in the Interim Report on the project) on a range of propylene glycol and glycerin antifreeze solutions challenged in a range of fire scenarios, as well as additional analysis and recommendations for further study.

The content, opinions and conclusions contained in this report are solely those of the author.
# Project Technical Panel

## Home Fire Sprinklers and Antifreeze Solutions

### Phase II

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnus Arvidson</td>
<td>Swedish Testing and Research Center</td>
</tr>
<tr>
<td>Elizabeth Buc</td>
<td>Fire and Materials LLC</td>
</tr>
<tr>
<td>Scott Futrell</td>
<td>Futrell Fire Design and Consult</td>
</tr>
<tr>
<td>Tonya Hoover</td>
<td>CAL FIRE – Office of the State Fire Marshal</td>
</tr>
<tr>
<td>Garner Palenske</td>
<td>Schirmer Engineering</td>
</tr>
<tr>
<td>Maurice Pilette</td>
<td>Mechanical Designs Inc (chair of NFPA 13D)</td>
</tr>
<tr>
<td>Noah Ryder</td>
<td>Packer Engineering</td>
</tr>
<tr>
<td>Joe Senecal</td>
<td>Kidde Fenwal</td>
</tr>
<tr>
<td>Pete Willse</td>
<td>XL Insurance</td>
</tr>
<tr>
<td>Jim Lake</td>
<td>NFPA Staff Liaison</td>
</tr>
</tbody>
</table>

### Contractors

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
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<tbody>
<tr>
<td>Steve Wolin</td>
<td>Code Consultants, Inc.</td>
</tr>
<tr>
<td>Kerry Bell</td>
<td>Underwriters Laboratories Inc.</td>
</tr>
</tbody>
</table>

### Sponsor Representatives

<table>
<thead>
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<th>Organization</th>
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</thead>
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<tr>
<td>Chris Dubay</td>
<td>NFPA</td>
</tr>
<tr>
<td>James Golinveaux</td>
<td>Tyco Fire Suppression and Building Products</td>
</tr>
<tr>
<td>Scott Franson</td>
<td>The Viking Corporation</td>
</tr>
<tr>
<td>Russ Fleming</td>
<td>NFSA</td>
</tr>
<tr>
<td>Roland Huggins</td>
<td>AFSA</td>
</tr>
<tr>
<td>Tom Multer</td>
<td>Reliable Automatic Fire Sprinkler Co.</td>
</tr>
<tr>
<td>Tom Wancho and Ken Swantek</td>
<td>Victaulic</td>
</tr>
</tbody>
</table>
Phase II Research
Antifreeze Solutions in Home Fire Sprinkler Systems

Prepared for:
The Fire Protection Research Foundation
1 BatteryMarch Park
Quincy, MA 02169

Prepared by:
CODE CONSULTANTS, INC.
1804 Borman Circle Drive
Saint Louis, MO 63146

CCI Project No. 100138.04.001

December 3, 2010

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Executive Summary

NFPA 13, *Standard for the Installation of Sprinkler Systems*, has included guidance on the use of antifreeze solutions in fire sprinkler systems since the 1940 edition. [1] Antifreeze solutions may be used in fire sprinkler systems where the piping system, or portions of the piping system, may be subject to freezing temperatures. [2] Antifreeze solutions permitted for use in sprinkler systems connected to potable water supplies include propylene glycol and glycerin.

Recent fire incidents, analysis of available literature, and preliminary testing have identified concerns with the use of certain antifreeze solutions. Under certain conditions, solutions of glycerin and propylene glycol antifreeze have been found to ignite when discharged from automatic sprinkler systems. A literature review, preliminary testing, and a long term research plan were developed as part of Phase I of this project. This Report outlines the results of Phase II of the project, which includes further testing of propylene glycol and glycerin antifreeze solutions for a range of concentrations and operating conditions. The testing and analysis were limited to antifreeze solutions discharged through residential sprinklers and did not investigate other types of sprinklers.

A test plan was developed for Phase II to investigate the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. Testing was conducted in two parts. Scope A consisted of fire tests using six (6) models of sprinklers at elevations of 8 ft and 20 ft to investigate the potential for large-scale ignition of antifreeze sprays at pressures ranging from 10 psi to 150 psi. Scope B consisted of room fire tests, similar to UL 1626, that were designed to investigate the effective of sprinklers discharging antifreeze solutions and their ability to maintain tenable conditions.

Results of the Scope A testing indicate that concentrations of propylene glycol exceeding 40% by volume and concentrations of glycerin exceeding 50% by volume have the potential to ignite when discharged through residential sprinklers. The potential for ignition depends on several factors including the ignition source, sprinkler model, sprinkler elevation, discharge pressure, and the location of the sprinkler with respect to the ignition source. Ignition of antifreeze spray increased the measured heat release rate in certain tests with 50% propylene glycol and 55% glycerin by more than 300%. For certain test conditions, the increase in heat release rate resulting from the application of 55% glycerin solution exceeded the increase in heat release rate from the application of 50% glycerin solution by a factor of 10. A similar level of sensitivity was observed between 40% and 50% propylene glycol solutions, but not between 40% and 45% propylene glycol solutions.
The results of the Scope B testing indicated that concentrations of propylene glycol not exceeding 40% by volume and concentrations of glycerin not exceeding 50% by volume have similar performance to water as compared to the UL 1626 fire control criteria. Both the 40% propylene glycol and 50% glycerin solutions met the UL 1626 fire control criteria and demonstrated similar performance to that of water alone throughout the series of tests.

The results of this research suggest that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in home fire sprinkler systems. Consideration should be given to an appropriate safety factor for concentrations of these antifreeze solutions that are permitted by future editions of NFPA 13, as well as warnings and limitations outlined in antifreeze product literature.

Based on the flammability properties outlined in Table 4, the use of solutions of diethylene glycol and ethylene glycol in home fire sprinkler systems should also be limited unless testing is conducted to establish that they are appropriate for use in home fire sprinkler systems. The results of this analysis are limited to residential sprinklers; the flammability of antifreeze solutions discharged through other types of sprinklers has not been investigated.

Recommendations are provided for further research in the following areas:

- Investigate the use of Antifreeze Solutions in Sprinkler Systems with Non-Residential Sprinklers
- Characterize Droplet Size Distributions from Sprinklers
- Develop a Small or Medium Scale Screening Test of Antifreeze Solutions
- Develop a Listing Standard for Solutions introduced into Sprinkler Systems
I. Introduction

Recent fire incidents raised questions regarding the effectiveness of antifreeze sprinkler systems in controlling residential fire conditions. As a result, the Fire Protection Research Foundation retained Code Consultants, Inc. (CCI) to perform a literature search and develop a research plan to investigate the impact of antifreeze solutions on the effectiveness of home fire sprinkler systems. [3] The literature review included the following subjects:

1. Antifreeze sprinkler system requirements
2. Mixing and separation of antifreeze compounds commonly used in sprinkler systems
3. Flammability of antifreeze solutions commonly used in sprinkler systems
4. Factors influencing the flammability of liquids, such as dispersion in droplets
5. Characterization of residential sprinkler sprays
6. Factors influencing the potential for flash fires or explosions from liquid sprays
7. Existing fire test data on the effectiveness of antifreeze solutions at controlling fire conditions
8. Fire incident reports involving antifreeze sprinkler systems

A research plan was developed to supplement the literature review in areas where existing information was limited. In addition, CCI observed a series of preliminary fire tests (Phase I) conducted by Underwriters Laboratories, Inc. (UL) to investigate the effectiveness of antifreeze sprinkler systems in controlling certain home fire scenarios. A summary of data from the preliminary testing was also provided by UL. [4] CCI provided suggestions for further research to provide a more complete analysis of currently permitted antifreeze solutions as well as to investigate other antifreeze solutions that could be used in sprinkler systems.

The Phase I testing identified the need for additional research regarding the potential for antifreeze solutions to create a large-scale ignition of spray when discharged through automatic sprinklers onto a fire. Additional research was also needed to further investigate the impact of antifreeze solutions on a sprinkler system’s ability to control a fire condition and maintain tenable conditions. As such, a Phase II test plan was created based on the Phase I information.
The Phase II test plan was separated into two scopes (A and B) which were intended to investigate additional research identified in Phase I. Scope A tested antifreeze solutions for the potential to create a large-scale ignition of the spray when discharged through sprinklers onto a fire. Scope B tested antifreeze solutions for its impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.
II. Background

Recent fire tests have indicated the potential for ignition of certain antifreeze solutions discharged from automatic sprinkler systems. [4] The potential for ignition of an antifreeze spray and the influence of antifreeze solutions on sprinkler effectiveness involves several complex and contemporary research topics. This section provides a basic summary of relevant background information; a more complete discussion can be found in the report from Phase I of this project. [3]

A. Antifreeze Solutions

NFPA 13 [5], 13D [6], and 13R [7] each include substantially similar requirements for antifreeze solutions used in sprinkler systems. Antifreeze solutions of propylene glycol and glycerin with water are each permitted in sprinkler systems connected to potable water supplies. The antifreeze solutions are intended to protect sprinkler piping that passes through areas that could be exposed to freezing temperatures. Freezing point data for propylene glycol and glycerin solutions provided in NFPA 13 is summarized in the following table.

<table>
<thead>
<tr>
<th>Material</th>
<th>Solution with Water (by Volume)</th>
<th>Specific Gravity at 60 °F (15.6 °C)</th>
<th>Freezing Point °F  °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin (C.P. or U.S.P grade)</td>
<td>50% glycerin</td>
<td>1.145</td>
<td>-20.9 -29.4</td>
</tr>
<tr>
<td></td>
<td>60% glycerin</td>
<td>1.171</td>
<td>-47.3 -44.1</td>
</tr>
<tr>
<td></td>
<td>70% glycerin</td>
<td>1.197</td>
<td>-22.2 -30.1</td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>40% propylene glycol</td>
<td>1.034</td>
<td>-6 -21.1</td>
</tr>
<tr>
<td></td>
<td>50% propylene glycol</td>
<td>1.041</td>
<td>-26 -32.2</td>
</tr>
<tr>
<td></td>
<td>60% propylene glycol</td>
<td>1.045</td>
<td>-60 -51.1</td>
</tr>
</tbody>
</table>

C.P.: Chemically pure. U.S.P.: United States Pharmacopoeia 96.5%
Table 1: Adapted from NFPA 13 Table 7.6.2.2 Antifreeze Solution to be Used if Potable Water is Connected to Sprinklers

Antifreeze solutions of ethylene glycol and diethylene glycol are also permitted, but only in sprinkler systems that are connected to non-potable water supplies. This research focuses on propylene glycol and glycerin antifreeze solutions, because they are believed to be much more commonly used in home fire sprinkler systems.

Antifreeze solutions of glycerin, diethylene glycol, and ethylene glycol were included in NFPA 13 starting in the Appendix of the 1940 edition, known at the time as National Board of Fire Underwriters Pamphlet No. 13. [1] The 1953 edition of NFPA 13 included requirements for
Antifreeze Solutions in Home Fire Sprinkler Systems

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antifreeze sprinkler systems in the body of the standard and permitted the use of propylene glycol or calcium chloride solutions as well as glycerin, diethylene glycol, and ethylene glycol. [8] The antifreeze solutions and concentrations permitted by the 1953 edition of NFPA 13 are the same as those permitted by the current (2010) edition of NFPA 13, with the exception that calcium chloride is no longer permitted. [2]

Table 2, below, illustrates the freezing point and the specific gravity values (at 25°C) for a propylene glycol-water mixture in addition to the corresponding percent volume and percent weight of propylene glycol. The difference in percent volume and percent weight of propylene glycol solutions is minimal, because its density is only slightly higher than the density of water.

<table>
<thead>
<tr>
<th>% Vol.</th>
<th>% Wt.*</th>
<th>Freezing Point (°F)</th>
<th>Specific Gravity at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>32</td>
<td>1.000</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
<td>26</td>
<td>1.004</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>25</td>
<td>1.008</td>
</tr>
<tr>
<td>15%</td>
<td>15%</td>
<td>22</td>
<td>1.012</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
<td>19</td>
<td>1.016</td>
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<td>25%</td>
<td>25%</td>
<td>15</td>
<td>1.020</td>
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<td>30%</td>
<td>30%</td>
<td>11</td>
<td>1.024</td>
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<tr>
<td>35%</td>
<td>35%</td>
<td>2</td>
<td>1.028</td>
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<td>40%</td>
<td>40%</td>
<td>-6</td>
<td>1.032</td>
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<td>45%</td>
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<td>-18</td>
<td>1.035</td>
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<td>50%</td>
<td>50%</td>
<td>-26</td>
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<tr>
<td>55%</td>
<td>55%</td>
<td>-45</td>
<td>1.040</td>
</tr>
<tr>
<td>60%</td>
<td>60%</td>
<td>-60</td>
<td>1.041</td>
</tr>
</tbody>
</table>

*% Vol. to % wt. conversion is at 25°C

Table 2: Propylene Glycol Properties [9] ( Portions of data are calculated or interpolated).

Similar to Table 2 (above), Table 3 (below) depicts the freezing point and specific gravity values (at 25°C) for a glycerin-water mixture in addition to the corresponding percent volume and percent weight of glycerin. Unlike the propylene glycol properties, the values for percent volume and percent weight vary significantly, because the density of glycerin is approximately 26% higher than the density of water.
As illustrated by the v-shaped curve in Figure 1, below, glycerin-water solutions reach their maximum freeze protection at a concentration of approximately 60% glycerin by volume. A glycerin-water solution that contains more than approximately 60% by volume glycerin will provide the same freeze protection as a less concentrated mixture. From a freeze protection standpoint, there is no reason to use a glycerin-water solution that contains more than 60% glycerin by volume.

<table>
<thead>
<tr>
<th>% Vol.</th>
<th>% Wt.*</th>
<th>Freezing Point (°F)</th>
<th>Specific Gravity at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>32</td>
<td>1.000</td>
</tr>
<tr>
<td>5%</td>
<td>6%</td>
<td>31</td>
<td>1.014</td>
</tr>
<tr>
<td>10%</td>
<td>12%</td>
<td>28</td>
<td>1.029</td>
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<td>15%</td>
<td>18%</td>
<td>25</td>
<td>1.043</td>
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<td>20%</td>
<td>24%</td>
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<td>1.059</td>
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<td>25%</td>
<td>29%</td>
<td>16</td>
<td>1.071</td>
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<td>30%</td>
<td>35%</td>
<td>10</td>
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<td>35%</td>
<td>40%</td>
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<td>40%</td>
<td>45%</td>
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<td>55%</td>
<td>60%</td>
<td>-31</td>
<td>1.155</td>
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<td>60%</td>
<td>65%</td>
<td>-46</td>
<td>1.168</td>
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<td>65%</td>
<td>69%</td>
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<td>1.179</td>
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<td>74%</td>
<td>-25</td>
<td>1.193</td>
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<td>75%</td>
<td>79%</td>
<td>-8</td>
<td>1.207</td>
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<td>80%</td>
<td>83%</td>
<td>6</td>
<td>1.217</td>
</tr>
<tr>
<td>85%</td>
<td>87%</td>
<td>19</td>
<td>1.228</td>
</tr>
<tr>
<td>90%</td>
<td>92%</td>
<td>36</td>
<td>1.241</td>
</tr>
<tr>
<td>95%</td>
<td>96%</td>
<td>49</td>
<td>1.252</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td>63</td>
<td>1.262</td>
</tr>
</tbody>
</table>

*% Vol. to % wt. conversion is at 25°C

Table 3: Glycerin Properties [10] (Portions of data are calculated or interpolated)
B. Flammability of Liquids

Liquids have many quantifiable flammability properties that vary depending on the type of liquid and the surrounding environment. The flash point is the temperature at which a liquid must be raised in order to produce sufficient vapors for flash ignition under specified test conditions. The flash point can be measured by one of many standardized test apparatus. Figure 2, below, illustrates an example of a closed-cup tester (ASTM D 93). The tester utilizes a heated stirrer (intended to maintain temperature uniformity) inserted into the test liquid. The test liquid is heated at a rate of approximately 41°F to 43°F per minute. The tester is capable of measuring the flash point of liquids between 174°F and 750°F. [11]
Maintaining a liquid at a temperature below its measured flash point does not guarantee that ignition will be prevented. There are many factors that may influence a liquid’s actual flash point. This is because the flash point of a liquid, as measured by test apparatus, is not necessarily the flash point of a liquid in its end-use environment. Liquids with flash point temperatures greater than the temperature of the environment of the liquid may sometimes be ignited by spraying, wicking or other means. Liquids that are mixtures, as opposed to pure substances, may demonstrate a tendency for vaporization of one component and not the other. The flash point of the remaining liquid may be different than that of the mixture when it was originally tested. [11]

At some temperature above a liquid’s flash point temperature, a liquid’s vapor can ignite without the presence of an ignition source. This is known as the autoignition temperature (AIT). There is no known relation between a liquid’s flash point and its AIT. The AIT is primarily determined by a liquid’s reactivity (rate of oxidation) while the flash point is determined by a liquid’s volatility (rate of evaporation). Many factors may affect a liquid’s AIT. Some known factors are the concentration of the vapor given off by the liquid, the shape and size of the container, the rate and duration of heating, and the test method. [11]

Figure 3, below, is an example of a test method used to measure the AIT of liquids (ASTM E 659). In this method, the testing vessel is a glass flask surrounded by an electrically heated oven equipped with several thermocouples. During a test, a 0.1 mL sample of liquid is injected
into the glass flask and is heated to a constant temperature while being observed for indications of ignition. Once the AIT is observed, both larger and smaller amounts of liquid are analyzed to determine the overall lowest AIT. [11]

![Figure 3: ASTM E 659 Autoignition Test (Setchkin Flask Test)](image)

Flammable substances may also have an upper flammability limit (UFL) and lower flammability limit (LFL). The UFL is the highest concentration (or lowest in the case of LFL) of gas or vapor of the liquid in air capable of producing a flash fire in the presence of an ignition source.

The following table summarizes flammability properties of chemicals permitted for use in antifreeze solutions by NFPA 13.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Flammable Limits in Air (% by volume)</th>
<th>Flash Point (°F)</th>
<th>Autoignition Temperature (°F)</th>
<th>Boiling Point (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propylene Glycol</td>
<td>2.6 / 12.5</td>
<td>210</td>
<td>700</td>
<td>370</td>
</tr>
<tr>
<td>Glycerin</td>
<td>Not Provided / Not Provided</td>
<td>390</td>
<td>698</td>
<td>340</td>
</tr>
<tr>
<td>Diethylene Glycol</td>
<td>Not Provided / Not Provided</td>
<td>255</td>
<td>435</td>
<td>472</td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>3.2 / Not Provided</td>
<td>232</td>
<td>748</td>
<td>387</td>
</tr>
</tbody>
</table>

Table 4: Flammability Properties of Pure Antifreeze Chemicals Permitted by NFPA 13 [12]

A suspension of finely divided droplets of flammable liquid in air can yield a flammable mixture that has many of the characteristics of a flammable gas/air mixture. These droplets have the potential to burn or explode. Researchers have observed that a 10 μm diameter droplet of flammable liquid behaves like a vapor with respect to burning velocity and LFL. Droplets with diameters larger than 40 μm behave differently. [13]
Flame propagation can occur at average concentrations well below the LFL. A flammable mixture can also form at temperatures below the flash point of a combustible liquid when atomized into air. Testing shows that with fine mists and sprays (particles less than 10 μm) the combustible concentration at the lower limit is about the same as that in uniform vapor-air mixtures. However, as the droplet diameter increases, the lower limit appears to decrease. It was observed that coarse droplets tend to fall towards the flame front in an upward propagating flame, and as a result the concentration at the flame front actually approached the value found in lower limit mixtures of fine droplets and vapors. [14]

Mists made up of coarser aerosols are capable of sustaining a flame at considerably lower fuel-air ratios than fine aerosols (vapors). The reason for this lies in the ability of the droplets to move in relation to the ambient air. Mists made up of coarser aerosols prove to be more responsive to acceleration and random movement than that of finer aerosols. As such, coarser aerosols communicate flame more readily. [13]

In the case of water-glycols, flash points will not exist until the excessive water has been removed. Research indicates that a high-temperature environment is required to realize a flash point hazard with the vapors of these fluids at normal pressure conditions. [15]

In pure form, propylene glycol and glycerin are Class IIIB Combustible Liquids. As discussed above, existing research and testing suggests that the combustibility characteristics of antifreeze-water mixtures in droplet form are not completely characterized by standardized test methods for flash point or autoignition temperature. As such, these methods are not a reliable indication of the potential for ignition of a liquid dispersed into droplets. Under certain conditions, atomized antifreeze-water mixtures can combust when sprayed onto an ignition source. Increasing the concentration of the antifreeze in the antifreeze-water solution increases the combustibility of the solution.

Antifreeze solutions of propylene glycol and water have been permitted in sprinkler systems for more than 50 years at concentrations as high as 60% by volume, which is equal to 60% by weight. However, the following disclaimer is included in the MSDS for a premix antifreeze solution specifically intended for sprinkler systems:

*Fire and Explosion Hazards – Heat from fire can generate flammable vapor. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Vapors may travel long distances along the ground before igniting and flashing back to vapor source. Fine sprays/mists may be combustible at temperatures below normal flash point. Aqueous solutions containing less than 95% propylene glycol by weight have no flash point as obtained by standard test methods. However aqueous solutions of propylene glycol greater than 22% by weight, if heated sufficiently, will produce flammable vapors. Always drain and
flush systems containing propylene glycol with water before welding or other maintenance. [16]

The disclaimer above identifies the potential for vapors of aqueous solutions that contain certain concentrations of propylene glycol to combust. It is important to consider this potential for combustion when dealing with aqueous solutions that contain flammable liquids (e.g. propylene glycol and glycerin). Furthermore, the disclaimer identifies that fine sprays/mists may be combustible at temperatures below their normal flash point.

The discussion above describes the complexity of whether a certain antifreeze solution has the potential to ignite when supplied through automatic sprinkler systems. Existing research indicates that under certain conditions the energy released during a fire condition could increase upon interaction with certain antifreeze-water mixtures currently permitted by NFPA 13, 13D and 13R. [17] [18] Recent testing conducted by UL [4] demonstrates that, under certain conditions, a large-scale sustained ignition is possible from the discharge of certain sprinkler systems containing antifreeze solutions. The intent of the Phase II testing is to more completely investigate the potential for large-scale ignition of flash fires from antifreeze solutions and to investigate the impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.

C. Sprinkler Droplet Sizes and Distributions

Droplet sizes and distributions produced by automatic sprinklers have been studied using a variety of techniques. Measurements of the droplet sizes produced by automatic sprinklers are relatively complex because the droplet size distribution measured is expected to vary with several factors including:

- Position with respect to the sprinkler in three dimensions
- Sprinkler model
- Operating pressure/flow rate
- Liquid supplied to the sprinkler, e.g. water or antifreeze solution
- Surrounding air currents, including fire induced flows

Even with all of the variables above held constant, measurements include a range of droplet sizes and not a single uniform droplet size. Additionally, it is possible for sprinklers operating with identical k-factors and pressures to have different spray patterns. Sprinklers that have identical orifice sizes (k-factor) can have varying geometric parameters such as arms, deflectors or tines. Changes in any of these geometric parameters may substantially alter the droplet size
and distribution. For example, the figure below illustrates sprinkler discharge from two sprinklers with the same k-factor operating under the same pressure, but with spray distribution patterns that are significantly different.

![Figure 4. Spray distribution from automatic sprinklers. (Courtesy: Prof. André Marshall, University of Maryland)](image)

Many of the existing methods are point measurement techniques that only measure data at a single point. Point measurement techniques are capable of measuring droplet size and velocity and work well for spherical droplets. However, sprinkler droplets are not always spherical.[19] In addition, point measurements must be taken at various locations in the sprinkler flow so that the results are temporally and spatially averaged. This limits measurement accuracy because fire sprinkler sprays are unsymmetrical and unsteady. Certain areas of the spray distribution are denser than others which may cause results to vary based on measurement locations. [19]

Studies of standard orifice, pendent spray fire sprinklers indicate droplet sizes between approximately 200 and 3,000 μm. [19] This approximation agreed with existing research which indicated that droplets larger than approximately 5,500 μm in diameter are unstable and break up into smaller droplets, predominantly in the range of 1,000 to 2,000 μm. [20] Previous research indicates that while a large number of very small drops are present, they comprise a small portion of the total water volume. Data indicates that 98% of the water from standard orifice fire sprinklers is contained in droplets larger than 200 μm in diameter. [19] A study of residential sprinklers measured water droplets ranging from an arithmetic mean of 200 to over
500 μm, depending on location. [21] However, droplets with diameters of less than 100 μm
were measured. [21]

D. Phase I Testing

During Phase I of this project a series of preliminary tests were sponsored and conducted by
Underwriters Laboratories. Tests were conducted in UL’s large-scale test facility in Northbrook,
IL and several of the tests were witnessed by CCI on behalf of the Fire Protection Research
Foundation.

Initial tests were conducted with a small ceiling above an elevated pan of heptane using
residential pendent sprinklers with nominal k-factors of 3.1 and 4.9 gpm/psi. The tests used
premixed solutions of 70% glycerin and 60% propylene glycol with water. The tests indicated
the potential for large-scale ignition of a 70% glycerin solution using a 3.1 k-factor sprinkler at an
operating pressure of 100 psi. This large-scale ignition resulted in flames surrounding the
majority of the sprinkler spray. A similar large-scale ignition did not occur for initial tests with
60% propylene glycol solutions or tests using a 4.9 k-factor sprinkler at an operating pressure of
50 psi.

Further tests were conducted in a three sided room measuring approximately 12 feet by 12 feet
with a ceiling height of 8 feet. A single sprinkler with a k-factor of 3.1 was located in the center of
the ceiling for each test. The majority of the room tests were conducted using a nominal 12-inch
cast-iron pan with cooking oil as the initial fire source. An electric cooktop was used to heat the
pan and ignite the cooking oil. One room test was conducted with a pan of heptane as the initial
fire instead of the cooking oil. In various tests, the sprinkler was supplied with water only as well
as premixed solutions of 70% glycerin, 50% glycerin, and 60% propylene glycol in water. Sprinkler
operating pressures of 20, 100, and 150 psi were investigated.

Test results in the room configuration ranged from extinguishment of the fire to large-scale,
sustained ignition of the antifreeze solution. Preliminary observations during the tests indicated
that the results depend, at a minimum, on a combination of the following factors:

- Location of the initial fire with respect to the sprinkler
- Initial fire source
- Type of sprinkler and operating pressure
- Type and concentration of antifreeze solution
Large-scale, sustained ignition of the 70% glycerin solution supplied at 100 psi occurred when the initial fire was in close proximity to the sprinkler, but the initial fire was controlled using the same concentration of antifreeze at the same operating pressure when the initial fire was located farther from the sprinkler. Large-scale ignition of the 60% propylene glycol solution occurred in the room configuration during a cooking oil fire, but did not occur in the open configuration during a heptane fire. Large-scale ignition of the antifreeze solution did not occur in any of the tests with the 50% glycerin solution.

Preliminary observations during the UL testing indicate the following:

- Large-scale ignition of antifreeze solutions occurred in certain tests for 70% solutions of glycerin and 60% solutions of propylene glycol with water.

- Large-scale ignition of antifreeze solutions of 50% glycerin with water did not occur for any of the tested configurations.

Preliminary observations from the tests highlighted the need for further research into the effectiveness of currently permitted antifreeze solutions and consideration of their suitability for use in sprinkler systems.
III. Phase II Test Plan and Setup

The Phase II testing was intended to further study the potential for contribution of antifreeze solutions to fire conditions. The Phase II test plan was separated into two scopes. Scope A tested antifreeze solutions for the potential to create a large-scale ignition of the spray when discharged through sprinklers onto a fire. Scope B tested antifreeze solutions for their impact on a sprinkler system’s ability to control a fire condition and maintain tenable conditions.

Tests were conducted with premixed solutions of propylene glycol and glycerin with water obtained from a single commercial distributor. Application of the test results is limited to the solutions tested and not to other formulations of antifreeze solutions that were not tested. Phase II tests were conducted at UL’s fire test facility in Northbrook, IL and a Summary of Fire Test Data was provided by UL in Reference [22].

A. Scope A: Fire Tests for Spray Ignition using Sprinklers

Scope A was developed to investigate the potential for ignition of antifreeze solutions supplied by automatic sprinklers. The tests were designed to use a strong, continuous ignition source to identify whether flammable mixtures of antifreeze were created by the antifreeze spray. The tests used several models of residential sprinklers to investigate their impact of the potential for ignition.

Scope A tests were conducted without an enclosure, other than the walls and roof bounding the laboratory. As discussed in the report from Phase I of this project [3], the difference between a flash fire and an explosion is the degree of confinement of the flash fire. Because an explosion could not occur in this context without a flash fire, the flash fires themselves were used as criteria for the tests without the need to evaluate a resulting, enclosure dependant, explosion. While the test setup was designed to avoid explosions within the laboratory, the confinement of flash fires can produce over-pressurizations or explosions.

The test setup for Scope A is illustrated in Figure 5, below.
The test setup included a long ignition source that was designed to extend radially from the sprinkler location. The long ignition source allowed a single test to investigate the potential for ignition over a range of locations within the spray pattern. The arrangement allowed for multiple sprinkler heights to be tested and data was collected to allow for heat release rate measurements using oxygen consumption calorimetry.

Initial testing was conducted to investigate appropriate ignition sources. Ignition sources investigated included:

- 6" wide and 12" wide rectangular pans of heptane extended radially from the point directly below the sprinkler.
- 4-nozzle heptane spray burners under a metal grate (the metal grate functions as a hot surface to vaporize antifreeze solution).
- Electric range heating elements (also functioning as a hot surface to vaporize antifreeze solutions).
Figure 6, below, illustrates each of the ignition sources investigated as part of Scope A.

The ignition sources are also shown in the photographs below.
The heat release rate of each of the ignition sources, with the exception of the electric range coils, is illustrated in the following graph. The heat release rates were measured using an oxygen consumption calorimeter. Because the electric range coils are heated by electricity and not combustion, the oxygen consumption calorimeter could not measure the heat release rate during that test. The electric range coils were tested based on the high temperature of the coils and not due to their total heat release rate.
The heat release rate of the pan fires increases for several minutes after ignition before reaching a steady heat release rate. For tests with the pan fires sprinkler flow was initiated three minutes after ignition of the pan fire to allow the pan fire to reach a nearly steady heat release rate.

The following graph shows the maximum heat release rate of various household furniture items [23] in comparison with the heat release rate of the heptane spray burner.

Figure 8. Comparison of ignition source heat release rates.
Figure 9, above, shows that the heat release rate of the ignition sources is less than the maximum heat release rates of some common household furniture items. The data above indicates heat release rates measured under the specific conditions tested without the benefit of sprinkler protection. Thus, in a residence protected by automatic sprinklers, the heat release rate at the time of sprinkler activation could be less than the heat release rates illustrated in Figure 9.

An estimate of the heat release rate at the time of sprinkler activation was calculated using the Sprinkler/Detector Response routine in the computer fire model FPETool. [24] The model was originally developed by the National Bureau of Standards, now the National Institute of Standards and Technology, as DETACT-QS. The DETACT-QS model is a basic computer fire model that calculates the temperature and velocity at a sprinkler based on correlations developed by Alpert [25] and combines them with a lumped-capacitance heat transfer model to estimate the time and heat release when sprinkler activation is calculated to occur. The model is designed to large, open spaces and does not account for the effect of the room enclosure on the temperatures at the sprinkler. Thus, for residential scale rooms the model typically over-
predicts the fire size at the time of sprinkler activation. The results below are based on the following parameters:

<table>
<thead>
<tr>
<th>INPUT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>70°F</td>
</tr>
<tr>
<td>Sprinkler activation temperature</td>
<td>155°F</td>
</tr>
<tr>
<td>Response Time Index (RTI)</td>
<td>91 (ft.s)^{1/2}</td>
</tr>
<tr>
<td>Horizontal Distance from Fire to Sprinkler</td>
<td>10.6 ft</td>
</tr>
<tr>
<td>Fire growth rate</td>
<td>Medium t-squared (growth time of 300 s to reach 1,055 kw)</td>
</tr>
</tbody>
</table>

The following graph shows the calculated heat release rate at the time of sprinkler activation along with the heat release rate of the heptane spray burner fire used for the Scope A tests.

![Calculated Heat Release Rate at Sprinkler Activation](image)

Figure 10. Heat release rate at sprinkler activation based on ceiling height.

The results summarized in Figure 10, above, show that the heat release rate of the ignition source used in the Scope A tests was generally conservative for spaces with ceiling heights of
less than 20 feet. The calculated heat release rate at the time of sprinkler activation for ceiling heights of less than 20 feet are less than the heat release rate of heptane burner ignition source used in the Scope A tests. The calculated heat release rate for a ceiling height of 20 feet was within approximately 5% of the heat release rate of the heptane burner used in the Scope A tests.

Ignition sources were tested using solutions of 50% propylene glycol and 60% propylene glycol supplied from a residential pendent sprinkler with a k-factor of 3.1. Prior testing indicated that a 60% propylene glycol solution can be ignited by a kitchen grease fire when supplied from a k3.1 sprinkler. Thus, the ignition source selected should be capable of igniting the 60% propylene glycol solution supplied through a k3.1 sprinkler. It was unclear prior to the start of testing whether the 50% propylene glycol solution would be ignited.

The ignition sources selected for the Scope A testing are very unlikely to be extinguished during sprinkler activation. This is unlike most home fire conditions that would be expected to reduce in intensity upon the application of water. Some increase in heat release rate could be expected for the ignition sources, but observations of flash fires or ignition of the spray away from the fire source were considered an immediate failure. The initial testing was also intended to validate the use of a variable sprinkler operating pressure. Varying the sprinkler operating pressure allowed each test to collect data for a range of sprinkler operating pressures. This approach reduced the overall number of tests conducted and helped yield more complete results.

Following the initial testing, a series of tests was conducted to investigate the potential for ignition of select concentrations of antifreeze for the following variables:

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES TESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreeze concentration</td>
<td>• Propylene glycerol</td>
</tr>
<tr>
<td></td>
<td>o 40%, 45%, 50%, 60%</td>
</tr>
<tr>
<td></td>
<td>• Glycerin</td>
</tr>
<tr>
<td></td>
<td>o 50%, 55%</td>
</tr>
<tr>
<td>Antifreeze temperature</td>
<td>• Ambient 80-90°F</td>
</tr>
<tr>
<td></td>
<td>• Elevated 140°F</td>
</tr>
<tr>
<td>Sprinkler height</td>
<td>• 8 ft</td>
</tr>
<tr>
<td></td>
<td>• 20 ft</td>
</tr>
<tr>
<td>Horizontal position of ignition source</td>
<td>Considered through the use of a long ignition source that extended radially from the sprinkler</td>
</tr>
<tr>
<td>Sprinkler operating pressure</td>
<td>10 to 150 psi (varied in 10 psi increments)</td>
</tr>
<tr>
<td>Sprinkler type and nominal k-factor</td>
<td>• Fixed deflector residential pendent (k3.1, k4.9, k7.4)</td>
</tr>
<tr>
<td></td>
<td>• Drop-down deflector (concealed) residential</td>
</tr>
<tr>
<td>VARIABLE</td>
<td>VALUES TESTED</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Pendent (k4.9, k5.8)</td>
<td></td>
</tr>
<tr>
<td>• Residential sidewall (k4.2, k5.5)</td>
<td></td>
</tr>
</tbody>
</table>

The majority of the testing was conducted with solutions of 40%, 50%, and 60% propylene glycol as well as 50% glycerin. Select tests of 45% propylene glycol and 55% glycerin were used to evaluate the sensitivity of the results to the antifreeze concentration.

Ceiling heights of 8 ft and 20 ft were used to evaluate a range of residential applications. The 8 ft ceiling height is typical of many residential spaces and the 20 ft ceiling height is intended to account for a tall, double-height space in a residential occupancy. It was theorized prior to the initial testing that the atomization and dispersion of the droplets in the sprinkler spray would behave differently for varying ceiling heights. The initial testing confirmed that the spray distribution reaching the fire sources changes with the height of the sprinkler.

The Phase I testing demonstrated that the position of the ignition source within the sprinkler spray significantly impacted the potential for ignition of the spray. The long ignition source extending radially from below the sprinkler was used to allow a single test to generate data for a range of ignition source locations.

Data was gathered for a wide range of sprinkler operating pressures by varying the operating pressure during each test. The low pressure (10 psi) was intended to capture data near the minimum flow rates that would be permitted for the larger orifice sprinklers in the test plan. The high pressure (150 psi) was intended as a high pressure anticipated for a typical residential occupancy. In some instances the tests were conducted starting at a higher operating pressure greater than 10 psi or were terminated prior to reaching 150 psi based on the data to be collected from that test.

Due to the complex nature of the droplet size and sprinkler spray distribution produced during sprinkler discharge, several different types of sprinklers were selected for the Scope A testing. This approach was used to develop information on how changes in sprinkler geometry (deflector, arms and tines) and orifice size impacted the results.

**B. Scope B: Room Fire Tests of Sprinkler Effectiveness**

The Scope B tests were intended to investigate the effectiveness of residential sprinklers using an antifreeze solution compared with water alone. The Scope B tests were not intended to investigate the potential for large-scale ignition of the sprinkler spray.

The Scope B testing is similar to the UL 1626 fire test, with certain additional variables considered as outlined in the table below.
### VARIABLE

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES TESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreeze solutions</td>
<td>• 50% Glycerin&lt;br&gt;• 40% Propylene glycol (single test)&lt;br&gt;• Water alone</td>
</tr>
<tr>
<td>Ceiling height</td>
<td>• 8 ft</td>
</tr>
</tbody>
</table>
| Sprinkler operating pressure/flow rate             | • Minimum permitted flow based on NFPA 13D design criteria<br>  
|                                                   |   o Pendent: 18 gpm one sprinkler / 13 gpm each for two sprinklers<br>  
|                                                   |   o Sidewall: 24 gpm one sprinkler / 17 gpm each for two sprinklers<br>  
|                                                   | • 80 psi<br>• 150 psi                                                         |
| Sprinkler type, temperature rating, and nominal k-factor | • Ordinary temperature fixed deflector residential pendent (k3.1, k4.9)<br>  
|                                                   | • Ordinary temperature residential sidewall (k4.2)                             |
| Fire Source                                         | • UL 1626 fuel package<br>• Furnished living room (sofa, chair, tables)       |

The tests are designed to directly compare the performance of sprinkler systems supplied with antifreeze solutions to the performance of sprinkler systems supplied with water alone. The tests measured temperature at several locations within the room to evaluate tenability in accordance with the criteria specified in UL 1626. In addition, the test setup included sprinklers installed within the room that were designed to evaluate whether the fire condition would be expected to overwhelm the sprinkler system. Figure 11, below, illustrates the test setup for Scope B.

For the purposes of the Scope B testing, a ceiling height of 8 ft was used. This ceiling height was intended to represent that of a typical residential dwelling.

Similar to the Scope A tests, Scope B tests included multiple sprinkler operating pressures, but the pressure was not varied during each test. The low flow tests were intended to match the NFPA 13D criteria of 18 gpm for the activation of the first sprinkler and 13 gpm per sprinkler for the activation of two sprinklers. For the sidewall sprinklers a minimum flow rate of 24 gpm for the first sprinkler and 17 gpm per sprinkler for the activation of two sprinklers was required based on the listing of the sprinkler. Higher sprinkler operating pressures of 80 and 150 psi were also tested to evaluate their impact on the results.

A range of sprinkler types and models were tested in Scope B. Two sprinklers were located within the test room in accordance with UL 1626 to control the fire condition and a third sprinkler was located near the doorway to the enclosure, as illustrated in Figure 11, below, to investigate...
the potential for activation of sprinklers away from the area of fire origin. The test enclosure measured 32 ft by 16 ft by 8 ft high, which was within the listed spacing of the k4.9 and sidewall sprinklers. The enclosure was somewhat larger than the 14 ft by 14 ft listed spacing of the k3.1 sprinkler, so the larger enclosure provided a severe test of the antifreeze solution.

The tests primarily used the fuel package specified in UL 1626 that consists of a wood crib ignited by a pan of heptane that is positioned adjacent to two simulated furniture ends. The potential for fire spread is evaluated by locating the fuel package in the corner of the room with walls covered with wood paneling. In addition to tests with the UL 1626 fuel package, a test was also conducted with a fuel package typical of a residential living room. The fuel package consisted of a sofa, chair, end table, and coffee table, along with a trash can filled with paper.

Failure criterion for the Scope B testing was based on the UL 1626 fire control criteria. Based on these criteria, residential sprinklers installed in a fire test enclosure with an 8-ft ceiling are required to control a fire for 10 minutes with the following limits:

1. The maximum gas or air temperature adjacent to the sprinkler 3 inches below the ceiling at two locations within the room must not exceed 600°F.
2. The maximum temperature 5 feet 3 inches above the floor at a specified location within the room must be less than 200°F during the entire test. This temperature must not exceed 130°F for more than a 2 minute period.

3. The maximum temperature ¼ inch behind the finished surface of the ceiling material directly above the test fire must not exceed 500°F.

4. No more than two residential sprinklers in the test enclosure can operate.

Any variation from the limits outlined above was considered an immediate failure. [26]
IV. Phase II Test Results

A. Scope A – Spray Ignition

Initial tests were conducted to investigate potential ignition sources. The tests used solutions of 50% and 60% propylene glycol to investigate the effectiveness of each ignition source in igniting antifreeze sprays. The following graph compares the increase in heat release rate due to ignition of 60% propylene glycol antifreeze spray for each of the ignition sources.

![Scope A Comparison of Ignition Sources with 60% Propylene Glycol](image)

Each of the ignition sources, with the exception of the electric range coils, was able to ignite the 60% propylene glycol solution. The increase in heat release rate from the spray burner assembly was somewhat higher than the other ignition sources at the same sprinkler flow rate. Note that the pan and spray burner tests were terminated early due to the size of the resulting fire condition.

Figure 13, below, shows the increase in heat release rate as a function of sprinkler flow rate for a 50% propylene glycol solution using each of the ignition sources that ignited the 60% solution.
The results with the 50% propylene glycol solution show significant differences between the ignition sources. There was very little increase in the heat release rate of the 6-inch wide heptane pan upon application of the antifreeze solution. The 12-inch wide heptanes pan had an initial increase in heat release rate, but higher sprinkler flow rates extinguished portions of the pan fire and reduced the heat release rate. The heat release rate of the spray burner increased throughout the test as the sprinkler flow rate increased.

The heptane spray burner was selected as the ignition source for the remaining tests based on its ability to efficiently ignite sprays of both the 50% and 60% propylene glycol solutions. As illustrated in Figure 13, above, the heptane spray burner represented the worst-case ignition source of those investigated, because it was not extinguished by the 50% propylene glycol solution. Additionally, the heptane spray burner produced a steady baseline fire size that increased the overall reproducibility and reliability of the ignition source.
Tests were conducted by lighting the heptane burners, adjusting the heptane flow rate, allowing for 2 minutes of heating, and flowing antifreeze solution to an open sprinkler. The sprinkler operating pressure was typically varied during each test from 10 psi to 150 psi, unless the test was terminated early due to the growth of the fire condition.

The tests investigated the impact of several variables in causing ignition of antifreeze sprays.

1. Sprinkler

Tests of 50% propylene glycol solution were conducted for the full range of sprinklers investigated. The graph that follows shows the increase in heat release rate due to an antifreeze spray of 50% propylene glycol for the range of sprinklers.

![Graph showing the increase in heat release rate due to an antifreeze spray of 50% propylene glycol for different sprinkler flow rates.](image)

Figure 14: Comparison of Sprinklers at 8’ Above Floor with 50% Propylene Glycol

The results presented in Figure 14, above, show that a 50% propylene glycol solution results in a significant increase in the size of the initial fire when supplied by certain sprinklers. Data for three of the six sprinklers tested shows an increase of more than 4,000kW or 300% in the heat release rate due to the application of 50% propylene glycol.
antifreeze solution depending on the operating pressure. Very little ignition of the spray was observed during the test with the k7.4 pendent sprinkler. The results for the two k4.9 pendent sprinklers show that the portion of the spray that is ignited can differ for sprinklers with the same k-factor. For example, at a flow of approximately 55 gpm the increase in heat release rate during the test with the k4.9 pendent sprinkler was approximately 3,000 kW compared with more than 4,500 kW in the test with a concealed sprinkler. Further testing primarily used the k3.1 and k4.9 concealed sprinklers based on the results outlined above.

2. Antifreeze Solution

Scope A tests were conducted for solutions of 40%, 45%, and 50% propylene glycol as well as 50% and 55% glycerin. Results of the tests are summarized in Figure 15, below, which shows the increase in heat release rate due to the application of each antifreeze solution using the same sprinkler and ignition source.

![Comparison of Antifreeze Solutions](image)

Figure 15: Increase in fire size for various antifreeze solutions.

The results presented above show increases in heat release rate of more than 6,000 kW or 500% for the 50% propylene glycol and 55% glycerin solutions at certain flow rates. This is...
due in large part to ignition of the antifreeze spray extending away from the initial fire condition. A significantly lower increase in heat release rate was measured for the 45% propylene glycol solution, which showed little ignition of the sprinkler spray away from the ignition source. The application of antifreeze solutions of 40% propylene glycol and 50% glycerin resulted in much smaller changes in heat release rate during otherwise identical test conditions. The 40% propylene glycol and 50% glycerin solutions resulted in very similar changes in the heat release rate of the fire condition. Although there was some increase in the heat release rate that was measured for both solutions at certain operating pressures, flames were not observed to extend away from the initial fire source.

Figure 16 and Figure 17, below, illustrate the maximum increase in heat release rate caused by 50% glycerin solution for tests with sprinklers at 8 ft and 20 ft above the floor, respectively. The maximum heat release rate measured for the test at 8 ft was approximately 3,300 kW and 2,800 kW for a test at 20 ft, compared with a baseline ignition source heat release rate of approximately 1,400 kW.

![50% Glycerin k3.1 Sprinkler at 8' Above Floor](image)

**Figure 16.** Detailed results for 50% glycerin supplied through k3.1 sprinkler at 8 ft.
3. Sprinkler Height

Tests were conducted for solutions of 40%, 50% and 60% propylene glycol for sprinkler heights of 8 feet and 20 feet. Results of the tests are summarized in Figure 18, below, which shows the increase in heat release rate due to the change in ceiling height for each antifreeze solution using the same sprinkler and ignition source.
The results presented above show that for 40% and 60% propylene glycol solutions, the height of the sprinkler had a less significant effect on the increase in heat release rate. The 40% solution resulted in very little increase in heat release rate regardless of the sprinkler height and the 60% solution resulted in a substantial increase in the heat release rate for both sprinkler heights. However, the height of the sprinkler had a significant impact on the results with the 50% propylene glycol solution, particularly at higher flow rates. The 50% propylene glycol solution discharged at a height of 8 ft had an increase in heat release rate of approximately 5,000 kW while discharge at a height of 20 ft yielded an increase in heat release rate of approximately 1,200 kW. Thus, while the sprinkler and antifreeze concentration seem to be of primary importance in determining the potential for ignition, the change in spray distribution with height can significantly impact the results for marginal solutions.
4. Temperature of Antifreeze Solution

Tests were conducted that compared the performance of glycerin solution at ambient temperature (80°F to 90°F) and glycerin solution heated to 140°F. Results of the tests are summarized in Figure 19, below, which illustrates the increase in heat release rate for heated and unheated 50% glycerin solutions.

![Figure 19: Comparison of Heated Glycerin Solution](image)

The results presented above shows a minor difference in heat release rate during tests with ambient temperature and heated glycerin solutions. Each of the solutions produced a maximum increase in heat release rate of approximately 500 to 1,000kW. While there may be some difference based on temperature over the range investigated, it appears that the effect of temperature is minor compared with the impact of solution concentration.
B. Scope B – Room Fire Tests

Failure criterion for the Scope B testing was based on the UL 1626 fire control criteria. Based on these criteria, residential sprinklers were installed in a fire test enclosure with an 8-ft ceiling and are required to control a fire for 10 minutes within the limits established by the UL 1626 fire control criteria. UL 1626 includes provisions for extending the duration of the test to 30 minutes if continued burning is observed at 10 minutes, but the test duration was limited to 10 minutes for the purposes of this comparison.

1. Temperature 3 inches Below Ceiling

Tests were conducted to ensure that the maximum temperature adjacent to the sprinkler 3 inches below the ceiling did not exceed 600°F. Figure 20, below, illustrates the results of these tests.

![Scope B Results Temperature 3 inches Below Ceiling](image)

The results in Figure 20, above, show that water, 40% propylene glycol, and 50% glycerin demonstrate similar performance. Regardless of variation in sprinkler operating pressure...
and k-factor, both of the antifreeze solutions and water did not exceed a measured temperature of 246°F. This is well below the maximum temperature of 600°F specified in the UL 1626 fire control criteria.

2. Temperature at 5'-3" Above Floor

Temperature results at 5'-3" above the floor are illustrated in Figure 21 and Figure 22, below. Figure 21 shows the maximum temperature measured during the test, which is limited by UL 1626 to 200°F, and Figure 22 shows the temperature that is sustained for 2 minutes during the test, which must be less than 130°F based on the criteria in UL 1626.

![Figure 21: Maximum Temperature 5'-3" Above Floor](image-url)
All of the tests remained well below the temperature criteria specified in UL 1626. The maximum temperature for water and 50% glycerin were each slightly higher than 125°F compared with a criteria of 200°F. For the low flow condition and the 2 minute temperature criteria, the results with the 50% glycerin solution were better than water for the test with the k4.9 sprinkler, the results with water were better for the k3.1 sprinkler, and the results with the k4.2 sidewall sprinkler were nearly the same. The results for the 2 minute temperature criteria in the tests at 80 psi and 150 psi show somewhat higher temperatures with the 50% glycerin solution compared with water. This may be due in part to the flow rate of glycerin solution being lower than the flow rate of water at the same pressure, which should be accounted for in the design of a sprinkler system. Overall, the temperature results at 5'-3” above the floor were similar with water, 40% propylene glycol, and 50% glycerin.

3. Temperature ¼-inch Behind Ceiling Surface

The temperature results at ¼-inch behind the ceiling surface above the fire are illustrated in Figure 23, below.
As shown in the figure above, the majority of the tests had similar results and all of the tests remained within the criteria specified by UL 1626. In two of the configurations the test with 50% glycerin solution had significantly higher temperatures than the similar test with water and in one of the configurations the test with water had significantly higher temperatures than the similar test with glycerin solution. The highest measured temperature behind the ceiling material was during the test with the k3.1 sprinkler supplied with water at 150 psi. This result is likely due to the test room being larger than the listed protection area of the sprinkler; however, the same test configuration with 50% glycerin solution better controlled the fire condition.

4. Number of Sprinkler Activated

The UL 1626 criteria allows no more than two of the three sprinklers in the room to activate for a successful test. Figure 24, below, shows that the number of sprinklers activated met this criteria for each of the tests.
Two sprinklers were activated in the enclosure during two of the tests with glycerin solution and one of the tests with water. For the remaining tests only a single sprinkler activated. Based on the results of these tests, as illustrated above, the UL 1626 criteria was satisfied.

5. Scope B Summary

The results for Scope B are summarized in Table 5, below, along with the UL 1626 criteria.
Antifreeze Solutions in Home Fire Sprinkler Systems

<table>
<thead>
<tr>
<th>Sprinkler [Flow/Pressure]</th>
<th>Temperature 3&quot; Below Ceiling</th>
<th>Temperature 5'-3&quot; Above Floor</th>
<th>Temperature Behind Ceiling Material</th>
<th>No. of Sprinklers Activated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum (°F)</td>
<td>Maximum (°F)</td>
<td>2-Minute (°F)</td>
<td>Maximum (°F)</td>
</tr>
<tr>
<td>UL 1626 Criteria</td>
<td>600</td>
<td>200</td>
<td>130</td>
<td>500</td>
</tr>
<tr>
<td>k3.1 Low Flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>190</td>
<td>118</td>
<td>90</td>
<td>148</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>188</td>
<td>115</td>
<td>99</td>
<td>148</td>
</tr>
<tr>
<td>k3.1 80 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>178</td>
<td>100</td>
<td>88</td>
<td>140</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>184</td>
<td>117</td>
<td>106</td>
<td>308</td>
</tr>
<tr>
<td>k3.1 150 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>190</td>
<td>102</td>
<td>91</td>
<td>440</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>186</td>
<td>113</td>
<td>102</td>
<td>190</td>
</tr>
<tr>
<td>k4.9 Low Flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>241</td>
<td>122</td>
<td>107</td>
<td>137</td>
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<tr>
<td>40% Propylene Glycol</td>
<td>180</td>
<td>106</td>
<td>92</td>
<td>127</td>
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<tr>
<td>50% Glycerin</td>
<td>196</td>
<td>105</td>
<td>98</td>
<td>139</td>
</tr>
<tr>
<td>k4.9 80 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>189</td>
<td>115</td>
<td>91</td>
<td>138</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>172</td>
<td>107</td>
<td>97</td>
<td>117</td>
</tr>
<tr>
<td>k4.9 150 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>191</td>
<td>119</td>
<td>88</td>
<td>124</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>185</td>
<td>107</td>
<td>99</td>
<td>128</td>
</tr>
<tr>
<td>k4.2 Sidewall Low Flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>200</td>
<td>127</td>
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<tr>
<td>50% Glycerin</td>
<td>223</td>
<td>115</td>
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<td>319</td>
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<td>k4.2 Sidewall 80 psi</td>
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<tr>
<td>Water</td>
<td>175</td>
<td>109</td>
<td>89</td>
<td>144</td>
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<tr>
<td>50% Glycerin</td>
<td>180</td>
<td>113</td>
<td>100</td>
<td>142</td>
</tr>
<tr>
<td>k4.2 Sidewall 150 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>209</td>
<td>119</td>
<td>88</td>
<td>143</td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>246</td>
<td>129</td>
<td>101</td>
<td>161</td>
</tr>
<tr>
<td>Furniture Fire k4.9 Low Flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% Glycerin</td>
<td>165</td>
<td>96</td>
<td>94</td>
<td>104</td>
</tr>
<tr>
<td>Without Sprinklers</td>
<td>&gt; 1,074</td>
<td>&gt; 545</td>
<td>&gt;130</td>
<td>&gt; 571</td>
</tr>
</tbody>
</table>

Table 5. Scope B Test Results
In addition to the results of tests with the UL 1626 fuel package, Table 5 also includes the results of a test conducted with living room furniture. The test used 50% glycerin solution supplied to a k4.9 sprinkler at 18 gpm. The fire was controlled by one sprinkler. The results of the test indicate that the UL 1626 fuel package is a more severe test of the sprinkler system than the living room furniture fuel package. The temperatures measured during the test with actual furniture were lower than any of the tests with the UL 1626 fuel package.

Table 5 also includes results of a UL 1626 type test conducted by Underwriters Laboratories without the use of sprinklers. The test without sprinklers was conducted as part of a prior research project and used a 12 ft by 24 ft enclosure meeting the requirements of UL 1626. The test was terminated after less than 4 minutes when the temperature in the room exceeded 1,000°F. While all of the Scope B tests with antifreeze solutions and water maintained temperatures within the UL 1626 criteria for a full 10 minutes, a similar test without sprinklers resulted in flashover of the enclosure in less than 4 minutes. The results demonstrate the effectiveness of water as well as solutions of 40% propylene glycol and 50% glycerin in controlling home fire conditions represented by UL 1626.
V. Analysis

The fire test program conducted as part of Phase II of this project was intended as an empirical evaluation of the potential for ignition and impact on sprinkler system effectiveness of various antifreeze solutions. The following observations and analysis provides additional insight into the fire test data discussed above.

A. Observations

The Scope A ignition tests conducted with the heptane spray burner were unique in that the ignition source had a steady heat release rate that was not significantly impacted by the antifreeze spray and the ignition source could not readily be extinguished by the antifreeze spray. This allowed the contribution of the antifreeze solution to the fire condition to be accurately measured, since the heat release rate of the ignition source itself could not be enhanced by the antifreeze spray, i.e. the fuel contributed by the spray burner was a function of the heptane flow rate and was not impacted by the antifreeze spray. In addition, it provided a conservative assessment of the potential for ignition, because many fire sources would be extinguished even by antifreeze solutions that had a significant increase in heat release rate during the tests.

Even the lowest antifreeze concentrations tested resulted in some increase in heat release rate when exposed to the heptane spray burner fire for certain test conditions. For example, Figure 15 shows that the 40% propylene glycol solutions result in some increase in the heat release rate of the initial fire at certain flow rates. The increase in heat release rate can be included in one of two categories:

1. Ignition of antifreeze spray that reaches the ignition source; or
2. Ignition of antifreeze spray extending away from the ignition source.

Based on the tests conducted, it appears that some portion of the antifreeze spray reaching the fire source will ignite even for the lowest antifreeze concentrations tested and even when the antifreeze spray could be expected to extinguish most anticipated fire sources in a residential occupancy. The potential for this relatively small increase in heat release rate to reduce the effectiveness of residential sprinklers was investigated in Scope B. Results of the Scope B tests demonstrate no significant differences in the capability of water, 50% glycerin, and 40% propylene glycol to control the tested fire condition.

Antifreeze sprays that ignite and propagate away from the initial fire source are a significant concern. In addition to being a hazard on its own, ignition of antifreeze sprays extending away from the ignition source can significantly increase the heat release rate of the fire and, if confined, may result in an overpressurization or explosion.
Following Phase I of this project, it appeared that the ignition of antifreeze sprays was likely to be either localized close to the ignition source or the ignition would be sufficient to involve nearly the entire volume of the sprinkler spray. The results were readily characterized as a relatively minor localized ignition that could still allow for fire control or an ignition of the majority of the sprinkler spray that would significantly enhance the initial fire condition.

Tests during Scope A of Phase II showed that at certain antifreeze concentrations, intermittent ignition of the antifreeze spray could occur that extended away from the ignition source without involving the majority of the sprinkler spray. This expanded the results of the Phase I tests by showing that intermittent ignition of a portion of the sprinkler spray could occur and that ignition of the antifreeze spray could not be characterized as only localized or involving the majority of the spray.

The importance of the droplet size distributions and concentrations was apparent during the Phase II tests, particularly for tests where the sprinklers were positioned at 20 ft above the floor. In certain tests, ignition of the antifreeze solution was observed to extend away from the ignition source, but only into a discrete portion of the sprinkler spray. Thus, while the droplet size distribution in a portion of the sprinkler spray was sufficient to allow ignition, the droplet size distribution in the majority of the sprinkler spray was not sufficient to allow the fire to spread within the spray.

The droplet size distribution from sprinklers is not currently regulated and is often not characterized for commercially available sprinklers. In addition, even if a standard method were developed to characterize the droplet size distribution from each sprinkler over a range of operating pressures, the distribution could be modified by the properties of the antifreeze solution, the airflows in the enclosure, or the installed configuration of the sprinkler. Thus, for most residential sprinklers it does not currently appear to be practical to rely solely on the droplet size distribution as a means of preventing significant ignition of antifreeze sprays. Thus, the analysis below focuses on the characteristics of the antifreeze solution that may impact the potential for significant ignition of the spray.

B. Classification based on Solution Heat of Combustion

The heat of combustion of the antifreeze solution reduced by the additional mass of the water in the solution was investigated for its ability to characterize the relative contribution of various antifreeze solutions. The parameter investigated is the heat of combustion of the antifreeze in the solution normalized by the mass of the solution.
Figure 25, above, shows that for a given solution concentration, a solution of propylene glycol will have a higher heat of combustion per unit of solution mass than a solution of glycerin.

The table below shows the solution concentration by volume of propylene glycol and glycerin as a function of the solution heat of combustion.
<table>
<thead>
<tr>
<th>Solution Heat of Combustion (MJ/kg)</th>
<th>Solution Concentration (% Vol.)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Propylene Glycol</td>
<td>Glycerin</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14</td>
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<td>18</td>
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<td>5</td>
<td>23</td>
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<td>6</td>
<td>28</td>
<td>34</td>
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<tr>
<td>7</td>
<td>32</td>
<td>39</td>
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<td>8</td>
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<tr>
<td>10</td>
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<td>11</td>
<td>51</td>
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<td>12</td>
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</tr>
<tr>
<td>13</td>
<td>60</td>
<td>73</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Solution Heat of Combustion

The table above indicates that a 42% solution of propylene glycol by volume has the same solution heat of combustion as a 50% solution of glycerin. Figure 26, below, compares the maximum increase in heat release rate measured in tests with k3.1, k4.9, and k7.4 pendent sprinklers as a function of the solution concentration. All data is from tests conducted with a sprinkler at 8 ft above the floor using the heptane spray burner ignition source. The k-factor of the sprinkler used in the test is indicated in the legend.
Figure 26, above, shows a strong relationship between the solution heat of combustion and the increase in heat release rate measured during tests with k3.1 and k4.9 sprinklers. Thus, analyzing the heat of combustion of the overall solution may be a useful method of comparing the potential contribution of different antifreeze solutions to a fire condition. However, Figure 14 showed that the sprinkler model also has a significant impact on the potential increase in heat release rate. Thus, the solution heat of combustion cannot, by itself, be used to determine the potential for ignition of an antifreeze spray.
VI. Future Research and Recommendations

The National Fire Protection Association has taken steps to implement changes based in part on information provided in prior versions of this report. Specific modifications to NFPA and other documents are not addressed in this report, but should instead be addressed through the appropriate standards revision processes. The following recommendations address research and technical areas where further investigation is warranted as a result of this work.

A. Investigate the use of Antifreeze Solutions in Sprinkler Systems with Non-Residential Sprinklers

The results of this project indicate that antifreeze solutions of propylene glycol or glycerin supplied through residential sprinklers at concentrations permitted by NFPA 13 can substantially increase the heat release rate of a fire condition. The same antifreeze solutions that are used in residential sprinkler systems are also used in sprinkler systems for non-residential applications.

Residential sprinklers differ from other spray sprinklers in that they have a different spray distribution pattern. Residential sprinkler also most commonly have k-factors of 4.9, while other types of sprinklers usually have k-factors of 5.6 or greater. Thus, the droplet size distributions produced by residential sprinklers may differ from the droplet size distributions produced by other types of sprinklers in a way that impacts the potential for ignition of antifreeze sprays. Further investigation is needed to evaluate the potential for ignition of antifreeze solutions supplied by sprinkler systems not using residential sprinklers.

Based on the results of this project with residential sprinklers, research should be conducted into the use of antifreeze solutions in non-residential applications.

B. Characterize Droplet Size Distributions from Sprinklers

Characterization of droplet size distributions from sprinklers is an active area of research and influences the potential for ignition of antifreeze sprays. An improved characterization of droplet size distributions from sprinklers over a range of sprinkler models and operating conditions could be helpful in limiting the potential for significant ignition of antifreeze sprays. The results summarized in Figure 14 indicate that the droplet size distributions produced by certain sprinklers are less likely to create conditions where an antifreeze solution can be ignited. Further research into the droplet size distributions created by a range of sprinkler models over a range of operating conditions could be used as a basis to allow the use of antifreeze solutions under conditions when the droplet size distribution created is not anticipated to ignite.
C. Develop a Small or Medium Scale Screening Test for Antifreeze Solutions

Full scale tests were conducted as part of this project to investigate antifreeze solutions supplied by actual residential sprinklers. The tests were conducted for a wide range of operating conditions and produced a variety of droplet size distributions. Ideally, a small scale test could be used to investigate only the worst case droplet size distribution produced by residential sprinklers.

FM Global Class Number 6930, Approval Standard for Flammability Classification of Industrial Fluids, was identified in Phase I of this project as a test method that could be adapted to investigate the potential for ignition of antifreeze solutions. A research effort would be needed to correlate the results of any such small or medium scale test with the results of this or other full scale testing. The investigation of a small or medium scale test might also provide additional insight into the droplet size distributions that increase the potential for ignition.

D. Develop a Listing Standard for Solutions introduced into Sprinkler Systems

NFPA 13 currently only permits glycerin or propylene glycol antifreeze solutions to be used in antifreeze sprinkler systems connected to potable water supplies. This report documents concerns with the use of certain concentrations of glycerin and propylene glycol antifreeze solution. Thus, there is a need to develop alternative solutions that could be used in instances where glycerin and propylene glycol are not suitable.

Issues of flammability, freeze protection, toxicity, and material compatibility would need to be addressed for any solutions that are introduced into sprinkler systems. A research effort would be needed to develop a series of tests that is sufficient to demonstrate the appropriateness of a new antifreeze solution and could be extended to cover other solutions that are used in sprinkler systems. The development of a listing standard that could be referenced by NFPA 13 may encourage development of alternative antifreeze solutions and help ensure that the solutions are appropriate for use in sprinkler systems.
VII. Summary

A test plan was developed for Phase II to investigate the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers. This test plan also explored the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress.

Testing was conducted in two parts (Scope A and B). Scope A consisted of fire tests using six (6) models of sprinklers operating at pressures of 10 psi to 150 psi at elevations of eight and twenty feet. The Scope A testing was intended to investigate the potential for large-scale ignition of antifreeze sprays at pressures ranging from 10 psi to 150 psi. Scope B consisted of room fire tests, similar to UL 1626, that were designed to investigate the effectiveness of sprinklers discharging antifreeze solutions and their ability to maintain tenable conditions.

Results of the Scope A testing indicated that concentrations of propylene glycol exceeding 40% by volume and concentrations of glycerin exceeding 50% by volume have the potential to ignite when discharged through automatic sprinklers. The potential for ignition depends on several factors including the ignition source, sprinkler model, sprinkler elevation, discharge pressure, and the location of the sprinkler with respect to the ignition source. Ignition of antifreeze spray increased the measured heat release rate in certain tests with 50% propylene glycol and 55% glycerin by more than 300%. For certain test conditions, the increase in heat release rate resulting from the application of 55% glycerin solution exceeded the increase in heat release rate from the application of 50% glycerin solution by a factor of 10. A similar level of sensitivity was observed between 40% and 50% propylene glycol solutions, but not between 40% and 45% propylene glycol solutions.

The results of the Scope B testing indicated that concentrations of propylene glycol not exceeding 40% by volume and concentrations of glycerin not exceeding 50% by volume have similar performance to water as compared to the UL 1626 fire control criteria. Tests with the 40% propylene glycol and 50% glycerin solution met the UL 1626 fire control criteria and demonstrated similar performance to water throughout many of the tests.

The results of this research suggest that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in home fire sprinkler systems. Consideration should be given to an appropriate safety factor for concentrations of antifreeze solutions that are permitted by future editions of NFPA 13, as well as warnings and limitations outlined in antifreeze product literature. In addition, based on the flammability properties outlined in Table 4, the use of solutions of diethylene glycol and ethylene glycol in home fire sprinkler systems should also be limited.
Recommendations for further research are also provided. Further research should be conducted to investigate the use of antifreeze solutions supplied through non-residential sprinklers. The results of this study are based on tests with residential sprinklers, which are not directly applicable to other types of sprinklers due to the unique spray pattern of residential sprinklers. However, the results documented in this report are sufficient to indicate that the use of antifreeze solutions with non-residential sprinklers should also be investigated.

The droplet size distributions produced by sprinklers is an ongoing area of research that is important to understanding the potential for ignition of antifreeze sprays. Further development is needed to characterize the droplet size distributions produced by a variety of sprinklers.

The development or investigation of a small or medium scale test for ignition of antifreeze sprays may contribute to understanding the droplet size distributions of antifreeze that have the potential to ignite. Finally, the results of this research indicate that certain concentrations of glycerin and propylene glycol antifreeze solutions are not appropriate for use in residential sprinkler systems. Thus, there is a need for alternative antifreeze solutions that are not currently permitted by NFPA 13. A listing standard for antifreeze solutions or other solutions that are introduced into sprinkler systems could encourage the development of alternative antifreeze solutions and help ensure that the solutions are appropriate for use in sprinkler systems.
VIII. References


    http://www.dow.com/glycerine/resources/physicalprop.htm


    http://www.noblecompany.com/Portals/0/PRODUCT%20INFO/MSDS/MSDS.FFPG.FREEZE.pdf


and Technology, Gaithersburg, MD, 2004.


Amy Beasley Cronin
Secretary, Standards Council

16 August 2010

To: Interested Parties

Subject:

<table>
<thead>
<tr>
<th>Standards Council Decision (Final):</th>
<th>D#10-10</th>
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<tr>
<td>Standards Council Agenda Item:</td>
<td>#10-8-15 thru 10-8-20</td>
</tr>
<tr>
<td>Date of Decision*:</td>
<td>5 August 2010</td>
</tr>
<tr>
<td>TIA Nos. 1000, 995, 994, 996, 997 and 998 on NFPA 13, 13D and 13R, all 2010 editions</td>
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</table>

Dear Interested Parties:

At its meeting of 3-5 August 2010, the Standards Council considered an appeal on the above referenced matter.

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

Sincerely,

Amy Beasley Cronin
Secretary, NFPA Standards Council

c: D. Berry, M. Brodoff, L. Fuller, J. Lake, J. Moreau-Correa
   Members, TC on Residential Sprinkler Systems (AUT-RSS)
   Members, TC on Sprinkler System Installation Criteria (AUT-SSI)
   Members, TCC Automatic Sprinkler Systems (AUT-AAC)
   Members, TC on Inspection, Testing, and Maintenance of Water-Based Systems (INM-AAA)
   Members, NFPA Standards Council (AAD-AAA)
   Individuals Providing Appeal Commentary

*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. Notice of the intent to file such a petition must be submitted to the Clerk of the Board of Directors within 15 calendar days of the Date of Decision noted in the subject line of this letter.
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</table>

**SUMMARY ACTION:** The Standards Council voted to issue TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, which, for new installations, prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R sprinkler systems. In addition, the Council directed that the responsible technical committees conduct further activities as set forth in the decision.

At its meeting of August 3-5, 2010, the Standards Council considered six proposed Tentative Interim Amendments (TIAs), together with related appeals, regarding antifreeze in new residential fire sprinkler installations. Two TIAs were submitted on each of the following documents: NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes, and NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height. Of the TIAs, one group of three (TIAs 1000, 995, and 994) sought collectively to prohibit the use of antifreeze solutions within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “No Antifreeze” TIAs). The other group of three (TIAs 996, 997, and 998) sought collectively to prohibit the use of antifreeze solutions in excess of 50% by volume within all NFPA 13D applications and within the dwelling unit portions of NFPA 13 and NFPA 13R systems (the “50% Antifreeze” TIAs). These latter TIAs permitted only the use of factory premixed antifreeze solutions.

The six proposed TIAs were balloted through the responsible Technical Committees – the Technical Committee on Sprinkler System Installation Criteria for NFPA 13, and the Technical Committee on Residential Sprinklers for NFPA 13D and NFPA 13R – as well as the Technical Correlating Committee on Automatic Sprinkler Systems (the TCC). Balloting was completed in accordance with the NFPA Regulations Governing Committee Projects, but, as detailed further in this decision, the ballot results are of limited significance because of new technical data and information that has recently become available. The TIAs, ballot results, and several related appeals have nevertheless been forwarded to the Council for consideration. In this unusual and compelling situation, in which the status quo in the existing sprinkler documents is no longer tenable, and in which circumstances require emergency action, the Council has voted to issue three TIAs, the effect of which, pending further technical committee consideration, will be to prohibit the use of antifreeze within the dwelling unit portions of sprinkler systems.
BACKGROUND

Antifreeze solutions have long been used in sprinkler systems to protect piping in unheated areas subject to freezing temperatures. Since at least 1940, NFPA standards have included guidance on the use of antifreeze solutions in sprinkler systems. The events that led to the development of the proposed TIAs to limit or prohibit the use of antifreeze solutions in residential sprinkler applications began when the NFPA became aware of a fire incident in Truckee, California, which took place in August of 2009. Emerging information concerning this incident raised concern surrounding the combustibility of antifreeze solutions in residential sprinkler systems. The incident reportedly involved a grease fire in a kitchen where a sprinkler system with a reportedly high - possibly in excess of 70% - concentration of antifreeze deployed. The fire resulted in a single fatality and serious injury to another person, and the possibility was raised that the antifreeze solution discharging from the sprinkler intensified the fire and resulting harm.

In response to these reports, several activities were initiated within the NFPA and the NFPA-affiliated Fire Protection Research Foundation (the Research Foundation). These activities and especially the resulting reports of the Research Foundation will be described here only in brief, and the reader is urged to consult the Research Foundation reports available at www.nfpa.org/antifreeze for the presentation of the available research and analysis. With this caveat, it suffices to say, in outline, that the NFPA, in response to reports of the Truckee incident, commissioned the Research Foundation to conduct a literature review and develop a research plan on antifreeze solutions and residential fire sprinkler systems. A report on this project was published by the Research Foundation as "Literature Review and Research Plan Antifreeze Solutions in Home Fire Sprinkler Systems," (prepared for the Fire Protection Research Foundation by Code Consultants, Inc., May 28, 2010) (the First Research Foundation Report). Meetings of the NFPA Technical Correlating Committee on Sprinkler Systems (the TCC) were also convened to review available information. During this period, Underwriters Laboratories (UL) conducted a series of tests in an effort to begin exploring the effect of antifreeze solutions in certain residential sprinkler configurations (the Phase I tests). The Phase I tests were not conducted as part of the Research Foundation activities, but several of the tests were witnessed by researchers working on behalf of the Research Foundation and are summarized in the First Research Foundation Report. The results of these Phase I tests were also presented at a meeting of the TCC. The results of these limited Phase I tests could not provide answers to all questions concerning the safe use of antifreeze solutions in residential sprinkler systems. They did point to serious concerns with the use of higher concentrations of antifreeze and were inconclusive as to the safety of antifreeze in lower concentrations of 50% by volume or less.

With the Phase I tests, the First Research Foundation Report and other available information, two sets of competing TIAs on antifreeze in residential sprinkler systems were developed and submitted by several parties. As summarized more fully above, the three No Antifreeze TIAs, prohibited the use of antifreeze solutions and the 50% Antifreeze TIAs prohibited the use of antifreeze solutions in excess of 50% by volume and required that only factory premixed solutions be used. The TIAs were submitted to the ballot of the responsible technical committees and the TCC. Five of the TIAs failed letter ballot of the technical committees. The No Antifreeze TIAs showed considerable support, including one TIA which failed by only a single vote. One of the TIAs, the 50% Antifreeze TIA on NFPA 13 did pass ballot. Unlike the balloting on the TIAs for NFPA 13D and NFPA 13R, however, the 50% Antifreeze TIA on NFPA 13 was balloted separately from the No Antifreeze option for NFPA 13, and it is not clear what effect the sequencing of the balloting on NFPA 13 may have had on the outcome.

The confusing and inconclusive ballot results may have stemmed from the limited nature of the data then available to the technical committees. The Council, however, need not undertake to
analyze these TIA results in any depth because events have largely superseded them. Specifically, the First Research Foundation Report had concluded that "the existing research as well as the recent near-term [Phase I] testing conducted by UL indicate the urgent need for further research into the effectiveness of currently permitted antifreeze solutions." This conclusion led to the development of a Phase II test plan to investigate in greater depth the potential for large-scale ignition of antifreeze solutions discharged from residential sprinklers and the influence of antifreeze solutions on the effectiveness of residential sprinkler systems in controlling a fire condition and maintaining tenable conditions for egress. With great rapidity, the Research Foundation mounted a project to fund and conduct the Phase II testing, with UL and Code Consultants, Inc. under contract to do the testing and to develop a report. However, even under the aggressive testing schedule, the test results did not become available until after the close of balloting on the TIAs. Indeed, the Phase II tests were completed just prior to the commencement of the Standards Council's August meeting and have now been published as “Interim Report: Phase II Research Antifreeze Solutions in Home Fire Sprinkler Systems, (Prepared for the Fire Protection Research Foundation by Code Consultants, Inc., August 11, 2010) (www.nfpa.org/antifreeze) (the Second Research Foundation Report).

At the Standards Council meeting, Steve Wolin, of Code Consultants, Inc., presented the Research Foundation reports, including the results of the Phase I and II tests. A hearing then proceeded to consider appeals and arguments as to what course of action the Council should pursue with respect to the TIAs. Rather than focus on the various arguments presented on the TIAs, the Council for purposes of this decision, focuses on some undisputed conclusions of the Phase II testing, namely that the existing provisions in NFPA 13, NFPA 13R and NFPA 13D, relating to antifreeze are no longer supportable as written. Specifically, current standards recommend the use of the antifreeze solutions, depending on the chemical being used and level of freeze protection being sought, to exceed 50% concentration, by volume, up to, in some cases, as much as 70%. See, e.g., NFPA 13, Table 7.6.2.2. The conclusions of the Research Foundation report, however, were clear this was no longer acceptable. Specifically, the new research from the Phase II testing clearly indicates that antifreeze solutions of propylene glycol exceeding 40% and glycerin exceeding 50% by volume are not appropriate for use in residential sprinkler systems, and the fire size increased (to some extent) for all the antifreeze solutions tested under certain sprinkler discharge and fire test conditions. Moreover, although these concentrations met UL 1626 fire control criteria and exhibited similar performance to that of water alone, consideration must also be given to adding appropriate safety factors for concentrations of these antifreeze solutions in the relevant standards. See Second Research Foundation Report at Executive Summary, pp. 1-2.

Given these conclusions, the Council must now determine how to proceed. At the hearing to consider the TIAs, several alternatives were suggested and advocated to varying degrees, including: take no action and refer the matter back to the responsible technical committees to review the new technical data from the Phase II testing and consider further appropriate action; issue the 50% Antifreeze TIAs; issue the No Antifreeze TIAs; or issue modified TIAs taking into account the test results reported by the Research Foundation.

In normal circumstances, the Council might well have delayed taking any action in order to give time to the responsible technical committees to review and take action based on the technical issues and new data presented by the Research Foundation reports. It is clear, however, from the discussion at the hearing, and from the complicated nature of the technical information that will need to be reviewed that consideration by the technical committees will require some time. Given the serious nature of the safety concerns related to the current concentrations of antifreeze permitted in existing NFPA standards, the Council believes that immediate action needs to be taken.
As to the actions that have been proposed, issuing TIAs that would merely limit antifreeze solutions to 50% by volume is not an adequate step. The Phase II test results showed that a 50% by volume limitation for propylene glycol is not appropriate, and, depending on what safety factors may be needed, may not be appropriate for glycerin either. The 50% Antifreeze TIAs, moreover, would allow 50% solutions of other antifreeze compounds including diethylene glycol and ethylene glycol, which have not been tested and may well require different limits. Given the circumstances, the Council does not believe it would be appropriate for the Council to issue the 50% Antifreeze TIAs.

Nor is it appropriate for the Council itself to craft and issue new TIAs that fully consider and address the technical issues raised by the Research Foundation data and other information now available. Crafting new TIAs is the province of the technical committees. In the interim, however, emergency action needs to be taken. This is not in dispute as the balloting on all the TIAs confirmed the emergency nature of addressing the existing antifreeze provisions concerning residential applications.

Considering the entire record before it, the Council has concluded that the most prudent course of action at this time must be the most conservative approach to assuring safety in new residential sprinkler installations. That course of action is to prohibit the use of antifreeze in new residential sprinkler systems unless and until the responsible technical committees, after due consideration and any correlation by the TCC, reach consensus on a different approach. Accordingly, the Council has voted to issue the three TIAs 1000, 995 and 994 on NFPA 13, NFPA 13R and NFPA 13D, respectively, that prohibit the use of antifreeze solutions in new residential sprinkler applications.

In reaching this decision, the Council wishes to make several points. First, the Council's action follows on previous action already taken by the NFPA. On July 6, 2010, the NFPA, separate from its standards development process, and acting in its role as a safety advocate, issued a Safety Alert responding to developing concerns about the use of antifreeze solutions in residential applications. The Safety Alert urged that, until further information was available, new residential sprinkler systems should be designed and installed so as not to require the use of antifreeze solutions. The TIAs now being issued merely extend this recommendation, pending any further consideration and action by the responsible technical committees.

Second, it should be noted that for 13R and 13D residential systems, sprinklers are not required to be installed in unheated areas. At any rate, the use of antifreeze should be avoidable in most if not all residential installations through alternative design approaches including the use of insulation and other means.

Third, the Council wishes to emphasize that in issuing the TIAs, it is not undertaking to make any final technical determination about the correct course of action that may eventually emerge. The technical issues concerning the content of NFPA codes and standards are generally for the responsible consensus based technical committees to determine, and the same should be true in this case. The Council’s action is an emergency action only, and is not intended to prejudge the merits of any further revisions that the responsible technical committees may propose. As to the technical committees’ further consideration of the technical issues, the record suggests that the Research Foundation reports and other information now available will require careful and considered review. This, of course, may take some time, but it is also possible that the technical committees may be able to act quickly to bring new recommendations to the Council. The Council urges the committees to address this matter with reasonable speed and provide clear technical substantiation for any further actions that are proposed. Should the committees do so
prior to the Council's next scheduled meeting, the Council will make every effort to expedite its consideration of the matter through a special meeting or letter ballot.

The Council wishes to address two additional important matters beyond the scope of the present TIAs. First, the TIAs that were presented to the Council all involve standards that address the design and installation of new sprinkler systems. The important question of what should be done to address antifreeze in existing residential sprinkler systems is, therefore, not addressed by these TIAs. Fortunately, the NFPA in its July 6, 2010 Safety Alert has addressed existing systems. Specifically, the Safety Alert stresses that fire sprinklers are extremely effective protection devices, significantly reducing deaths, injuries and property loss from fire. It urges that these systems should not be disconnected and it recommends that the following actions be taken:

- If you have, or are responsible for, a residential occupancy with a fire sprinkler system, contact a sprinkler contractor to check and see if there is antifreeze solution in the system.

- If there is antifreeze solution in the system, as an interim measure, drain the system and replace it with water only. Problems associated with freezing of sprinkler pipes can be mitigated by alternative measures such as insulation. NFPA hopes to provide further guidance based on additional testing before the winter freezing months.

These recommendations and any updates that the NFPA may provide as a result of the Phase II testing (see www.nfpa.org/antifreeze for any updates as they may become available) provide important guidance on the handling of antifreeze in existing residential sprinkler systems. The responsible technical committees within the NFPA consensus codes and standards development process, however, should now review where and how relevant NFPA standards might be made to address antifreeze in existing systems. Relevant committees, including the Technical Committee on Sprinkler System Installation Criteria, the Technical Committee on Residential Sprinkler Systems, the Technical Correlating Committee on Automatic Sprinkler Systems, and the Technical Committee on Inspection, Testing, and Maintenance of Water-Based Systems, should consider this question in a coordinated manner and report back to the Council no later than its October 2010 meeting with any proposed actions or recommendations.

Finally, the actions taken in this decision do not address antifreeze in non-residential commercial applications. As the Research Foundation reports suggests, commercial sprinklers and occupancies present quite different characteristics than residential sprinklers and occupancies and, as the First Research Foundation Report suggests, any analysis of antifreeze in sprinkler systems is highly dependent on the specific characteristics of the sprinkler design and setting. The current activities, driven by clear concerns identified in residential sprinkler systems, have been a necessary response to an emerging problem. Further research will likely be necessary to better understand and address the use of antifreeze in various non-residential commercial settings. The role of the relevant committees in considering further standards development activities in this area and in recommending needed research is clear, and the Council is, therefore, requesting that they begin to review and consider the use of antifreeze in non-residential contexts and report back to the Council by its October 2010 meeting with any proposed actions or recommendations.

In conclusion, the Council wishes stress the importance of fire sprinklers in safeguarding lives and property. The home in particular is the place where most fire fatalities occur, and when home sprinklers are present, the risk of dying in a home fire decreases by 83%. It is hoped that the actions of the Standards Council, the valuable contributions of the NFPA and the Research Foundation, (including the project contractors, technical panel and sponsors), and the continuing
activities of the sprinkler related NFPA technical committees will all combine to help ensure the continued effectiveness and wide use of these important safety devices.

Council Member Roland Huggins recused himself during the hearings, deliberations and vote on the issue. Council Members Shane Clary and Ralph Gerdes wished to be recorded as voting negatively.
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13, Standard for the Installation of Sprinkler Systems, 2010 edition. The TIA was processed by the Technical Committee on Sprinkler System Installation Criteria and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add a new section 7.6.1 as follows:

7.6.1 Dwelling Units. Antifreeze shall not be permitted to be used within the dwelling unit portions of sprinkler systems.

2. Renumber the remainder of the section accordingly.

Issue Date: August 5, 2010
Effective Date: August 25, 2010
Tentative Interim Amendment

NFPA 13D
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes

2010 Edition

Reference: 3.3.9.1, 4.1.4, 5.2.7, 8.3.3, and A.8.3.3.1
TIA 10-1
(Version 10-8-18/TIA Log #994)

Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

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1. Delete 3.3.9.1 and renumber remainder of subsection 3.3.9.

2. Delete entire subsection 4.1.4, Antifreeze Systems.

3. Revise 5.2.7 to read as follows:
   “Joints for the connection of copper tube for wet type systems shall be soldered joints or be brazed.” (delete the words “and antifreeze systems”).

4. Delete Item (2) of subsection 8.3.2 and renumber (3) as (2).

5. Revise section 8.3.3.1 to read:
   **8.3.3.1** Antifreeze shall not be permitted in sprinkler systems.

6. Delete A.8.3.3.1.

7. Delete all subsections and accompanying Annex A paragraphs commencing with 8.3.3.2 and ending with 8.3.3.5.

**Issue Date:** August 5, 2010

**Effective Date:** August 25, 2010

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/codelist)
Pursuant to Section 5 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2010 edition. The TIA was processed by the Technical Committee on Residential Sprinkler Systems and the Technical Correlating Committee on Automatic Sprinkler Systems, and was issued by the Standards Council on August 5, 2010, with an effective date of August 25, 2010.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add new sections as follows:

4.7 **Antifreeze Systems.** Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

5.4.3 Antifreeze shall not be permitted within the dwelling unit portions of sprinkler systems.

2. Renumber 5.4.3 as 5.4.4.

**Issue Date:** August 5, 2010  
**Effective Date:** August 25, 2010
Item 12-3-10
Dear Sir / Ma’am,

I am writing to provide comment on the proposed project to create standards for “Emergency Mass Shelters” as proposed by Dean Larson of Larson Performance Consulting and published for comment solicitation by the NFPA Standards Council. While the proposal for such a standard is noble, there are several areas of concern that should be addressed regarding the scope of the proposal. Further, as the scope is currently constructed, its applicability is quite limited.

As proposed, the scope of the standard is limited to the operation of shelters within large buildings such as an arena, large sporting venues, and warehouses that are outside the normal sheltering provided by Non-Governmental Organizations. This scope does not consider the fact that in many areas, sheltering is a governmental responsibility that is not delegated to NGOs. As written, this could cause the standard to become applicable to any governmentally operated shelter particularly if operated within a large public facility. As further explained within section B if the proposal, the intention of the standard would be to provide relevant standards based guidance for sheltering operations such as the use of the use of the “Astrodome” during Hurricane Katrina. A sheltering operation, such as the use of the Astrodome during Katrina is not consistent with best practices whenever possible and is quite limited in frequency.

The operation of large shelters should be considered as a scaled response consistent with that of any other shelter operation. Should it be the desire of the NFPA Standards Council to entertain the establishment of a standard related to sheltering and mass care, that standard should be formed with the scope of sheltering and mass care in general and/or created within NFPA 1600 “Disaster/Emergency Management Business continuity Programs”.

James E Hamilton, AEM
Emergency Preparedness Manager
Cecil County Department of Emergency Services
107 Chesapeake BLVD Suite# 108
Elkton, MD 21921
Office: (410) 392-2022
http://www.ccdes.org

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Maynard, Mary

From: Coletta, Anthony [AColetta@riversideca.gov]
Sent: Saturday, November 05, 2011 2:37 PM
To: stds_admin
Subject: Comments on new project on Emergency Mass Shelters

Kindly find attached documents that have assisted us with mass care & shelter operations. I hope they may assist with this important project.

Documents Available from NFPA Upon Request

Thank you,

Anthony

Anthony E. Coletta Jr.
Emergency Services Manager
UASI Administrator

Riverside Fire Department - Office of Emergency Management
UASI Regional Homeland Security Program
3085 Saint Lawrence Street
Riverside, CA 92504
(951) 320-8100 Main
(951) 320-8104 Direct
(951) 320-8102 Fax

http://www.riversideca.gov/fire
http://www.readyriverside.com

Please consider the environment before printing this email
Project is viable and needed at the local level. Project should also identify the entities that should be the authority on coordinating and establishing the designated shelter in the jurisdiction.

Thank you,
Dave Carpenter, Jr., MPA, CEM
Coordinator, Office of Emergency Management
New Castle County Department of Public Safety
3601 N. DuPont Highway - New Castle, DE 19720
302-395-2700 o
302-395-2705 f
302-528-4842 c
KB3PTN
I agree that Emergency Mass Shelters should be a new project.

Ginnie Stouffer, MBCP, MBCI

ACP Corporate Director of Information
215-855-0810 (o)
610-246-9592 (c)
1006 Weikel Road
Lansdale, PA 19446
gstouffer@idc-partners.com
www.acp-international.com
November 8, 2011

Re: Request for Member Comment—Proposed New NFPA Project on Emergency Mass Shelters

To Whom It May Concern:

The Texas Department of Family and Protective Services serves a vulnerable clientele dependent upon the Department’s continued vigilance in all circumstances, exigent or otherwise. The Department’s mission, “To protect children, the elderly, and people with disabilities from abuse, neglect, and exploitation by involving clients, families and communities” is relevant to the subject matter of emergency mass sheltering because the chaotic circumstances under which such sheltering takes place provides opportunity for predatory, negligent or abusive behavior to occur unnoticed.

The use of large buildings for long-term mass sheltering is not a common occurrence in Texas, even in realm of large emergencies/disasters. Having acknowledged that, their use has been employed in the past (e.g., the Houston Astrodome during Hurricane Katrina), and does constitute a concern for state agencies required to respond to difficult emergency circumstances with little/no blueprint, experience, or even a “best practices” model. For this reason the Texas DFPS would welcome NFPA standards that clarify responsibilities and roles, and sets standards for threshold protection by responsible agencies during emergency sheltering scenarios. We would also welcome the opportunity to participate in the formulation of such standards as a member of the NFPA committee.

The proposed scope of the new project under consideration by the NFPA will almost assuredly involve the interests of state agencies like DFPS that deal with the interests and protection of clientele in the following areas:

- Sexual exploitation and abuse prevention;
- Defining the duty to report for shelter managers;
- Providing guidance for agencies with conservatorship responsibilities;
- Temporary childcare and daycare facilities standards.

Those listed above are among the regulatory and protective umbrella of DFPS, but there are potentially many more social services topics that may be appropriate for the NFPA standard.

DFPS serves in the Texas State Operations Center (SOC) in the “ESF 6/Mass Care, Emergency Assistance, Housing and Human Services” section. Our experience has unfortunately been that circumstances that stress families tend to increase our workload—and few events stress families like disasters. Leaving home with the uncertainty of knowing whether it will be intact upon return is stressful enough; that stress should not be added to because a lack of standards and preparation on the part of a hosting governmental agency, especially when it is within our power to take action prior to the emergency. We have all heard the stories that have come out of the Hurricane Katrina/ Louisiana Superdome experience; Texas DFPS would welcome a proactive and preventative approach that promulgation of standards would potentially bring to any future disaster.
Please let me know if I may provide further information.

Sincerely,

Randy Templeton

Randy Templeton, Business Continuity/Emergency Management
Texas Department of Family and Protective Services
2401 Ridgepoint Dr. Austin, TX 78754
Randy.templeton@dfps.state.tx.us
512/929-6911

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I am a long term member of the NFPA 1600 Technical Committee on Disaster Management, Emergency Response & Business Continuity Planning and would like to comment on your proposed Standard on Mass Emergency Care Shelters.

In my experience in this field for the past 30 years I have found that the most thorough of these Shelter plans have included plans for 'animals', both large and small as most families don't want to leave an area due to disasters without their 'pets'. In reviewing most County Emergency Management Plans in recent years, and I have reviewed many, they include Shelter Planning for animals, both small and Large. Many counties have 'Animal In Crisis' Task Forces that work on developing the plans and interacting with the appropriate community and State organizations on this issue.

Rural areas have to have these plans due to the large populations of cows, horses, goats, sheep, llamas, etc., and in some cases 'exotic' animals. Vet Care, Feed and Hay as well as sheltering is always considered in these plans as well. Preparing for this mass evacuation and sheltering involving these animals can be more easily prepared for by using an Evacuation Preparedness for Large & Small Animals educational program in communities, and we have done that here and have used checklists as well.

I sincerely hope you consider this issue in your proposal, and if you need any insight into what can go into this preparedness, please feel free to give me a call and I will be glad to help as I have done this for my county, Burnet, Texas and am on their Animals in Crisis Task Force, as well as their Community Emergency Response Team (CERT).

Best regards,

Pat Moore, CBCP, FBCI, CERT, CASA
President, Highland Lakes VOAD (Voluntary Organizations Active in Disasters)
Member NFPA 1600 Technical Committee since 1995

830-598-1587 home/office
830-385-4833 cell

241 Oxbow Trail
Marble Falls, Texas 78654
A comment on the “Identify the technical expertise and interest necessary to develop the project/document and if the committee membership currently contains this expertise and interest.”
I assume that this will list also include local emergency management staff as they are the ones responsible for these shelters. In addition, medical and pharmaceutical experts should also be included. These have become major concerns during longer term sheltering of large populations.
Thank you for the opportunity to comment.

David MacNamee, FPEM
Operations Manager
Pinellas County Emergency Management
400 S Ft Harrison Ave, Clearwater, FL 33756
Room 111
Phone (727) 464-5550
Fax (727) 464-4024
dmacnamee@pinellascounty.org

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All government correspondence is subject to the public records law.
At its December 1, 2012 meeting the IFMA board approved to support the Proposed New Project on Emergency Mass Sheltering.

IFMA is in support of the Proposed New Project on Emergency Mass Sheltering with the expansion of the scope to include all shelters.

The proposed new project should address many of the safety issues our members encounter when facilities normally not used to house large number of individuals for extended periods of time, and for sleeping purposes are used as shelters during emergencies. We believe the project should also include smaller facilities used for shelters and for shorter periods of time which occurs much more frequently than the proposed project is looking to address. If the project is approved we would also be interested in having a representative on the committee.

Ed Altizer, IFMA President

Steven Sawyer  
Senior Fire Service Specialist  
Executive Secretary IFMA  
NFPA  
1 Batterymarch Park  
Quincy, MA 02169  
617.984.7423  
Fax 617.984.7056  
ssawyer@nfpa.org
From: Ramil C [rc1849@gmail.com]
Sent: Saturday, December 03, 2011 2:31 PM
To: stds_admin
Subject: Comment on New Project - Emergency Mass Shelters

Project Name: Emergency Mass Shelters

Suggestion: Consider the possible use of Parking Facilities as an alternative for cities to use in lieu of schools, stadiums and arenas.

Supportive Arguments: Efficiency of vertical and surrounding space versus use of arenas and stadiums.
Efficiency of utility support versus the above (heat, air-conditioning).
Physical proximity to business and civic resources, preserving job access, assistance processing and other living arrangements.
Impact of lost school days on municipality and families.
Tax base and revenue base preservation.

Relevant Parties: Public Sector Official (City) Familiarity with OSHA & ADA, City Business Development Organizations (or the like), Re-entry Planning, State of Emergency Policies & Renumeration
(FEMA) Marcie Roth or a Sheltering/Functional Needs Expert Familiarity with sheltering standards. Knowledge of Federal resourcing timelines
(UASI) Public-Private Sector Partnership Expert Knowledge of Restoration Timelines, Resource Densities to support Construction, Restoration, Habitation, Transportation & Utilities
Public Health Official Experience in event impacts, mass sheltering and current expectations in sheltering standards.

Tangent Concerns:Availability of inspection teams post event (non-warning) and pre-event (hurricane evacuation, flooding)
Speed of modifications (as necessary, tarp covering on sides, lighting, etc.)
Availability of supporting equipment (generators, heaters, portable toilets/showers)

Kind Regards,

Ramil Cabantog
American Red Cross
Disaster Planning and Response
Emergency Mass Shelters
I think this is a valuable project. If NFPA for some reason doesn't want to run with it, please send those folks over to the ASTM E54 (Homeland Security) committee to develop the standard there.

~~~

Jorene Downs
SAR, CERT, Emergency Communications
Mounted SAR
http://www.ceoates.com/msar
Jorene@CEOates.com
559/779-2777 cell (PM in CA for non-emergency)
KJ6JCD
In reviewing the project, in item “b”, tornado outbreaks should also be included since these outbreaks can have widespread devastation that disrupts an entire city or county which can have a long effect while buildings are replaced or repaired.

Item “c” should include the survivors of the disaster, and or citizens of the community. They will need to know where some of these mass shelters are located before hand in order to assist them in getting to these locations ahead of time or immediately after the disaster.

Item “d” should include the Army Corp of Engineers, State Building Councils, and companies within an area that have excess warehouse space or the ability to provide space in a relatively short time period.

Item “e” should include the Army Corps of Engineers to review the locations of the shelters. This review would let other agencies know that the facility is or is not in a flood plain and could or could not be used based on the type of disaster to ensure the protection of those directed to the mass shelters. Along with this fact, if the mass structure locations are identified, the State Building Councils could review these structures for integrity and to ensure that they meet the needs that could potentially be placed on them or identify the items that would need to be added prior to or during a disaster in order for the mass shelter to offer safe harboring for the people using it. Lastly, the companies that are relinquishing space should benefit either by a tax break for participating there facility or for payment if the facility is used.

Item “g” should include the Army Corps of Engineers and State Building Councils as I stated above to ensure the locations and structures are approved for mass shelter use.

Item “i” should also include the Army Corps of Engineers and State Building Councils as stated in “e” and “g” comments above.

If there are any questions, please feel free to contact me.

Thank You
David Modrowski
(former LEPC Chairperson Lake County, IN)

Environmental Specialist
Union Tank Car Company
175 W. Jackson Blvd.
Chicago, IL 60604

Email: modrowski@utlx.com
Telephone: 312-431-3111 ext 3189
NFPA MASS SHELTER PROJECT
Comments by David Modrowski

Another comment that I have for the Mass Shelter project is that FEMA just announced the National Preparedness System of which the NFPA Mass Shelter Project could be a part of.

If there are any questions, please feel free to contact me.

Thank You
David Modrowski
(former LEPC Chairperson Lake County, IN)

Environmental Specialist
Union Tank Car Company
175 W. Jackson Blvd.
Chicago, IL  60604

Email : modrowski@utlx.com
Telephone: 312-431-3111 ext 3189
NFPA solicits comments on a guide for the use of large buildings as emergency mass shelters - comments due by 1/27/2012

Potentially the most significant value of this project as well as the most difficult aspect of creating such a standard is ADA compliance. The standard must certainly address ADA compliance given DOJ guidance to government entities on the requirements for ADA compliance during sheltering even when the facility is not owned or operated by a government entity. This standard will not be useful unless it addresses ADA issues during sheltering.

____________________________

Timothy R Gablehouse
President
Colorado Emergency Preparedness Partnership, Inc.
410 17th St, Ste 1375
Denver CO 80202
303.572.0050
800.818.0050
Maynard, Mary

From: Khlok, Rakdy [Rakdy.Khlok@oes.sbcounty.gov]
Sent: Thursday, December 29, 2011 4:49 PM
To: stds_admin
Cc: Anthony Coletta (AColetta@riversideca.gov); Serrano, Cindy; Mullennix, Zackary
Subject: RE: UASI INFO: NFPA Comment on Mega Shelters

Codes and Standards Administration:

The National Fire Protection Association’s new proposed project for mega-shelters will be a valuable resource. San Bernardino County has been developing a Mass Care and Shelter Plan, and through this planning process there were gaps and helpful components that were identified. Below is a list of topics that the new project may consider addressing.

- Determining a coordination process to move shelter residents from spontaneous shelters into mega-shelters.
- Determining a personnel/workforce module to manage the mega-shelter. This module should emulate or reference the American Red Cross’s strategy as they are the leading agency in sheltering.
- Consider developing a trailer/cache of shelter equipment/supplies that can be deployed to mega-shelters or are already stored in mega-shelters. Supplies and equipment for the trailer should be standardized.
- Develop a management plan for spontaneous volunteers.
- Develop a donations management plan.

Best Regards,

Rakdy Khlok, Mass Care & Shelter Planner
San Bernardino County Fire Department
Office of Emergency Services
Office: (909) 356-3933
rakdy.khlok@oes.sbcounty.gov

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From: Coletta, Anthony [mailto:AColetta@riversideca.gov]
Sent: Saturday, November 05, 2011 11:38 AM
Subject: UASI INFO: NFPA Comment on Mega Shelters

UAWG MEMBERS;

NFPA’s Standards Council is seeking comments on a proposed new project on Emergency Mass Shelters.

Responses should be sent to Codes and Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471 or by email at stds_admin@nfpa.org, by January 27, 2012.

At its October 2011 meeting, The Standards Council considered the request of Dean Larson of Larson Performance Consulting that NFPA consider the establishment of a new project on Emergency Mass Shelters. After review of all the material before it, the Council voted to publish a notice to solicit comments on the need for the project, information on resources on the subject matter, those interested in participating if established, and other organizations actively involved with the subject. Anyone interested in commenting on this proposed project is invited to do so in writing.

The following justification for the new project has been submitted:

a. Explain the Scope of the new project/document:
A mega shelter planning guide was already developed in October 2010. See document at:


Evidently NFPA didn’t do much research on this before proposing a project to complete an inquiry on a topic that has already been researched and developed.

Sent from my iPad
Michael Whitehead, CEM
DBPR – ESF 6
850-717-1290
Cell: 850-443-8163
Dear Ms. Fuller:

Thank you for your letter regarding a proposal to establish a new project on Emergency Mass Shelters. We appreciate you inviting CDC, along with other organizations, to provide input related to the planning and execution of mass evacuations. However, your inquiry may be more accurately addressed by the Federal Emergency Management Agency and/or the American Red Cross, which are agencies that deal more directly with mass evacuation related activities.

The Centers for Disease Control and Prevention’s (CDC) primary focus is on protecting health through health promotion, prevention of disease, injury, and disability, and preparedness for new health threats and by creating holistic approaches for improving public health across all stages of life. For more information CDC’s guidance on preparing for and managing emergency situations, please visit http://www.cdc.gov/niosh/topics/emergency.html.

Again, thank you for your interest in this important matter and in CDC’s related perspectives.

Sincerely,

Thomas Frieden, M.D., M.P.H.
Director, CDC, and
Administrator, Agency for Toxic Substances and Disease Registry
Good Afternoon,

Attached are documents requested in support for your new project on Emergency Mass Shelters. You will also find the available documents on Mega Shelters Planning that the American Red Cross and the International Association of Venue Managers (IAVM) had put together. Here is the link to that website:

http://www.iavm.org/cvms/mega_sheltering.asp

Any questions, please do not hesitate to contact me.

Kind regards,

_Ina Chan_
Program Specialist
Mass Care
FEMA Headquarters
500 C Street SW
Washington DC 20472
Office: 202-212-1098
Mobile: 202-812-1073
ina.chan@dhs.gov
January 17, 2012

Ms. Linda Fuller, Manager
Codes and Standards Administration
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Dear Ms. Fuller:

On behalf of the nearly 12,000 IAFC members, we appreciate the opportunity to provide the Standards Council with comments on the proposal submitted on Emergency Mass Shelters by Dean Larson. We recommend that the NFPA move forward with the project and that the goal or objective of the project be “to provide a clear and nationally-recognized framework for the safe and effective evacuation of our communities during times of natural disasters or other related emergency incidents or events.”

In regards to this topic, the Standards Council also should be informed that during a joint meeting of the IAFC’s 2010 Wildland Fire Policy Committee and Emergency Management Committee (a committee that was formed to lead the way for post-Katrina fire service concerns), it was agreed that the topic of evacuation and evacuation procedures needed additional focus by both groups.

As a result of that action, a project was initiated with the National Governors Association to jointly create with federal, state, local and public and private sector involvement (to include appropriate association representation), a “national evacuation framework” entitled Toward a Common Mass Evacuation Framework (see attached) by the National Governors Association. Since that time, the group has been expanded to include the NFPA as a key element to move forward not only a “framework” but also a recommended practice, guide, or if needed, a standard on emergency evacuation.

In conclusion, we recommend that the Standards Council support the efforts to create and embrace a framework for evacuation to include Emergency Mass Sheltering as an essential element of the “evacuation framework” that your association and its members and committees work diligently to develop the appropriate document up to and including a standard.

Sincerely,

Chief Al H. Gillespie, EFO, CFO, MiFireE
President and Chairman of the Board

Attachment
/slj
National Governors Association
Center for Best Practices

Toward a Common Mass Evacuation Framework
A Concept Paper¹ presented in partnership
by the NGA Center for Best Practices and
The International Association of Fire Chiefs

April 20, 2011

This concept paper proposes a project to support state and local governments in preparing a “common mass evacuation planning framework,” and the coordination of homeland security and emergency management evacuation planning in the FEMA regions and state and local governments. The project will be a partnership between the NGA Center for Best Practices (NGA Center) and the International Association of Fire Chiefs (IAFC). The project builds upon the success of the NGA Center’s prior work with the Governors’ Homeland Security Advisors Council and the development of homeland security and emergency management practices in the states. The project also augments the successes of the IAFC on emergency management issues at the local level over the past 30 years. The period of performance necessary to complete this proposed project is 18 months.

The NGA Center and IAFC envision five project tasks:
- Create a stakeholders working group to advise the development of the common mass evacuation framework (the framework);
- Review all relevant state, local and federal policies on mass evacuation planning for analysis;
- Develop and publish the framework;
- Maintain resources for state and local efforts to implement the framework on the NGA Center website; and
- Provide technical assistance to the state and local governments for dissemination of the framework.

Background
Evacuation planning is an essential component of emergency management and homeland security in the states. Planning for mass evacuation has ranked among the top committee priorities of the Governors Homeland Security Advisors Council (GHSAC) since 2008. Likewise, the IAFC Emergency Management and Wildfire Committees find mass evacuation planning to be a major challenge at the local level. The focus of this project would be to help state and local agencies meet the challenges of evacuations as a result of catastrophic incidents. The project will work toward the creation of an all-hazard, all-discipline common mass evacuation framework (the framework) that both emergency responders and citizens could follow during a time of disaster. This framework will consist of concept language and policy, as well as an operations guide that will include checklists for use in planning the various stages of an evacuation process.

¹ This document is a concept paper for your consideration. It does not constitute a formal proposal by NGA Center or the International Association of Fire Chiefs. A full proposal with budget will be submitted upon request. The estimated cost to implement this concept may be subject to change in the final proposal.
The NGA Center and IAFC Partnership
The NGA Center and the IAFC are partnering to leverage organizational assets toward the development of a robust suite of documents that will be used as a Common Mass Evacuation Planning Framework (the framework). The NGA Center and IAFC partnership will bring both the state and local government an understanding of mass evacuation planning. More importantly, the partnership will bring executive level decision makers—such as governors and their policy staff—into the planning process.

The National Governors Association is the collective voice of the nation’s governors, and its members are the governors of the 50 states, three territories, and two commonwealths. The NGA Center for Best Practices is the only policy research and development firm that directly serves the nation’s governors by developing innovative solutions to today’s most pressing public policy challenges.

The IAFC represents more than 12,000 fire chiefs across the U.S., drawing its membership from a diverse cross section of organizations, ranging from major metropolitan multi-disciplinary agencies to small city and rural departments and includes both paid and volunteer organizations. The IAFC’s members are the world’s leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, wildland fire, search and rescue, public safety legislation, and fire prevention and education.

The Mass Evacuation Challenge
While mass evacuation may appear to be a low-probability event, poor planning for evacuations can have high-impact consequences not only for governors affected by a disaster, but governors of neighboring states that receive refugees from a disaster. For example, in 2005, all 50 states, the District of Columbia and Puerto Rico received evacuees from the Gulf Coast states as a result of Hurricane Katrina. As a result, state governments as distant as Maine and Alaska cared for victims, and applied for federal assistance on their behalf.

The evacuation planning process is critical to saving lives, coordinating scarce community resources, and providing for speedy recovery in the aftermath of a disaster. Evacuations can take the form of a planned event—such as an incoming hurricane, or spontaneous event—such as the evacuation of Manhattan on 9-11-2001. Both events provide challenges not only to the disaster-stricken state, but neighboring states who may receive evacuees. While states have developed state-specific plans for evacuating their citizens in the event of a natural disaster, the US Department of Homeland Security has identified three major gaps in evacuation planning:

- Current federal evacuation guidance, plans, and exercises do not adequately reflect requirements for local, state and federal coordination for mass evacuation from a catastrophic event;
- Planning rarely addresses the intake of evacuees to neighboring states, nor addresses the difference between planned evacuations—such as a hurricane route, and unplanned evacuations—such as fleeing a terrorist attack; and
- Evacuation plans are narrow in scope, omitting planning for special needs populations and public transportation away from an affected area.

In addition, plans for evacuation are rarely coordinated at a regional level. Pass-through states are not always consulted on available emergency routes and resources by the evacuating state. Despite the overall progress made on raising citizen awareness on disaster planning, basic questions, such as sheltering-in-place vs. evacuation, are not often addressed nor well-understood.
Creating a Planning Framework
A common planning framework for mass evacuations will address the gaps in current planning efforts. This framework will provide clarity and definition for state and local stakeholders on how to evacuate a community. The framework will define terms, provide checklists and timelines and integrate with existing guidance and plans. Most importantly, the development of a framework with key executive stakeholders—such as the NGA Center and the IAFC—will provide a bottom-up, community driven solution to the challenges in evacuation planning. The framework will address major planning challenges, including:

- Citizen preparedness for mass evacuation;
- Public communication strategies;
- Mass sheltering and care of special needs populations;
- Intake of evacuees in neighboring jurisdictions;
- Resource needs and identification;
- Inter-dependencies of public and private sector;
- Cross-border coordination;
- Multi-modal evacuation (e.g. public transportation, walking out, etc);
- Shelter-in-place; and
- Managing repopulation of the region.

By partnering with the IAFC, the NGA Center will develop a framework that brings all the relevant disciplines together at the state-level, with the expertise of the local officials who will have primary responsibility to implement state and local evacuation plans.

Concept of Operations
The NGA Center and the IAFC envision an 18-month program to develop a common evacuation framework with five major tasks:

- Create a Stakeholders Working Group to advise the development of the common mass evacuation framework (the framework);
- Review all relevant state, local and federal policies on mass evacuation planning for analysis;
- Develop and publish the framework;
- Maintain resources on the NGA Center website for state and local efforts to implement the framework; and
- Provide technical assistance to the state and local governments for dissemination of the framework.

Task One: Stakeholders Working Group
The NGA Center and the IAFC will identify stakeholders involved in the planning and execution of mass evacuations to assist in the development of a common evacuation planning framework. The stakeholder group will meet both virtually and in-person to provide guidance to the NGA Center and IAFC on the development of the framework. The working group may include, but not be limited to, preparedness partners such as:

- The American Red Cross
- FEMA
- The Governors Homeland Security Advisors Council
- The National Emergency Management Association
- The International Association of Emergency Managers
• The National Sheriffs’ Association
• The International City/County Management Association
• The International Association of Chiefs of Police
• The American Association of State and Highway Transportation Officials

Task Two: Review of Extant Policy and Literature
The NGA Center and the IAFC will conduct a review of state and local evacuation plans. The NGA Center will review state policy and the IAFC will review local policy. This review will help define the common language among planning efforts in the country for the framework and reduce redundancies that may exist in policy in the states. The Center and the IAFC will use the review of policies to identify tools and procedures to build upon past FEMA guidance, such as the FEMA Comprehensive Preparedness Guide and State and Local Guidance 101.

Task Three: Common Evacuation Framework
Using the data collected from the literature and policy review, and with the guidance of the stakeholders working group, the NGA Center and IAFC will produce a framework for a common evacuation framework that state and local governments can use to better plan for mass evacuation. The framework will outline a national method for evacuation planning. This framework will:
- Identify common conventions and terms for evacuation planning;
- Develop policy implementation strategies for governors, and state and local officials to develop uniform plans in their states and localities;
- Create a timeline that identifies key activities during the four phases of emergency management—prepare, prevent, respond and recover;
- Provide an appendix with sample checklists, procedures, and suggested local documents for inclusion in a jurisdiction’s framework.

The framework will consist of a 40-to-50 page publication, that includes conventions, definition of terms, suggested planning templates and baseline concepts that all jurisdictions should consider in evacuation planning. The appendix will supplement the framework. The appendix section will give state and local users the flexibility to insert their own local documents and resources specific to their jurisdiction into the framework. These documents may take the form of standard operating procedures or planning documents. This approach respects the existing work of local and state governments while providing an overall context by which the state and local plans may integrate with the framework.

The NGA Center will also contract with an academic institution—the Johns Hopkins University Applied Physics Laboratory—to assist in the development of the framework as well as supplemental appendices to the framework. Upon completion of the common framework and final review by the steering committee stakeholders, the NGA Center and IAFC will encourage its respective membership to adopt the framework and appendices at the state and local level. The NGA Center and the IAFC will also encourage the organizations in the steering committee to adopt the framework for their respective organizations.

Task Four: Maintain Resources on NGA Center Website
The framework, as well as resources for implementation, will live on the NGA Center website as well as the GHSAC HSIN portal.
**Task Five: Technical Assistance for Dissemination of the Framework**

The NGA Center proposes to provide technical assistance to the state and local governments to disseminate and promote the use of the framework. The NGA Center will be called on to provide expert policy research and support to governors and their staff. The NGA Center proposes to serve as a liaison between federal agencies, governors’ offices, state homeland security advisors and other key state officials to disseminate information, gather comments and data, and ensure close collaboration with the full community of state stakeholders for mass evacuation planning. The NGA Center will respond to requests from the states as needed. The IAFC will coordinate with the NGA Center regarding local level requests for assistance specific to the framework. The NGA Center and the IAFC would use web-based tools—such as webinars and webcasting—to promote the framework.

**Budget**

The NGA Center estimates a funding requirement of approximately $375,000 for the activities outlined in this concept paper.
January 13, 2012

Linda Fuller
Codes and Standards Administration
NFPA
One Batterymarch Park
Quincy MA 02269-9190

Re: Project on Emergency Mass Shelters

Dear Ms. Fuller:

This is in response to your letter dated November 29, 2011, regarding the NFPA proposal for Emergency Mass Shelters.

Given that FEMA is the lead agency for Mass Care during a federally declared disaster and/or response to any event involving Mass Care sheltering, it is important that the interface between NFPA and FEMA is developed and encouraged as this project develops.

My staff has reviewed this proposal and has made the following suggestions:

- The NFPA should be invited to present the project at a FEMA Regional Inter-Agency Steering Committee (RISC) meeting; this would enable the NFPA to inform federal, state and local partner agencies about the project and allow stakeholders to provide input in a face to face environment.

- FEMA can partner with the NFPA on this project, using the concept of the “whole community” approach, to produce a better product.

- The Regional Catastrophic Planning Team, under the Regional Catastrophic Preparedness Grant, is working on a similar project to develop the Regional Catastrophic Coordination Plan which includes a Mass Care sheltering component. The NFPA should contact that group to share knowledge and eliminate a duplication of efforts.
• FEMA can assist with introductions to other stakeholders and provide general guidance and input, given that subject matter experts on Mass Care sheltering exist in every FEMA region, and that the subject matter experts coordinate with partner agencies and stakeholders also responsible for Mass Care sheltering.

FEMA Region 1 would be happy to facilitate any of the above suggestions and ensure that the NFPA is given the proper contacts to engage with other stakeholders, should you wish us to aid you in that endeavor.

If you have questions, please contact Becky Szymcik, Individual Assistance Branch Chief, at 617-956-7565 or via email at Becky.Szymcik@dhs.gov.

Sincerely,

[Signature]

Don R. Boyce
Regional Administrator

DRB:bms
While this topic, Emergency Mass Shelters, is one that virtually everyone “assumes” has been addressed, it has not. As the Director, Office of Emergency Preparedness/Homeland Security for the University of California, Berkeley campus, I can assure you that this area should be reviewed, examined and guidance put forth so that everyone understands what is at stake and the process that is required to establish these emergency shelters.

As I stated, most everyone assumes that organizations (NGO) like the American Red Cross (ARC) automatically arrives and sets up shelters whenever there is a catastrophic event, mainly because that’s is what they see on television news. What people do not realize is there is a “process” that has to happen BEFORE an emergency takes place in your area to facilitate this actually taking place.

Speaking from my point of view, at the university/college level, one of our first priorities after any major emergency is the safety of the student population. Specifically here in California, earthquakes and fires are two of the most probable events that could affect us and the consequences of both events could require almost immediate (and potentially long term) mass sheltering resources. With a daytime campus population of approximately 50,000 people, intertwined in a community of 113,000 people, I can only speak for our locale, but I know we are not prepared for that eventuality. By that I mean we have not gone through the “vetting” process for ARC shelters and the city we are located in and several neighboring communities have not either. While we have looked into the “circus tent” concept for these situations, in reality that is not a feasible plan (unless you already own them and have the resources to put them up at a moment’s notice and provide the other support services that would be absolutely necessary for their operation). As I indicated, we are now embarking on the vetting process to identify shelters, but I must say it is a very detailed, cumbersome undertaking and some of the requirements, while I do understand ARC’s logic, are not practical. Because of these stringent requirements, even with our campus buildings and facilities (a number of large gymnasiums and other large capacity venues), we will not be able to designate the numbers of shelters we would definitely need.

I firmly believe this Emergency Mass Shelter project could be very beneficial not only to my situation, but other Higher Education (HE) facilities across the country and the many local governments they cohabitate with, all faced with the same dilemma. This project could help define a “graded approach” to determining appropriate shelter locations and certainly simplify the process so that more shelters can be “pre-identified”.

Stephen Stoll
Director, Office of Emergency Preparedness/Homeland Security
UC Berkeley Police Department
510-642-1258
The USDA Food and Nutrition Service provides disaster nutrition assistance through State agency requests to operate a Disaster Supplemental Nutrition Assistance Program (D-SNAP) or for the use of USDA Foods (commodities) for congregate feeding (in mass shelters) or household feeding. FNS offers the following resources on the subject matter of the new project:


We hope the resources are useful to you.
NFPA Emergency Mass Shelters Project

A standardized minimum guide for general population and responder sheltering would be helpful for any emergency sheltering needed as a result of either a manmade or natural event. Limiting the project to large mass shelters may be shortsighted. The site survey, selection, MOU of potential use (lease), and preplan; can all be done ahead of time in most jurisdictions, but especially the ones that have the potential to be responder staging hubs or evacuation destinations. There is also the practical reality that small town USA doesn’t always have a large facility such as an arena or stadium for mass sheltering but may have a series of smaller facilities that together must meet their need. “Normal evacuation sheltering” is not always provided by non governmental entities. Texas has private, faith based, and other NGO partner organizations that operate under the local or state agency’s direction and supervision.

Starting with Katrina; through Rita, Dolly, Edouard, Gustav, Ike, and Alex; general population evacuation and responder shelters have gotten better and more sophisticated with hands on experiences and best practices that kept improving. There is however, a variety of “systems” used to shelter evacuees. Bringing the various systems and processes together under one national consensus standard would benefit all involved and provide a roadmap for those entities setting up a shelter for the 1st time or trying to improve their current plan for a future event.

There will be a great many users for the new standard along with an equal number affected. Anyone that will be involved in evacuee or responder sheltering will have this document as a minimum guideline to follow. This would apply to everyone involved in the process of shelter operations. The impact on the pre-event planning phase of shelter operations would be significant. Right now, there are a variety of guidelines out there, but none are the “standard”. Consolidating all the information and experience available into one standard would narrow the interpretation by the self appointed experts and substantiate the factual information into one document.

I know that there is a substantial amount of technical expertise in Texas. The Gulf Coast has been subjected to quite a few storms starting with Katrina. Texas stepped up to take care of its neighbors when the need arose. Most of that initial evacuee reception, processing, sheltering, and repatriation were done on the fly with a minimum of preparation, if any at all. We learned quickly from our triumphs and our mistakes. We fixed our mistakes and built on the successes. We have people that started out as shelter workers, moved to shelter managers, and became shelter branch managers. San Antonio developed its own shelter manager/shelter worker class and it is taught every year to all police and firefighters that will be working in shelters. We have developed our own site assessment and acquisition team with our partners to secure agreements for buildings before events happen. Our planning starts in February and is normally complete by July.

The Alamo Regional Command Center (ARCC) in San Antonio Texas has a significant amount of data and information. The shelter operations group operating from this center also has a great deal of knowledge and expertise; hands on practical expertise. And; as with other user standards, it would be a mistake to not include task level operations personnel in the standards development process. They same logic here would apply as it does with all user standards; if you want to know how well something works, ask the people who use it.

Jim Reidy - Deputy Shelter Branch Director – Alamo Regional Command Center

Member NFPA 1851 / 1971 Committee
To whom it may concern:

Save the Children would value the opportunity to serve as an advisor to this project. As the national and global leader in helping protect children in disasters, we respectfully submit our comments here on this project.

Based on the work of the National Commission for Children and Disasters, and the National Coalition for Children and Disasters, Save the Children strongly urges the NFPA Standards Council to include the specific needs of children in all appropriate aspects of this project.

Specifically, we urge the following additions to the scope of the project:

a. **Identify intended users of the new project/document:**
   
   Local, State and Federal agencies, NGO, Not-For-Profit, Faith Based Organizations (FBO)
   
   ADD: Child serving organizations who may provide care and support for children in the mass care site.

b. **Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document, and provide contact information for these groups:**
   
   Local, State and Federal agencies, NGO, Not-For-Profit, Faith Based Organizations (FBO) [see g. below] and FEMA.
   
   ADD: NVOAD Child Advocate Groups, like Save the Children, who can provide input on the need for the proposed new project/document.

   Save the Children
   
   2000 L Street NW, Suite 500
   Washington, DC 20008
   
   Attn: Jeanne-Aimee De Marrais, Domestic Emergencies Advisor
   
   Email: jdemarrais@savechildren.org
   
   Cell: 203-919-2219
   
   Office: 202-640-6675

c. **Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly by the proposed new project/document, and what benefit they will receive by having this new document available:**
   
   Local, State and Federal agencies, emergency management coordinators and planners, NGO, Not-For-Profit and Faith Based Organizations (FBO).
   
   ADD: Child serving organizations who may provide care and support for children in the mass care site.
d. Identify other related documents and projects on the subject both within NFPA and external to NFPA:

Specifically, we urge the NFPA Standards Council to include the following documents to help inform the creation of guidance:

1. Mass Care Standards and Indicators to help ensure the safety and protection of children. Developed in collaboration with the Red Cross, FEMA and NVOAD partners. (Attached)

2. Training on temporary respite care (a common standard of mass care in domestic disaster response). An example of this is Save the Children’s temporary respite care program entitled Child Friendly Spaces (CFS) program. (Attached is a one page fact sheet, general child protection guidance as well as the program training guidance).

4. Temporary Child Care in Emergencies (Attached)

Additionally, Save the Children urges all leadership and staff at mass care sites to take the on-line FEMA Emergency Management Institute Course IS-366: Planning for the Needs of Children in Disasters.

http://training.fema.gov/EMIWeb/IS/is366.asp

If you have any questions or would like additional details, please do not hesitate to call or email me.

Best regards,
Jeanne-Aimee

Jeanne-Aimee De Marrais, Advisor, Domestic Emergencies, Save the Children 202.640-6675 (work) 203.919-2219 (cell), 202.640.6659 (fax), jdemarrais@savechildren.org
Codes and Standards Administration
NFPA
One Batterymarch Park,
Quincy, MA 02269-9190

To whom it may concern,

On behalf of the National Volunteer Fire Council (NVFC), I would like to express my support for the proposal to have NFPA establish a new project on Emergency Mass Shelters. A copy of the Project Initiation Form was circulated to the NVFC Board with a request for comments on the proposed project. The reasons that NVFC supports the creation of a project on Emergency Mass Shelters are articulated through the following responses from various Board members:

I don't know what triggered this idea but I will tell you as a retired emergency manager that we spent oodles of time trying to anticipate what was needed at a shelter. In one case we had everything on our list nailed down only to find the main requests centered around showers which were not available at the selected location.

Ken Knipper, NVFC Kentucky Director

In my past job experience, I had responsibility for sheltering in my county as the Emergency Manager for the county. I believe what is being considered is far too big for volunteer fire companies to have to deal with. Just at the local level, I found sheltering to be very challenging because many agencies believed they were in charge when in fact, I was responsible. The American Red Cross was the most challenging because to get their services which were truly needed, you had to comply with their rules, some of which were not workable and did not make sense.

With that being said, we should probably endorse such as committee to look at large event sheltering. However, we would need to be cautious not to get the volunteer companies responsible since most large sheltering areas would probably be in areas of paid departments.

Allen Metheny, NVFC Delaware Director

I agree with Allen Metheny. During a 2007 Nor’easter we used the fire station as a shelter and EOC, that is not a good match.

When the Red Cross did come in they wanted to take over and run things their way.

Bob Kilpeck, NVFC Vermont Director

In South Mississippi FEMA is funding hurricane/tornado shelters. Lamar County has one under construction now that if used for a hurricane will house 1000 people for up to three days. The
shelter is built to FEMA 361 standards, is located on the county’s fairground and could be used during a tornado warning.
From Katrina I learned:
Requests for assistance will be more than a volunteer or career department can furnish, we received requests for help with distribution, special needs etc. A large population sheltered in your area will increase your call volume. Our population is 3500, we probably picked up a thousand people after Katrina that fled the coast and stayed with friends and family. This shelter will add more people to serve. Another problem we had was people fleeing the coast getting off of the Interstate and getting lost at night in rural areas. We needed more evacuation signs in rural areas. We are concerned when this new shelter is at capacity, we will have people driving around looking for shelter. Motorists were also stranded due to car trouble. As busy as we were, the Sheriff’s Office was even busier and asked for our assistance with some of these calls. The 911 system may be down for days, plans need to be made for alternate dispatch procedures, we manned the station and people reported emergencies to us directly. We maintained radio contact using handheld radios with the distribution centers. This may be an option for shelters.
There may not be access to the hospitals. Our largest hospital closed due to loss of water and power. Shelters need to be able to deal with this type issue. Drug stores are also closed.
I think we need to make sure planners know that assistance from fire departments will be limited and we need to try to limit any additional responsibilities added in the code. We do need to limit the possibility of fire in these structures. No deep fat fryers, non-combustible building material, use of sprinklers etc.
One of my concerns with the multi-million dollar facility is its limited use. I think with modest increased cost the facility could serve as a fallout shelter. The shelters that FEMA is funding now are self-contained as far as water, sewer, and power. I would like to see such facilities be capable to be used as a fall-out shelter. I would think the concrete walls and ceiling would provide a good bit of protection from radiation. Codes might be able to address air purification and other needs.

George Stevens, NVFC Mississippi Alternate Director

In addition to supporting the creation of an Emergency Mass Shelters project, I would encourage NFPA to make participation accessible to organizations that bring an important perspective to the table but are not able to fund the travel and lodging costs generally associated with appointing a representative to an NFPA Committee.

Sincerely,

Philip C. Stittleburg
Chairman
January 27, 2012
To: NFPA Standards Council

We were notified that NFPA was considering a project to develop guidelines for emergency mass shelters. I wanted to make you aware of two documents that would potentially negate the need for such a project.

First, the American Red Cross and the International Association of Venue Managers (IAVM, formerly known as the International Association of Assembly Managers or IAAM) collaborated with a number of other agencies and partners to develop a guide for mega-shelters. This purpose of this guide, entitled Mega-Shelter Planning Guide, is to provide public assembly venues, their communities, emergency managers, shelter operators and many others with a comprehensive guide to formulate a plan for mega-sheltering. The guide is designed to be a resource for in all phases of mega-sheltering, from planning and preparedness efforts to actual response and recovery. This document was published October 2010 and can be accessed most easily through the IAVM website here: http://www.iavm.org/cvms/mega_sheltering.asp.

Second, the American Red Cross just finalized a document called Non-Traditional Sheltering Concept of Operations (NTS ConOps). This document was produced as part of a grant from FEMA’s Regional Catastrophic Preparedness Grant Program. The NTS ConOps is designed to be used as a template that jurisdictions can use to prepare for non-traditional sheltering situations such as mega-shelters and open space shelters. The NTS ConOps references and builds from the Mega-Sheltering Planning Guide. Because this document was finalized on December 31, 2011, it is not yet available for distribution. However, we anticipate being able to share that document in the near future; we will make sure your organization receives it.

Another concern regarding the proposal is the inclusion of the various organizations that would contribute to the effort. Many of the organizations listed have no involvement in sheltering whatsoever. Even in the largest sheltering operation in recent history, following Hurricane Katrina, about half of these organizations were not involved in the large scale sheltering operations. Many of them have a different (and quite valuable) focus during disasters so would not typically have the technical expertise to contribute to an effort around sheltering.

While there are certainly additional tools that could be discussed to make sheltering in large environments more effective, the project as proposed seems to duplicate the existing guidance documents. I would be happy to discuss these issues with The Standards Council or Dean Larsen as appropriate.

Lynn Crabb, CEM
Director, Mass Care

American Red Cross
2025 E St NW
Washington, DC 20006
(202) 303-5739 (p)
(202) 438-5707 (c)
(202) 303-6505 (f)
crabbl@usa.redcross.org
Maynard, Mary

From: Harold C Hansen [Harold-Hansen@sbcglobal.net]
Sent: Friday, January 27, 2012 3:10 PM
To: stds_admin; deanlarson@larsonperformance.com
Cc: CrabbL@usa.redcross.org
Subject: Response - Guidelines for Mass Sheltering

January 27, 2012

To: NFPA Standards Council

Response to Proposal for NFPA Standards Council Regarding Emergency Mass Shelters:

There has been a great amount of work done by many organizations over many years to develop and establish guidelines, standards and resources for the sheltering of individuals affected by disasters. This is ongoing and grown extensively since Hurricanes Katrina and Rita. The International Association of Venue Managers (IAVM) (formerly known as International Associations of Assembly Managers – IAAM) and American Red Cross published a comprehensive Mega-Shelter Planning Guide in October 2010 for the use of large venues as shelters. IAVM published a Mega-Shelter Best Practices and Operations Guide in July 2006 that specifically addresses the lessons learned and provides proactive guidance from Hurricanes Katrina and Rita. American Red Cross has established guidelines and procedures for shelters, as well as provides training on shelter operations. FEMA has established a NIMS Mass Care Working Group that has for the past two years been at work defining resources (resource typing) and establishing job tiles to assist government, local officials, and mass care responders plan, prepare and respond to emergencies.

These resources are becoming available as completed and more is under development. Observing that none of this information is listed in the proposal as submitted to the NFPA Standards Council, it would appear there is a gap in the knowledge and the general awareness of the information that is currently available and work that has been done. The link to the some of this information is:
http://www.iavm.org/CVMS/mega_sheltering.asp See Comment No. 24 for Attachment

For NFPA to embark on a project that is already rather comprehensively addressed and available to venues, emergency managers, and government officials would be redundant efforts to what has already been accomplished. It clearly appears that the proposer and NFPA needs to be more aware of the extensive body of work that exist and is ongoing before considering or attempting the project as described.

Additionally, for NFPA to establish guidance and standards for Mega-Sheltering, Mass Sheltering, and/or Mass Care, in general, would add an additional level of regulation to a situation that is extensively defined by federal legislation, FEMA regulation, guidance, and procedures, and the standards and indicators established by the response community American Red Cross, National Voluntary Organizations Active in Disasters (NVOAD), IAVM, and many others. Such guidance and regulation is un-need and unnecessary and most likely be duplicating or restating what already exists and is set out by higher authorities. It would be far more beneficial and applicable for NFPA, IAEM, and interested individuals to lend their efforts and expertise to the work and body of knowledge that is already in place. Such expertise and input would be welcomed and could assist in specific areas.

While it is recognized that not all shelter operations is done by FEMA, American Red Cross, or IAVM member venues, the body of work and guidance that is available guides shelter operation by many others
and is recognized throughout the mass care community as the standard by which shelter operations are evaluated. There are evaluation procedures in place for shelter operations. There is ongoing efforts to enhance and strengthen the systems and procedures to protect the lives and wellbeing of those impacted by emergencies and disasters. We would encourage NFPA and interested individuals to support and become involved in the work in progress and not begin a separate and duplicative effort. Much has changed since the experiences of hurricanes Katrina and Rita, and these experience should not be the basis to judge preparedness, readiness, and quality of care in place today. Although, we know there is always more to be done to refine and strengthen the sheltering processes. Additional and new expertise is always welcome.

Joining efforts through recognition of existing guidance, sharing and discriminating information, and the delivery of training throughout the mass care community is a better approach to addressing the needs and concerns expressed in the proposal to the NFPA’s Standards Council. Starting a new set of guidance is duplication and redundant.

Respectfully,

Harold C. Hansen
Director Life Safety & Security

International Association of Venue Managers, Inc.

Office: 7414 N Sheridan Road
Chicago, IL 60626
Office: 773-973-2049
Cell: 773-480-7412
Harold-Hansen@sbcglobal.net
www.IAVM.org

Be Prepared: Purchase the IAVM’s AVSS Severe Weather Planning Guide!
January 26, 2012

Codes and Standards Administration
NFPA
1 Batterymarch Park
Quincy, MA 02169-7471

To the members of the Standards Council:

The International Association of Emergency Managers – USA Council is grateful for the opportunity to provide comment related to the NFPA’s Standards Council proposed new project on Emergency Mass Shelters.

In October 2010, the Mega-Shelter Planning Guide was released. This document was created in partnership by the International Association of Venue Managers, and the American Red Cross utilizing a working group of subject matter experts.

In November 2010, FEMA’s Guidance on Planning for Integration of Functional Needs of Supportive Services in General Population Shelters was released.

Currently the National Mass Care Council is finalizing their work and will release a National Mass Care Strategy in the near future. IAEM would recommend and support NFPA adopting this strategy and incorporating it into NFPA 1600.

As you can see a great deal of work has been done recently on this important subject. As practitioners we are concerned with yet another document which may create confusion or conflict. As with any document we believe that the current guidance and strategy will need to remain dynamic and flexible to allow implementation so that we can continue to improve on this critical function in our response.

Thank you again for the opportunity to provide comment.

Respectfully Submitted,

Hui-Shan Walker, CEM
IAEM-USA 2011-2112 President
Orlando:

Thank you for contacting me in regards to whether there is a need for a standard for shelters. FEMA’s Mass Care Section believes that there is no need for a standard for shelters because there are several documents that have been published that address the issue. The following documents are available at this link

http://www.iavm.org/cvms/mega_sheltering.asp

APPLICATION for MEGA-SHELTER ASSISTANCE TEAM (MAT)
Mega-Shelter Assistance Team (MAT) Volunteer Opportunities with the American Red Cross
Mega-Shelter Assistance Team (MAT) Application Processes and Guidelines
Mega-Shelter Assistance Team (MAT) Job Description
MEGA-SHELTER PLANNING GUIDE
Mega-Sheltering Framework Roles-Responsibilities Worksheet
Mega-Shelters and the Role of the Public Assembly Venue
Shelter Field Guide - FEMA P-785 / Interim
Shelter Guidance Aid and Shelter Staffing Matrix - October 2010
Venue Chapter MOU Mega sheltering TEMPLATE

Please review these documents and if you have any questions, do not hesitate to contact me.

Thank you,

Jen Noonan
Mass Care Section
FEMA Headquarters
500 C Street SW
Washington DC  20472-3100
Email:  jennifer.noonan@fema.dhs.gov (please note new email address)
Office:  202-212-1247
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<th>Salutation</th>
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<tr>
<td>Chief</td>
<td>Ricky</td>
<td>Ziebart</td>
<td>U.S. Fire Administration, Emergency Response Support Branch</td>
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<td>Ms.</td>
<td>Elizabeth</td>
<td>B.</td>
<td>Armstrong IAEM CEO</td>
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<td>Ms.</td>
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<td>Mr.</td>
<td>Robert</td>
<td>J.</td>
<td>Bennett National Fire Academy, Incident Management Training Specialist</td>
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<td>Mr.</td>
<td>Glenn</td>
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<td>Gaines Deputy US Fire Administrator</td>
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<td>Mr.</td>
<td>Wayne</td>
<td>Yoder</td>
<td>National Fire Academy, Training Specialist, Hazardous Materials Program</td>
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<td>CEM International Association of Emergency Management</td>
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<td>Mr.</td>
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<td>Plaugher International Association of Fire Chiefs</td>
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<td>Ms.</td>
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<td>International Association of Fire Fighters</td>
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<td>Ms.</td>
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<td>National Volunteer Fire Council</td>
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<td>Mr.</td>
<td>Timothy</td>
<td>P.</td>
<td>Butters US Department of Transportation</td>
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<td>Mr.</td>
<td>Thomas</td>
<td>J.</td>
<td>Qieczorek ICMA</td>
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<td>Mr.</td>
<td>Russell</td>
<td>Sanders</td>
<td>NFPA c/o Metropolitan Fire Chiefs</td>
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<td>Chief</td>
<td>Mark A.</td>
<td>Marshall</td>
<td>International Association of Chiefs of Police</td>
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<td>Ms.</td>
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<td>Ms.</td>
<td>Jennifer</td>
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<td>Director</td>
<td>Thomas R.</td>
<td>Frieden</td>
<td>Centers for Disease Control and Prevention</td>
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<td>President</td>
<td>Mickey</td>
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<td>Southern Baptist Disaster Relief</td>
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<td>Mr.</td>
<td>Ashley P.</td>
<td>Moore</td>
<td>National Integration Center (NIC)</td>
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<td>Mr.</td>
<td>Craig</td>
<td>Fugate</td>
<td>FEMA Administrator</td>
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<td>Ms.</td>
<td>Marcie</td>
<td>Roth</td>
<td>FEMA Director, Office of Disability Integration and Coordination</td>
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<td>Mr.</td>
<td>Rich</td>
<td>Serino</td>
<td>FEMA Deputy Administrator</td>
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<td>Mr.</td>
<td>Don R.</td>
<td>Boyce</td>
<td>FEMA Regional Administrator, Region One</td>
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<td>Mr.</td>
<td>Paul</td>
<td>Ford</td>
<td>FEMA Deputy Regional Administrator, Region One</td>
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<tr>
<td>Ms.</td>
<td>Kate</td>
<td>McCarthy</td>
<td>FEMA Disability Integration Specialist, Region One</td>
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New Project Proposed on Emergency Mass Shelters

At its October 2011 meeting, The Standards Council considered the request of Dean Larson of Larson Performance Consulting that NFPA consider the establishment of a new project on Emergency Mass Shelters. After review of all the material before it, the Council voted to publish a notice to solicit comments on the need for the project, information on resources on the subject matter, those interested in participating if established, and other organizations actively involved with the subject. Anyone interested in commenting on this proposed project is invited to do so in writing.

The following justification for the new project has been submitted:

a. **Explain the Scope of the new project/document:**
   Provide a guide for using large buildings such as an arena, large sporting venues and warehouses for mass sheltering outside of the normal sheltering provided by a Non Government Organization (NGO) such as the Red Cross.

b. **Provide an explanation and any evidence of the need for the new project/document:**
   Events such as Katrina, major flooding events such as the Mississippi River that would require a jurisdiction to provide sheltering for several thousands of people for longer periods of time that your normal sheltering plan, which could be for two to three days. These long term sheltering plans could last several weeks and up to a couple of months.

c. **Identify intended users of the new project/document:**
   Local, State and Federal agencies, NGO, Not-For- Profit, Faith Based Organizations (FBO)

d. **Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document, and provide contact information for these groups:**
   Local, State and Federal agencies, NGO, Not-For- Profit, Faith Based Organizations (FBO) [see g. below] and FEMA.

e. **Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly by the proposed new project/document, and what benefit they will receive by having this new document available:**
   Local, State and Federal agencies, emergency management coordinators and planners, NGO, Not-For-Profit and Faith Based Organizations (FBO).

f. **Identify other related documents and projects on the subject both within NFPA and external to NFPA:**
   NFPA 1600 Disaster/Emergency Management Business continuity Programs 2010 edition
   U.S. Department of Health and Human Services Administration for Children and Supplies “Title 9 Sheltering Standards, Services and Supplies”
   Red Cross Red Crescent “Guidelines for the Domestic Facilitation and Regulation of international Disaster Relief and Initial Recovery Assistance”
   Guidance on Planning for Integration of Functional Needs Support Services in General Population Shelters. FEMA

g. **Identify the technical expertise and interest necessary to develop the project/document and if the committee membership currently contains this expertise and interest:**
   Volunteers serving the following organizations represent the type of experience needed for this type of standard: Adventists Community Services, American Baptist Men, American Radio Relay League, American Red Cross, Brethren Disaster Ministries, Catholic Charities USA, Christian Disaster Response International, Christian Reformed World Relief Committee, Church World Service, churches of Scientology Disaster Response, City Team Ministries, Convoy of Hope, Episcopal Relief and Development, Feeding America (Formerly America’s Second Harvest), Feed the Children, Habitat for Humanity International, Hope Coalition America, The Humane Society of the United States, International Aid, International Relief Friendship Foundation, Latter Day Charities, Lutheran Disaster Response, Mennonite Disaster Service, Mercy 4 November 2011
h. Provide an Estimate on the amount of time needed to develop the new project/document:
   Two years

i. Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document:
   Extensive experience gathered from long-term mass sheltering caused by Hurricane Katrina and Rita. There are several jurisdictions and Emergency Management coordinators that have firsthand knowledge of locating and supporting Mass Sheltering Facilities, such as the ones used during Hurricane Katrina and Hurricane Rita. The key is that this type of sheltering goes on for several weeks and jurisdictions will be faced with fire safety issues, ADA requirements and security issues such as unidentified pedophiles sleeping next to children in general population shelters.

Responses should be sent to Codes and Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471 or by email at stds_admin@nfpa.org, by January 27, 2012.
Item 12-3-11
### New Project Initiation Form

(To be completed by proponent of new project/document)

Additional pages may be attached if necessary.

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<td><strong>a.</strong> Explain the Scope of the new project/document:</td>
<td>A Guide for the Development of Community Paramedicine Programs. The scope of this document would be to assist EMS systems in integrating EMS into public health as called for in the EMS Agenda for the Future.</td>
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<tr>
<td><strong>b.</strong> Provide an explanation and any evidence of the need for the new project/document:</td>
<td>The landmark publication <em>EMS Agenda for the Future</em> called for the integration of pre-hospital medical systems into the continuum of medical care to include the spectrum of public health. While many EMS systems have begun to consider methods of answering this call, few resources exist to guide administrators in this underdeveloped niche of pre-hospital medicine. Fueling the recent interest in community paramedicine initiatives is the latest pronouncement by CMS that hospitals will begin to receive penalties for patients who are re-admitted to a facility for the same diagnosis within 30 days of discharge. Hospital administrators are now looking to EMS as a possible bridge between inpatient discharge and outpatient follow-up appointments to identify those patients at highest risk for relapse. It is a natural fit for EMS in many ways. First, EMS systems are designed to expand and contract resources based on demand. The infrastructure exists having mobile resources placed around a service area that could easily perform a post-discharge wellness check on a patient. Second, the EMS providers themselves are highly accustomed to working under physician protocols and standing orders. These providers have the experience and training necessary to recognize the acutely ill or decompensated patient and to stabilize them if transport is necessary. Third, a number of highly skilled and experienced EMS providers leave the work force due to physical limitations that prevent them from tolerating the daily abuse and demands typical of a street medic. These providers are often relegated to desk duty where their skill and experience is no longer benefiting direct patient care. Community paramedicine programs allow these seasoned providers to continue using their valuable assessment skills and inherent patient advocacy position to directly benefit high-risk patients while fulfilling the vision for complete integration of EMS into the healthcare continuum. We believe that an NFPA document addressing community paramedicine development would become a highly sought after resource for EMS leaders across the country.</td>
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<td><strong>c.</strong> Identify intended users of the new project/document: Any EMS system and hospitals, community health centers, public health advocates, and physicians.</td>
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<td><strong>d.</strong> Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups: IAFF, IAFC, NAEMT, NAEMSP, Insurance industry, ACEP, NREMT, NVFC, NASEMSO, NAEMSE, Advocates for EMS, NEMSMA, Fire Based Advocates for EMS.</td>
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<td><strong>e.</strong> Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available: IAFF, IAFC, NAEMT, NAEMSP, Insurance industry, ACEP, NREMT, NVFC, NASEMSO, NAEMSE, Advocates for EMS, NEMSMA, Fire Based Advocates for EMS.</td>
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<td><strong>f.</strong> Identify other related documents and projects on the subject both within NFPA and external to NFPA: None within the NFPA. Unknown of any that address this subject, however there is a large need or demand for a document to address this subject.</td>
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<td><strong>g.</strong> Identify the technical expertise and interest necessary to develop the project/document, and if the committee membership currently contains this expertise and interest: The EMS-AAA TC has the sufficient technical expertise necessary to develop this document.</td>
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h. Provide an estimate on the amount of time needed to develop the new project/document:
2-3 years.

i. Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document:
The data is sparse where no formal study has been done to evaluate this subject. This is the reason for the desire of the EMS-AAA TC to develop this document with the expertise on the TC with input from any and all interested parties.

Please send your request to:
NFPA
Codes and Standards Administration
1 Batterymarch Park
Quincy, MA 02169
Std Admin@nfpa.org
Rev. 10/09

Signature: ________________________

Name: David K. Ten, M.D., FAAEM

[please print]

Affiliation: National Association of EMS Physicians
NFPA TC on Emergency Medical Services Meeting

July 29-30, 2010

Members Present:
Ken Holland, NFPA Staff Liaison
Ken Knipper, Chair & Principal
Richard Patrick, Principal (acting Secretary)
David Simmons, Principal
Jonathan Moore, Principal
Frank Pratt, Principal

Known excused: Jack Krakeel, Kyle Gorman, Ron Pirrallo

Guest: Tim Crowley (Chief ret. Las Vegas, NV, Fire Dept.)

The meeting was called to order at 8:55 a.m. by Chairman Ken Knipper.

Ken Knipper explained to the group that NFPA 450 is scheduled to enter the Annual 2012 cycle. The committee charge from the Standards Council is to consider the new project of recommended practice as a stand alone project and or to incorporate it into the existing NFPA 450. The committee is also reviewing NFPA 450.

Introductions of attendees

There was some discussion on the potential timelines for future meetings.

I. Discussion of NFPA Updates.

Ken Holland briefed the group on the passing of Chief Frank Florence. Ken is now the NFPA Staff Liaison to this committee.

NFPA 450 entered cycle on July 9, 2010 and proposal closing date is November 23, 2010.

II. Approval of Minutes.

Minutes from January 21, 2010 meeting were approved.

III. Discussion of Document Development Process.

Ken Knipper and Ken Holland provided an overview of how the EMS Systems standard originated and the rationale to the document and it being a guide versus a standard.
Ken Knipper inquired on clarification of the ‘committee charge’ and are we addressing the entire NFPA 450 or a specific section. Discussion ensued pertaining to ties with national programs such as NEMSIS and evidence based rationale. The following is the charge for consideration as previously described.

**Description:** NFPA 450 provides a template that identifies the essential elements of an EMS system. While the purpose of NFPA 450 is to provide guidelines and recommendations to assist those interested or involved in EMS system design, provision of local pre-hospital care requires the coordination and cooperation of disparate elements. System design is critical to effective patient care, NFPA 450 does not comprehensively provide a standard methodology to determine if the system design is effective. The proposed document will provide for local system design evaluation. It is the intent of the proposed document to create a system of analysis utilizing the essential design elements provided in NFPA 450.

**Scope:** This document is designed to assist individuals, agencies and organizations as well as those interested or involved in EMS system a method by which to evaluate the effectiveness of the EMS system. The evaluation methodology is predicated on the utilization of NFPA 450 design elements and locally established standards for the delivery of emergency medical services.

**Rationale:** There are a multiple evaluation processes such as CAAS, CFAI, CALEA, JCAHO and NHSTA that assess the capabilities of individual system agencies, however none of these processes are designed to evaluate the EMS system throughout the continuum of patient care. The document intends to create a recommended practice that allows for the evaluation of multiple system parameters that are frequently provided by many different participants that have a defined role in the delivery of EMS.

Group reviewed the EMS Performance Measures document produced jointly by the NASEMSO, NAEMSP, NHTSA/OEMS and HHS. Discussion followed on how to best approach the development of measurement models. Suggestion was made to thoroughly review the performance measures document and assure that we crosswalk the information with the NFPA 450 functional intervals (table 5.6 Essential System Analysis Components, page 450-13, 2009 Edition).

Following additional discussion the group decided to pursue a link of NEMSIS, NHTSA Performance Measures and NFPA 450. As part of the due diligence the committee reviewed the EMS Performance Measures document line by line.

The group recommended to NFPA staff liaison to communicate the NHTSA EMS Performance Measures along with NFPA 450 information with the committees intent to incorporate the performance measures into the NFPA 450 versus creating a separate document. The committee present reviewed the NHTSA Performance Measures document with discussions and no conflicting issues.
Group discussed the Standards Councils pointed comment regarding comprehensive performance measures and how the NHTSA Performance Measures are not comprehensive, specifically in relation to NFPA 450. The resulting question remains - Should the committee look at additional measures applicable to NFPA 450 or focus on the identified measures within the NHTSA document?

Performance measures identify the targets to measure. There is no reference as to the performance expected. Group discussed. Examples identified were some known performance expectations such as medical care for MI, STEMI.

**Link to NHTSA Performance Measures:** [http://www.ems.gov/pdf/811211.pdf](http://www.ems.gov/pdf/811211.pdf)

The committee recessed for the day at 4:30 p.m.

**July 30, 2010**

The committee reconvened at 8:00 a.m. Chairman Knipper called the meeting to order.

III. (con’t)

Committee worked on development of a committee ballot regarding the Standards Council recommendation. David Simmons made a motion to accept the draft ballot, 2nd by Rick Patrick.

Committee discussed several recommendations for proposed revisions to NFPA 450. Ken Holland has the draft of proposed revisions. These proposed changes that were discussed at the meeting are not official changes as they will need to be balloted officially through the entire TC. These are just here to get any further discussion from the committee regarding these specific changes. The committee can also make any proposed changes at the Report on Proposal meeting to be held in January, 2011.

Proposed revision of 1.2 Purpose

….This document provides a template resources for local stakeholders to evaluate EMS systems and make improvements based on that evaluation…….

OR

**1.2 Purpose.**

The purpose of this document is to provide guidelines and recommendations to assist those interested or involved in EMS system design. Provision of local prehospital care requires the coordination and cooperation of disparate elements. This document provides a template for local stakeholders to evaluate EMS systems and make improvements based on that evaluation. While other resources on this topic exist, this document provides a framework for designing and/or evaluating a comprehensive EMS system.
Proposed revision of 5.5.3.2.2

NHTSA. The National Highway Traffic Safety Administration (NHTSA) is currently working on has developed published the document “EMS Performance Measures: Recommended Measures for System and Service Performance” using a consensus process to develop performance measures for EMS. The document contains indicators and attributes which EMS practitioners identified as critical for performance measurement and evaluation of any emergency medical services system. This resource describes the sources of required data, the formulas or questions necessary to examine critical components as well as other evaluation criteria parameters.

2.3.4 NHTSA Publications.
National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, DC 20590.
EMS Performance Measures: Recommended Measures for System and Service Performance
National EMS Education and Practice Blueprint.
NHTSA Uniform Prehospital Data Set.

Add new text:
2.3.X NEMSIS Publication reference.

5.11.3 NEMSIS. Add statement regarding NEMSIS here.

Discussion on recommendations to assure that the definitions used are consistent with those in NEMSIS and to reference NEMSIS as a standard for prehospital EMS data collection and the National EMS Database. The committee agreed to recommend insertion of language to address these topics in Chapter 2. Reference Documents, 2.3 Other Publications of NFPA 450.

Committee membership

Group discussed suggested recommendations for membership. Several names were provided to NFPA. Additional discussion on the importance of having alternates for the current principal representatives.

Next Meeting:

The next meeting will be scheduled in January 6-7, 2011 location options are Memphis, TN and San Antonio, TX.

Meeting Adjourned

Respectfully submitted,

Richard W. Patrick
Community Paramedic

To address the critical shortages of health care professionals and services in rural and remote areas, the Community Healthcare and Emergency Cooperative is developing a Community Paramedic training program. The Community Paramedic will not replace existing health care services, but will fill the gaps revealed by examining each community. The Community Paramedic will ensure basic and advanced levels of care appropriate to prevention, emergencies, evaluation, care, triage, disease management, mental health and referrals. The Community Paramedic will receive standardized training—training that is consistent internationally—yet can be modified for each community, state and nation.

Role

The Community Paramedic will respond to identified health needs in underserved communities, ultimately improving the quality of life and health of rural and remote citizens and visitors. Roles will include outreach; wellness; health screening assessments; health teaching; providing immunizations; disease management, including a thorough understanding of monitoring diabetes, congestive heart failure and other high cost diseases and the methods and medications used to treat them; recognition of mental health issues and referral into the existing mental health care system; wound care; safety programs; and, functioning as physician extenders in rural clinics and hospitals in communities that have them.

Partners

Creighton University in Nebraska, Dalhousie University in Nova Scotia, the MNSCU Healthcare Education-Industry Partnership in Minnesota, the Mayo Clinic Medical Transport, the North Central EMS Institute, the state Offices of Rural Health in Minnesota and in Nebraska, and the University of Nebraska Medical Center formed the Community Healthcare and Emergency Cooperative in July 2007 to create a new community health provider model to serve rural and remote communities.

Status

The partners are working to create a Community Paramedic health care model, are writing a curriculum that builds on the MNSCU Community Health Worker curriculum and are planning a pilot of the model. The partners studied the Alaska Community Health Aide, the Nova Scotia Community Paramedic model, and the Australia Rural and Remote Paramedic Program. Each home grown project has something unique to offer. For example, Nova Scotia informally expanded the role of their paramedics in a three-phase process and demonstrated a 40 percent reduction in emergency room visits and a 28 percent reduction in clinic visits over five years.

For more information, contact Dennis Berens, director of the Nebraska Office of Rural Health at (402) 471-0142 or dennis.berens@dhhs.ne.gov or Gary Wingrove, director of strategic affairs for Mayo Clinic Medical Transport in Minnesota at (612) 366-3532 or wingrove.gary@mayo.edu. More information is available at http://checc.neemsli.org.
Health and Human Services

Contact Us

Aven
100 W. Beaver Creek Blvd. 107
P.O. Box 3419
Avon, CO 81620
Phone: 970-948-7026
Fax: 970-948-8120

Eagle
551 Broadway
P.O. Box 860
Eagle, CO 81631
Phone: 970-328-8340
Fax: 970-328-8529

El Jebel
020 Eagle County Dr. Ste E
El Jebel, CO 81633
Phone: 970-704-2760
Fax: 970-704-2763

County and WECAD launch community paramedic pilot program

Contact: Anne Robinson, Public Health Nurse Manager, 970-748-2005, anne.robinson@eaglecounty.us or Chris Monterra, Chief Eagle County Western Eagle County Ambulance District, 970-328-1130, cmontera@wecadems.com

Through a collaborative effort between Eagle County’s Public Health Department and the Western Eagle County Ambulance District (WECAD), a new community paramedic pilot program is being launched that will provide better, more cost-effective access to essential healthcare services. As part of the community paramedic model, patients are referred to Emergency Medical Services (EMS) personnel by their primary care physician to receive services in the home, including hospital discharge follow-up, blood draws, medication reconciliation and wound care. The program is the first of its kind in the state and officially begins on Aug. 17.

Currently, Colorado Mountain Medical, Eagle Care, Eagle Valley Medical Center, Vail Valley Medical Center and Valley View Hospitals’ primary care physicians are committed to the pilot and will begin referring patients immediately. The program will initially serve individuals within the WECAD district, which encompasses 1,100 square miles in western Eagle County and eastern Garfield County.

Future expansion is a possibility, according to Chris Monterra, WECAD Chief. “Geographically speaking, we live in an area that would greatly benefit from this program. Many of our most vulnerable patients live miles away from the hospital, it can be difficult or costly for them to find transportation for regular visits or routine checkups,” said Monterra.

Patients will not be charged for services during the pilot. Funding includes approximately $500,000 in grant money, with $225,000 from the Colorado Health Foundation. Anne Robinson, Public Health Nurse Manager with Eagle County, says the grants will cover two years of operation without reimbursement. “During the five-year pilot program, Eagle County will serve as a test case for the State of Colorado,” said Robinson. “We expect to collect enough compelling data to petition to have the program reimbursed by Medicare, Medicaid and private insurers,” she said.

The program will initially operate with two specially-trained community paramedics who will coordinate with the referring physician to ensure quality of care and appropriate overnight. In addition, paramedics will work with Eagle County’s Public Health Department to provide preventative services throughout the community.

“The key to the success of the program will be the integration of all healthcare entities, so that we can give the best possible care to all patients,” said Robinson. “This model for healthcare has resulted in tremendous benefits in other communities, including reduced emergency room visits and high levels of patient satisfaction.”

The launch will follow this week’s 6th Annual International Roundtable on Community Paramedicine, taking place today through Wednesday at Manor Vail Lodge in Vail. Approximately 100 attendees from around the world will discuss major trends and topics in paramedicine, including the community paramedic model. “We are excited to host those on the forefront of paramedics in our valley, especially with the launch of our own leading-edge program so close,” said Robinson. For more information, contact Robinson at 970-748-2005 or Monterra at 328-1130.
Emergency Medical Services EMS-AAA

Committee Scope:
This Committee shall have primary responsibility for documents relating to emergency medical services, except those documents covered by other existing NFPA committees.
Item 12-3-12
**New Project Initiation Form**

(To be completed by proponent of new project/document)

Additional pages may be attached if necessary.

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>a.</td>
<td>Explain the Scope of the new project/document: This standard will identify the operating environment parameters, as well as the minimum requirements for the design, performance, testing, and certification of two-way, portable (i.e. hand-held) land mobile radios (LMR) for use by emergency services personnel during emergency incident operations without compromising compatibility with field emergency services communications networks. The purpose of this standard shall also be to establish minimum requirements for the proper function of the electronics embedded in or associated with emergency services electronic safety equipment where exposed to hostile thermal, immediate dangerous to life and health (IDLH), and non-hostile emergency scene environments.</td>
</tr>
<tr>
<td>b.</td>
<td>Provide an explanation and any evidence of the need for the new project/document: LMRs are a critical safety tool that must be in the hands of every responder at every emergency scene. They must meet the unique demands of the job of fire fighting. Fire fighters must be able to communicate in cold and hot temperature extremes, in wet and humid atmospheres full of combustion byproducts and dust, while under or above ground, inside and below buildings and in rubble piles. Other environmental challenges include loud noise from apparatus, warning devices, tools and the fire itself. Most first responders’ LMRs are currently manufactured to military specifications (Mil Std 810 C, D, E, F) which are not representative of the fire fighting environment. As part of this project a definition of the fire fighting environment needs to be established and performance and design criteria developed to ensure operability. [See NIST Technical Note 1477, Testing of Portable Radios in a Fire Fighting Environment and NTIA Technical Report TR-08-453, Intelligibility of Selected Radio Systems in the Presence of Fireground Noise, FEMA/IAFF manual Voice Radio Communications Guide for the Fire Service.]</td>
</tr>
<tr>
<td>c.</td>
<td>Identify intended users of the new project/document: Users of equipment designed to meet this standard include all emergency services personnel. However, as with many NFPA standards, this project will have a positive impact on those users that are involved in defense operations, maritime operations, aviation operations, as well as industrial, manufacturing, and petro-chemical marketplaces where operations occur in hazardous environments and LMRs are required for user safety.</td>
</tr>
<tr>
<td>d.</td>
<td>Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups: The IAFF, IAFC, SAFECOM, National Institute for Standards and Technology (NIST), Association of Public-Safety Communications Officials International, Inc. (APCO), NIMS Integration Center, National Wildfire Coordinating Group (NWCG), National Public Safety Telecommunications Council (NPSTC), Interagency Board for Equipment Standardization and Interoperability (IAB), and the US Fire Administration.</td>
</tr>
<tr>
<td>e.</td>
<td>Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available: This document will benefit all existing emergency services personnel who utilize a LMR while working in a hazardous environment. While the existing mil spec was developed for military operations, this document would identify which LMRs meet the needs and requirements of domestic emergency services personnel in a hazard zone environment. Those benefiting from this standard also include a combination of those identified in c. and d. listed above. Further, the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment has unanimously endorsed the IAFF’s proposal for this new project. Further, the Chair of the NFPA Technical Committee on Electronic Safety Equipment has endorsed this request and has confirmed his committee’s interest and expertise in developing this document.</td>
</tr>
<tr>
<td>g.</td>
<td>Identify the technical expertise and interest necessary to develop the project/document, and if the committee membership currently contains this expertise and interest: The current NFPA Technical Committee on Electronic Safety Equipment has the expertise to initiate this project. I have also addressed this with the following fire department experts and they, with me representing the IAFF, are interested and committed to work on this project. They include LA City Fire (Mark Saxelby), Phoenix Fire (Leif Anderson and Mike Worrell), Seattle Fire (Chris Lombard); Fairfax County Fire/Rescue (Don Bowers), Boston Fire (Joe Brooks) and Boise Fire Department (Paul Roberts). LMR manufacturers including Motorola (who has committed their full participation for this project), as well as Harris, Relm, Erickson and iCOM could certainly assist with this project.</td>
</tr>
</tbody>
</table>
h. Provide an estimate on the amount of time needed to develop the new project/document:

This is a critical health and safety project, so completion is critical to save lives. The project can be drafted as an ROC document within 6 months and issued by NFPA within 2 years.

i. Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document: Substantial documentation exists on the need for this project, including the FEMA/IAFF manual *Voice Radio Communications Guide for the Fire Service*; LA City Fire and Phoenix Fire have white papers/documentation regarding failings/experiences utilizing current radio assemblies in varying time/temperature/humidity extremes. NIOSH fatality investigations and numerous additional fire department reports are available to assist project development.

Please send your request to:

NFPA
Codes and Standards Administration
1 Batterymarch Park
Quincy, MA 02169
[Stds_admin@nfpa.org](mailto:Stds_admin@nfpa.org)
Rev. 10/09

Signature: _______________________________

Name: Richard M. Duffy  
(please print)

Affiliation: International Association of Fire Fighters
State investigators have cited the San Francisco Fire Department for "serious" worker safety violations in the deaths of two firefighters killed battling a Diamond Heights house fire in June.

Firefighters lost track of Lt. Vincent Perez, 48, and firefighter-paramedic Anthony Valerio, 53, after they went into the four-level home at 133 Berkeley Way on June 2 and failed to respond quickly to the men's last radio communication, investigators with the state Department of Industrial Relations' Division of Occupational Safety and Health said in a report issued Monday.

In recommending that the Fire Department be fined $21,000, the state investigators also said the department had violated state rules requiring that two firefighters be designated outside to assist any two firefighters who venture into a life-threatening environment.

Only one firefighter from Perez and Valerio's engine company - the first on the scene - was available to come to their help during the blaze, the investigation found.

The state also cited the Fire Department for an incident - evidently before the fatal flareup - in which an unidentified battalion chief ventured into the burning building alone, without keeping in contact with Perez and Valerio. That was also deemed a serious violation of safety rules.

**Didn't follow protocols**

"These are serious in that they had protocols in place, but they weren't following them," said Erika Monterroza, spokeswoman for the worker safety agency. "There's no question that a lack of communications was a big issue here. The investigator found there was a breakdown there."

Fire Chief Joanne Hayes-White said the department would appeal the findings. She said state officials have told her commanders that the violations fell short of finding the department's actions responsible for the two firefighters' deaths.

"None of the citations involved a direct cause of the line-of-duty deaths," Hayes-White said.

Monterroza confirmed that, saying the exact circumstances of the firefighters' deaths could not be determined.
The Fire Department is still conducting its own investigation into the incident. "If it is recommended that we need to make a change, we owe it to Lt. Perez and firefighter Valerio" to implement it, Hayes-White said.

First on the scene

Valerio, Perez and a third member of Engine Company 26 in Diamond Heights were the first firefighters to arrive at the mid-morning blaze, which started when a sparking electrical outlet set curtains on fire.

The third firefighter manned the pumper hose while Valerio and Perez went inside to fight the fire, but the safety regulations require a fourth firefighter to be available outside to assist.

A scene commander, identified by firefighters as Battalion Chief Thomas Abbott, ordered a crew from Engine Company 24 to back up Valerio and Perez inside the building. For several minutes, however, scene commanders tried to find the Engine 26 firefighters, without success.

Finally, what appeared to be the last communication from the crew came over the radio. "This is 26, this is 26. ... Battalion 6, what's your location?" said a muffled voice.

"Twenty-six, this is command, I need to know your ..." came a reply.

"This is Engine 26, we're on the third ..." At that point, the voice over the radio trailed off.

Gap in search

There was an unspecified gap between that last communication and any effort by firefighters to respond over the radio or track down the men, the state investigation found.

Hayes-White said the department's investigative report - still in draft form - concluded that the fire had melted one of the firefighters' microphone cords, cutting off communications. She said any delay in firefighters' response would be addressed in the final report.

Firefighters ultimately found Perez and Valerio in a landing area and carried the injured men outside. Perez was pronounced dead at San Francisco General Hospital, and Valerio died there two days later.

The state probe also faulted the actions of the unnamed battalion chief who went into the building "alone and also did not remain in contact with the firefighters who were inside."

Hayes-White said the battalion chief had gone inside only briefly, had seen Perez and Valerio alive and had never been out of other firefighters' view.

E-mail Jaxon Van Derbeken at jvanderbeken@sfchronicle.com.

http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2011/12/03/MNNQ1M7JBO.DTL
VIA CERTIFIED MAIL

November 3, 2011

Amy Beasley Cronin
Secretary, NFPA Standards Council
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Dear Ms. Cronin,

The San Francisco Fire Department (SFFD) suffered tragic multiple Line of Duty Deaths as a result of a fire that occurred on June 2, 2011. Lieutenant (Lt.) Vincent Perez died on June 2, 2011 and Firefighter/Paramedic (FF/PM) Anthony Valerio died on June 4, 2011.

During our investigation a very troubling matter surfaced with regard to equipment used by Lt. Perez and FF/PM Valerio, specifically the portable radios with remote speaker/microphones attached. Our testing and investigation determined that both members' portable radio remote speaker/microphones failed due to the heat from the fire.

The investigation was able to determine that the cord that connects the radio and the remote speaker/microphone had melted, rendering the remote speaker/microphone inoperable.

The SFFD Investigative Team researched the remote speaker/microphones and found that the operating temperature, per the manufacturer specification sheet, states that the normal operating temperature range for the remote speaker/microphones is between -30c to +60c. This temperature range does not appear adequate for the conditions Firefighters encounter in the course of their duties.

The Investigative Team spoke with several fire service experts throughout the Country regarding the remote speaker/microphones and the lack of regulations that the manufacturers must meet with regards to the heat threshold that the portable radios can operate in.

The Investigative Team was able to speak with the National Institute of Standards and Technology (NIST) regarding a study they had conducted in 2006 regarding to the operations of portable radios under varying heat levels common to which Firefighters may encounter in the course of their duties. The study (NIST technical report # 1477) indicated that the remote speaker/microphones would not withstand the extreme heat conditions that Firefighters may encounter. In the research, NIST indicated that the cords would melt and fail.

The Investigative Team was unable to locate or reference a current NFPA standard that portable radio manufacturers must meet that takes into account the conditions that Firefighters encounter. NFPA sets very
high standards for personal protective equipment (PPE) in order to keep our Firefighters safe. Unfortunately, the same standards are not currently regulated for communication equipment for the Fire Service.

I respectfully urge NFPA to research and develop a standard for Firefighters for portable radios and the remote speaker/microphones, similar to those standards developed for the heat condition requirements for PPEs. A Firefighter should feel confident that the equipment provided for their protection is of the highest quality and will endure the most extreme conditions to keep them safe. The portable radio is a key piece of equipment that each and every Firefighter utilizes and depends on to allow them to communicate when they are operating in an immediately dangerous to life or health (IDLH) environment.

Please do not hesitate to contact Assistant Chief David Franklin regarding our Department’s findings related to the line of duty deaths as a result of the June 2, 2011 fire. Assistant Chief Franklin, who is assigned as a member of the Investigative Team, can be reached via email at David.Franklin@sfgov.org or on his cell phone at (650)922-8984.

Thank you for your continued support in researching and developing standards to help protect, support and assist members of the Fire Service.

Sincerely,

[Signature]

Joanne Hayes-White
Chief of Department

cc: Assistant Chief Dave Franklin, Division 3
SFFD cited for 'serious' violations in fatal fire

Jackson Van Der Beek, Chronicle Staff Writer
Saturday, December 3, 2011

State investigators have cited the
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Fire Chief Joanne Hayes-White said the department would appeal the findings. She said state officials have told her commanders that the violations fell short of finding the department’s actions responsible for the two firefighters’ deaths.

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Monterroso confirmed that, saying the exact circumstances of the firefighters’ deaths could not be determined.

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*E-mail Jaxon Van Derbeken at jvanderbeken@sfchronicle.com.*
SFFD cited for 'serious' violations in fatal fire.
NIST Technical Note 1477

Testing of Portable Radios in a Fire Fighting Environment

W. D. Davis
M. K. Donnelly
M. J. Selepk
NIST Technical Note 1477

Testing of Portable Radios in a Fire Fighting Environment

W. D. Davis
M. K. Donnelly
M. J. Selepak
Building and Fire Research Laboratory

August 2006

U.S. Department of Commerce
Carlos M. Gutierrez, Secretary

Technology Administration
Robert Cresanti, Under Secretary for Technology

National Institute of Standards and Technology
William Jeffrey, Director
Certain commercial entities, equipment, or materials may be identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.
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ABSTRACT

Handheld portable radios are one of the critical electronic devices that firefighters and other first responders use during emergency response. These radios must operate in severe environmental conditions while maintaining acceptable radio communication. This paper focuses on the thermal environment that radios would be expected to withstand while being used in building firefighting operations. The thermal classes for electronic equipment defined in an earlier paper (Donnelly, et al, 2006) are applied to investigate the performance of emergency responder radios. Current National Fire Protection Association (NFPA) standards for radios are reviewed and recommendations for establishing performance standards are presented. The need for providing additional protection from the thermal environment is documented.
INTRODUCTION

The National Fire Protection Association (NFPA) standards for portable radios and other two-way mobile communication equipment are not specific as to temperature, heat flux and other environmental conditions. The devices are included in the NFPA 1221 standard for Installation, Maintenance and Use of Emergency Services Communications Systems (NFPA 1221, 2002 Ed.). Sections 8.3.5 and 8.3.6 summarize general equipment usage. The only requirements pertaining to the fire environment are section 8.3.5.4, which states “Mobile radios and associated equipment shall be manufactured for the environment in which they are to be used”, and section 8.3.6.2 which states “Portable radios shall be manufactured for the environment in which they are to be used and shall be of a size and construction to allow their operation with the use of one hand.” The NFPA standard is not specific with regards to the details of the “environment” in which the radios are to be used. No testing procedures or performance criteria are outlined.

This paper applies the Thermal Classes, see Table 1, that were developed in an earlier study (Donnelly, et al, 2006) to define the environment and performance criteria for portable handheld radios. Radios currently in use by firefighters were tested using the Fire Equipment Evaluator (FEE) to determine their current capability to withstand conditions as severe as Thermal Class III. The results will be used to develop test methods and recommendations that will be submitted to NFPA 1221 for standards development for portable radios.

Table 1  
Thermal Classes

<table>
<thead>
<tr>
<th>Thermal Class</th>
<th>Maximum Time (min)</th>
<th>Maximum Temperature (°C)/(°F)</th>
<th>Maximum Flux (kW/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>25</td>
<td>100/212</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>15</td>
<td>160/320</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>260/500</td>
<td>10</td>
</tr>
<tr>
<td>IV</td>
<td>&lt;1</td>
<td>&gt;260/500</td>
<td>&gt;10</td>
</tr>
</tbody>
</table>

Radio Testing

Three models of radios from three different manufacturers were selected for this study. They will be identified in this report as Radio A, Radio B and Radio C. The radios were marketed for use by firefighters and other first responders. The radios ranged in price from approximately $800 each to $2500 each. The radios tested for this project were a sampling of the many makes and models that are available to first responders. The selected radios are commonly used and represent a variety of price ranges. The goal of this study was not to compare and rank the performance of individual radios, but rather to evaluate the general performance of portable radios at elevated thermal conditions and to identify shortcomings and suggest standards for the radios.
All of the radios tested for this investigation listed their maximum operating temperatures at 60 °C (140 °F). The frequency stability for the radio signal was guaranteed to 60 °C (140 °F) as well. The radios, however, are marketed to and used by firefighters in firefighting situations, so it is reasonable to expect that they may be used at temperatures above 60 °C (140 °F). Firefighters routinely spend time at temperatures up to 100 °C (212°F), and often encounter much higher temperatures such as the peak conditions of Thermal Class III. Radio operation may be most crucial when the firefighter is experiencing an emergency situation, possibly trapped at elevated temperatures, and the radio would be instrumental in calling for assistance. As shown in Table 1, which lists the thermal classes, electronic equipment should be able to withstand a minimum of 100 °C (212°F) for up to 25 minutes in order to survive Thermal Class I conditions while Thermal Class III conditions would require the electronic equipment to survive 260 °C (500 °F) for five minutes.

![Diagram of Fire Equipment Evaluator (FEE)](image)

**Figure 1**  Diagram of Fire Equipment Evaluator (FEE)

**Testing Procedures**

Testing of the radios was performed using the Fire Equipment Evaluator (FEE). The FEE is a closed-loop, recirculating wind tunnel designed to simulate thermal conditions up to Thermal Class III. A diagram of the FEE is shown in Figure 1. It consists of a stainless steel enclosed, fan driven, air flow loop 219.5 cm (86.4 in) long by 174 cm (68.5 in) high. The testing section is 910 mm (36 in) long with a cross section of 380 mm² (15 in²). It is capable of reaching
temperatures up to 300 °C (572 °F) and velocities from 0.5 m/s to 2.0 m/s. Temperature measurements inside the FEE were made using type K (Chromel-Alumel) thermocouples, each with a bead diameter of 1.0 mm ± 0.2mm. A bidirectional probe was used for the velocity measurement. Details of the FEE can be found in Donnelly, et al., 2006.

For the elevated temperature tests, the radio was placed into the test tunnel at ambient temperature, subjected to a heat-up time reaching the target temperature for the particular thermal class and then maintained at this temperature for the time period specified for that thermal class. The radio performance was also monitored during the cool down period. Heating of the radio at constant temperature for a prescribed time period will be referred to as “soak” throughout the remainder of the paper. This would simulate a firefighter entering a structure and encountering progressively higher temperatures before reaching the maximum temperature, performing firefighter tasks at this maximum temperature for a period of time, and then exiting the high temperature region. Actual times encountered by a firefighter would depend on the building geometry and conditions within the building. The heat-up time varied depending on the soak temperature, but was held constant for all tests at the same soak temperature. See Figure 2 for a temperature profile displaying a typical heat-up time for Thermal Class III conditions.

![Figure 2 Plot of Temperatures inside and outside of pocket.](attachment:image)

Radios tested inside the FEE were placed in the test section where they were visible through the access door window. The radios were suspended by the radio belt clip from a 50 mm wide Kevlar strap with the front of the radio (speaker and microphone) facing the airflow. They were placed with the long side along the vertical at a height such that the center of the radio was
centered, 190 mm from the walls of the test section. The radio hung at a slight angle of approximately 20 degrees from vertical, with the top tilted towards the airflow.

Testing was also performed with the radios protected inside of a turnout gear style pocket. When portable radios are carried into firefighting environments, the radios are often worn clipped close to the body underneath the turnout gear coat, or placed in pockets located on the outside of the turnout gear coat where they are protected from direct heating by the pocket as displayed on a mannequin in Figure 3.

![Figure 3](image)

**Figure 3  Radio inside turnout coat pocket with speaker/microphone**

To investigate the operation of these protected radios, a pocket was constructed and used for testing. The pocket was fabricated by a company that produces firefighter turnout gear. It was made from $2.5 \times 10^{-2}$ kg/m$^2$ (7.5 oz/yd$^2$) PBI Gold, material that is a blend of 40% polybenzimidizole and 60% Kevlar. The pocket measures 100 mm wide by 90 mm deep and is 220 mm tall. It is open at the top for radio insertion, with a flap to cover the top of the radio. Figure 3 shows the pocket suspended from the Kevlar strap inside the FEE. The radio was placed inside the pocket for testing.
Figure 4 Pocket inside FEE for testing. Radio is inside with insulated cable attached. The speaker/microphone cable is the front cable with the aluminum foil at the top while the coax cable connecting the radio output to the spectrum analyzer is the back cable. A thermocouple tree is attached to the ring stand in front of the pocket and the airflow is from the left.

For the majority of the tests, the radio antenna was removed and the antenna jack was connected to a coaxial cable leading to a Tektronix RSA3303A Spectrum Analyzer. This permitted the radio transmission signal to be observed and recorded during testing, and degradation of the signal to be identified and measured. The coaxial cable was well insulated to insure that any decrease in the signal was due to heating of the radio, and not to heating of the cable. During the temperature soaks, the transmissions from the radios were tested by keying the “Push to talk” (PTT) button and recording the resulting output signal using the spectrum analyzer. The PTT button on the radio was activated manually through an access hole in the bottom of the tunnel. For some tests, an external speaker/microphone was connected to the radio and its PTT button was used to trigger the radio. In these cases, the cable to the external speaker/microphone was well insulated. A small number of tests were performed with the radio antenna in place. For tests with the antenna in place, the signal analyzer was not used to measure radio transmission.

In addition to the portable radios, thermal exposure testing was also performed on the radio’s external speaker/microphones. Firefighters often use external speaker/microphones that are connected to their portable radios by a cord. These external speaker/microphones are usually worn near the firefighter’s neck or mouth so that voice may be transmitted easily. This also provides the additional benefit of having a speaker close to the ears so that radio transmissions can be more easily heard. The external speaker/microphone allows the body of the radio to be worn in a harness, coat pocket or otherwise secured, possibly underneath their turnout gear to
protect the radio. Often it is only the external speaker/microphone that is exposed to the extreme thermal environment, making this the part most vulnerable to malfunction.

To investigate the possible problems, tests were conducted using the FEE. Each speaker/microphone was placed in the test section, with a cord connecting it to a radio located in ambient conditions outside of the FEE. Each radio was tested with its own proprietary speaker/microphone designed for use with the radio. The cords connecting the speaker/microphones to the radios were not thermally insulated, which provided a realistic test of the speaker/microphone/cord system. The ruggedized version of the speaker/microphone was used when available. The speaker/microphones were suspended from the same Kevlar strap used to support the radios. The strap was lowered so that the center of the speaker was located at the center of the test chamber cross section. The portable radio was located outside of the test chamber, and the cable connecting the radio to the speaker/microphone was well insulated. Transmission from the speaker/microphones was initiated the same way as it was for the radios, by keying the PTT button on the microphone, using the access hole in the bottom of the tunnel.

The radios and speaker/microphones tested were subjected to thermal exposures consistent with the maximum time and temperature for the Thermal Classes shown in Table 1. Testing was performed with the radios both inside a turnout gear pocket and exposed to the airflow. Testing of the external speaker/microphones was conducted with the speaker/microphones exposed to the airflow. Radios and speaker/microphones that did not suffer permanent damage were reused for repeat tests. The majority of the tests were performed at an air flow velocity of 0.9 m/s. This velocity was chosen to represent a typical human walking speed or a flow velocity that might be experienced with Thermal Class III exposure.

RESULTS

Testing with Radio in Turnout Coat Pocket

Elevated temperature tests were performed using the FEE with the portable radios placed inside the turnout gear pocket. Two thermocouples were located inside the pocket. One monitored the air temperature directly in front of the radio, and the other was attached to the body of the radio. The pocket was able to provide significant thermal protection to the radio, with the air inside the pocket remaining more than 75 °C cooler than the air inside the rest of the tunnel, when the flow rate was 0.9 m/s. Figure 2 is an example of the thermal difference between the pocket air and the tunnel air for a 260 °C temperature soak with airflow 0.9 m/s. When the FEE air speed was increased to 2 m/s, the air inside the pocket still remained at least 57 °C cooler. The air temperature inside the pocket was continually increasing during the temperature soaks, so the difference between the pocket air temperature and the tunnel temperature was even greater at the start of the soaks.

The test results are listed in Table 2. The protection provided by the turnout gear pocket kept the radio temperatures low enough for the radios to survive even the severity of the class III tests. Radio A worked well throughout the class II tests and did not have any evident damage. Radio A also received and transmitted during the class III testing, suffering only some slight melting deformation to the outer casing and buttons. Radio B was able to survive all of the
temperature soaks attempted during the pocket testing. Transmission and reception of the signals were clear. There was no damage evident to the body of radio B during the pocket tests. Radio C was also able to transmit and receive at the test conditions when located inside the pocket. Some variations on the basic testing conditions were performed and the results are shown in Table 3. Tests were performed at the Thermal Class III condition using radios A and B with the regular antenna connected, instead of the shielded cable connected to the analyzer. The antenna was sticking up out of the pocket and was directly exposed to the elevated temperatures. For these tests, no signal was recorded using the analyzer. Transmission and reception were measured qualitatively by the FEE operator. For both Radio A and Radio B, transmission and reception were considered to be the same as when not exposed to elevated temperature conditions for the duration of the soak. Some damage did occur to the antennas as a result of their exposure to the heat outside of the pocket. For Radio A, there was some slight melting and deformation of the antenna. The antenna for Radio B was very deformed curving approximately 90 degrees and remained permanently bent over after the test. However, even with the bending of the antenna, transmission and reception worked in the laboratory setting.

### Table 2 Testing inside turnout coat pocket, air velocity 0.9 m/s

<table>
<thead>
<tr>
<th>Radio</th>
<th>Temp (°C)</th>
<th>Time Soak (min)</th>
<th>Survive Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>A</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>A</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>Some melting, deformation of PTT button and display</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
</tbody>
</table>
Table 3 Testing inside Turnout Coat Pocket, Variations

<table>
<thead>
<tr>
<th>Test</th>
<th>Radio</th>
<th>Temp (°C)</th>
<th>Time Soak (min)</th>
<th>Survive Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna</td>
<td>A</td>
<td>260</td>
<td>5</td>
<td>Yes*</td>
<td>Slight melting on antenna</td>
</tr>
<tr>
<td>Antenna</td>
<td>B</td>
<td>260</td>
<td>5</td>
<td>Yes*</td>
<td>Antenna bent over</td>
</tr>
<tr>
<td>Increased velocity</td>
<td>B</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>Air velocity at 2 m/s for this test</td>
</tr>
<tr>
<td>Rotated 90 degrees</td>
<td>B</td>
<td>260</td>
<td>5</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>Speaker/ Microphone</td>
<td>C</td>
<td>260</td>
<td>5</td>
<td>No</td>
<td>Speaker/mic failure – standard mic</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>260</td>
<td>5</td>
<td>No</td>
<td>Speaker/mic failure – rugged mic</td>
</tr>
</tbody>
</table>

Yes* – Qualitative measurement by operator. The change in the orientation of the antenna may impact the ability to transmit but this change in transmission capability was not quantified.

An additional pocket test was performed on Radio B with the flow rate doubled to 2 m/s in order to increase the heat transfer into the pocket. As noted above, the air temperature inside the pocket increased to within 57 °C of the air outside the pocket. However, even with the increased temperature, radio B continued to transmit and receive during the 5 minute soak with the FEE air at the Thermal Class III temperature of 260 °C. Another test was performed on Radio B with the pocket rotated 90 degrees so that the radio was horizontal inside the tunnel. This modified geometry had no affect on the results, the radio operated successfully inside the pocket.

The only problems that occurred with the radio inside the pocket were for Radio C when the external speaker/microphone was connected. For these tests, the external speaker/microphone was located outside the FEE and connected to the radio by a well insulated cable. Two different speaker/microphones were tried, a standard one first, followed by a ruggedized one. For both tests at Thermal Class III conditions, with the external speaker/microphone connected, the radios malfunctioned. They became stuck in the transmit mode and could not receive. Although the cables were insulated, inspection of the cables after the test found that they had experienced melting and shorting of the wires inside. A test performed with just the ruggedized cable inside the FEE tunnel, and the radio and speaker/microphone outside also produced melting and shorting of the wires inside as well as signal failure. See the section on Speaker/Microphone testing for additional information.

Testing of Radios without Turnout Coat Pocket Protection

In some cases, the portable radios used in a fire fighting situation would be protected from direct exposure either inside a pocket or worn under the turnout gear. However, testing of the radios exposed directly to the heat was performed as a “worst case scenario” for thermal conditions the radios may encounter. The tables below show the results of testing the radios directly exposed to
the heated airflow. Unlike the radios inside the pocket, the unprotected radios could not withstand the higher temperatures. This emphasizes the protection provided by the pocket.

The results of the radios tested fully exposed at the Thermal Class I conditions of 100 °C for 25 minutes are given in Table 4. Both Radio B and Radio C had no trouble maintaining performance at this temperature for the designated time. Inspection of these radios showed no damage evident after the Thermal Class I temperature soak. The results for Radio A were mixed. Radio A was tested three times and it worked properly throughout two of the three tests. However, during the second test, the radio stopped working and would not transmit or receive after 25 minutes at 100 °C. This radio did recover on cool down.

Table 4 Thermal Class I – 100 °C for 25 min soak, velocity 0.9 m/s

<table>
<thead>
<tr>
<th>Radio</th>
<th>Survive Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>A</td>
<td>No</td>
<td>At 25 minutes – no transmit or receive</td>
</tr>
<tr>
<td>A</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>B</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
<tr>
<td>C</td>
<td>Yes</td>
<td>No damage to radio evident</td>
</tr>
</tbody>
</table>

Tests performed at the Thermal Class II conditions of 160 °C for 15 minutes exposed the vulnerabilities of the unprotected radios at higher thermal conditions. As Table 5 shows, all of the radios experienced some degradation of operation at these test conditions. Radio A went completely dead 8.5 to 9.5 minutes into the soak, ceasing to either transmit or receive. For Radio B, there was increased noise on transmission, and the signal shifted off target frequency before the end of the soak. For one of the tests there was also power loss of 2.4 dBm on cool down. Radio C also had performance problems during the Thermal Class II conditions. Its transmission frequency shifted just 5 minutes into the soak in both tests. The signal continued to degrade, before completely stopping at 6 minutes into cool down for the first test, and 4 minutes for the second test. During the repeat test the radio also lost reception on cool down. Figure 5 shows the progression of the signal for Radio C from normal transmission at ambient temperature through the shifted transmission during heating to the degraded signal on cool down. At the end of the 15 minute soak at 160 °C, the centerline frequency had shifted approximately 0.5 kHz lower with and peak intensity drop of approximately 7%. At 5 minutes after the soak, the peak intensity has dropped by a factor of 10 with the centerline frequency shifting by another 0.1 kHz.
Table 5  Thermal Class II – 160 ºC for 15 min soak, velocity 0.9 m/s

<table>
<thead>
<tr>
<th>Radio</th>
<th>Survive Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No</td>
<td>9 ½ min – no transmit or receive</td>
</tr>
<tr>
<td>A</td>
<td>No</td>
<td>8 ½ min – no transmit or receive</td>
</tr>
<tr>
<td>B</td>
<td>No</td>
<td>Transmission signal shift, increased noise</td>
</tr>
<tr>
<td>B</td>
<td>No</td>
<td>Transmission signal shift, power loss and increased noise</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
<td>Transmission signal shift, no transmission on cool down</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
<td>Transmission signal shift, no transmit or receive on cool down</td>
</tr>
</tbody>
</table>

Because none of the radios survived at the Thermal Class II conditions, testing did not immediately progress to Thermal Class III conditions. The radios were tested at high temperatures for the relatively short 5 minute time period, but were subjected to temperatures lower than the Thermal Class III temperature of 260 ºC, with the air velocity remaining at nominally 0.9 m/s. Because Radio C had shown transmission signal irregularity after only 5 minutes at the Thermal Class II temperature of 160 ºC, it was not tested at a higher temperature. Table 6 shows the results for the 5 minutes soaks at temperatures beyond 160 ºC. The transmission signal for Radio A did not maintain frequency when the temperature was at 190 ºC and 200 ºC. Radio B was able to transmit and receive for 5 minutes at the temperature of 220 ºC; however there was some melting of the radio casing, especially around the speaker, the display area and the top switches. When radio B was tested at 230 ºC, the radio reception was not successful during either trial.

Table 6  Temperatures beyond 160 ºC, for 5 min soak velocity 0.9 m /s

<table>
<thead>
<tr>
<th>Radio</th>
<th>Temp (ºC)</th>
<th>Time Soak (min)</th>
<th>Survive Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>190</td>
<td>5</td>
<td>No</td>
<td>transmission signal shift, melting of casing</td>
</tr>
<tr>
<td>A</td>
<td>200</td>
<td>5</td>
<td>No</td>
<td>Reception quality and volume degrades, transmission signal shift</td>
</tr>
<tr>
<td>B</td>
<td>220</td>
<td>5</td>
<td>Yes</td>
<td>Some melting of casing</td>
</tr>
<tr>
<td>B</td>
<td>230</td>
<td>5</td>
<td>No</td>
<td>Reception loss at 150s into soak (analog)</td>
</tr>
<tr>
<td>B</td>
<td>230</td>
<td>5</td>
<td>No</td>
<td>Reception loss at 150s into soak (digital)</td>
</tr>
</tbody>
</table>

Speaker/Microphone testing

The results of the speaker/microphone testing are summarized in Table 7. The flow velocity was set at nominally 0.9 m/s for all tests. In general, the speaker/microphones for all radios remained fully functional and did not have any damage during the tests at Thermal Class I and Class II conditions. The only problem occurred for Radio C, where during a Thermal Class I test, the reception volume of the speaker decreased. For two subsequent tests at this Thermal Class I condition, the speaker/microphone operated normally without any decrease in volume. None of the speaker/microphones were able to operate normally during the soak at the Thermal Class III
conditions of 260 °C for 5 minutes. For radio A, the PTT button melted and no transmission could be made. Additionally for radio A, the sound level on the speaker/microphone decreased, and then the speaker began making a humming sound, preventing clear reception over the speaker. For radio B, the speaker worked and messages could be received clearly throughout the Thermal Class III tests, but the PTT button melted and no transmission could be sent from the microphone. For radio C, the transmission worked, but the reception volume of the speaker decreased significantly. Melting and deformation of the casing occurred for all three speaker/microphones.

Tests at an intermediate temperature of 210 °C for 5 minutes were performed in order to determine if the speaker/microphones could handle a temperature halfway between Thermal Class II and Thermal Class III. The speaker/microphone for Radio A did not maintain normal operation at this temperature. The speaker volume became increasingly lower during the soak. Melting of the cord was also observed. The speaker/microphone for Radio B could receive messages, but transmission was impeded due to difficulty operating the PTT button and melting of the cord. The speaker/microphone for Radio C was able to successfully transmit and receive throughout the 5 minute soak. The speaker/microphone for Radio C was also tested at 220 °C and survived at this temperature as well.
a. Signal at ambient temperature

b. Signal at 160 °C for 15 minutes

c. Signal on cool down, 5 minutes after Soak

Figure 5 Radio Transmission Signal for Radio C during Thermal Class II Soak
Table 7  External Speaker/Microphone Testing, velocity 0.9 m/s

<table>
<thead>
<tr>
<th>Radio</th>
<th>Temp (ºC)</th>
<th>Time Soak (min)</th>
<th>Survive</th>
<th>Soak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>A</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>A</td>
<td>210</td>
<td>5</td>
<td>No</td>
<td>No</td>
<td>Reception volume decreased, cord and case melted</td>
</tr>
<tr>
<td>A</td>
<td>260</td>
<td>5</td>
<td>No</td>
<td>No</td>
<td>No transmit or receive, Push to talk button (PTT) melted-does not work, cord melted, case deformed</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>B</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>B</td>
<td>210</td>
<td>5</td>
<td>No</td>
<td>PTT</td>
<td>PTT difficult to press, cord melted</td>
</tr>
<tr>
<td>B</td>
<td>260</td>
<td>5</td>
<td>No</td>
<td>No</td>
<td>No transmission, PTT melted, cord melted</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>25</td>
<td>No</td>
<td>Yes</td>
<td>Reception volume decreased</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>160</td>
<td>15</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>210</td>
<td>5</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>220</td>
<td>5</td>
<td>Yes</td>
<td>No</td>
<td>No damage</td>
</tr>
<tr>
<td>C</td>
<td>260</td>
<td>5</td>
<td>No</td>
<td>Volume decreased, some melting and deformation</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

The results of these tests exposed the vulnerability of the portable radios to elevated temperature conditions, and emphasized the need to protect the radios when used in firefighting situations. Radios tested inside the turnout gear pocket showed that the turnout gear pocket was able to protect the radios and allow them to operate at the Thermal Class III temperature of 260 ºC. This contrasts with tests where the radios were exposed directly to the airflow, in which the radios did not survive at Thermal Class II conditions and beyond. In all but one test, the exposed radios were able to operate properly at the Thermal Class I temperature of 100 ºC, above the listed maximum operating temperature of 60 ºC.

Failure of the electronics due to heating was not permanent for the radios. In all cases where the radio casing was not damaged, the radios regained normal operating function once they had sufficiently cooled. Permanent damage to the casing, such as difficulty turning knobs or pressing buttons did occur for some radios whose casings experienced melting. Permanent damage also occurred to the external speaker/microphones, especially due to the melting of the connecting cables.

The radio transmission signal was measured using the signal analyzer. Each radio was programmed to Very High Frequency (VHF) frequency 162.175 MHz assigned for testing purposes. Baseline transmissions were recorded with the radio at ambient room temperatures. When the radio was heated, a deviation of the transmission signal from the programmed
frequency of greater than 0.1 kHz signaled the start of degradation of the transmission signal, and indicated that further problems were imminent.

It should be noted that in most tests when the radio was heated above 160 °C the liquid crystal display (LCD) display became darkened and in some cases it became unreadable. The impaired display was not considered a communication malfunction because the display was not needed for radio communication; it was used for radio programming and other setup functions that would not be used in the emergency situation. Not all of the radios had an LCD displays.

Testing of the external speaker/microphones fully exposed to the heated airflows showed that these parts were better able to perform at the elevated temperatures than the radios themselves. While none of the speaker/microphones survived the Thermal Class III conditions of 260 °C for 5 minutes, they were able to operate during most of the tests at lower temperatures. Since this is the part of the radio system most likely to be directly exposed to harsh environments, it is crucial for this part to be able to withstand thermal stress without protection.

Connecting the external speaker/microphones required that the connector cord be screwed into place on the side of the radio. Some of the radios operated such that when the external speaker/microphone was connected, it disabled the PTT and speaker on the radio itself, diverting all transmission and reception to the external speaker/microphone. If the external speaker/microphone or its cord were to fail, in an emergency situation it would be extremely difficult (if not impossible) to disconnect the speaker/microphone and operate the radio by itself. Thus failure of the external speaker/microphone, the part most likely to be exposed to extreme conditions, could mean loss of the radio operation entirely.

**CONCLUSION**

The performance of handheld radios in thermal environments encountered by firefighters based on the experimental data in this paper suggests the following recommendations.

1. Handheld radios without additional thermal protection should be treated as Thermal Class I electronics.
2. Radios protected in turnout gear pockets may be treated as Thermal Class II electronics.
3. Standards for the thermal protection afforded by turnout gear pockets need to be developed to support recommendation 2.
4. While pocket protected radios withstood Thermal Class III conditions, the cord and speaker/microphone limited their performance to Thermal Class II conditions. Improving the thermal performance of the speaker/microphone and cord could move pocket protected radios to Thermal Class III electronics.

Since firefighter turnout gear is designed to protect firefighters exposed to Thermal Class III conditions, handheld radios should be constructed to handle these conditions. One of the radios tested, Radio C, had a speaker/microphone and cord that almost survived Thermal Class III conditions which suggests that small design changes may be all that are necessary to reach the Thermal Class III rating.
The next step for this project is to work with the NFPA to develop a radio standard that would include requirements for the thermal testing of handheld radios.
REFERENCES


ACKNOWLEDGEMENT

This work was sponsored by the Department of Homeland Security (DHS) via the NIST Office of Law Enforcement Standards (OLES) to advance the development of Standards for Electronic Equipment used by Emergency Responders.
Ken:
I talked to Bruce Varner on Friday about the portable radio project. He has been working with Chief Hayes-White’s staff on this, and is aware of the letter that was sent to Amy. He also said another letter is coming in from the Carrollton, TX FD, also in support of this project.
This week I will be finishing up work with Rich Duffy and Bruce on the new project request form, and will forward it to Linda for the Standards Council March agenda. I believe what happens next is that the Council will issue a request for public comment. The letters from San Francisco and Carrollton should be held by Standard Administration, and presented to the Council at the appropriate time.
Bruce said he would call Chief Hayes-White this week so that she is in the loop and has some idea of the time frame until a Council decision is made.
One other thing - although Bruce strongly believes that the new document should reside with the Electronic Safety Equipment TC because these devices are used in hazardous atmospheres during emergency operations, he mentioned that there could be a scope issue with the NFPA 1221 TC (see TC scopes below) that might need to be resolved. For that reason, I have cc’d Orlando with this message. I will talk to him this week.
All of these issues will be clearly addressed in the new project request form.
Thank you,
Dave

Electronic Safety Equipment (FAE-ELS) Committee Scope

Staff Liaison: David Trebisacci

This committee shall have primary responsibility for documents on the design, performance, testing, and certification of electronic safety equipment used by fire and emergency services personnel during emergency incident operations, and shall also have primary responsibility for documents on the selection, care, and maintenance of electronic safety equipment.

Public Emergency Service Communication (PUF-AAA) Committee Scope

Staff Liaison: Orlando Hernandez

This Committee shall have primary responsibility for documents relating to the operation, installation, and maintenance of public emergency services communications systems.

David G. Trebisacci, CIH, CSP
Sr. Fire Protection Specialist
NFPA
Linda:

Regarding the new project request from Rich Duffy for portable radios for emergency response personnel, I spoke with Bruce Varner, FAE-ELS TC Chair yesterday. He is okay with the proposed technical committee scope change as indicated below.

**Committee Scope:** This committee shall have primary responsibility for documents on the design, performance, testing and certification of electronic safety and portable communications equipment used by fire and emergency services personnel during emergency incident operations, and shall also have primary responsibility for documents on the selection, care, and maintenance of electronic safety equipment.

Please let me know if you need anything additional for the Council.

Thanks,
Dave

David G. Trebisacci, CIH, CSP
Sr. Fire Protection Specialist
NFPA
1 Batterymarch Park
Quincy, MA 02269
Phone: (617) 984-7420
Fax: (617) 984-7056
dtrebisacci@nfpa.org

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The United States Fire Administration (USFA) and National Fire Protection Association (NFPA) are working together to remind everyone that home fires are more prevalent in winter than in any other season. Learn how to reduce your risk of experiencing a fire this winter.

[www.nfpa.org/winter](http://www.nfpa.org/winter)

Check out NFPA on social media...
[www.nfpa.org/socialmedia](http://www.nfpa.org/socialmedia)
Here is the response from the Chair of NFPA 1221, concerning the new project regarding the new project request from Rich Duffy for portable radios for emergency response personnel.

As the Chair of the Technical Committee on Public Emergency Service Communication, which has responsibility for NFPA 1221, I believe that this would be a worthy project and one that should go forward. However, I also believe that there could be a scope overlap issue with the Technical Committee on Electronic Safety Equipment. I would like to see a member of the NFPA 1221 technical committee possibly assigned to this committee or be part of the discussions. I believe that being part of the development of this new standard would allow NFPA 1221 to import the requirements, much as is done with UPS and stationary generators. I am very interested in the work these committee members do, of course, and I think that one or more members of our committee might want to be (or already are) involved in these discussions.

Orlando P. Hernandez
Sr. Specialist / Emergency Services
617-984-7482 Office
617-653-6444 Cell
ohernandez@nfpa.org
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169

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Fire and Emergency Services Protective Clothing and Equipment - Electronic Safety Equipment (FAE-ELS)

Current Committee Scope:
This committee shall have primary responsibility for documents on the design, performance, testing, and certification of electronic safety equipment used by fire and emergency services personnel during emergency incident operations, and shall also have primary responsibility for documents on the selection, care, and maintenance of electronic safety equipment.

Proposed Committee Scope:
This committee shall have primary responsibility for documents on the design, performance, testing, and certification of electronic safety and portable communications equipment used by fire and emergency services personnel during emergency incident operations, and shall also have primary responsibility for documents on the selection, care, and maintenance of electronic safety equipment.

Public Emergency Service Communication (PUF-AAA)

Current Committee Scope:
This Committee shall have primary responsibility for documents relating to the operation, installation, and maintenance of public emergency services communications systems.
SAN FRANCISCO FIRE DEPARTMENT

Safety Investigation Report
Line of Duty Deaths
133 Berkeley Way
June 2, 2011
Box 8155
Incident # 11050532

February 2012
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CHIEF OF DEPARTMENT LETTER

On Thursday, June 2, 2011 at 10:45 a.m., the San Francisco Fire Department responded to Box 8155, at 133 Berkeley Way. What was seemingly a routine working fire in a single family residence quickly transformed into a fierce and unrelenting incident with ultimately tragic results. When we answered the call to a career in the Fire Service and took our Oath of Allegiance, we were aware of the inherent danger of our occupation. Despite this awareness, we do not expect to encounter a line of duty death of a brother or sister, especially not in our very own Department. The profound loss of Lieutenant Vincent Perez and Firefighter/Paramedic Anthony Valerio has left an indelible impression in our hearts and will forever be remembered in the annals of SFFD history.

Even as we mourned our fallen brothers in the early days after the tragedy, our Department began the painful and difficult, but necessary, steps of a Line of Duty Death Investigation. We were resolute in understanding what occurred during those fatal minutes and compelled to uncover any recommendations for improvement that may arise to future operations so that their passing will not have been in vain. For over six months, the Investigative Team worked tirelessly, scrutinizing every piece of evidence in order to produce a comprehensive report.

The attached Line of Duty Death Safety Investigation Report has been compiled through this extensive examination and analysis. I would like to acknowledge and express my gratitude and appreciation to the Safety Investigation Team who spent countless hours, weeks and months, to ensure that no piece of evidence, no matter how small, was overlooked. The members of the Safety Investigation Team included, retired Assistant Deputy Chief Frank Cardinale, Assistant Deputy Chief Jose Velo, Assistant Chief David Franklin, Lieutenant Richard Slattery, and Firefighter Shon Buford, as well as staff from the Division of Training who assisted with the compilation of research data. Completing this report was not an easy task for the Safety Investigation Team. Each phase of the process was an emotional challenge as every interview conducted and every piece of evidence examined relived and solidified the loss of Vince and Tony. The constant reminder of Vince and Tony’s ultimate sacrifice and the desire to honor their memories kept the Safety Investigation Team strong and determined in their efforts.

I would like to dedicate this report to Vince and Tony, their families, and all of the men and women who were involved in the 133 Berkeley Way incident. We take to heart all the findings and recommendations in this report and will vow to do everything within our power to ensure a similar tragedy does not occur again in our Department.

Once again, I would like to again express my deepest sympathies to Mrs. Irene Perez, Mr. and Mrs. Frank Valerio and the all of members of the Perez and Valerio families. We will forever be grateful and blessed to have worked with and known Vince and Tony.

Respectfully,

Joanne Hayes-White
Chief of Department

Lt. Vincent A. Perez

FF/PW Anthony M. Valerio
8/14/1957 – 6/04/2011
DEDICATION

On the morning of June 2\textsuperscript{nd}, 2011 Lt. Vincent Perez and Firefighter/Paramedic Anthony Valerio made the ultimate sacrifice. Both men died in the line of duty while making a valiant effort to extinguish a horrific blaze. Their tragic deaths have left behind many broken hearts, both in the San Francisco Fire Department and in their respective families. There are no words that can describe the pain and hurt that we all feel...no words that can even begin to do justice to the loss that we are left with.

Vincent and Tony were two men who had every gift but length of years. They were men who had dedicated their lives to serving others. Most importantly, Vincent and Tony were two men who were role models, not in how they died, but in how they lived every day.

While there is nothing we can do to change the outcome of that fateful day, we can learn lessons from this tragedy and make every effort to ensure that this does not happen again. By heeding the words of this report and by promising to implement the lessons learned, we pay the greatest tribute to Vince and Tony. By implementing the recommendations from this report, the San Francisco Fire Department will honor the courage, dedication and sacrifice that these men exhibited on that tragic day, and every day.

We dedicate this report to the Perez and Valerio families and we thank them for sharing two men who will not be forgotten.

Thomas P. O’Connor, President,
San Francisco Firefighters Local 798
SAN FRANCISCO FIRE DEPARTMENT OVERVIEW

The City and County of San Francisco is 49 square miles with an approximate population of 825,000 residents. The weekday population increases to over 1.2 million people. San Francisco sits at the tip of a peninsula with the San Francisco Bay on two sides and the Pacific Ocean on the third side. San Francisco has two major freeways entering the City from the South, with the Golden Gate Bridge on the North and the San Francisco Oakland Bay Bridge on the East.

The San Francisco Fire Department (SFFD) is a paid department with a staff of approximately 1400 uniform members. The Department has 43 stations, which house 43 Engine Companies, 19 Truck Companies, 2 Heavy Rescue Squads and 2 Fire Boats. The Fire Operations for the City is divided into two Divisions that oversee nine Battalion Districts. The daily staffing for the Department is 294 on duty suppression members. The Fire Department also provides Emergency Medical Services and transport which is a separate Division within the Department. The Fire Department also provides fire protection services to San Francisco International Airport.

The SFFD utilizes the following response plan for all reports of for either smoke or fire in the building. A full box will be dispatched with a single phone call reporting either one. A full box consists of the following Companies and the staffing for each.

3 Engine Companies – each with 1 Officer and 3 Firefighters
2 Truck Companies – each with 1 Officer and 4 Firefighters
1 Heavy Rescue Squad – 1 Officer and 3 Firefighters
1 Division Chief – 1 Assistant Chief and 1 Incident Support Specialist
2 Battalion Chiefs – 1 Battalion Chief (3 out of 9 Battalion Chiefs have an Incident Support Specialist)
1 Medic Unit – 1 Paramedic and 1 EMT

Total personnel responding to a 1st alarm is 35 members.

Once a working fire has been confirmed by on-scene units, the response is upgraded to add the next due Engine Company as a RIC (Rapid Intervention Crew) and a Rescue Captain (as Medical Group Supervisor).

The average response time for the Department is approximately 3:30 minutes from the time of dispatch.

The Department of Emergency Management (DEM) is a separate department within the City. Within the DEM is the Division of Emergency Communications (DEC). The DEC handles all 911 calls plus dispatches for both the Police and Fire Departments. The SFFD has line Officers assigned to the DEC to oversee Fire Department dispatch operations, along with assisting the civilian Dispatchers during major incidents.
SAFETY INVESTIGATION TEAM

The Chief of the Department directed the Department Safety Officer to conduct a Safety Investigation of this incident. The Safety Investigation Team of the San Francisco Fire Department consisted of Assistant Deputy Chief Frank Cardinale, Assistant Chief David Franklin, Battalion Chief Jose Velo, Lieutenant Richard Slattery and Firefighter Shon Buford. The Safety Investigation Team began gathering evidence, conducting interviews and sketching diagrams immediately. All of this information has been analyzed to assist in providing recommendations to the Department.

The primary purpose of this investigation is to identify and analyze the contributing factors that led to this incident as well as to create situational awareness to prevent future occurrences. The Safety Investigation Team has examined the details of the incident over the past months. The main objective of the Team’s investigation and subsequent report is to discover the key factor that led to the fatal outcome of two Firefighters. This report contains the findings and recommendations to help prevent Firefighter injuries or fatalities in the future.

In analyzing and recording these events, the Investigation Team acknowledges and respects that members confronted a challenging situation. On-scene personnel reacted quickly to the changing conditions at this incident. We request that every person who reads this report show respect, appreciation and consideration for all personnel who responded to this incident.

As is a common industry practice, for this report Lieutenant Vincent Perez will be referred to as Victim 1 and Firefighter Paramedic Anthony Valerio will be referred to as Victim 2, with the exception of the Rescue Events Section.
EXECUTIVE SUMMARY

On June 2, 2011 at 10:45 hours, the San Francisco Fire Department was dispatched to a report of a fire in the building at 133 Berkeley Way in the City’s Diamond Heights neighborhood. The first unit arriving on the scene, Engine 26, observed light smoke showing from the garage of the 4 story (2 above grade, 2 below grade) wood framed building, detached on the Bravo side. An aggressive interior fire attack was initiated through the front door, which is on a level between the ground level and second floor. After investigating the garage (ground level), Engine 24, the second Engine on the scene, led a small line through the garage to the interior door to back up the first Company. Battalion 9 was assigned Fire Attack by Battalion 6, who had assumed Command. Battalion 9 entered the fire building and, after conferring face to face with Engine 26 on the first floor (ground level), concluded that the fire was below them. Battalion 9 exited the building and proceeded to the Bravo side to check for an entrance leading directly to the fire floor.

Engine 11 led a large line wye to the driveway with the intention of leading a 1 3/4 inch line through the garage. They were redirected by Battalion 6 to make their lead down the Bravo side of the building to Sublevel 1 (one floor below grade) to assist Battalion 9. The Division Chief, upon arrival, assumed Command. He assigned Battalion 6 to Division 3 (ground floor). Truck 15 was assigned Roof Division. Truck 11 split their crew, two members to the roof and three members to search and ventilate the top floor of the fire building. The Rescue Squad was ordered to conduct a search. Two members initially attempted to make entry through the garage but, due to extreme heat conditions, redeployed and entered through Sublevel 1 on the Bravo side. The other two members of the Rescue Squad made entry through the front door, were pushed back by the heat and then made a successful second effort and conducted a search of the top floor.

In the course of fireground operations, members of several Companies came upon the stricken members on the first level and removed them from the building. All possible efforts were employed to revive the members and they were transported to San Francisco General Hospital (SFGH). One member (Victim 1) succumbed to his injuries that day and the second member (Victim 2) succumbed to his injuries two days later. Two other Firefighters were treated at SFGH for various injuries and released that day.

The Medical Examiner determined the cause of death for both members was due to complications from external and internal thermal injuries. Both victims suffered burns to 40% of their body surface.
This fire was determined to be accidental by the SFFD Fire Investigative Unit. The fire originated on Sublevel 1, on the West side of the family room, near the large floor to ceiling windows. The ignition was a non-specific electrical sequence in the electrical wiring or appliance (handheld vacuum cleaner) in this area. There was a delay in reporting the fire due to the occupants' attempting to extinguish it on their own. (SFFD Fire Investigation Report 11-0500532)

The investigation identified that the failing of the window on Sublevel 1, located near the seat of the fire and directly across the stairwell leading to the ground floor, led to the extreme fire behavior which ultimately caused the death of two Firefighters. This fire was in a stage of deprived oxygen when the window failed, causing a rapid extreme high heat event to occur. The extreme heat followed the natural flow path up the interior stairs where Victims 1 and 2 were located.

The Safety Investigation Team found no conclusive evidence that the members were exposed to direct flame impingement during this rapid extreme heat event. However, Victims 1 and 2 received varying degree of burns up to 40% of their body. The investigation concluded that this was caused by the rapid extreme heat conditions that radiated through their Personal Protective Equipment (PPE) to their bodies. These temperatures exceed the ability for human survival regardless of PPE.

The PPE was inspected and evaluated by NIOSH and the manufacturer. Both reviewing parties concluded that the PPE performed to its specifications and design. The manufacturer concluded that the PPE was exposed to temperatures in the range of 550-700°F. These extreme temperatures were short in duration which caused limited damage to the outer shell of the PPE.

The Safety Investigation Team noticed severe heat damage to the portable radios remote speaker/microphones on Victims 1 and 2 and had the radios tested. The testing indicated that the remote speaker/microphones failed to operate correctly due to heat damage. The Safety Investigation Team was not able to determine, after testing, exactly when the remote speaker/microphones failed. The investigation has shown that multiple attempts were made to contact Engine 26 with no response. The investigation also found that no radio transmissions of distress were received from Victims 1 or 2.
Command and Control of any incident in the San Francisco Fire Department is acquired and maintained through the use of the Incident Command System (ICS). The Incident Command System provides the tools for clear objectives, a single action plan, clear and acknowledged communications, and accountability for all members assigned to an incident. At this incident, some of the components of Incident Command System that were not followed include:

- Single action plan
- Fireground Accountability

From these findings, this report makes recommendations for several areas of the Department, including:

- Training
- Equipment
- Policy Development
- Policy Enforcement

The Safety Investigation Team gathered and analyzed many facts and conducted interviews of members directly involved in this incident. The Team identified several factors that occurred that contributed to the deaths at this incident.

These factors include:

- Extreme heat conditions accelerated by the failure of a window on the fire floor.
- Layout of building
- Excessive live fuel load which contributed to the growth of the fire
Conclusion

This incident appeared from the onset to be a routine “room and contents” fire that the SFFD encounters on a regular basis. As the Companies were performing standard fireground operations, the incident rapidly deteriorated due to a hostile fire event. The failure of a window in the fire room allowed fresh oxygen to enter the room, providing a fire that was deprived of one of the key elements of combustion to rapidly intensify. Due to the growth of the fire, the room flashed, causing extreme and rapid heat conditions which traveled up the interior stairs (the flow path) to the location which our members were operating. Our members were caught in this high heat, causing the injuries that ultimately claimed their lives. Due to this fire event, other Companies attempting to conduct fireground support operations were prevented from making entry into the structure from street level (through garage) to back up Engine 26. These Companies were forced to regroup and find an alternate point of entry. In the process of doing so, crews made entry from the Bravo side directly into the fire room and extinguished the fire. This allowed members to make entry from above which led to the discovery and rescue of our members. These events happened in a time frame of less than fourteen minutes.

During the course of this investigation, the Safety Investigation Team recognized that no matter how experienced or properly prepared we are, we must always approach all incidents with the utmost awareness. This incident showed that a simple failure of a piece of glass/window caused unforeseeable and fatal consequences.

We, as a Department, need to gain further knowledge and understanding of the following:

- Having Situational Awareness prior to taking action, this would include the ongoing process when conditions change
- How Risk Management must be used when making all decisions
- Limitations of the PPE (turnouts, SCBA, and equipment)
- Building construction, including layout and how fire/smoke will move within the structure
- Ventilation practices and how they affect fire conditions
- Importance of Communications for all members operating on the scene
- Companies must use strict discipline when assigned task/locations
INTRODUCTION

Safety Investigation of 2/2 Box 8155
133 Berkeley Way
June 2, 2011
10:45 hours
Incident #1150532

On June 2, 2011, at 10:45 hours, four Firefighters were injured in an occupied, single family 4 story, type 5, wood framed building, at a first alarm fire. Two Firefighters succumbed to their injuries. Two other Firefighters were treated and released from the hospital.

The Safety Investigation Team identified the following areas of focus, including:

- Fireground Operations
- Fireground Communications
- Fireground Accountability including Personnel Accountability Reports (PAR)
- Procedures
- Personal Protective Equipment (PPE)
- Rapid Intervention Crew (RIC) procedures
- Portable Radios and their accessories
- Division of Emergency Communications

The Safety Investigation Team would like to acknowledge the following outside resources that assisted in reviewing and analyzing the information that was gathered during the investigation: San Francisco Department of Public Health, Dr. Ellen Moffatt (Office of the Medical Examiner), San Francisco Police Department including the Crime Lab and Arson Task Force, San Francisco City and County Department of Technology, Lion Apparel, Lieutenant John Ceriello (FDNY), Chief Rick Kolomay (Carol Stream, Illinois), Dan Madrzykowski (NIST), Chief (ret.) Bruce Varner (Santa Rosa, California), Chief (ret.) Alan Brunacini (Phoenix, Arizona), Angie Shepperd (NIOSH), Mike McKenna, (McKenna and Associates).
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STRUCTURE DESCRIPTION

Site overview: Steep downhill slope adjacent to Glen Canyon

Date of Construction: 1975

Building overview:
- Attached garage located in the front of the house. Main structure is 2 stories above grade and 2 stories below grade

Type of Construction:
- Four story, Type 5 wood framed, single family home, detached on three sides
- Approximate square footage: 4,000 sq ft.
- Four stories of living space
  - First Floor (Ground floor): garage, 3 bedrooms, 2 bathrooms
  - Second floor: dining room, living room, kitchen, bathroom and family room
  - Sublevel 1: large family room (origin of fire), mechanical room, bathroom, bedroom, balcony, side entrance on Bravo side
  - Sublevel 2: enclosed finished storage area, bathroom (no windows)
- Construction features:
  - Roof type: Flat roof, bitumen roofing membrane, normal dimensional lumber
  - Exterior: siding T1-11 plywood, 5/8”
  - Interior: drywall over normal insulated framing
    - Note: Fire origin room had decorative plywood veneer panels over drywall
  - Steel I beams wrapped in drywall were used as structural supports
    - Note: Fire origin room had a steel I beam that spanned horizontally from Bravo to Delta side
  - Rear of structure had extensive use of glass to capture views, including windows and sliding doors
  - Second floor and Sublevel 1 (fire origin) had large balconies
  - Flooring consisted of tile, carpet and sheet vinyl throughout the house
  - Dual glazed windows throughout, installed in 2003
- Ground level had a two car garage with access to residence
  - Note: Two large vehicles occupying garage at time of fire
- Main entrance was accessed by ascending a flight of stairs adjacent to the garage
  - Note: Main entrance stairs led to an interior landing which allowed access to top floor (5 stairs up) or grade level (7 stairs down)
- Sublevel 1 had an access door from the exterior Bravo side along with access from interior stairs
- Sublevel 2 had access door from exterior Bravo side. (no interior access)
  - Note: Access through the Bravo side was difficult due to unfinished terrain and poor housekeeping

Aerial view of 133 Berkeley Way (Courtesy of Google maps)
BRAVO SIDE (rear view)
Sublevel 1 (Fire Room) with steel I beam.

Sublevel 1 (Fire Room) Charlie/Delta corner with arrow on point of origin.
TIME OF DAY AND WEATHER

10:45 hours, Temperature 57 degrees (F), wind speed, 5.7 mph (South)
See Attachment B – Weather Report

DISPATCH TIMELINE

See Attachment C – CAD

Initial Dispatch

10:45:01  E26, E11, E24, T11, T15, B06, B09, B10, RS1, M74
(D3 replaces B10)

Working Fire

10:50:50  E32 (RIC), RC3

Replacement RIC

11:01:44  E20

Additional personnel:
11:09:09  M95, M57
11:09:18  CD2
11:10:33  B2 RIC
11:11:24  RC2

(B2 self dispatched to assist in RIC operation)

Second Alarm
11:11:50  E39, E06, E07, E09, T12, AR1, MA1, BE1

Additional personnel
E15, RS2, B8, D2
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INITIAL ACTIONS

The following is a summary of initial actions taken by Fire Department units prior to the rescue of two Firefighters:

ENGINE 26

Engine 26 responded staffed with one Officer and two Firefighters. Engine 26 arrived on scene at 10:47:58. The Officer (Victim 1) reported “light smoke coming from garage, more to follow”. Initial actions were to bring a CO2 extinguisher and a water extinguisher (initial dispatch indicated electrical fire). After conferring with the resident, Victim 1 directed crew to stretch 200 ft. ready line. Victim 1 updated Battalion 6, “this is a working fire, looks like at the third level of this three story wood frame house”. Victim 1 reported to Battalion 6 that they were making a lead from top down to the fire that was below grade.

Engine 26 ( Victims 1 & 2) advanced the 200 ft. 1 ¾ inch ready line up the front exterior stairs and down the interior stairs to the bedroom level (ground level). Victim 1 gave another report to Battalion 6 “We’re still looking for it. Zero visibility, more to follow” (10:52:40) (last radio transmission by Engine 26). (See Diagram 1)

FINDINGS

Engine 26 responded with one Firefighter understaffed due to a Self-Contained Breathing Apparatus (SCBA) mask fitting test. Victim 1 met face to face with Battalion 9 (Fire Attack) and stated that the fire was below them. Battalion 9 replied that they were going to attack the fire from the side. Engine 26 did not exit the building with Battalion 9. Engine 26 did not respond to seven attempts to contact them by radio. Based on measurements, the amount of the 200 ft. 1 ¾ ready line that was deployed into the building was approximately 30 feet. This would have allowed Victims 1 and 2 to advance to the set of five stairs leading down to the laundry area. Both Victims were found in full PPE, including SCBA masks and hoods.
ENGINE 11

Engine 11 responded staffed with one Officer and three Firefighters. Engine 11 supplied Engine 26 from the corner of Crags Court, North of the fire building, at Berkeley Way. Engine 11 pulled a 3 inch line with a wye and layed it out in front of the garage and proceeded to attach a 1 ¾ bundle to it. Engine 11's initial actions were intended to lead the 1 ¾ line through the garage and enter the house through the doorway leading from the garage to the house, however Engine 11 was redirected by the Incident Commander (IC) (Battalion 6) to advance the line down the Bravo side and assist Fire Attack (Battalion 9). Engine 11 advanced their 1 ¾ line down the Bravo side and met with Fire Attack (Battalion 9) who forced entry on the Sublevel 1 door. Engine 11 then proceeded to attack and extinguish the fire in Sublevel 1. (See Diagram 1)

FINDINGS

Engine 11 had to reconnect the wye due to an Engine 24 Firefighter attempting to connect a 2 ½ inch hoseline to the 3 inch line. During Engine 11 fire attack, they encountered heavy smoke from the Sublevel 1 door and, after opening the nozzle, heavy fire rolled above them, forcing one member back, and causing 1st degree burns to the neck. The fire room was fully involved. With a second effort, Engine 11 was able to advance the hoseline and extinguish the fire. The injured Firefighter was transported to San Francisco General Hospital and released after treatment.

ENGINE 24

Engine 24 responded staffed with one Officer and two Firefighters. Engine 24 supplied Engine 26 from a low pressure hydrant midblock on Berkeley Way. Engine 24 Officer entered the garage and located the door leading from the garage into house. Engine 24 Officer ordered the Firefighter/Paramedic to “get a large line” (member proceeded to Engine 26 apparatus and got a 2 ½ inch hose bundle). Engine 24 Officer opened the door and encountered heavy smoke conditions, floor to ceiling, with light heat conditions. Engine 24 Officer heard movement of people inside the vestibule area, and assumed this was the crew of Engine 26. Engine 24 Officer determined that leading a line through this door would be the easiest way to provide back up. Engine 24 Officer exited the garage, proceeded to Engine 26 apparatus and deployed the 150 ft 1 ¾ inch ready line. Engine 24 Officer returned to the doorway in the garage that led into the house, opened the door again and encountered heavy smoke and extreme heat conditions, which prevented them from making entry. Engine 24 Officer did not hear any movement of people inside the doorway at this time. Engine 24 Officer opened the nozzle briefly to try to cool down heat conditions, but shut the hoseline down out of concern that it would force heat/fire onto the crew of Engine 26.
After a couple of attempts, Engine 24 was unable to make entry through garage door due to extreme heat conditions. Engine 24 redeployed the 150 ft. 1 ¾ inch ready line through the front door and down the interior stairs, following Engine 26’s initial ready line. Battalion 6 simultaneously gave the order to back up Engine 26 through the front door. While entering the front door, Engine 24 encountered heavy smoke conditions but moderate to light heat conditions. Engine 24 Officer, while advancing the line, came across Victim 1. Victim 1 was located at the top of the stairs in the vestibule, face down, unconscious, unresponsive with SCBA on (see Rescue Event Section). Firefighter/Paramedic of Engine 24 discovered Victim 2. Victim 2 was located in the hallway, just outside bedroom 1 and the bathroom, face down, unconscious and unresponsive, with SCBA on (see Rescue Event Section). Engine 24 Officer attempted to make a radio report of “Firefighter down” but was unable, due to radio traffic. Engine 24 Officer located the door leading to garage and proceeded to move Victim 1. Engine 24 Officer was notified by Engine 24 Firefighter/Paramedic that he located Victim 2. Engine 24 Firefighter/Paramedic brought Victim 2 partially to doorway but was blocked by the Engine 24 Officer who was attempting to move Victim 1. Engine 24 Firefighter/Paramedic exited the garage and verbally notified (via line of sight) the Incident Commander (Division 3) of two Firefighters down and the need for assistance. Engine 24 Officer received assistance from Rescue Squad 1 Officer (Team 1A) and Engine 24 Firefighter/Paramedic in carrying Victim 1. Victim 2 was carried by a Rescue Squad 1 Firefighter (Team 1A) and a Firefighter from Truck 11. Engine 24 Officer and Engine 24 Firefighter/Paramedic assisted with the medical care of Victim 1. (See Diagram 1)

FINDINGS

Engine 24 responded with one Firefighter understaffed due to member being authorized to obtain meal supplies for the Company. There was also a misunderstanding of terminology of hoseline selection. Engine 24 Firefighter/Paramedic thought his Officer was requesting a large line (2 ½ inch attack line), while Engine 24 Officer was actually requesting a 3 inch line with a wye. After hearing members of Engine 26 inside the door to the vestibule on the ground floor, Engine 24 Officer decided to lead a 150 ft. ready line through the garage to back up Engine 26. Aware that this line was 50 feet shorter, Engine 24 Officer felt he could reach them quicker this way. Engine 24 Officer was positioned on the nozzle. Engine 24 Officer does not recall hearing a Personal Alert Safety System (PASS) alarm until Victim 1 was moved. Engine 24 Officer does remember seeing strobe light from PASS device while moving Victim 1. Engine 24 Officer indicated that he attempted to radio “Mayday” but was unable to, due to radio traffic. Engine 24 Firefighter/Paramedic, concerned about Victim 2 suffocating, quickly removed the Victim’s SCBA and checked for any signs of breathing. Engine 24 Driver secured the garage door by placing visegrips on the door channel. Engine 24 Officer received a burn to his ear and was later transported to San Francisco General Hospital and released after treatment.
TRUCK 11

Truck 11 responded staffed with one Officer and four Firefighters. Truck 11 parked apparatus in front of Exposure Bravo 2 and Bravo 3. Truck 11 laddered Bravo building and sent two members with saws to conduct roof operations. Two members on the roof reported to Truck 11 Officer that the building was detached. The members then bridged across the buildings with a 22 ft. fire escape ladder and assisted Truck 15 with ventilation. Truck 11 Officer and two Firefighters checked with Command (Division 3). Truck 11 Officer was assigned interior with Battalion 6. Truck 11 proceeded to the top floor and conducted primary search and ventilation operations. Truck 11 Driver followed the hoseline down to the ground floor where he discovered Victim 2 in the doorway to the vestibule. He joined Firefighter from Rescue 1 Team A in removing Victim 2 through the garage. Truck 11 Officer, upon hearing Command requesting assistance in front of the building, ordered his crew off of the roof and assisted with airway management and CPR of both victims.

FINDINGS

Truck 11 Officer laddered the Bravo building because Truck 15 had just laddered the fire building. Truck 11 Officer was notified by the crew that the Bravo exposure was detached. Upon receiving this information, Truck 11 roof crew bridged from the Bravo building to the Fire building (see picture next page). Officers should thoroughly size up a structure before committing to a course of action to ensure safe and effective ladder placement. Bridging the buildings was not the proper course of action for this situation. A safer alternative would have been to ladder the Delta exposure which is connected to the fire building and is similar in height. Truck 11 Driver became separated from the Officer and proceeded to go down the stairs instead of up the stairs. Truck 11 Driver stated that he did not know who he was with.
TRUCK 15

Truck 15 responded staffed with one Officer and four Firefighters. Truck 15 parked in front of exposure Delta 5. Truck 15’s crew proceeded to ladder the fire building with a 35 ft. ladder on the Bravo side to the garage roof. They opened the sliding doors on the top floor and heavy smoke came out of those doors. Truck 15 laddered the roof with a ridge ladder from Truck 11. The Incident Commander assigned Truck 15 as Roof Division. Two Firefighters from Truck 15 entered the top floor from the garage roof to initiate a search. The Officer and two Firefighters proceeded to the roof and joined two Firefighters from Truck 11 and opened a ventilation hole in the roof.

FINDINGS

Truck 15 split their crew but did not inform the Incident Commander of this fact and therefore, the Incident Commander did not have a true account of where personnel were on the fireground. This caused a duplication of efforts on the top floor with multiple Companies searching the same floor.
RESCUE SQUAD 1

Rescue Squad 1 responded staffed with one Officer and three Firefighters. Rescue Squad 1 parked in front of Bravo 4. Rescue Squad 1 Officer split his crew into Rescue 1 Team A (RS1A) and Rescue 1 Team B (RS1B). RS1A was comprised of the Officer and a Firefighter. RS1B was comprised of the Driver and a Firefighter. RS1A entered through the garage, meeting up with Engine 24 at the door to vestibule. RS1A, along with Engine 24, made two attempts to gain entry into the building (residence) through the garage door and was confronted with an extreme heat condition emanating through the entry door into the garage. Due to these conditions, RS1A decided to withdraw and look for an alternative way of entry. Visibility was very low at this time, to the point that the Firefighter of RS1A believed someone closed the garage door. RS1A Officer signaled by hand gestures to Division 3 from the edge of the garage that RS1A would go to the Bravo Side and RS1B would go above the fire, to the second floor.

RS1A then proceeded down the Bravo side, checked the rear of building, and then the Sublevel 2. RS1A then followed Battalion 9 and Engine 11 into the fire room. Upon entering the fire room, RS1A split into a Left hand and Right hand search and proceeded to perform a primary search on the fire room. They met up at the stairs that led up to ground level. RS1A proceeded upstairs, and the RS1A Officer found Engine 24 Lieutenant moving Victim 1 to the door leading into garage and assisted him. RS1A Firefighter arrived at top of stairs, encountered Victim 2 (who was discovered by Engine 24 Firefighter/Paramedic) and proceeded to move him out of the residence with assistance of the Firefighter from Truck 11. RS1A assisted with CPR to the Victims.

After positioning the apparatus, the RS1B Driver located his designated partner, RS1B Firefighter, in front of the structure. Upon attempting to enter the structure through the front door, they were confronted with heavy black smoke and extreme heat conditions. RS1B returned to the street, regrouped and reentered behind the crew of Engine 24 who was leading a 1 ¾ hoseline. Upon reentering the building, they proceeded to the top floor and performed a primary search. Upon completion, they made their way to the ground level and performed a primary search of the bedroom area.

FINDINGS

Members of RS1A were not wearing full PPE (hood) when making initial entry attempts.
BATTALION 6

Battalion 6 responded from the Division of Training. Engine 26 declared on the Tactical Channel that this was a working fire, below grade. Division 3 reported this on the Dispatch Channel for Battalion 6. Battalion 6 parked his vehicle close to Engine 11 and away from the street in a driveway. Battalion 6 requested a progress report from Engine 26 upon arrival. Engine 26 reported as follows "zero visibility, we're looking for it". Battalion 6 radioed to Engine 26 to look for an alternate means of egress as he was considering "attacking it from the side" but received no reply.

Battalion 6 received a report from Battalion 9, that Battalion 9 was going inside, Battalion 6 assigned him (Battalion 9) as Fire Attack. Battalion 6 positioned himself across the street from the fire building to establish the Command Post. He requested a progress report from Engine 26 but there was no response. Battalion 6 saw Engine 11 assembling a 3 inch hoseline with a wye, and ordered them to go down the Bravo side. Battalion 9 exited the building, and signaled to Battalion 6 that he was going to go down the Bravo Side. Battalion 6 then ordered Rescue Squad 1 to split his crew and send one team through the garage door (RS1A) and one team (RS1B) through the front door. Battalion 6 again asked Engine 26 for another progress report with no reply. Battalion 6 ordered Engine 24 to back up Engine 26.

Battalion 6 transferred Command to Division 3 following a face to face meeting. Division 3 ordered Battalion 6 to obtain a layout of the building. Battalion 6 then conferred with the resident, gathered information, and relayed it to Command. Battalion 6 was then assigned as Division 3 by the Incident Commander. At the front door, Battalion 6 encountered Engine 24, Rescue Squad Team B (RS1B) and Truck 11. Battalion 6 assigned RS1B to conduct a search on the top floor. He assigned Truck 11 to assist in advancing Engine 24’s hoseline. Battalion 6 followed Engine 24 through the front door.

As Battalion 6 proceeded downstairs, smoke was banked down to ground level and was "hot but not unbearable" heat. Battalion 6 heard a PASS alarm and received an oral report that they found a "man down". Battalion 6 transmitted a "Mayday" over the Tactical Channel, this Mayday was stepped on by other radio traffic and was not heard by the Incident Commander. Battalion 6 was then ordered outside by Command. Once at the Command Post, he was assigned to supervise the RIC Operation. Battalion 6 assisted with the care of the Victims and kept track of members departing with the Medic Units.

FINDINGS

Battalion 6 initially did not have a clear understanding of the exact location and extent of the fire. Battalion 6 believed that Engine 26 was on the fire floor based on communications from Engine 26. Battalion 6 requested Engine 26 to locate another means of egress but received no confirmation from Engine 26 of this transmission. Battalion 6 made several requests to Engine 26 to obtain their location in the fire building. However, Battalion 9 did not inform Battalion 6 that Battalion 9 had met Engine 26 at the ground floor level or the conditions in that area. Once the plan of attack was to make
entry from the Bravo Side, Command (Battalion 6) did not notify all Companies operating on the fireground that the point of entry to attack the fire had changed. During transfer of Command, Battalion 6 informed Division 3 that the exact location and status of Engine 26 was unknown. Once Battalion 6 was assigned Division 3 (ground floor), Battalion 6 tried to use the Thermal Imaging Camera but could not get a clear image due to sooting on his mask and the high temperatures. Battalion 6’s initial Mayday transmission was not received by the Incident Commander due to radio traffic.

**BATTALION 9**

Battalion 9 responded staffed with one Battalion Chief and one Incident Support Specialist (ISS). Battalion 9 responded from Station 39. Battalion 9 parked in front of 93 Berkeley Way, South of the fire building. As he approached the fire building, he reported in to Battalion 6 (via radio) and was assigned Fire Attack. Battalion 9 proceeded into the fire building, while the Incident Support Specialist reported to the Command Post to assist the Incident Commander.

Battalion 9 followed the initial hoseline from Engine 26 into the building through the front door and met with Victim 1, who was located on the landing at the bottom of the stairs. The area was fully charged with smoke but very little heat. Victim 1 told Battalion 9 that he believed the fire was on the floor below. Battalion 9 agreed with his assessment and told Victim 1 that they would attack the fire from the side. Victim 1 and Victim 2 began to proceed through the hallway door leading into the vestibule area which had an opened door that led into the garage. Battalion 9 reported that he could see the street from the doorway and that he had intended to exit through that door, but because the passage way through the garage was narrow, he turned around and followed the hoseline back up the stairs and out the front door to the street.

Once outside in front of the building, Battalion 9 informed Battalion 6 that the fire was on a lower floor and that he was going to look for a side entrance and attack the fire from there. Battalion 6 said that he would send Companies down to assist.

Battalion 9 proceeded down the Bravo side of the building and immediately noticed two doors. The door on the Sublevel 1 had a security gate. Battalion 9 then called Command and requested that a Chicago Door Opener be sent down. Battalion 9 stated that there was no sign of smoke or fire along the Bravo side of the building at this time. Battalion 9 forced the door to Sublevel 2 to check for fire and found only light smoke in the room. Battalion 9 reported to Command that the floor was clear.

Battalion 9 then exited the building and went up the exterior staircase to the landing of Sublevel 1, where he found that the door was hot to the touch. At this time, he was
joined by the crew of Engine 11. Battalion 9 radioed Command and informed Command that he had "located the fire on the second floor" (Sublevel 1) and was making entry. Battalion 9 also requested a second line. Battalion 9 forced the door and heavy black smoke immediately came out of the doorway. Engine 11 then began to flow water and make entry to the fire room. Heavy fire then appeared in the doorway pushing Engine 11 back out onto the landing. Battalion 9 was informed by the Firefighter/Paramedic from Engine 11 of the heavy fire that was showing from the back of the building. Battalion 9 reported conditions to Command and recommended that units be sent to the floors above to check for auto exposure. Additionally, Battalion 9 recommended a Second Alarm.

Approximately 4 minutes later, Battalion 9 reports "we got it knocked down here in the second level," (Sublevel 1). Engine 32 then reported to Battalion 9 and was ordered to bring the second line into the fire room. Moments later Battalion 9 heard a RIC operation announced over A16, at which time Battalion 9 switched his radio to A1 as per Department’s RIC protocol. After hearing normal radio traffic on A1, Battalion 9 switched his radio back to A16. Battalion 9 then heard a call from the Incident Commander for any Battalion Chief to respond to the Command Post. Battalion 9 assigned Engine 32’s Officer in charge of fire attack and reported to the Command Post. Battalion 9 was directed to assist in the efforts to provide care for the victims.

Battalion 9 Incident Support Specialist monitored the Control Channel, interviewed residents and assisted the Incident Commander’s Incident Support Specialist with the Incident Command Worksheet.

FINDINGS

Battalion 9 had a face to face meeting with a member of Engine 26 Officer (Victim 1) in zero visibility with no remarkable heat conditions. Engine 26 reported that the fire was below them. Battalion 9 then relayed to Victim 1 that they were going to see if they could get it from the side. Because of the smoke conditions, Battalion 9 did not see the stairs leading to the fire floor. Battalion 9 exited through the interior stairs and assumed Engine 26 was going to exit through the garage “because it looked like they were going that way”.

As Battalion 9 exited the building, he did not inform Battalion 6 that he had met Engine 26 at the ground floor level or the conditions in that area.

Battalion 9’s Incident Support Specialist did not respond in Full PPE (did not have SCBA). He did not start an SFFD Incident Command Worksheet.
ENGINE 32

Engine 32 responded staffed with one Officer and three Firefighters. Engine 32 was designated and dispatched as the Rapid Intervention Crew (RIC), which is Standard Operating Procedure when a working fire was declared. Engine 32 arrived on the scene and was immediately reassigned by Command to assist Battalion 9 and Engine 11 on the Bravo Side of the building. Engine 32 dragged a large line with a wye and brought a 1 ¼ hose bundle in order to deploy another attack line. Engine 32 assisted in extinguishment and checked for extension of the fire room. (See Diagram 1)

FINDINGS

No significant findings of the actions of Engine 32 were found.

ENGINE 20

Engine 20 responded staffed with 1 Officer and 3 Firefighters. Engine 20 was dispatched as the replacement RIC team, as requested by the Incident Commander, due to Engine 32 being reassigned to assist with Fire Attack. Engine 20 extinguished hot spots on the fire floor and stood fire watch.

FINDINGS

Engine 20 did not acknowledge response via Mobile Data Terminal (MDT) or radio. The Division of Emergency Communications (DEC) attempted to contact Engine 20 (via radio and landline for approximately 5 minutes) to verify response along with the activation of the emergency button in a portable radio. A member of Engine 20 accidentally pressed their emergency button on a portable radio. When Engine 20 did not respond to the DEC about their response and the emergency button activation, the DEC alerted the Incident Commander on the Tactical Channel with the following message “Engine 20 has activated their emergency alarm and has not confirmed a response for 5 minutes”. This message congested radio traffic and caused confusion. Eventually Engine 20 responded to the DEC that they were on the Tactical Channel.

DIVISION 3

Division 3 responded staffed with one Division Chief and one Incident Support Specialist. Division 3 was out of service at Headquarters when the incident was dispatched. Division 3 placed himself on the incident and recalled the last Battalion Chief (Battalion 10). Division 3 monitored the Tactical Channel and heard Engine 26 give a progress report to Battalion 6 of a working fire, below grade. Division 3 advised Battalion 6 that he would update the DEC on the Control Channel. Upon arrival, Division 3 parked behind Truck 15, North of the fire building.
Division 3 performed a size up of the incident. Truck 15 reported in and they were assigned Roof Division. Division 3 observed “lightly pushing black smoke at the top of the garage door”. Division 3 asked for the location of all Companies on the scene and a transfer of Command from Battalion 6 took place. He ordered Battalion 6 to get a general layout of the building and locate the fire. The Incident Commander (Division 3) observed a rapid increase in the volume and velocity of the smoke to the point that it covered the Command Post causing him to step aside to the Alpha/Bravo corner.

After Battalion 9 had cleared Sublevel 2 for fire, the Incident Commander asked him which Companies he had with him, Battalion 9 replied he had Engine 11. After receiving a report from Battalion 9 that they had located the fire and a request for a second hoseline, the Incident Commander reassigned Engine 32 (RIC) to assist Battalion 9. The Incident Commander then immediately asked via radio for another RIC Company. The Incident Commander asked Battalion 9 if Engine 26 was with them, but the reply was unintelligible. The Incident Commander and Battalion 6 tried calling Engine 26 several times but did not receive an answer. At this point, Incident Command received a transmission from the DEC on the Tactical Channel, stating that Engine 20 had activated their emergency alarm and had not confirmed their response for 5 minutes. The Incident Commander acknowledged the transmission, and responded “I copy that, I’m going to look for them right now.” At which point the Incident Commander looked down the street and saw Engine 20 walking up to the Command Post.

Immediately following this transmission, the Incident Commander observed a Firefighter exiting the garage and reporting that he had “two guys down”. Command reported on the Tactical Channel that he had a RIC operation in progress and requested 2 additional Medical Units. He reassigned a Battalion Chief to assume Command of the RIC Operation and two Companies on the fireground to assist. He directed Companies not assigned to the RIC operation to continue firefighting operations. The Incident Commander requested Division 2 to respond and oversaw that medical care was given to the downed Firefighters. Recognizing the magnitude of the incident, the Incident Commander ensured that the scene was preserved for both the fire investigation and the serious injury investigation. Once Division 2 arrived on the scene, a transfer of Command took place and Division 3 responded to San Francisco General Hospital.

Division 3 Incident Support Specialist placed obstructions in the doorway of the garage door to prevent it from coming down and tracked Companies on the fireground using the SFFD Incident Command Worksheet.

FINDINGS

There was not a clear transfer of Command with an understanding of the location of the fire and all Companies on the fireground. Based on hoseline placement, initial reports of Engine 26 and the assignment of Battalion 9 as Fire Attack, Division 3 presumed that Engine 26 was with Fire Attack. On the transfer of Command, Battalion 6 reported to Division 3 that “he had not heard from Engine 26 in a while.” Division 3 attempted to locate Engine 26 several times.
Just prior to receiving a report from the DEC regarding Engine 20, the Incident Commander attempted to locate Engine 26 once more and this time traffic was received but the Safety Investigation Team could not determine who made that transmission. On two occasions there were transmissions that Division 3 believed to be Engine 26 answering his call, however, one of them was Battalion 6 looking for Engine 26 and the other remains undetermined.

Division 3 did not feel it was necessary to switch radio channels, as per RIC Standard Operating Procedure, due to the members already being extricated from the garage. Due to Division 3 not notifying Companies, Companies operating on the fireground switched to Channel A1, as per RIC Standard Operating Procedure. Companies reverted back to the original Tactical Channel when they recognized that there was normal Channel A1 traffic and no fireground traffic.

Division 3 saw two Firefighters being removed from the garage, but did not know if any other Firefighters were missing. A Personnel Accountability Report was not conducted immediately to account for any other possible missing Firefighters.

Division 3 recognized the need to preserve the fire scene and to call for another Division Chief to assume Command. Division 3 immediately notified a Lieutenant from the Division of Training, present at the scene, to contact the Department's Safety Officer and initiate the investigation of this incident.

Division 3 and Division 3 Incident Support Specialist did not respond in Full PPE (turnout pants).

**RESCUE CAPTAIN 3**

Rescue Captain 3 (RC3) responded when a working fire was declared, as is Standard Operating Procedure. RC3 reported to the Command Post and observed nothing unusual. The crew of Medic 74 reported in to RC3, where they reviewed the multiple O2 valve. While reviewing the equipment, large volumes of smoke engulfed their location across the street. Upon hearing of Firefighters down, RC3 proceeded to the front of the garage and supervised crews in medical care of the victims.

**FINDINGS**

RC3 was preparing for possible injury to civilians and/or Firefighters by reviewing procedures for multiple victims with Medic 74.
MEDIC 74

Medic 74 responded on the first alarm assignment staffed with one Paramedic and one Emergency Medical Technician (EMT). Medic 74 positioned their apparatus out of the way and ready for transport. Medic 74 reported in to RC3 where they reviewed the use of the multiple O2 valve. While reviewing the equipment, large volumes of smoke engulfed their location across the street. Upon hearing of Firefighters down, Medic 74 immediately reported to the front of the garage and started medical care on Victim 1. Medic 74 provided ALS treatment and transported Victim 1 to San Francisco General Hospital.

FINDINGS

Medic 74 was well prepared to start immediate medical care to the downed Firefighters, and provided proper Advanced Life Support (ALS) care to Victim 1.

MEDIC 95

Medic 95 was special called as one of two Ambulances requested by the Incident Commander. Medic 95 responded staffed with one Paramedic and one Emergency Medical Technician and they transported Victim 2 to San Francisco General Hospital.

FINDINGS

Medic 95 provided proper Advanced Life Support (ALS) care to Victim 2.

DEPUTY CHIEF OPERATIONS

The Deputy Chief of Operations (CD2) responded to the fire upon hearing of the RIC operation. He checked in with the Incident Commander and ensured that the downed members were receiving medical attention. The Deputy Chief made notification to the Chief of Department and Deputy Chief of Administration on the circumstances and the destination of the injured members. He responded with Division 3 to San Francisco General Hospital, where he met with the Chief of Department and the Deputy Chief of Administration.

FINDINGS

No significant findings on the actions of the Deputy Chief Operations were found.
DIVISION OF EMERGENCY COMMUNICATIONS

The Division of Emergency Communications (DEC) received a 911 phone call reporting a fire in the building at 133 Berkeley Way. DEC dispatched a full first alarm assignment. DEC received additional information regarding the incident and notified responding units, which included that the fire had spread to the drapes and the building had been evacuated. DEC followed current RIC procedures when notified of a RIC Operation which included upgrading to a Greater Alarm. DEC kept the Command Staff updated on the incident through the use of the paging system. DEC helped coordinate the request for outside agencies (San Francisco Police Department, San Francisco Municipal Transportation Agency [Parking and Traffic], American Red Cross – Bay Area Chapter).

FINDINGS

DEC recognized an issue with Engine 20 not acknowledging their response to their dispatch. DEC attempted to reach Engine 20 via radio and phone call to Station 20 with no response. When Engine 20 activated their emergency button on a portable radio, DEC notified Command via the Tactical Channel that “Engine 20 has activated their emergency alarm and has not confirmed a response for 5 minutes” By using the Tactical Channel instead of the Control Channel, the DEC was stepping over units that were attempting to transmit an Emergency Traffic/Mayday of the two Firefighters down.

During the course of the investigation, the Safety Investigation Team found that the safety feature of the radio system which logs all push to talk transmissions was turned off. DEC advised that this feature had not been turned back on after the breakdown of the mobile data communications portion of the radio system on May 12, 2011 (See Recommendation #9). The Safety Investigation Team has verified that this feature has been restored at the time of this report.
Apparatus placement diagram (not to scale)
THE FIRE EVENT

This fire was determined to be accidental by the SFFD Fire Investigative Unit (Arson). The fire originated on Sublevel 1 on the West side of the family room near the large floor to ceiling windows. The ignition was a non-specific electrical sequence in the electrical wiring or appliance (handheld vacuum cleaner) in this area. There was a delay in reporting the fire due to the occupants attempting to extinguish it. (SFFD Fire Investigation Report 11-0500532).

A resident noticed the drapery for the windows on fire on the Charlie Side. The resident stated that she went upstairs to obtain an extinguisher and returned to the location of the fire in an attempt to discharge the extinguisher. Unable to extinguish the fire, the resident left the fire area, notified other occupants and exited the building. At approximately 10:44 hours, Division of Emergency Communications received a phone call from the resident reporting the fire.

The resident stated that she spoke with the first arriving unit (Engine 26) regarding the location and materials on fire.

Upon Engine 26’s arrival, Victim 1 reported light smoke showing from the garage. An additional report to Battalion 6 was communicated that it was a working fire, below grade.

Several minutes later, Engine 26 reported “we’re still looking for it, zero visibility, more to follow.”
10:52:28 Officer of Engine 24, Engine 26's 200 ft. ready line deployed. Resident standing by car (0853)
10:53:52 Battalion 9 in front doorway, prior to descending stairs to meet with Engine 26.

In this picture, Engine 11 has deployed large line and a member from Engine 11 is breaking a hose bundle to connect to the wye. Engine 24 Officer is in rear of garage near the front right corner at the door leading into the house checking conditions and access. Resident is standing next to car. (0855)

Battalion 9 informed the Safety Investigation Team that when he met with Engine 26 inside the fire building that the conditions were heavy smoke with little heat. Engine 26 and Battalion 9 discussed the fire being below them and possibly attacking it from the side. Battalion 9 exited the building and proceeded down the Bravo side, and assumed Engine 26 was going to exit through the garage.
In this series of pictures, note how quickly the fire and smoke conditions progress from light smoke, with no fire visible, to heavy black smoke and the entire fire room involved. These pictures were taken from a resident on the other side of Glen Canyon over a ten minute time span. Note pictures from the front will be inserted when available and the time frame corresponds.

10:57:09 Battalion 6 as initial IC (657 S.B.)

10:57:11 First picture showing conditions from the rear of the building. Note Battalion 9 coming down the hill side on the Bravo side. Noticing a metal gate on the door to Sublevel 1, Battalion 9 requests a forcible entry tool. (6565)
10:57:18 Battalion 9 forcing entry into Sublevel 2. Note fire in lower right hand window (6567)

10:57:45 Battalion 9 has entered Sublevel 2 to check for fire (6568)
10:58:21 Battalion 9 is checking door to Sublevel 1. Note fire in window is growing (6572)

10:58:21 Division 3 assumes Command from Battalion 6 (858 S.B.)
10:58:42 Window in the rear of Charlie Side fails. Battalion 9 and Engine 11 at door of Sublevel 1. Crews have not made entry into Sublevel 1. Note smoke conditions change in the front of the building and IC has moved due to smoke obscuring the Command Post. (6574)
These two pictures were taken one second apart. Top picture shows rapid fire spread in Charlie/Delta corner. Note Engine 11 and Battalion 9 have not yet breached door. Bottom picture shows Battalion 6 conferring with the Incident Commander (not in frame). At this time, Engine 24 and Rescue 1 Team A are inside garage attempting to gain entry through access door from garage. During the post incident interviews, both crews reported that they confronted extreme heat conditions (See Rescue Squad 1 Findings).
10:58:54 Note fire growth on Sublevel 1. Crews have not yet made entry. (6576)

10:59:23 Engine 11 and Battalion 9 make entry to Sublevel 1. Battalion 9 requests additional hoseline to assist. Note the smoke change on the Bravo side along with the change in the front. (6577)
10:59:54 Note change of smoke color coming front Sublevel 1 door (Bravo Side) due to water application (6580)

10:59:58 Note second window from the left has failed. Smoke conditions continue to change, due to application of water. (6582)
11:00:31 Bottom picture shows a still image from a cell phone video taken from the building across the street. The image is not clear due to being shot through a glass window. Rescue 1 Team A is coming out of the garage and Team B is preparing to make entry through front door. (Still from video.)
11:04:51 Battalion 9 reported in this time frame that fire was knocked down (6605)

11:05:07 (6608)
Note Truck 15 and Truck 11 crews on roof and Battalion 9 on the balcony (6620)

Looking up the stairs from the fire room, note the heat damage on the walls
Color of the smoke being generated, indicates a hot and high carbon based fire.

Top of stairs leading down to fire room, note amount of carbon material deposited on the surfaces.
Note amount of carbon material that has been baked onto the SCBA of Victim 1

Note heat damage to helmet and the carbon material on the helmet
Note Engine 24 Officer's gear (clean)

Note Engine 24 Officer's gear (sooted after attempting to make entry through the garage)

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Looking from the bottom of the stairs out the windows and the room of origin.

In the fire room looking out towards the door on the Bravo side, this is the door that Engine 11 and Battalion 9 made entry from.
From the front door area looking down the stairs.

Engine 26 and Engine 24 1 3/4" hose leads down the stairs to ground level.

Door leading to fire room and garage.

E24 lead (E26 - 150' ready line).

E26 - 200' ready line.

Looking left from the bottom of the stairs to the left. Hoselines are Engine 26 and Engine 24 location after the fire.
RESCUE EVENTS

Multiple Companies and Department members assisted in the rescue of Lieutenant Vincent Perez and Firefighter/Paramedic Anthony Valerio.
Lieutenant Perez was found in the vestibule area on the ground floor, located just inside the garage door leading into the house. He was found unconscious, unresponsive, face down on or near the stairs leading up from laundry area by Engine 24 Officer (Approximate location indicated by arrow).
Engine 24 Officer and Engine 24 Firefighter/Paramedic, with the assistance of Rescue Squad 1 Officer, carried Lt. Perez, exiting through the garage door. While moving Lt. Perez, members encountered obstacles due to homeowner’s contents, which hampered the rescue. In the process of the rescue, Lt. Perez’s SCBA mask got caught under a car tire, which required the members to cut the air hose to the mask. Once Lt. Perez was brought outside the building, members performed CPR.
FF/PM Valerio was located in the hallway outside the bedroom/bathroom on the ground floor. He was found unconscious and unresponsive, face down, by Engine 24 Firefighter/Paramedic who moved him to the doorway leading to the vestibule (Approximate location indicated by arrow).
Rescue Squad 1 Firefighter along with Truck 11 Firefighter carried FF/PM Valerio by exiting through the garage, following behind the crew that was carrying Lt. Perez. Once FF/PM Valerio was brought out of the building, members performed CPR and provided medical care. This picture shows the door that both Lt. Perez and FF/PM Valerio were carried out of, through the garage during the rescue.
Lt. Perez and FF/PM Valerio were transported to San Francisco General Hospital (SFGH) with a San Francisco Police Department escort. Upon arrival at SFGH, Emergency Room Staff, including Trauma and Burn Specialists worked on both members. After all possible efforts and medical intervention, Lt. Perez succumbed to his injuries and was pronounced deceased in the Emergency Room. FF/PM Valerio was stabilized in the Emergency Room and then moved to the ICU for further care. FF/PM Valerio succumbed to his injuries two days later, on June 4, 2011.

The Safety Investigation Team recognizes that the members of the San Francisco Fire Department and San Francisco General Hospital did everything possible to care for and treat both Lt. Perez and FF/PM Valerio.
KEY EVENTS / TIMELINE

(A) = Audio tape, (C) = CAD record, (P) = Photograph

10:44:22 (A)  Resident calls 911 and reports fire (resident delayed calling 911 in an attempt to extinguish fire herself)

10:45:22 (A)  Box 8155 dispatched. E26, E11, E24, T11, T15, B6, B9, B10, RS1, M74, Dispatched (Div 3 recalls B10 and responds immediately)

10:47:58 (C)  E26 arrives on scene (via MDT)

10:48:09 (A)  E26 Officer gives on scene report to Communications Center "Three Story wood frame, light smoke showing from garage, more to follow"

10:49:20 (A)  E26 Updates Battalion 6 on the Tac Channel "working fire, below grade, making a lead from top down"

10:50:50 (C)  Division of Emergency Communications upgrades Box to Working Fire, calling E32 as RIC and Rescue Captain 3

10:51:00 (C)  Engine 24 on scene

10:51:09 (C)  Engine 11 on scene. E11 Officer pressed on scene button after arriving on scene

10:51:51 (C)  Battalion 6 on scene (via MDT)

10:52:40 (A)  Last transmission from E26 (to Battalion 6), "we're still looking for it, zero visibility, more to follow". Battalion 6 replies "copy that, see if you got a second egress off that lower floor, if we could attack it from the bottom as well from the outside" (this transmission was not acknowledged).

10:53:50 (A)  Battalion 9 assigned Fire Attack by Battalion 6. Battalion 9 goes inside, meets with E26 and has a face to face. E26 reports that the fire is below them and Battalion 9 replies that they are going to try to get it from the side. Battalion 9 exits the building and proceeds to the Bravo side.

10:56:00 (A)  Division 3 arrives on scene

10:56:33 (A)  Battalion 6 attempts to contact E26 with no reply

10:57:20 (A)  Battalion 6 orders E24 to back up E26. Battalion 6 asks E26 for their location with no reply.

10:57:40 (A)  Battalion 9 requests a forcible entry tool and checks Sublevel 2. Battalion 6 attempts to contact E26 to get an update but receives no response.

10:58:20 (A)  Division 3 assumes Command via radio

10:58:42 (P)  Window fails in Charlie side on basement. Seconds after this, Rescue 1 Team A and Engine 24 report untenable conditions in the garage door to house that forces them to look for an alternate way to enter the structure.

10:59:20 (A)  Battalion 9 reports that Engine 11 is making entry in Sublevel 1 with a hoseline and requests an additional hoseline.

11:01:44 (C)  E20 dispatched as back up RIC to replace E32 that was reassigned to assist Fire Attack.

11:02:00 (A)  Division 3 asks Battalion 9 if Engine 26 is with them.

11:03:00 (A)  Battalion 6, inside the building, asks E26 for their location with no reply
11:04:00 (A) Division 3 believes E26 had made a transmission and attempts to get an update from them. ("Engine 26, slow down your traffic and let me know where you're located"). This was Battalion 6 attempting to transmit.

11:05:40 (A) Battalion 9 reports "fire knocked down in the basement"

11:07:20 (A) Communications Center reports on Tac Channel that E20 has activated their emergency alarm and has not responded for 5 minutes. Command acknowledges this and observes that E20 is not on scene yet. (At approximately this time Battalion 6 attempted to broadcast a Mayday but was stepped on by Dispatcher).

11:08:00 (A) Command reports on Tac Channel that there is a RIC operation in progress. Lt. Perez and FF/PM Valerio were removed from the building and EMS care given.

11:12:50 (C) Second Alarm upgraded by Division of Emergency Communications at the request of Division 3 Command.

11:23:00 Victim #1 arrives at San Francisco General Hospital

11:34:00 Victim #2 arrives at San Francisco General Hospital

Victim #1 pronounced deceased on June 2, 2011 at 11:55 hours
Victim #2 pronounced deceased on June 4, 2011 at 07:37 hours.
PERSONAL PROTECTIVE EQUIPMENT FINDINGS

Victims 1 and 2 were wearing full PPE which included Coat, Helmet, Pants, Hood and Gloves. Victim 1 was wearing the following items under his PPE: Wool Station pants, t-shirt, socks, undergarments. Victim 2 was wearing the following items under his PPE: t-shirt, socks and undergarments.

NIOSH

The complete PPE garments of Victim 1 and Victim 2, along with several additional items from members that suffered other injuries, were shipped to the National Institute for Occupational Safety and Health (NIOSH) facility in Morgantown, West Virginia for inspection and review.

NIOSH completed visual inspections of all garments provided by the San Francisco Fire Department.

On December 9, 2011, the Safety Investigation Team met with the NIOSH representative who inspected the PPE garments. The NIOSH representative indicated that her findings were that the PPE performed as it was intended. The conclusions were that the PPE worn by Victims 1 and 2 were exposed to temperatures of approximately 500°F.

At the time of the writing of this report, the final report from NIOSH has not been completed.

LION Apparel (PPE manufacturer)

A representative from LION Apparel traveled to the NIOSH facility in Morgantown, West Virginia on July 19, 2011 to conduct a review and inspection of the PPE.

Lion Apparel’s conclusion is as follows:

The turnout gear coat of Victim 1 showed dye sublimation from high levels of heat exposure, indicating extreme levels of heat exposure in those areas. The pants of Victim 1 and the coat and pants of Victim 2 do not indicate any dye sublimation. In both cases, although the heat may have been at severe emergency levels, the materials used in the gear did not reach extreme temperatures to have destroyed the fabrics. The degradation temperature of the high heat and flame resistant fibers used in the various outer shells of the garment are approximately 800°F to 1000°F for the Fusion (Nomex and Kevlar) outer shell and 1000°F-1200°F for the PBI Matrix (PBI and Kevlar) outer shell.
Based on the condition of the materials, the surface temperature of the garment fabrics did not reach degradation temperature, otherwise heavy charring or break open would have occurred. Flashover conditions can expose Firefighters to air temperatures of approximately 1800°F. In these extreme conditions, in less than 45 seconds, enough heat can transfer through the protective clothing system to cause severe injury or death to a Firefighter wearing full protective clothing, however, depending on the conditions, the exposure may not be high enough and long enough to cause the garment materials to reach degradation temperature.

Compared to existing samples of new outer shell materials exposed to various thermal conditions for 5 minutes, it is estimated that the surface temperature of the gear reached the 550°F -700°F range. The critical thermal protection components such as the outer shell, thermal liner, moisture barrier, reinforcements and major A seams appeared to have been in good condition prior to the incident, and were not worn out or damaged. The garments performed as intended.
SELF CONTAINED BREATHING APPARATUS (SCBA)
REPORT FROM NIOSH

SCBAs were collected from Victims 1 and 2 at the scene and held in a secure location. The San Francisco Police Department Crime Lab photographed the units in the presence of a SFFD Safety Investigation Team member. The units were secured in Police Custody to await NIOSH Investigators.

After consultation with the NIOSH On-Scene Investigation Team, the SCBAs were packaged and shipped to the NIOSH Facility in Bruceton, PA. The SCBAs arrived on June 22, 2011 at the NIOSH facility.

A general inspection of the SCBAs was conducted on August 24 and 25, 2011. The main findings of the inspection were:

- Both units exhibited minimal heat damage
- Both units exhibited signs of wear and tear
- Both units had the cylinder valves in the closed position and empty
- Visibility through both lenses was poor as the lenses were black and covered in soot
- The backpack harnesses on both units were in good condition with no fraying or tears.
- The mask head harness on both units were dirty

On September 18 and 26, 2011, Unit #2 was operationally checked in accordance with NFPA 1981 Standards, 1997 Edition. The SCBA Unit passed all testing.

SCBA Unit #1 was not tested by NIOSH due to the damage level of the SCBA (low pressure air hose to regulator was cut, NIOSH is not certified to conduct repairs to equipment). Upon arrival back at the SFFD, Unit #1 was tested by a certified technician (SFFD member). Technician replaced low pressure air hose and duplicated the same test that NIOSH conducted on Unit #2. Unit #1 passed all tests.

Neither NIOSH, nor the SFFD technician, tested SCBA mask on Unit #1 due to missing voice emitters.
Unit #1 and Unit #2 SCBAs were manufactured and put into service in 2001. In 2005, the NFPA issued an alert notice entitled "PASS alarms signals can fail at high temperatures". According to this report, high temperature exposures can cause the volume of PASS alarm signals to be reduced. While there are no reports of SCOTT SCBA with this problem, the Investigation Team through interviews, has concerns regarding the PASS audible operations. Several members interviewed reported not hearing any, or hearing low volume PASS alarms, at this incident. The new 2007 edition of NFPA 1982 addressed this issue along with water ingress in the electronic and power supply compartments. The SFFD's current SCBA do not meet the 2007 edition.

Victim 1's SCBA note the heavy sooting
Victim 1’s SCBA low pressure hose. This hose was cut during rescue operation (hose/mask was wedged under vehicle’s tire in garage).

Victim 2’s SCBA with Helmet, note the heavy sooting.
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PORTABLE RADIOS

All members operating on the fireground were equipped with an 800 Mhz Fire Department issued portable radio. All Firefighter's radios were equipped with remote speaker/microphones. Victim 1 and 2's radios showed extreme heat damage.

Victim 1 had a portable radio located in the large lower left coat pocket with the remote speaker/microphone running along the outside of the coat to the collar area.
Victim 1’s radio

Victim 1’s radio
Victim 2 had a portable radio. The Safety Investigation Team was unable to determine the location to which the portable radio was carried (picture of radio in coat pocket not available).
Engine 24 Officer had a portable radio located in the upper radio pocket on the left side of the coat with the remote speaker/microphone attached to the radio speaker/microphone tab on left side of coat.

Findings of the radio test were:

The portable radios were tested on July 14, 2011 by a technician at the City and County of San Francisco’s Radio Shop. The report is included as Attachment I. For this report, Victim 1’s radio is the second radio tested, Victim 2’s radio is the third radio tested and Engine 24 Officer’s radio is the first radio tested.

Victim 1’s remote speaker/microphone failed due to high heat/fire, causing constant transmit condition. This disabled the radio from transmitting or receiving after 60 seconds.

Victim 2’s remote speaker/microphone failed due to high heat/fire, causing no transmit or receive functions.
Engine 24 Officer’s radio and remote speaker/microphone functioned normally.

The test results showed that when the remote speakers/microphones on Victim 1 and 2’s portable radios were removed, the radios operated correctly.

The test also showed that even with the damage that the remote speaker/microphone cord received, the Emergency Button on Victim 1 and 2’s portable radios still operated correctly.

After testing, the Safety Investigation Team was unable to determine when the remote speaker/microphone’s failed. The Safety Investigation Team does know that 7 attempts were made to contact Engine 26 via the radio, with no response. The Safety Investigation Team has found no information that an Emergency Traffic or Mayday transmission was received from either Victim 1 or 2. The Investigation Team has found no record of either Victim 1 or 2 activating their emergency button on their portable radio.

The Safety Investigation Team has determined, through manufacturer’s specifications, that the remote speaker/microphone has an operating temperature of -30°C to +60°C (22°F to +140°F). The manufacturer testing of the system is for a Thermal Shock level of -57°C to +80°C (-71°F to +176°F) (See Attachment K).

At the time of writing this report, the National Fire Protection Association (NFPA) has no standard that manufacturers must meet regarding portable radios for firefighting use. The Chief of Department sent a letter on November 3, 2011 to NFPA requesting a standard to be adopted (See Attachment M).

The Safety Investigation Team spoke with members from the National Institute of Standards and Technology (NIST) regarding NIST Technical Report 1477 “Testing of Portable Radios in a Fire Fighting Environment” published August 2006. The findings in this report indicated that portable radio remote speaker/microphone were subject to heat damage under fire fighting conditions. A finding noted in this report is that, since Firefighter turnout gear is designed to protect Firefighters exposed to thermal Class III conditions*, handheld radios should be constructed to handle these conditions. NIST also recommended that the NFPA develop a radio standard that would include requirements for the thermal testing of handheld radios.

The Safety Investigation Team met with representatives from Motorola regarding the portable radios (See Attachment J).

*NIST defines Thermal III Class as a maximum exposure of 5 minutes with Maximum temperatures of 260°C/500°F.
RECOMMENDATIONS

1. Incident Commanders should ensure that when a Company/(and/or) personnel has not responded to several radio attempts, immediate steps shall be taken to deploy resources to locate the Company/personnel.

   Engine 26 was called via radio multiple times with no response. At one time, the Incident Commander thought Engine 26 responded, however this could not be verified. The Safety Investigation Team, after carefully reviewing audio tapes, discovered that it was Battalion 6 looking for Engine 26 (See Recommendation 9).

   ICS Manual Section 2-6: Should a situation occur where a later arriving Company or Chief Officer cannot locate or communicate with Command (after several radio attempts), they will assume and announce their assumption of Command and initiate whatever actions are necessary to confirm the safety of the missing crew.

2. Incident Support Specialist shall initiate an Incident Command Worksheet immediately and begin the tracking of all resources. An accurately completed fireground Incident Command Worksheet should assist in the transfer of Command.

   The Investigation found that the initial Incident Support Specialist’s Incident Command Worksheet did not have the location and assignments of all assigned resources.

3. All Companies operating on the incident scene must keep the Incident Commander updated when changing from one location to another. The ISS tracking resources on the SFFD Incident Command Worksheet must ensure this information is documented (i.e. Engine 65 moving from second floor up to third floor).

   Battalion 9 (Fire Attack) changed point of entry for Fire Attack from Interior stairs to making entry from Bravo Side. This was not reflected on the Incident Command Worksheet.
4. The Incident Commander should use all available resources to increase his/her situational awareness during an incident.

The Safety Investigation Team found that the Incident Commanders were presented with significant challenges in gaining critical information, such as the building layout, and location/extent of fire. The Incident Commanders made several attempts to acquire this information by contacting the building occupant, as well as attempting to contact the Companies operating at the scene. The use of all available resources, including Incident Support Specialists if available, should assist in the gathering of information to increase situational awareness.

5. Crews on the fireground should update the Incident Commander when they are unable to complete an assignment due to a change in conditions/events.

Engine 24 and Rescue Squad 1 were unable to make entry through the garage due to extreme heat and smoke conditions. While the Incident Commander was able to see Engine 24 and Rescue 1 exiting from the garage, the Incident Commander was never informed of the conditions that prevented Engine 24 and Rescue 1 from entering the house through the garage.

ICS Manual Section 3-9: Command must be advised immediately of significant changes, particularly those involving the ability or inability to complete an objective, hazardous conditions, accidents, structural collapse, etc.

6. Second due Engine Companies should ensure that the first due Engine Company’s hoseline is in position and operating correctly.

Multiple Engine companies on the scene proceeded to deploy and advance hoselines prior to confirming that Engine 26’s hoseline was in the proper location and operating correctly.

7. Truck and Rescue Squad Companies should notify Command when they split their crews with the assignment/location of each team, so that they are accurately accounted for in the Incident Command Worksheet.

Truck 11 and Rescue Squad 1 appropriately split their crews to conduct various tasks which were not accurately documented on the Incident Worksheet.
8. The Department should reinforce that Officers are not to be on the nozzle.

The Investigation found that Officers were on the nozzle instead of being in the position to function as the Company Officer. The Company Officer has the responsibility for the actions of their entire crew. Officers need to be in a position to observe conditions and monitor the radio. Company Officers need to stay aware of changes in conditions that may influence their situational awareness.

9. The Division of Emergency Communications shall ensure that all features of the radio system are available and functioning.

The Division of Emergency Communications experienced a breakdown of the mobile data communications portion of the radio system on May 12, 2011. After the system was restored, a secondary component of the Fire Communications was not reactivated. This component allows the Division of Emergency (DEC) to track the Push to Talk buttons of every radio on the fireground and is able to create a report that would allow Investigators and Dispatchers to monitor which radio transmitted, at what time, and for how long. This would have allowed the Investigation Team to identify any unintelligible transmissions. At the time of the writing of this report the Investigation Team has confirmed that this feature has been restored in the radio system, however, it is recommended that a checklist be developed to ensure full functionality of this feature in the event of a future breakdown.

10. The Department shall work with the DEC to develop policy and protocols regarding critical communications between DEC and the Incident Command Post. The policy should clarify the roles of the Department and DEC in the coverage and monitoring of the Control Command and Tactical Channels (if activated).

Engine 20 accidentally activated their emergency alarm while en route to the incident. DEC communicated over the Tactical Channel this information to the Command Post while fireground units were attempting to relay Emergency Traffic/Mayday information to the Incident Commander.

When the Incident Commander became aware of a Firefighter emergency, he notified the DEC via the Tactical Channel that a RIC operation was in effect and requested additional resources. This could have stepped over other transmissions on the fireground and/or could have been missed by the DEC.
11. The Department should research and determine feasibility of purchasing radio systems to enhance verbal and radio communications in conjunction with properly worn SCBA.

The Department should research and determine feasibility of purchasing integrated systems that will allow Firefighters to communicate more clearly while wearing their SCBA.

12. The Department should work with manufacturers in order to research radio equipment that can sustain heat conditions which Firefighters experience.

The damage on the radios of Victims 1 and 2 was to the coiled cord between the radio attachment and the remote speaker/microphone. According to manufacturer’s specifications the maximum operating temperature of the remote speaker/microphones is +140 °F with a thermal shock of +176°F. (As of the writing of this report the Department is working with Lion Apparel to develop a protective sleeve for the remote speaker/microphone cords.)

13. The Department should make a request to the NFPA to develop a standard on the use of Portable radios under firefighting conditions.

At the time of this report, the NFPA does not have a standard for portable radios used under firefighting conditions. In 2006, NIST recommended that a standard be developed regarding the use of portable radios for Firefighters. The Chief of Department sent a letter on November 3, 2011 to NFPA making this request (See Attachment M).

14. The Department should review and update a standardized location and type of name identification for the Personal Protective Equipment (PPE).

At the scene of this incident, members were unable to readily identify who the victims were inside or outside the building. Also during the investigation, while analyzing photographic evidence, the names of members on a uniformed/designated location on the turnouts would have allowed for a quicker identification of members located on the fireground.
15. The Department should work toward updating SCBA to the current NFPA standard.

The SFFD should purchase SCBA that meet the 2007 edition of the NFPA 1982 Standard. The SFFD has applied for a grant to purchase the new SCBA and replace all the units in the Department. (See Self Contained Breathing Apparatus Report from NIOSH, page 91.) Current SCBA meet the 1997 edition of the NFPA 1982 Standard.

16. The Department should establish a Line of Duty Death/Serious Injury Investigation policy, including on scene procedures for the Incident Commander.

At the current time, the Chief of the Department, following a serious event, evaluates and determines if an investigation is warranted. If it is determined that an investigation will be conducted, the Chief will assign a Safety Investigation Team. (At the time of this report, the Department is reviewing a draft Line of Duty Death/Serious Injury Investigation Policy.)

17. The Department should develop an all Risk Management Policy.

Members should be able to use a procedure which includes a risk/benefit analysis in order to choose the appropriate action plan. (At the time of this report, the Department is reviewing a draft Risk Management Policy.)

18. The Department should develop a standardized transfer of command procedure for all incidents that would include situational status and complete accountability report.

During the transfer of command, there was not a clear understanding on the location and extent of the fire. In addition, all assigned resources were not accurately accounted for, nor was their location and assignment. The investigation found that the building description was inconsistent with ICS terminology as to the location of the fire and the assignment of resources (At the time of the writing of this report the Department is reviewing a draft policy for Command Post Operations).
19. The Department should develop a Standard Operating Guideline (SOG) for fighting fires in residences built on downhill slopes.

First arriving units started initial attack as they would with any normal single family residence. Buildings of this type, with large windows and with limited or no Fire Department access to the Charlie side, present a unique situation. Fires on lower levels of these buildings could place our members in extremely dangerous positions while conducting standard fireground operations.

20. The Department should develop a policy and procedure for coordinating ventilation operations.

At this incident, a window in Sublevel I failed (due to heat conditions), influencing the fire and causing the rapid extreme heat conditions to travel up the stairwell. All members operating on the fireground must understand how ventilation will influence the fire including the intensity and path. Ventilation must be coordinated with interior crews to ensure that members will not be placed in the “flow path”.

21. The Department should update their communications protocols to include Company acknowledgment of new assignments and critical information via radio.

At this incident, Command made multiple transmissions with critical information that was not acknowledged by multiple units. All Companies that received critical information or are assigned a task/assignment from Command via radio should acknowledge it by repeating it (i.e. “Fire Attack, this is Command, be advised you have heavy fire in the attic space; Command, Fire attack copies, heavy fire in the attic”).

22. The Department should develop a procedure in which Companies that are due for administrative duties (i.e. hearing, mask fitting, etc.) shall do so as a Company, in order to minimize understaffing of crews.

At this incident, two Engine Companies responded understaffed by one member.
23. The Department should develop a policy in which Companies will notify the responding Chief Officer/s when responding understaffed.

At this incident, the first two Engine Companies were responding understaffed and the Incident Commanders were not aware of this until late in the incident.

24. The Department shall ensure that all members wear appropriate Personal Protective Equipment (PPE) at incidents.

At this incident, not all members responding to the fire were in complete Personal Protective Equipment (PPE).

25. The Department should reinforce to the public the importance of calling 911 immediately in the event of an emergency.

The resident at the incident attempted to extinguish the fire prior to calling 911.

The Safety Investigation Team identified a need for a comprehensive and continuous training program that encompasses many of the recommendations that were listed above. The training program would include simulations that would enhance our members' knowledge and skills in the following areas:

- Situational Awareness
- Risk Management
- Command Post Operations
- Fireground Tactics including Engine and Truck Operations
- Safety
- ICS Terminology
- Mayday/Emergency Traffic/RIC
- Communications
- Building Construction
- Fire Behavior
- Single Action Plan
ATTACHMENT LIST

Attachment A - Green Sheet
Attachment B - Weather report
Attachment C - CAD printout
Attachment D - SFFD Incident Command Worksheet
Attachment E - SCBA Report from NIOSH
Attachment F - SCBA Report from SFFD
Attachment G - Mask Fit Reports
Attachment H - Personal Protective Equipment report from NIOSH
Attachment I - Portable Radios Report
Attachment J - Motorola Response to SFFD
Attachment K - Remote Speaker Microphone Fact Sheet
Attachment L - Bureau of Equipment E26 Pump test
Attachment M - NFPA request for Portable Radio Standard by Chief Hayes-White
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## ATTACHMENT A - GREEN SHEET

### Preliminary Injury Investigation 11-01
**Green Sheet**

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<tr>
<th>Date</th>
<th>Time</th>
<th>Inc.#</th>
<th>Location</th>
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<tbody>
<tr>
<td>06/02/11</td>
<td>1045 hrs</td>
<td>11050532</td>
<td>133 Berkeley Way</td>
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**Incident Facts**

3 story Type 5 single family residence with no visible fire but light smoke showing. The first Engine on the scene, Engine 26 led a 1 1/2" line through the main entrance in search of the fire. The 2nd engine led line through the garage and then was redirected to take the lead through the front door. The 3rd and 4th engines led lines to the 2nd level below grade where they found the fire and made an aggressive attack. The 1st truck laddered the building and conducted an interior search of the 2nd floor. The 2nd truck ventilated the roof of the building. During a primary search and checking for fire extension, members of Engine 24, T11, and Rescue Squad 1 found members of Engine 26 on the floor above the fire.

| Civilian Injuries/Deaths | None |

<table>
<thead>
<tr>
<th>Firefighter Injuries</th>
<th>Injury</th>
<th>Location</th>
<th>Cause</th>
<th>Comments</th>
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<tr>
<td>Firefighter #1</td>
<td>Fatality</td>
<td>Under Investigation</td>
<td>Under Investigation</td>
<td>Firefighter was wearing full PPE</td>
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<tr>
<td>Firefighter #2</td>
<td>Fatality</td>
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<td>Under Investigation</td>
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<tr>
<td>Firefighter #3</td>
<td>Burn</td>
<td>Neck</td>
<td>Heat of fire</td>
<td>Firefighter was wearing full PPE</td>
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<tr>
<td>Firefighter #4</td>
<td>Burn</td>
<td>Ear</td>
<td>Heat of fire</td>
<td>Firefighter was wearing full PPE</td>
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## ATTACHMENT B - WEATHER REPORT

**History for San Francisco, CA**

Thursday, June 2, 2011 — View Current Conditions

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<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
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<tbody>
<tr>
<td>Actual</td>
<td>Averages</td>
<td>Record</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature
- Mean Temperature: 87 °F
- Max Temperature: 89 °F
- Min Temperature: 81 °F

### Degree Days
- Heating Degree Days: 5
- Cooling Degree Days: 0
- Since 1 June heating degree days: 3
- Since 1 July heating degree days: 0
- Since 1 June cooling degree days: 0
- Since 1 July cooling degree days: 0
- Growing Degree Days: 0

### Humidity
- Average Humidity: 43%
- Minimum Humidity: 41%
- Maximum Humidity: 46%

### Precipitation
- Total Precipitation: 1 in
- March to date precipitation: 0.15 in
- Year to date precipitation: 12.31 in
- Since 1 July precipitation: 21.54 in

### Wind
- Max Wind Speed: 14 mph (SW)
- Max Gust Speed: 23 mph
- Visibility: 10 miles

### Events
- Source: NWS Daily Summary

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February 29, 2012
Supplemental Agenda, March 5-6, 2012
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### Hourly Observations

<table>
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<tr>
<th>Time (PDT)</th>
<th>Temp.</th>
<th>Dew Point</th>
<th>Humidity</th>
<th>Pressure</th>
<th>Visibility</th>
<th>Wind Dir</th>
<th>Wind Speed</th>
<th>Gust Speed</th>
<th>Precip / Events</th>
<th>Conditions</th>
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<tbody>
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<td>12:50 AM</td>
<td>61.1°F</td>
<td>48.9°F</td>
<td>65%</td>
<td>30.17 in</td>
<td>10.6 mi</td>
<td>South</td>
<td>4.6 mph</td>
<td>-</td>
<td>N/A</td>
<td>Scattered Clouds</td>
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<tr>
<td>1:50 AM</td>
<td>61.0°F</td>
<td>48.8°F</td>
<td>77%</td>
<td>30.07 in</td>
<td>10.7 mi</td>
<td>SSE</td>
<td>5.8 mph</td>
<td>-</td>
<td>N/A</td>
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<td>61.1°F</td>
<td>48.9°F</td>
<td>69%</td>
<td>30.17 in</td>
<td>10.6 mi</td>
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<td>Clear</td>
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<td>3:50 AM</td>
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<td>48.6°F</td>
<td>77%</td>
<td>30.17 in</td>
<td>10.9 mi</td>
<td>South</td>
<td>4.5 mph</td>
<td>-</td>
<td>N/A</td>
<td>Overcast</td>
</tr>
<tr>
<td>4:50 AM</td>
<td>61.0°F</td>
<td>48.9°F</td>
<td>77%</td>
<td>30.17 in</td>
<td>10.9 mi</td>
<td>South</td>
<td>3.8 mph</td>
<td>-</td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>5:50 AM</td>
<td>62.0°F</td>
<td>48.6°F</td>
<td>77%</td>
<td>30.16 in</td>
<td>10.9 mi</td>
<td>SSE</td>
<td>4.6 mph</td>
<td>-</td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>6:50 AM</td>
<td>53.1°F</td>
<td>45.8°F</td>
<td>77%</td>
<td>30.17 in</td>
<td>10.9 mi</td>
<td>SSE</td>
<td>4.6 mph</td>
<td>-</td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>7:50 AM</td>
<td>54.0°F</td>
<td>45.6°F</td>
<td>70%</td>
<td>30.18 in</td>
<td>10.5 mi</td>
<td>SSE</td>
<td>5.8 mph</td>
<td>-</td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>8:50 AM</td>
<td>55.9°F</td>
<td>45.6°F</td>
<td>67%</td>
<td>30.16 in</td>
<td>10.5 mi</td>
<td>SSE</td>
<td>4.5 mph</td>
<td>-</td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>9:50 AM</td>
<td>55.9°F</td>
<td>45.6°F</td>
<td>67%</td>
<td>30.21 in</td>
<td>8.0 mi</td>
<td>South</td>
<td>5.8 mph</td>
<td>-</td>
<td>0.00 in</td>
<td>Overcast</td>
</tr>
<tr>
<td>10:50 AM</td>
<td>57.0°F</td>
<td>46.9°F</td>
<td>69%</td>
<td>30.21 in</td>
<td>9.9 mi</td>
<td>South</td>
<td>6.8 mph</td>
<td>-</td>
<td>0.00 in</td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>11:00 AM</td>
<td>58.4°F</td>
<td>48.4°F</td>
<td>72%</td>
<td>30.29 in</td>
<td>10.3 mi</td>
<td>Calm</td>
<td>Calm</td>
<td></td>
<td>N/A</td>
<td>Mostly Cloudy</td>
</tr>
</tbody>
</table>

Show full METERS | METAR FAQ | Closest Detailed File

9/19/2011 11:19 AM
<table>
<thead>
<tr>
<th>Time (PDT)</th>
<th>Temp.</th>
<th>Dew Point</th>
<th>Humidity</th>
<th>Pressure</th>
<th>Visibility</th>
<th>Wind Dir</th>
<th>Wind Speed</th>
<th>Gust Speed</th>
<th>Precip</th>
<th>Events</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:56 AM</td>
<td>67.6°F</td>
<td>68.9°F</td>
<td>72%</td>
<td>10.11 in</td>
<td>10.0 mi</td>
<td>NE</td>
<td>4.6 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>12:22 PM</td>
<td>63.3°F</td>
<td>65.6°F</td>
<td>69%</td>
<td>10.00 in</td>
<td>10.0 mi</td>
<td>Variable</td>
<td>5.9 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
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<tr>
<td>1:53 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.00 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>13.8 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Overcast</td>
</tr>
<tr>
<td>2:53 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.18 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>13.8 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>3:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.18 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>16.1 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>4:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.17 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>17.3 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
</tr>
<tr>
<td>5:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.16 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>16.0 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
</tr>
<tr>
<td>6:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.14 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>13.8 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>7:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.14 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>12.7 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Mostly Cloudy</td>
</tr>
<tr>
<td>8:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.12 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>8.1 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
</tr>
<tr>
<td>9:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.12 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>6.9 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
</tr>
<tr>
<td>10:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.10 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>5.2 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
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<tr>
<td>11:56 PM</td>
<td>62.1°F</td>
<td>65.0°F</td>
<td>63%</td>
<td>10.09 in</td>
<td>10.0 mi</td>
<td>West</td>
<td>5.8 mph</td>
<td>-</td>
<td>NA</td>
<td></td>
<td>Scattered Clouds</td>
</tr>
</tbody>
</table>
Personal information and protected health information contained in the records has been redacted based on the privacy considerations expressed in the Federal Health Insurance Portability and Accountability Act (45 CFR §164), the Confidentiality of Medical Information Act (California Civil Code §56.20), the Public Records Act (California Government Code §6254(c)), and the San Francisco Sunshine Ordinance (SF Administrative Code §67.20 & §67.1(g)). Some of the information has been widely publicized in the media and has therefore become public domain. This information was therefore not redacted.
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ATTACHMENT E - SCBA REPORT FROM NIOSH

This report is a summary of the findings from the NIOSH investigative report for the SCBA for both victims. Victim 1’s SCBA was inspected but not functionally tested due to the low pressure regulator hose damage (the hose was cut during the removal of Victim 1). Victim 2’s SCBA met all the requirements and was fully tested.

Assistant Deputy Chief Frank Cardinale
Director of Training
2310 Folsom Street
San Francisco, California 94110

Dear Chief Cardinale:

The National Institute for Occupational Safety and Health (NIOSH) has concluded its investigation conducted under NIOSH Task Number TN-17888. This investigation consisted of the inspection of two Scott Health and Safety AirPak 4.5, 45-minute, 4500 psig, Self Contained Breathing Apparatus (SCBA) from the San Francisco, California, Fire Department. The SCBA units in question were contained inside corrugated cardboard boxes and were delivered to the NIOSH facility in Bruceton, Pennsylvania, on June 22, 2011. The packages were taken to the National Personal Protective Technology Laboratory (NPPTL), Technology Evaluation Branch (TEB) Respirator Equipment Storage Area (building 20) and stored under lock until the time of the examination and evaluation.

SCBA Inspection:

A general inspection of the SCBA units was conducted on August 24 and 25, 2011. The units were identified as the Scott Health and Safety AirPak 4.5 models.

The complete visual inspection of the SCBA units was conducted on August 24 and 25, 2011. The units were examined, component by component in the condition received, to determine conformance to the NIOSH-approved configuration. The visual inspection process was photographed.

The complete SCBA inspections are summarized in Appendix I of the enclosed Status Investigation Report. The condition of each major component was photographed with a digital camera. Images of the SCBA units are contained in Appendix III of the report.

The SCBA units in question, Unit #1 and Unit #2, suffered minimal heat damage, but exhibited other signs of wear and tear, and the units were covered lightly with general dirt and soot. The cylinder valves as received, Unit #1 was in the closed position and Unit #2 was in the closed position. The cylinder gauges read approximately 0 psig on Unit #1 but could not be read on Unit #2 but 0 psig remained in the cylinder.
The cylinder valve hand-wheels could be turned easily. The regulator and facepiece mating and sealing areas on the units were clean. The harness webbing on the units was in good condition with no fraying or tears, but both head harnesses were dirty. The PASS devices on the units functioned. The NFPA approval labels on the units were present and readable. Visibility through the lens of the Unit #1 facepiece was poor, as the lens was completely covered in soot and black. Visibility through the lens of Unit #2 was poor, as the lens was completely covered in soot and black.

**Personal Alert Safety System (PASS) Device**

The Personal Alert Safety System (PASS) device on Unit #1 and Unit #2 was operable and functional. The PASS devices were activated both manually and Unit #2 automatically and appeared to function normally. However, the units were not tested against the specific performance requirements of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, 1998 Edition. Because NIOSH does not certify PASS devices, no further evaluation was performed.

**SCBA Compressed Air Cylinder Contents**

During the inspection, it was noted that the compressed air cylinders were not pressurized. No air samples were collected for analysis as there was no air remaining in the cylinders.

**SCBA Testing**

The purpose of the testing was to determine the conformance of the SCBA to the approval performance requirements of Title 42, *Code of Federal Regulations*, Part 84 (42 CFR 84). Further testing was conducted to provide an indication of the conformance of the SCBA to the National Fire Protection Association (NFPA) Air Flow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 Edition.

**NIOSH SCBA Certification Tests** (in accordance with the performance requirements of 42 CFR 84):

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(e)]
6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]

7. Air Flow Performance Test [Chapter 5, 5-1.1]

Testing was only conducted on Unit #2 on September 18 and 26, 2011, using a substitute compressed air cylinder supplied by Scott Health and Safety. The SCBA unit did pass all testing.

Appendix II of the Statue Investigation Report contains complete NIOSH and NFPA test reports for the SCBA. Tables One and Two summarize the NIOSH and NFPA test results.

Summary and Conclusions

Two SCBA units were submitted to NIOSH/NPPTL by the NIOSH Division of Safety Research (DSR) for the San Francisco, California, Fire Department for evaluation on June 22, 2011. The SCBA’s were inspected on August 24 and 25, 2011. The units were identified as a Scott Health and Safety AirPak 4.5, 45-minute, 4500 psig SCBA (NIOSH approval number TC-13F-0212). The units were in fair condition but covered in soot. The cylinders appeared to be in specification as they are required to be recertified every 5 years and both cylinders were not past that required date.

The integrated PASS units were activated and appeared to function normally.

No air sample could be taken and analyzed from the compressed air cylinders as the cylinders were found to be empty upon delivery.

SCBA Unit #1 was not tested due to the damage level of the SCBA.

SCBA Unit #2 was tested on September 18 and 26, 2011, utilizing a replacement cylinder that was supplied by Scott Health and Safety. The unit did meet all the requirements as tested.

After the inspection and testing of the SCBA units, the respirators were placed back into storage pending the return to the San Francisco, California, Fire Department.

If these SCBA units are to be placed back into service, then the units should be cleaned, the cylinders replaced, and any damaged components replaced and tested by a qualified SCBA technician.
# SCOTT PosiChek3 Test Report

**SCOTT PosiChek3**

**Visual / Functional Test Results**

<table>
<thead>
<tr>
<th>Location</th>
<th>E-26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Air-Pak 4.5</td>
</tr>
<tr>
<td>ID</td>
<td>0115000045</td>
</tr>
<tr>
<td>Reducer S/N</td>
<td>011590646</td>
</tr>
<tr>
<td>Regulator S/N</td>
<td>01290322</td>
</tr>
<tr>
<td>Tested by</td>
<td>BAFF</td>
</tr>
<tr>
<td>Service Center</td>
<td>BARF</td>
</tr>
</tbody>
</table>

## Functional Tests

- **Facepiece Leak Test:** Pass 0.1 in. H2O
- **Exhalation Pressure:** Pass 2 in. H2O
- **Remote Gauge Test:** Cndl
- **Alarm Accuracy:** Pass 1031 PSI
- **Air Saver Switch:** Pass -5 in. H2O
- **Static Facepiece Pressure:** Pass 1 in. H2O
- **Primary Reducer Lockup:** Pass 105 PSI
- **Primary Creep:** Pass 0 PSI
- **Low Cylinder Transfer Pr:** Pass 1148 PSI
- **Secondary Reducer Lockup:** Pass 195 PSI
- **Secondary Reducer Creep:** Pass 0 PSI
- **Purge Flow Test:** Pass 10 L/min
- **High Pressure Leakage:** Pass 10 PSI
- **Secondary Pr. at High Cyl.:** Pass

## Breathing Resistance

**Standard Work Rate**

<table>
<thead>
<tr>
<th>Location</th>
<th>SAN FRANCISCO FIRE DEPT. 1495 EVANS STREET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Pressure (PSI)</td>
<td>0 1000 2000 3000 4000 5000</td>
</tr>
<tr>
<td>Facepiece Pressure (inches H2O)</td>
<td>0 1.3 2.3 3.3 4</td>
</tr>
</tbody>
</table>

**Maximum Work Rate (102 Liter Minute Vol)**

<table>
<thead>
<tr>
<th>Location</th>
<th>SAN FRANCISCO FIRE DEPT. 1495 EVANS STREET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Pressure (PSI)</td>
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</tr>
<tr>
<td>Facepiece Pressure (inches H2O)</td>
<td>0 1.3 2.3 3.3 4</td>
</tr>
</tbody>
</table>

## Comments

- Facepiece Pressure: Minimum 0.3 Maximum 2.3 in. H2O
- Facepiece Pressure: Minimum 0.3 Maximum 2.8 in. H2O

---

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**ATTACHMENT G - MASK FIT REPORTS**

<table>
<thead>
<tr>
<th>EXERCISE</th>
<th>DURATION (sec)</th>
<th>FIT FACTOR</th>
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<tbody>
<tr>
<td>NORMAL BREATHING</td>
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<td>1000</td>
<td>Y</td>
</tr>
<tr>
<td>DEEP BREATHING</td>
<td>60</td>
<td>3590</td>
<td>Y</td>
</tr>
<tr>
<td>HEAD SIDE TO SIDE</td>
<td>60</td>
<td>695</td>
<td>Y</td>
</tr>
<tr>
<td>HEAD UP AND DOWN</td>
<td>60</td>
<td>643</td>
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<tr>
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<td>GRIFFACE</td>
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<tr>
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<td>30380</td>
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<tr>
<td>NORMAL BREATHING</td>
<td>60</td>
<td>1800</td>
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</table>

- OVERALL FIT FACTOR: 1480
- FITTEST OPERATOR: [Name]
- DATE: 7/1/2010

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**FIT TEST REPORT**

<table>
<thead>
<tr>
<th>ID NUMBER</th>
<th>LAST NAME</th>
<th>FIRST NAME</th>
<th>AV ISSUED</th>
<th>CUSTOMER</th>
<th>CUSTOMER</th>
<th>CUSTOMER</th>
<th>CUSTOMER</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| TEST DATE | 02/24/2010 | PORTACOUNT S/N | 42973 | N95 COMPARISON | N |
| TEST TIME | 11:41       |                 |       |             |   |
| DUE DATE  | 02/22/2011  |                 |       |             |   |
| MANUFACTURER | SCOTT |     | PASS LEVEL | 500 |
| MODEL      | AV        |     | APPROVAL   |     |
| MASK STYLE | 3000 MEDI |     | EFFICIENCY <95% | N |
| MASK SIZE  | MED       |     |           |     |

<table>
<thead>
<tr>
<th>EXERCISE</th>
<th>DURATION (sec)</th>
<th>FIT FACTOR</th>
<th>PASS</th>
</tr>
</thead>
<tbody>
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<td>NORMAL BREATHING</td>
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</tr>
<tr>
<td>DEEP BREATHING</td>
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<td>3600</td>
<td>Y</td>
</tr>
<tr>
<td>HEAD SIDE TO SIDE</td>
<td>60</td>
<td>5120</td>
<td>Y</td>
</tr>
<tr>
<td>HEAD UP AND DOWN</td>
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<td>12000</td>
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<tr>
<td>TALKING</td>
<td>90</td>
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**OVERALL FIT FACTOR:** 3780  Y

FITS OPERATOR

**DATE:** 02/24/2010  

**DATE:** 02/24/2010  

**DATE:** 02/24/2010  

**DATE:** 02/24/2010  

**DATE:** 02/24/2010  

---

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## Supplemental Attachment 12-3-12

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## ATTACHMENT H - PERSONAL PROTECTIVE EQUIPMENT REPORT FROM LION APPAREL

### LION

San Francisco Fire Department Gear Review - Visual Evaluation

**Requested by:** San Francisco Fire Department  
**Date of Visual Inspection:** 07/15/2011  
**Location of Visual Inspection:** NIOSH Morgantown, WV  
**Performed by:** Karen Lebowitz, Director of Product, LION

<table>
<thead>
<tr>
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<th>Value Coats</th>
<th>Value Pants</th>
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<td>E20027</td>
<td>E30027</td>
</tr>
<tr>
<td>Mfg. Date: 03/04/2003</td>
<td></td>
<td>03/05/2003</td>
</tr>
<tr>
<td>Size: 41/42</td>
<td></td>
<td>34/36</td>
</tr>
<tr>
<td>Tag: N/A</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Shell: Fusor</td>
<td></td>
<td>Fusor</td>
</tr>
<tr>
<td>Moisture Barrier: Crottech</td>
<td></td>
<td>Crottech</td>
</tr>
<tr>
<td>Thermal Liner: Glide Arashi Quilt</td>
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<table>
<thead>
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<td>Mfg. Date: 04/25/2007</td>
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<td>44/36</td>
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<td>Thermal Liner: Glide Arashi</td>
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<td>Glide Arashi</td>
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<table>
<thead>
<tr>
<th>Garment Label Information</th>
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</thead>
<tbody>
<tr>
<td>Brand: Jrs Exhile</td>
<td></td>
</tr>
<tr>
<td>Mfg. Date: 11/01/2007</td>
<td></td>
</tr>
<tr>
<td>Size: 44/35R</td>
<td></td>
</tr>
<tr>
<td>Tag: N/A</td>
<td></td>
</tr>
<tr>
<td>Shell: PBH Matrix</td>
<td></td>
</tr>
<tr>
<td>Moisture Barrier: Crottech</td>
<td></td>
</tr>
<tr>
<td>Thermal Liner: Glide Arashi</td>
<td></td>
</tr>
</tbody>
</table>

We received a request from the San Francisco Fire Department to review the gear utilized during a residential fire that resulted in two LODD on 06/02/2011. The review of the PPE took place at NIOSH in Morgantown, WV as they were in possession of the gear conducting further investigations. No incident reports or injury reports were provided by the fire department, only news accounts of the incident were reviewed. The news accounts indicate that the firefighters were exposed to a flashover in the structure fire. Flashover temperatures can reach 1800 F or greater and cause severe injury or death to firefighters in less than one minute even while wearing all personal protective equipment.

### Valero Gear Evaluation

The following gear was reviewed for Valero, Structural firefighting helmet, coat, pants and boots. Firefighter Valero died in the line of duty.

The coat outer shell exhibits no major dislocation or damage. There is some slight discoloration in the upper body but nothing distinct. There was a small cut on the lower left hem area of the shell but there is no corresponding cut on the liner. On the thermal liner there is a cut near the upper right chest near the arm but there is no corresponding cut on the outer shell. There is slight thermal damage to the moisture barrier substrate of the face cloth of the
thermal liner where the outline of the visibility trim can be seen on the moisture barrier substrate. There is slight damage to the trim on the lower left back here of the coat, however this is slight discoloration. A limited view of the liner through the aforementioned cut showed no damage to the moisture barrier film or thermal liner laminate. From this limited viewing the moisture barrier seam tape also appeared to be intact. All coat shell and liner materials were supple and strong. There was no evidence of migration of the thermal liner. Seams were intact and functional. Closure hardware was intact and functional. Labels were sealed and somewhat faded, but intact and visible.

There is no visible thermal damage to the pants outer shell. There is also no thermal damage or discoloration on the liner face cloth, however there is some heavy creasing. Slight discoloration of the moisture barrier substrate can be seen on the rear of the garment but it is not distinct. There is a cut at the top of the liner; however the suspenders on the pants were cut so this most likely occurred when the suspender was cut. All pant shell and liner materials were supple and strong. There was no evidence of migration of the thermal liner. Seams were intact and functional. Closure hardware was intact and functional. Labels were sealed and somewhat faded, but intact and visible.

There was no visible damage to the boots. The helmet had severe heat damage and distortion and was heavily coated in soot; the helmet was a non-NFPA compliant model. There was also discoloration to the sides and top of the hood. This discoloration appeared to be an accumulation of products of combustion as there was no thermal damage such as charring to the hood.

Discoloration of the Passion outer shell fabric begins when the temperature of the fibers reach approximately 500°F. Visibility trim discolors when its temperature reaches approximately 350°F and the moisture barrier substrate will begin to discolor when its temperature reaches approximately 400°F. In order for the materials to reach these temperatures in a short period of time, the ambient air temperature would be required to be much higher. The benchmarks and condition of the gear indicate that the heat exposure in this case was more likely short and intense, which concurs with news accounts of the incident.

PPE Gear Evaluation
The following gear was reviewed for Perez: Structural firefighting helmet, goggles, hood, coat, pants, boots, gloves, strike uniform and undergarments. The garments were cut open for removal allowing more viewing access to the inner layers of the various gear. Lt. Perez died in the line of duty.

The coat shell has severe thermal discoloration / slight browning to the upper back and shoulder area but no breakthrough of the material. There is also some browning to the visibility trim, indicating the initial stages of charring, but embrittlement has not occurred. The moisture barrier substrate is browned, indicating the initial stages of charring. The outline of the visibility trim can be seen on the substrate. The right moisture barrier in the right shoulder area is beginning to part but is not broken open. In this same area the moisture barrier seam tape has loosened and re-adjusted including catching the thermal liner basting. The thermal liner face cloth is very soiled but there is no evidence of heat discoloration. Closure hardware was intact and functional. Labels on thermal liner and outer shell were sealed and somewhat faded, but intact and visible.

There is no visible heat discoloration on the helmet; however there is evidence of soot. There is no visible damage in the visibility trim. The moisture barrier fabric has some slight browning at the outline of the pants but there is no visible damage to the liner. The thermal liner material is intact and supple, and in good condition. However there is soiling and underbaking. The interior liner fabric padding in the areas of the protective pants were intact and supple and minimal embrittlement by the thermal conditions. Closure hardware was intact and functional. Labels on Inside label andsomewhat faded, but intact and visible. Overall, the material in the pants remains supple and moist.

There was no visible damage to the boots. The gloves were still supple and pliable. There was no thermal damage to the strike uniform or undergarments. The helmet and goggles had severe heat damage and distortion and were heavily coated in soot; the helmet and goggles were non-NFPA compliant models. The hood had discoloration from soiling and seating.

The thermal discoloration in the garments and other PPE components indicate a high level of heat exposure and build up to the PPE itself. Discoloration of the Passion outer shell fabric begins when the temperature of its fibers reach approximately 500°F. Visibility trim discolors when its temperature reaches approximately 350°F and the moisture barrier substrate will begin to brown and disintegrate when its temperature reaches approximately 400°F. In order for the materials to reach these temperatures in a short period of time, the ambient air temperature would be
required to be much higher. These benchmarks and condition of the gear indicate that the heat exposure in this case was most likely short and intense, which concurs with news accounts of the incident.

Gear Evaluation: Engine 11 Firefighter

The following gear was reviewed for Structural firefighting helmet, hood and coat. There were no reported injuries for firefighter.

No visible damage to the coat shell or visibility trim. There is some soiling but no thermal damage. There is also no visible damage to the thermal liner. This coat was equipped with an inspection opening allowing for a visual examination to the inside of the liner.

The helmet showed heat and soiling buildup but minimal distortion; the helmet was a non-NFPA compliant model. There was no damage noted to the gloves or hood.

The condition of the gear and other PPE components indicate a severe level of heat exposure.

Gear Evaluation: Engine 11 Firefighter

The following gear was reviewed for Structural firefighting helmet, gloves and hood. There were no reported injuries for firefighter.

The helmet showed heat and soiling buildup but minimal distortion. There was no label on the helmet; therefore NFPA certification could not be verified. There was no damage noted to the gloves. The hood had a small hole in the back of the head area that appeared to be a cut.

No estimates can be made on the amount of heat sustained without further review of other PPE elements utilized, including the turnout gear.

Discussion

The insulating test of these tested and replicated these high-thermal扛heat exposure, indicating extreme levels of heat exposure in these areas. The pants of Fencer and the coat and pants of Officers did indicate any-like insulating. In both cases, although the heat may have been at severe emergency levels, the materials used in the gear did not reach maximum temperature to have destroyed the fabric. The degradation temperature of the fabric and fiber materials was noted to be the onset of charring at approximately 500°F to 1000°F for the turnout helmet and jacket, outer shell and Kevlar® material. Based on the condition of the materials, the surface temperature of the turnout helmet fell short of degradation temperature, otherwise heavy bending or break open would have occurred.

Flashover conditions can expose firefighters to air temperatures of approximately 1100°F. In these extreme conditions in less than 45 seconds, enough heat can transfer through the protective clothing system to cause severe injury or death to the firefighter wearing full protective clothing, but depending on the conditions the exposure may not be high enough and long enough to cause the protective materials to reach degradation temperature.

Compared to existing samples of new outer shell materials exposed to various thermal conditions for 5 minutes, I estimate that the surface temperature of the gear reached the 590°F - 700°F range. The critical thermal protection components such as the outer shell, thermal liner, maximum barrier, reinforcements and Kevlar® shell appeared to have been in good condition prior to the incident and were not worn out or damaged. The garments performed as intended.

Do not hesitate to contact me should you have any questions.

Sincerely,

Karen LeBlanc
Director, PPE Program...
ATTACHMENT I - PORTABLE RADIOS REPORT

Assistant Chief David Franklin
San Francisco Fire Department/Division 3
2300 Folsom Street
San Francisco CA 94110

On today's date, July 14, 2011 at 10:00am, I received three Motorola portable radios for inspection and have been asked to document my findings regarding their operational status and condition. I will differentiate between damage to the radio and its accessories separately. All radios were found set to A16 and had speaker microphones, depleted batteries and antennas attached to them.

The first radio I inspected is an XTS5000 Model 2, ID number 703206, serial number 721CHT1974. I removed the depleted battery and attached a fresh battery, and turned on the radio. I found the top of the radio to be covered in soot but all controls and functions were operational. The rest of the radio was dirty with wear and abrasions that did not affect the radio's performance. The speaker microphone attached to the radio is covered in soot and smells of smoke but is operational. The antenna was intact and also free of damage. I took apart the radio for an interior inspection and found no damage. A radio check was conducted with dispatch and transmissions were clear. The radio was purchased from Motorola and entered service in September, 2007. According to maintenance records it has not been in need of service since its acquisition.

Findings: Radio and its accessories functioned normally with fresh battery attached.

The second radio I inspected is an XTS5000 Model 2, ID number 703183, serial number 721CGK1200. I found the radio's top portion to be covered in soot and smell of smoke but did not observe any fire related damage. The radio was dirty, had wear and abrasions, and the power and channel knobs were missing. There was a speaker microphone, depleted battery and deformed antenna attached to the radio. The antenna's rubber coating had melted and the antenna had become misshapen. I attached a fresh battery, turned the radio on and observed the radio...
to be constantly transmitting on its own. After 60 seconds the radio emitted a steady bonking noise.

Note: Radios are programmed, via a 'time-out timer', to stop transmitting after the transmit button has been depressed longer than 60 seconds. This is to prevent a 'hot mic' condition from draining the battery. The radio will emit this steady bonking noise indicating you still have this button depressed. This is an audible warning that you are no longer transmitting and to release the transmit button.

I removed the speaker microphone from the radio and the radio stopped transmitting, indicating the transmit problem was in the speaker microphone and not the radio. The speaker microphone’s cord has suffered extensive heat damage as it was rigid, misshapen and stretched. I checked the radio’s transmit, receive and Emergency capabilities without the microphone attached and all performed normally, even with a deformed antenna. I then attached a new speaker microphone to the radio for testing purposes. A radio check with dispatch exhibited no problems in transmit or receive. I removed the new microphone and reattached the old one to see if the radio would go into Emergency while transmitting. With the faulty speaker microphone attached to the radio, and the radio stuck in transmit, I successfully sent out an Emergency signal on A16 to dispatch who was able to acknowledge and clear it. Dispatch was able to see the radio’s ID number and to whom it was aliased. Further testing revealed that the speaker microphone’s coiled cord, not the microphone body itself, had suffered heat damage causing the internal wiring to melt together and create a constant transmit problem. I disassembled the radio for an interior inspection and found no damage. This radio was purchased from Motorola and entered service in May, 2005 and according to maintenance records it has not been in need of service since its acquisition.

Findings: Speaker microphone failed due to high heat/fire, causing constant transmit condition. This disabled the radio from transmitting or receiving after 60 seconds.
The third radio I inspected is an XTS3000 Model 3, ID number 703064, serial number 326CCY4098. I found the top portion of the radio to be covered in soot, and smell of smoke. The rest of the radio was dirty with wear and abrasions. The top portion of the antenna was melted but still intact. The speaker microphone’s cord was broken and frayed in multiple places, exposing its internal wiring. I removed the depleted battery and replaced it with a fresh battery. I turned the radio on and tried to transmit using the speaker microphone but it did not work, nor did the radio receive. I removed the speaker microphone from the radio and conducted a successful radio check with dispatch. I attached a new speaker microphone and the radio successfully transmitted and received, indicating the old speaker microphone was faulty. I disassembled the speaker microphone and determined that the collared cord had failed and not the microphone body. I reattached the faulty speaker microphone and successfully sent out an Emergency signal to dispatch on A16, who was able to acknowledge and clear it even though I could not hear them. It was found this radio had not been aliased and that dispatch was only able to see the radio’s ID number. I disassembled the radio to perform an internal inspection and found no damage. The radio was purchased from Motorola and entered service in December, 2002. It was last in for service on August 29, 2008 for poor transmit function. The radio was aligned and calibrated and returned to service shortly thereafter.

Findings: Speaker microphone failed due to high heat/fire, causing no transmit or receive functions. Dispatch could not determine to whom the radio was assigned.

Gene Ashton
Radio Communications Technician
Department of Technology
901 Rankin Street
San Francisco CA 94124
(415) 550-2734 desk
ATTACHMENT J - MOTOROLA RESPONSE TO SFFD

September 21, 2011

Assistant Chief David Franklin
City and County of San Francisco, Fire Department

Subject: Inquiry Regarding Motorola Communications Equipment

Chief Franklin

Motorola Solutions would like to thank the San Francisco Fire Department for allowing Motorola the opportunity to provide greater detail concerning our communications products. As we discussed at our meeting on August 31st, 2011, the Department asked Motorola to provide it information related to the following topics:

1. Has Motorola ever been contacted by another customer regarding a melted Remote Speaker Microphone (RSM) cord?

Response Number 1. Motorola has reviewed our database going back seven years for any formal customer quality cases submitted for the remote speaker microphones (RSM) used in this occurrence and as well as an additional, similar product. We did not find any cases pertaining to melted or overheated RSM cords for either product. Motorola also remains very active in the Public Safety community, including holding and participating in formal roundtable discussions at industry trade shows as well as customer meetings. On August 23, 2011, Motorola Solutions hosted a Chiefs Roundtable discussion during the Fire Rescue International (FRI) meetings in Atlanta. About 35 Fire Chiefs attended from around the U.S. In the course of general discussions, one chief commented that “rubber and plastic cannot withstand the high heat that they have to endure.” There was general agreement from the Fire Chiefs that NFPA standards were in need of development to focus on this area.

2. If so (reference question 1), what guidance or corrective action did Motorola have for that customer?

Response Number 2. Again, Motorola did not find any cases submitted for corrective action related to the RSM used in this occurrence. However, Motorola continues to remain very active in the Public Safety industry in an effort to understand our customers’ needs through Voice of Customer (VoC) research as well as participating in and monitoring industry standards that relate to our communications products. To date, the industry has not defined environmental specifications beyond those provided under MIL Standard 810.

(See Response Number 3 below.) Motorola will continue, however, to work directly with our customers to better understand each Department’s specific needs.

3. Can Motorola provide the testing parameters, specific testing procedures, our subscriber and accessory designs must meet?

Response Number 3. Motorola designs its Mission Critical radios and accessory products to pass a suite of environmental tests performed according to an internal (proprietary) test standard based on the MIL-STD-810 methodologies. Mission Critical remote speaker microphones are designed to operate in an ambient environmental temperature range of +60°C (+140°F) to -30°C (-22°F). The challenge is to design and manufacture products that not only are capable of being used in high temperature environments, but also
are able to withstand other environmental impacts. The following outlines additional environmental testing that Motorola products must satisfy:

Storage Temp: -55°C to +85°C  
Thermal Shocks: -57°C to +80°C  
Humidity: 90-95% relative humidity at +30 C for 8 hours  
Rain: MIL810F Method 506.4  
Salt/Fog: MIL810F Method 509.4, Procedure 1  
Dust MIL810F: Method 510.4, Procedure 1  
Vibration: MIL810F Method 514.5, Procedure 1, Category 24  
Mechanical Shock: MIL810F, Method 516.5, Procedure 1  
ESD: IEC/EN61000-4-2

4. Can the XTS Subscriber be programmed to have audio (talk and listen) come through BOTH the Remote Speaker Mic (RSM) and radio speaker?

Response Number 4: The audio can only be routed to one speaker—either the RSM or the radio’s speaker. When the RSM is attached to the radio, the receiving audio is routed through the RSM.

To activate the Push to Talk (PTT), both the RSM and Radio PTT can be used. However, this transmitting audio is only sourced from the location of the PTT. In other words, if the PTT on the radio is pushed, then audio will be transmitted only from the radio mic. If the PTT on the remote speaker mic is pushed, then audio will only be transmitted from the remote speaker mic.

5. Can Motorola provide a “best practices” information for fire departments who Motorola subscriber radios with a Remote Speaker Mic attached?

Response Number 5: As far as best practices, Motorola would suggest the IAPC Best Practices presentation, which we provide here, as well as the video “Say It Loud and Clear,” which can be found at www.motorola.com/fire under “Featured Items.” In addition, Motorola has and will continue to work closely with each of our individual customers to help provide information and guidance on the use of our communications equipment. Through this effort, we have found that many departments are unique as it pertains to their specific SOP on wearing and using communications equipment. Motorola is interested in meeting with SFFD in future customer research settings to better understand the specific needs of SFFD.

6. Can Motorola advise if they, or know anyone in the industry, making progress towards improving the 140 degree temperature limit on the RSM?

Response Number 6: At this time, Motorola is not aware of any RSMs in the two-way radio audio accessory industry, or any two-way radio accessory product development companies, currently pursuing RSMs that operate at temperatures greater than 140°F (+60°C).

Motorola continually gathers different industry inputs through a Voice of Customer (VoC) process employed to understand and support diverse aspects of customer experiences, from solution roadmaps to specific product requirements to operational experiences. Because of the proprietary nature of some of these product development activities, Motorola is unfortunately unable to share details in a public setting but is willing to have further discussions in a private meeting, with certain protections in place.
Sincerely,

Motorola Solutions, Inc.

[Signature]

Mark Schludi
MSSSI Vice President
Motorola Solutions Sales and Services, Inc.

Attachment
Motorola Remote Speaker Microphones Enhance Communication

Introducing Remote Speaker Microphones that offer Windporting, Noise-Cancelling Acoustics and/or IP57 Submersibility features

Motorola's Remote Speaker Microphones (RSMs) are a vital two-way radio accessory solution for users who need to talk and listen without removing the radio from their belt or carry case. These RSMs boast new features that give public safety professionals the confidence of clear, understandable communication even when Mother Nature is uncooperative.

Four RSMs are available with a variety of features giving police, firefighters and other public safety officials the flexibility to choose the solution ideal for their needs:

- With omni-directional acoustics, the RSM picks up sound equally well from all directions.
- IP57 submersibility ratings provide reliable communications even in wet conditions.
- When injuries or emergencies arise, emergency-button-equipped RSMs can be used to signal that the operator needs help—a critical feature for public safety professionals.
- Volume buttons allow the user to adjust the audio volume without having to remove the radio.
- An audio jack located at the front of the microphone allows users to receive discreet audio communication, with an additional earpiece accessory. The new location of the audio jack eliminates unnecessary wires.

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- Volume buttons allow the user to adjust the audio volume without having to remove the radio.
- An audio jack located at the front of the microphone allows users to receive discreet audio communication, with an additional earpiece accessory. The new location of the audio jack eliminates unnecessary wires.
Note: on the column environmental specifications the temperatures are in Celsius (C).
The range of -30°C to 60°C is -22°F to 140°F. However as seen in the previous letter from Motorola the thermal shock test for the remote microphones is 80°C (176°F)
ATTACHMENT L - BUREAU OF EQUIPMENT E26 PUMP TEST

SAN FRANCISCO FIRE DEPARTMENT

Date: JUNE 3, 2011
From: BARRY, Paul L. H-2 Bureau of Equipment Tour 1
To: ADC Frank Cardinale, Division of Training
Subject: Pump Test E-26
Reference: SFFD Pump Test form attached

On this date, FF James Hodgins and myself performed a pump test to E-26, a 1991 Spartan triple combination pumper #145-559. The apparatus was found to be in generally good running condition and performed all functions consistent with age. The fire pump did not meet specification for capacity pumping to 1500 gpm, but did perform to an acceptable standard for both 70% and 50% pressure tests. This pump test was performed at Twin Peaks reservoir and the pump was operated from draft. The decrease in capacity output of this pump would not affect the operation of two 1-3/4 attack hose leads.
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ATTACHMENT M - LETTER TO NFPA REQUESTING A STANDARD FOR PORTABLE RADIOS

JOANNE HAYES-WHITE
CHIEF OF DEPARTMENT

EDWIN M. LEE
MAYOR

SAN FRANCISCO FIRE DEPARTMENT
CITY AND COUNTY OF SAN FRANCISCO

VIA CERTIFIED MAIL

November 3, 2011

Amy Beasley Cronin
Secretary, NFPA Standards Council
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Dear Ms. Cronin,

The San Francisco Fire Department (SFFD) suffered tragic multiple Line of Duty Deaths as a result of a fire that occurred on June 2, 2011. Lieutenant (Lt) Vincent Perez died on June 2, 2011 and Firefighter/Paramedic (FF/Pa) Anthony Valerio died on June 4, 2011.

During our investigation a very troubling matter surfaced with regard to equipment used by Lt. Perez and FF/Pa Valerio, specifically the portable radios with remote speaker/microphones attached. Our testing and investigation determined that both members' portable radio remote speaker/microphones failed due to the heat from the fire.

The investigation was able to determine that the cord that connects the radio and the remote speaker/microphone had melted, rendering the remote speaker/microphone inoperable.

The SFFD Investigative Team researched the remote speaker/microphones and found that the operating temperature, per the manufacturer specification sheet, states that the normal operating temperature range for the remote speaker/microphones is between -30s to +60s. This temperature range does not appear adequate for the conditions Firefighters encounter in the course of their duties.

The Investigative Team spoke with several fire service experts throughout the County regarding the remote speaker/microphones and the lack of regulations that the manufacturers must meet with regards to the heat threshold that the portable radios can operate in.

The Investigative Team was able to speak with the National Institute of Standards and Technology (NIST) regarding a study they had conducted in 2006 regarding the operations of portable radios under varying heat levels common to which Firefighters may encounter in the course of their duties. The study (NIST technical report #1477) indicated that the remote speaker/microphones would not withstand the intense heat conditions that Firefighters may encounter. In the research, NIST indicated that the cords would melt and fail.

The Investigative Team was unable to locate or reference a current NFPA standard that portable radio manufacturers must meet that takes into account the conditions that Firefighters encounter. NFPA sets very
high standards for personal protective equipment (PPE) in order to keep our Firefighters safe. Unfortunately, the same standards are not currently regulated for communication equipment for the Fire Service.

I respectfully urge NFPA to research and develop a standard for Firefighters for portable radios and the remote speaker microphones, similar to those standards developed for the heat condition requirements for PPEs. A Firefighter should feel confident that the equipment provided for their protection is of the highest quality and will endure the most extreme conditions to keep them safe. The portable radio is a key piece of equipment that each and every Firefighter utilizes and depends on to allow them to communicate when they are operating in an immediately dangerous to life or health (IDLH) environment.

Please do not hesitate to contact Assistant Chief David Franklin regarding our Department’s findings related to the line-of-duty death as a result of the June 2, 2011 fire. Assistant Chief Franklin, who is assigned as a member of the Investigative Team, can be reached via email at [redacted] or on his cell phone at [redacted].

Thank you for your continued support in researching and developing standards to help protect, support and assist members of the Fire Service.

Sincerely,

[Signature]

[Name]

Chief of Department

cc: Assistant Chief Dave Franklin, Division 3
Item 12-3-13
### New Project Initiation Form

(To be completed by proponent of new project/document)

Additional pages may be attached if necessary.

<table>
<thead>
<tr>
<th><strong>a.</strong> Explain the Scope of the new project/document:</th>
<th>Minimum performance requirements and test methods for flame resistant gloves and hoods for use in areas at risk from flash fires.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b.</strong> Provide an explanation and any evidence of the need for the new project/document:</td>
<td>Fills gaps in industry product standards not met by NFPA 2112; I receive numerous inquiries from end users, manufacturers, and other interested parties for the need to qualify gloves as adequate hand protection during flash fires. In my expert witness work defending burn victims, I have encountered several cases where individuals have been burned for the lack of appropriate hand protection. NFPA 2112 has not been written to accommodate types of protective clothing other than garments.</td>
</tr>
<tr>
<td><strong>c.</strong> Identify intended users of the new project/document:</td>
<td>Petrochemical and other industrial facilities where flash fire hazards exist, manufacturers of gloves and other hand or head protective clothing, research and testing facilities for evaluation and testing of prospective products, enforcement organizations such as Federal and state OSHA offices, and special experts for advised the industry for the use of qualified products.</td>
</tr>
<tr>
<td><strong>d.</strong> Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups:</td>
<td>The current NFPA 2112 membership, the American Petroleum Institute, the Chemical Manufacturers Association, the National Glove Distributors Association.</td>
</tr>
<tr>
<td><strong>e.</strong> Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available:</td>
<td>The three primary groups benefitting is industry by having products that can be specified for appropriate protection, manufacturers which can suitably establish claims for their respective products, and enforcement organizations that can cite the utility of the standard for defining appropriate protection.</td>
</tr>
<tr>
<td><strong>g.</strong> Identify the technical expertise and interest necessary to develop the project/document, and if the committee membership currently contains this expertise and interest:</td>
<td>Current membership on the Technical Committee on Flash Fire Protective Garments has most of the appropriate interests represented, but does not include companies that manufacture gloves or hoods. The committee could also benefit by having Federal OSHA as a participant.</td>
</tr>
<tr>
<td><strong>h.</strong> Provide an estimate on the amount of time needed to develop the new project/document:</td>
<td>The development of a new standard would be able to borrow test method and criteria from the existing NFPA 2112 standard as well as relative fire and emergency services protective clothing and equipment standards, specific to gloves (e.g., NFPA 1977 and NFPA 1951). The standard could be developed relatively quickly (within a 3-year period).</td>
</tr>
<tr>
<td><strong>i.</strong> Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document:</td>
<td>Information already exists in NFPA 2112, which limits the scope of that document to body protection (garments) only. A survey of end user organizations would yield a specific need for this type product standard.</td>
</tr>
</tbody>
</table>
Please send your request to:

NFPA
Codes and Standards Administration
Batterymarch Park
Quincy, MA 02169
Stds_admin@nfpa.org

Name: Jeffrey O. Stull
Affiliation: International Personnel Protection, Inc.

10/09
Derek,

I think this is an excellent idea. The scope of 2112 could be expanded to include this additional coverage. The TC scope already includes “the primary responsibility for documents on the manufacture, selection, care, and use of garments and equipment used for protection of industrial personnel where there is potential for flash fire”. Perhaps gloves and hoods would fall under the “and equipment” part – if not, I don’t think it is a far stretch to expand the scope.

FYI - I do know that NCSU has been working on a flash fire type test specifically for the hands (akin to the manikin test in 2112) but I don’t think that it has gone through the ASTM process yet.

As far as expertise goes, currently there are no specific glove manufacturers on the TC and I am not really sure as to the level of glove/hood expertise of the current members. We would also need to gauge the level of interest of industry.

This is my initial reaction – let me know if you need anything further.

Steven D. Corrado
Principal Engineer – Personal Protective Equipment

Underwriters Laboratories
12 Laboratory Drive
Research Triangle Park, NC  27709-3995
T:  919.549.1433
F:  919.547.6388
W:  www.ul.com

Steve,

NFPA received a request for a new project, minimum performance requirements and test methods for flame resistant gloves and hoods for use in areas at risk from flash fires. See attached for the new project request.

I know that currently the document, NFPA 2112, does not address the gloves or hoods, but is it something that the committee could address in upcoming revisions?

The standards council wants to get some input as to whether this could be addressed by this document and if it is outside the scope of this document, could we expand the scope to include it, or would we need to expand the scope of the committee as well?
Let me know your thoughts.

Regards,

**Derek R. Duval**

Industrial and Chemical Engineering  
National Fire Protection Association  
1 Babynamarch Park  
Quincy, MA 02269  
www.nfpa.org  
617.984.7434

Check out NFPA on social media...  
www.nfpa.org/socialmedia  
www.nfpa.org/blogs

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Flash Fire Protective Garments

Current Committee Scope:
This Committee shall have primary responsibility for documents on the manufacture, selection, care, and use of garments and equipment used for protection of industrial personnel where there is potential for flash fire. Industrial personnel include workers who are potentially or may accidentally be exposed to hydrocarbon or combustible dust flash fires, and not electrical flashes. These documents do not cover fire fighters and other emergency services personnel.

NFPA 2112, Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire

Current Document Scope:
1.1 Scope. The standard shall specify the minimum performance requirements and test methods for flame-resistant fabrics and components and the design and certification requirements for garments for use in areas at risk from flash fires.

NFPA 2113, Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire

Current Document Scope:
1.1 Scope.
1.1.1 This standard shall specify the minimum selection, care, use, and maintenance requirements for flame-resistant garments for use by industrial personnel in areas at risk from flash fires or short-duration flame exposure that are compliant with NFPA 2112, Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire.
   A.1.1.1 The use of garments providing protection against flash fires should be incorporated into a proper safety program that also utilizes appropriate administrative and engineering controls in addition to proper, safe work procedures. Flame-resistant garments are available from a variety of manufacturers, in a range of items (coveralls, pants, shirts, vests, parkas, rainwear, disposable garments, aprons, etc.). Flame-resistant garments are made out of a variety of either inherently flame-resistant fabrics or fabrics that have been treated with a flame retardant. NFPA 2112–compliant clothing is intended to reduce the probability and extent of burn injury during exposure or escape.
1.1.2 This standard shall not apply to protective clothing for wildland fire fighting, technical rescue, structural fire fighting, proximity fire fighting, or any other fire-fighting operations, or hazardous materials emergencies.
   A.1.1.2 Organizations responsible for fire-fighting applications should use protective clothing and equipment specifically designed for those activities. Applicable standards include the following:
   (1) NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting
   (2) NFPA 1977, Standard on Protective Clothing and Equipment for Wildland Fire Fighting Organizations responsible for hazardous materials emergencies should use protective clothing and equipment specifically designed for those activities. Applicable standards include the following:
   (1) NFPA 1991, Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies
   (2) NFPA 1992, Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies
Organizations responsible for emergency medical operations should use protective clothing and equipment specifically designed for those activities. The applicable standard is NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations.*

1.1.3 This standard shall not apply to protection from electrical flashes, radiological agents, biological agents, or hazardous materials.
Item 12-3-14
New Project Initiation Form
(To be completed by proponent of new project/document)

Additional pages may be attached if necessary.

a. Explain the Scope of the new project/document:

The Project Scope would be to create a Standard for the Development, Activation and Support of a Mass Evacuation Plan. The Standard will guide elected officials, emergency preparedness planners and emergency responders to prepare for a mass evacuation, will consider the risks found in the all hazards environment and will address:

Terms used in mass evacuation planning

Role of federal, state, and local preparedness and emergency management agency’s relative to mass evacuation

The pre-evacuation, decision to evacuate, and warning stages of an incident

Activation of the mass evacuation plan, evacuation resulting from an incident of national significance,

The withdrawal and shelter phase

Repopulation and restoration of normalcy

A new Technical Committee would be constituted comprised of subject matter experts drawn from federal and state emergency preparedness agencies, academic research institutions, field practitioners/emergency management and public safety officials along with governmental representatives. The National Governor’s Association and International Association of Fire Chiefs will provide organizational representatives.

b. Provide an explanation and any evidence of the need for the new project/document:

The National Governor’s Association and International Association of Fire Chiefs have identified the lack of a national framework to allow rapid mobilization of national, state, regional, and local emergency preparedness agencies during events where large numbers of the populace must be relocated. These agencies and governmental structures are hampered by not having a standard approach when evacuees are crossing jurisdictional boundaries. See attached letter from IAFC and White Paper from the National Governor’s Associationa.

c. Identify intended users of the new project/document:

Intended users are executive officials, emergency preparedness and public safety officials of national, state, regional, and local communities/agencies. Non Government Organizations, Faith Based Organizations, and others that provide support to mass evacuation shelters would also use the document.

d. Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups: The National Governor’s Association; International Association of Fire Chiefs; International Emergency Management Association; U.S. Department of Homeland Security, FEMA; Contact information attached.

e. Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available: The National Governor’s Association; International Association of Fire Chiefs; International Emergency Management Association; U.S. Department of Homeland Security, FEMA;
f. Identify other related documents and projects on the subject both within NFPA and external to NFPA:
   NFPA 1600; NFPA 1620; NFPA 1561

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<td>g.</td>
<td>Identify the technical expertise and interest necessary to develop the project/document, and if the committee membership currently contains this expertise and interest: No current Technical Committee has the technical expertise necessary to develop this document and a new Technical Committee should be formed.</td>
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<td>h.</td>
<td>Provide an estimate on the amount of time needed to develop the new project/document: 36 months</td>
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<td>i.</td>
<td>Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document: There is a tremendous amount of research developed following Hurricane Ike, Katrina, Rita. Recent wildfire activity has also provide ample data on evacuation activities during wildfires. The proposed document would draw on those experiences and the research that arose from them. On February 8 and 9th, NFPA is co hosting a Mass Evacuation Planning summit with the National Governors Association, U.S. Fire Administration and Federal Emergency Management Agency to identify action steps, including standards development, to develop a national framework for mass evacuation planning. The proceedings of the Summit will be available for the Standards Council Review at its March meeting and will provide a sense of the need provided by Summit attendees.</td>
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**Ed Plaugher**

Please send your request to:

NFPA Codes and Standards Administration
1 Batterymarch Park
Quincy, MA 02169
Stds_admin@nfpa.org

Signature: ____________________________

Ed Plaugher
Name: ____________________________

(please print)

Affiliation: Assistant Executive Director,
International Association of Fire Chiefs
National Programs and Consulting Services
4025 Fair Ridge Dr.
Fairfax, VA 22033

Rev. 10/09
August 15, 2011

National Fire Protection Association
Standards Council
1 Batterymarch Park
Quincy, MA 02169-7471

Dear Standards Council Members:

The International Association of Fire Chiefs (IAFC), which represents the leadership of more than 1.2 million firefighters, respectfully requests your consideration of our request to form an NFPA committee to develop standards and/or a guide or recommended practices for the development of a common mass evacuation planning template.

Educating the community is critical to the successful implementation of an evacuation plan. In most cases, disasters provide individuals little time to react or make plans to evacuate. Evacuation planning is an essential element of the coordination of homeland security and emergency management response in the state and local governments and FEMA regions. The lack of information often results in miscommunication and perplexity among the public, which in turn, makes the evacuation process more difficult. Currently, states and some local communities have implemented emergency plans that pertain solely to their jurisdictions, making it challenging and confusing for the general public to locate these plans and understand the meaning. Past circumstances have proven the need to make communities aware of impending danger, whenever possible, well in advance to minimize the inherent risks to both the citizens within the communities involved, as well as the emergency responders.

As chief fire officers, we urge the NFPA to address this critical issue related to the development of standards and/or a guide or recommended practices for mass evacuation planning. The IAFC recommends the creation of a mass evacuation standards committee that would work toward the development of all-hazard, all-discipline common mass evacuation language (template) that both emergency responders and citizens could follow during a time of disaster.
The IAFC is committed to this project, and we feel this is a critical issue that has a huge impact on our emergency operational responders and state and local governments. Evacuation planning is an essential component of emergency management and homeland security in the states. If we can be of additional assistance, please feel free to contact me at 703.537.4808.

Sincerely,

Mark W. Light, CAE
Chief Executive Officer and Executive Director

:nhw
National Governors Association
Center for Best Practices

*Toward a Common Mass Evacuation Framework*
A Concept Paper presented in partnership
by the NGA Center for Best Practices and
The International Association of Fire Chiefs

April 20, 2011

This concept paper proposes a project to support state and local governments in preparing a “common mass evacuation planning framework,” and the coordination of homeland security and emergency management evacuation planning in the FEMA regions and state and local governments. The project will be a partnership between the NGA Center for Best Practices (NGA Center) and the International Association of Fire Chiefs (IAFC). The project builds upon the success of the NGA Center’s prior work with the Governors’ Homeland Security Advisors Council and the development of homeland security and emergency management practices in the states. The project also augments the successes of the IAFC on emergency management issues at the local level over the past 30 years. The period of performance necessary to complete this proposed project is 18 months.

The NGA Center and IAFC envision five project tasks:

- Create a stakeholders working group to advise the development of the common mass evacuation framework (the framework);
- Review all relevant state, local and federal policies on mass evacuation planning for analysis;
- Develop and publish the framework;
- Maintain resources for state and local efforts to implement the framework on the NGA Center website; and
- Provide technical assistance to the state and local governments for dissemination of the framework.

**Background**

Evacuation planning is an essential component of emergency management and homeland security in the states. Planning for mass evacuation has ranked among the top committee priorities of the Governors Homeland Security Advisors Council (GHSAC) since 2008. Likewise, the IAFC Emergency Management and Wildfire Committees find mass evacuation planning to be a major challenge at the local level. The focus of this project would be to help state and local agencies meet the challenges of evacuations as a result of catastrophic incidents. The project will work toward the creation of an all-hazard, all-discipline common mass evacuation framework (the framework) that both emergency responders and citizens could follow during a time of disaster. This framework will consist of concept language and policy, as well as an operations guide that will include checklists for use in planning the various stages of an evacuation process.

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1. *This document is a concept paper for your consideration. It does not constitute a formal proposal by NGA Center or the International Association of Fire Chiefs. A full proposal with budget will be submitted upon request. The estimated cost to implement this concept may be subject to change in the final proposal.*
The NGA Center and IAFC Partnership

The NGA Center and the IAFC are partnering to leverage organizational assets toward the development of a robust suite of documents that will be used as a Common Mass Evacuation Planning Framework (the framework). The NGA Center and IAFC partnership will bring both the state and local government an understanding of mass evacuation planning. More importantly, the partnership will bring executive level decision makers—such as governors and their policy staff—into the planning process.

The National Governors Association is the collective voice of the nation’s governors, and its members are the governors of the 50 states, three territories, and two commonwealths. The NGA Center for Best Practices is the only policy research and development firm that directly serves the nation’s governors by developing innovative solutions to today’s most pressing public policy challenges.

The IAFC represents more than 12,000 fire chiefs across the U.S., drawing its membership from a diverse cross section of organizations, ranging from major metropolitan multi-disciplinary agencies to small city and rural departments and includes both paid and volunteer organizations. The IAFC’s members are the world’s leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, wildland fire, search and rescue, public safety legislation, and fire prevention and education.

The Mass Evacuation Challenge

While mass evacuation may appear to be a low-probability event, poor planning for evacuations can have high-impact consequences not only for governors affected by a disaster, but governors of neighboring states that receive refugees from a disaster. For example, in 2005, all 50 states, the District of Columbia and Puerto Rico received evacuees from the Gulf Coast states as a result of Hurricane Katrina. As a result, state governments as distant as Maine and Alaska cared for victims, and applied for federal assistance on their behalf.

The evacuation planning process is critical to saving lives, coordinating scarce community resources, and providing for speedy recovery in the aftermath of a disaster. Evacuations can take the form of a planned event—such as an incoming hurricane, or spontaneous event—such as the evacuation of Manhattan on 9-11-2001. Both events provide challenges not only to the disaster-stricken state, but neighboring states who may receive evacuees. While states have developed state-specific plans for evacuating their citizens in the event of a natural disaster, the US Department of Homeland Security has identified three major gaps in evacuation planning:

- Current federal evacuation guidance, plans, and exercises do not adequately reflect requirements for local, state and federal coordination for mass evacuation from a catastrophic event;
- Planning rarely addresses the intake of evacuees to neighboring states, nor addresses the difference between planned evacuations—such as a hurricane route, and unplanned evacuations—such as fleeing a terrorist attack; and
- Evacuation plans are narrow in scope, omitting planning for special needs populations and public transportation away from an affected area.

In addition, plans for evacuation are rarely coordinated at a regional level. Pass-through states are not always consulted on available emergency routes and resources by the evacuating state. Despite the overall progress made on raising citizen awareness on disaster planning, basic questions, such as sheltering-in-place vs. evacuation, are not often addressed nor well-understood.
Creating a Planning Framework

A common planning framework for mass evacuations will address the gaps in current planning efforts. This framework will provide clarity and definition for state and local stakeholders on how to evacuate a community. The framework will define terms, provide checklists and timelines and integrate with existing guidance and plans. Most importantly, the development of a framework with key executive stakeholders—such as the NGA Center and the IAFC—will provide a bottom-up, community driven solution to the challenges in evacuation planning. The framework will address major planning challenges, including:

- Citizen preparedness for mass evacuation;
- Public communication strategies;
- Mass sheltering and care of special needs populations;
- Intake of evacuees in neighboring jurisdictions;
- Resource needs and identification;
- Inter-dependencies of public and private sector;
- Cross-border coordination;
- Multi-modal evacuation (e.g. public transportation, walking out, etc);
- Shelter-in-place; and
- Managing repopulation of the region.

By partnering with the IAFC, the NGA Center will develop a framework that brings all the relevant disciplines together at the state-level, with the expertise of the local officials who will have primary responsibility to implement state and local evacuation plans.

Concept of Operations

The NGA Center and the IAFC envision an 18-month program to develop a common evacuation framework with five major tasks:

- Create a Stakeholders Working Group to advise the development of the common mass evacuation framework (the framework);
- Review all relevant state, local and federal policies on mass evacuation planning for analysis;
- Develop and publish the framework;
- Maintain resources on the NGA Center website for state and local efforts to implement the framework; and
- Provide technical assistance to the state and local governments for dissemination of the framework.

Task One: Stakeholders Working Group

The NGA Center and the IAFC will identify stakeholders involved in the planning and execution of mass evacuations to assist in the development of a common evacuation planning framework. The stakeholder group will meet both virtually and in-person to provide guidance to the NGA Center and IAFC on the development of the framework. The working group may include, but not be limited to, preparedness partners such as:

- The American Red Cross
- FEMA
- The Governors Homeland Security Advisors Council
- The National Emergency Management Association
- The International Association of Emergency Managers
• The National Sheriffs’ Association
• The International City/County Management Association
• The International Association of Chiefs of Police
• The American Association of State and Highway Transportation Officials

Task Two: Review of Extant Policy and Literature
The NGA Center and the IAFC will conduct a review of state and local evacuation plans. The NGA Center will review state policy and the IAFC will review local policy. This review will help define the common language among planning efforts in the country for the framework and reduce redundancies that may exist in policy in the states. The Center and the IAFC will use the review of policies to identify tools and procedures to build upon past FEMA guidance, such as the FEMA Comprehensive Preparedness Guide and State and Local Guidance 101.

Task Three: Common Evacuation Framework
Using the data collected from the literature and policy review, and with the guidance of the stakeholders working group, the NGA Center and IAFC will produce a framework for a common evacuation framework that state and local governments can use to better plan for mass evacuation. The framework will outline a national method for evacuation planning. This framework will:
• Identify common conventions and terms for evacuation planning;
• Develop policy implementation strategies for governors, and state and local officials to develop uniform plans in their states and localities;
• Create a timeline that identifies key activities during the four phases of emergency management—prepare, prevent, respond and recover;
• Provide an appendix with sample checklists, procedures, and suggested local documents for inclusion in a jurisdiction’s framework.

The framework will consist of a 40 to 50 page publication, that includes conventions, definition of terms, suggested planning templates and baseline concepts that all jurisdictions should consider in evacuation planning. The appendix will supplement the framework. The appendix section will give state and local users the flexibility to insert their own local documents and resources specific to their jurisdiction into the framework. These documents may take the form of standard operating procedures or planning documents. This approach respects the existing work of local and state governments while providing an overall context by which the state and local plans may integrate with the framework.

The NGA Center will also contract with an academic institution—the Johns Hopkins University Applied Physics Laboratory—to assist in the development of the framework as well as supplemental appendices to the framework. Upon completion of the common framework and final review by the steering committee stakeholders, the NGA Center and IAFC will encourage its respective membership to adopt the framework and appendices at the state and local level. The NGA Center and the IAFC will also encourage the organizations in the steering committee to adopt the framework for their respective organizations.

Task Four: Maintain Resources on NGA Center Website
The framework, as well as resources for implementation, will live on the NGA Center website as well as the GHSAC HSIN portal.
Task Five: Technical Assistance for Dissemination of the Framework
The NGA Center proposes to provide technical assistance to the state and local governments to disseminate and promote the use of the framework. The NGA Center will be called on to provide expert policy research and support to governors and their staff. The NGA Center proposes to serve as a liaison between federal agencies, governors’ offices, state homeland security advisors and other key state officials to disseminate information, gather comments and data, and ensure close collaboration with the full community of state stakeholders for mass evacuation planning. The NGA Center will respond to requests from the states as needed. The IAFC will coordinate with the NGA Center regarding local level requests for assistance specific to the framework. The NGA Center and the IAFC would use web-based tools—such as webinars and webcasting—to promote the framework.
Framework for a Nationwide Evacuation Model

Overview

This proposal is being developed to inquire about a potential partnership between the International Association of Fire Chiefs (IAFC) and the National Governors Association (NGA) to develop a framework for a Nationwide Evacuation Model. The focus of this project is to create an all-hazard, all-discipline nationwide evacuation model that both emergency workers and citizens would follow during a time of disaster. The evacuation planning process is critical to saving lives and preventing or minimizing the number of injuries resulting from a natural disaster or hazardous event.

Background

Educating the community is critical to the successful implementation of an evacuation plan. In most cases, disasters occur suddenly giving people little time to react or make plans to evacuate. The lack of information often results in miscommunication and perplexity among the public, which in-turn makes the evacuation process more difficult. Currently, states and some local communities have implemented emergency plans that pertain solely to their jurisdictions, making it challenging and confusing for the general public to locate these plans and understand the meaning. Past circumstances have proven the need to make communities aware of impending danger, whenever possible, well in advance to minimize the inherent risks to both the citizens within the communities involved, as well as the emergency responders.

As an example, a cooperative agreement was developed and funding was made available by the U.S. Forest Service and U.S. Fire Administration to support the IAFC's “Ready, Set, Go!” program. This program was created to improve coordination and communication between emergency response agencies and the community, as well as promote partnerships and clarify and refine priorities to protect life, property, infrastructure and valued resources. Ready, Set, Go! is a new approach at packaging existing public education to gain active public involvement toward reducing life-and property loss associated with wildland fires. The program is based on the idea that, during a major wildland fire, there may not be enough firefighting resources to protect every home. Ready, Set, Go! encourages residents to take personal responsibility for preparing their property and family and, by doing so, become a part of the solution to the problem of increasing fire losses during wildland fires. Citizens are educated in the importance of preparing themselves and their property in the event of a wildland fire.
The IAFC’s goal is to build upon the Ready, Set, Go! program by defining “Go” and clarifying when it is necessary to evacuate during a disaster or hazardous event. Our objective is to create a Framework for a Nationwide Evacuation Model that incorporates pre-evacuation, evacuation and repopulation of an area when the area is safe to return. This model will provide guidelines to help improve communication between emergency workers and the public in the event of any type of natural disaster or hazardous event.

**Project Goals**

The focus of this project is to partner with NGA to create a Nationwide Evacuation Model for both emergency responders and the public to use in the event of a disaster or hazardous event. This model would provide a more clear definition of evacuation stages:

- **Pre-evacuation - decision to evacuate and warning**
  - Pre-evacuation - Evacuation resulting from an event that provides adequate warning and does not overly limit preparation time. (e.g. hurricanes, floods and storm surge)
  - Areas for consideration include:
    - Vulnerability analysis
    - Movement of evacuees to prevent congested conditions resulting from large-scale evacuations
    - Defining egress routes to be capable of handling requirements of the evacuation
    - Identification of available resources to transport evacuees
    - Requirement to provide temporary accommodations will have to be assessed
    - Identification of special needs buildings or people
    - Public awareness and communication through defining warning messages and how they will be delivered to the public
    - Development of communications plan

- **Evacuation - withdrawal and shelter**
  - Evacuation resulting from a hazardous impact, which forces instantaneous action, allowing little warning and preparation time. (e.g. incidents with hazardous materials, earthquakes, wildfires)
  - Areas for consideration include:
    - Control and coordination of the event
    - Prioritizing evacuees
    - Defining resources to be used to transport evacuees
    - Defining egress routes
    - Phasing evacuations to avoid congestion or to ensure special-needs groups can be evacuated in time
    - Defining assembly areas for evacuees
    - Special arrangements may need to be defined for special-needs groups
    - Registration of evacuees
    - Securing the evacuation area
    - Identifying appropriate shelter accommodations
    - Catering services and medical support
Project Goals Continued

- Repopulating-returning home after area is clear
  - Areas for consideration include:
    - Securing unsafe structures
    - Provision of temporary utilities (restoring water, power, communications)
    - Provision of financial services (insurance, banking, etc.)
    - Provision of welfare services (counseling and health services)
    - Continued communication to keep evacuees apprised of aspects of returning home
    - Availability of suitable facilities, including permanent or temporary accommodations; permanent or temporary utilities; and hygiene facilities.

Conclusion

The Department of Homeland Security and other federal agencies have conducted thorough studies to be able to assess the general strengths and weaknesses of evacuation plans across various regions to serve as a basis for identifying the most significant needs for assistance in evacuation planning and how that assistance can most effectively be provided. There are three main issues that surfaced from various study findings, as follows:

- Current evacuation guidance plans and exercises do not adequately reflect requirements for federal, state, and local coordination to effectively execute a mass evacuation from a catastrophic incident.
- Evacuation plans and operations focus primarily on evacuations by private vehicles and do not adequately address the use of other safe and practical modes that could be used to evacuate persons, especially those with special needs.
- Plans generally include provisions for communicating information on evacuation routes, what evacuees using personal vehicles should take with them, and where shelters are located; however, plans for communicating essential information to those who do not have access to an automobile and to those with other special needs generally are not as well developed.

This proposal to partner with the NGA is necessary to seek funding to support the creation of a Framework for a Nationwide Evacuation Model that will help our State and local agencies to be able to meet the challenges of evacuations from catastrophic incidents.
International Association of Fire Chiefs (IAFC)

The IAFC represents the leadership of firefighters and emergency responders worldwide; our members are the world's leading experts in firefighting, emergency medical services, terrorism response, hazardous materials spills, natural disasters, search and rescue, and public safety policy. Since 1873, the IAFC has provided a forum for fire and emergency service leaders to exchange ideas, develop professionally and uncover the latest products and services available to first responders.

National Programs & Consulting Services

National Programs is an arm of the International Association of Fire Chiefs (IAFC) that directly impacts our membership's role as leaders. This is achieved by "Strengthening Fire Service Capabilities" through fortifying the response, supporting the effort and improving the health & safety of our firefighters. The efforts of National Programs are financially supported by federal agencies or private partners through either grants or cooperative agreements. These programs are external to the IAFC and provide a unique opportunity in planning and implementing the vast array of projects.

www.iafc.org
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<td>Chief</td>
<td>Ricky</td>
<td>Ziebart</td>
<td>U.S. Fire Administration, Emergency Response Support Branch</td>
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<td>Ms.</td>
<td>Elizabeth</td>
<td>B. Armstrong</td>
<td>IAEM CEO</td>
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<td>Ms.</td>
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<td>M. Sheets</td>
<td>NEMA</td>
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<td>Mr.</td>
<td>Robert J.</td>
<td>Bennett</td>
<td>National Fire Academy, Incident Management Training Specialist</td>
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<td>Mr.</td>
<td>Glenn A.</td>
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<td>Deputy US Fire Administrator</td>
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<td>Wayne</td>
<td>Yoder</td>
<td>National Fire Academy, Training Specialist, Hazardous Materials Program</td>
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<td>Rick</td>
<td>Cox, CEM</td>
<td>International Association of Emergency Management</td>
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<td>Mr.</td>
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<td>Mr.</td>
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<td>International Association of Fire Chiefs</td>
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<td>Ms.</td>
<td>Lori</td>
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<td>International Association of Fire Fighters</td>
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<td>Heather</td>
<td>Schaefer</td>
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<td>Mr.</td>
<td>Timothy P.</td>
<td>Butters</td>
<td>US Department of Transportation</td>
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<td>Mr.</td>
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<td>Qiezorek</td>
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<td>Mr.</td>
<td>Russell</td>
<td>Sanders</td>
<td>NFPA c/o Metropolitan Fire Chiefs</td>
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<td>Chief</td>
<td>Mark A.</td>
<td>Marshall</td>
<td>International Association of Chiefs of Police</td>
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<td>Sheriff</td>
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<td>Ms.</td>
<td>Amy</td>
<td>Green</td>
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<td>Ms.</td>
<td>Jennifer</td>
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<td>Director</td>
<td>Thomas R.</td>
<td>Frieden</td>
<td>Centers for Disease Control and Prevention</td>
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<td>President</td>
<td>Mickey</td>
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<td>Southern Baptist Disaster Relief</td>
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<td>Mr.</td>
<td>Ashley P.</td>
<td>Moore</td>
<td>National Integration Center (NIC)</td>
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<td>Mr.</td>
<td>Craig</td>
<td>Fugate</td>
<td>FEMA Administrator</td>
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<td>Ms.</td>
<td>Marcie</td>
<td>Roth</td>
<td>FEMA Director, Office of Disability Integration and Coordination</td>
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<td>Mr.</td>
<td>Rich</td>
<td>Serino</td>
<td>FEMA Deputy Administrator</td>
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<td>Mr.</td>
<td>Don R.</td>
<td>Boyce</td>
<td>FEMA Regional Administrator, Region One</td>
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<td>Mr.</td>
<td>Paul</td>
<td>Ford</td>
<td>FEMA Deputy Regional Administrator, Region One</td>
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<td>Ms.</td>
<td>Kate</td>
<td>McCarthy</td>
<td>FEMA Disability Integration Specialist, Region One</td>
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</tbody>
</table>
The Evacuation Conference conducted earlier this month achieved its desired outcome. The organizers had hoped to assemble a large group of stakeholders and win their agreement that a national evacuation framework is needed. With the favorable feedback we heard on the meeting’s second day, the challenge is now to harness that support, incorporating the contributions of all those present to bring this vision to reality.

Thanks to IAFC’s Sheila Jarboe and Carly Zoerb for providing extensive verbatim notes and the speakers’ presentations; with those documents as a supplemental resource, this memo will address the conference’s process, its outcomes, and proposed next steps for the future.

**Evaluation of Meeting Process**

One of the most striking successes of the Evacuation Conference was its attendance. With relatively modest pre-meeting effort, the organizers were able to coax fifty participants and an esteemed panel of speakers and presenters for the two-day meeting. Given the resource pressures that many organizations face (especially when considering out-of-town travel), this level of involvement suggests that the topic is of significant interest to the groups represented, which is a promising portent for future activities.

In any such meeting, attrition is to be expected: People are busy and have many conflicting obligations. Although we lost about 40% of the attendees during the course of the first day, we held onto almost 35 participants into the conference’s second day.
Administrator Mitchell and other prominent guests stayed far beyond their own presentations. And remarkably few people in the room seemed distracted by their mobile phones or laptops during the session.

The first day consisted of a series of presentations and remarks from the front of the room. Although we were seated in rounds, for most of the day, participants’ attention was directed to speakers and/or the projection screen. Many of these presentations were impressive and pertinent to the issues at hand; a few were less on-point for the purposes of this meeting, but still provided valuable information.

Day 2 had a more collaborative and interactive feel, as the emphasis moved from presentation to dialogue. The u-shaped conference table enabled every participant to see one another and facilitated remarks to the group, but there were few opportunities for attendees to converse one-on-one.

The flow of this conference was predicated on the idea that participants needed to be educated about aspects of the evacuation issue before addressing the call for a national framework. This may have been true, but in retrospect we still might have posed our central question (“Is there a need for a national evacuation framework?”) at the start of the first day too; had we done so, we might have discovered that many of the people in the room were already bought-into this concept from the start.

The parade of Day 1 speakers, while often intellectually stimulating, left the room feeling a little numb by midday. It’s no reflection on the presenters or their ideas: Most people simply cannot sit passively and listen to a long series of presentations without becoming impassive themselves.

And once torpor sets in, it’s difficult to shake. So when there were opportunities for dialogue, questions, and comments on the first day, only a few participants weighed in. This suggests a few take-aways that can help improve future meetings:

- **Start with dialogue.** Rather than assume participants’ level of knowledge or support, we should start by asking them what they think about the issue before launching presentations they may or may not need to hear. Had we asked our big question at the beginning of the first day and found widespread buy-in right away, we could have scrapped our planned agenda and used our time together to begin
designing the ideal framework, or outlining the plan to develop one.

- **Review experts’ presentations for relevance.** Although most presenters did an excellent job, the few that seemed off-base sapped energy and attention from the room.

- **Assure more process variety.** In addition to creating a better balance of full-group dialogue and expert presentations, meetings such as these also need tabletop activities or one-on-one discussions to maximize energy levels and participant engagement.

**Review of Meeting Outcomes**

The conference had modest but clear-cut goals, and they were assuredly achieved. As we hoped, the thirty-five participants on Day Two fully agreed that there is a need for a national evacuation framework. And there was general agreement that the organizations represented in the room would be involved in its creation.

But there was considerable uncertainty about how each group could or would contribute to the creation of such a framework. Since the framework is merely a concept (and not a proposal), there was no formal vote in favor of its adoption. Some participant organizations have formal approval processes, and others (such as governmental organizations) might never be able to “formally” approve such a plan created by nongovernmental organizations. Some NGOs would be reluctant to get engaged without a formal or informal imprimatur from FEMA. And several attendees were not the decision-makers from within their respective groups.

We were able to brainstorm a list of principles that could guide the creation of the framework; these appear in Appendix 2 of this document. These principles form the basis of the promised post-conference “communiqué” to be drafted by NFPA, IAFC, and NGA and shared via email with all attendees.

**It was the unstated presumption of these participants that the three convening organizations are the de facto leaders of this effort. And although it wasn’t debated extensively, we could also infer acceptance that NFPA should serve as the lead Standards Development Organization in creating a Mass Evacuation standard. Neither assumption was refuted or questioned during the two days together.**
Next steps
The single specific follow-on step discussed at the conference was the development of a post-meeting “communiqué,” a draft summary of the principles and components of a national evacuation framework as brainstormed by the group. Allowing time for participant review and feedback via email, this should be completed by early March.

Once the statement of principles is developed, it will quickly become time for the three convening organizations to transition from the task of shepherding a conceptual project to the task of co-leading a strategic planning effort. This means dedicating the time, energy, and other resources to a shared process that will define this project’s goals, create a development timeline and budget, and assign roles to individuals and groups. Once NGA, NFPA, and IAFC have committed themselves to a development process, enlist other participant organizations to take on specific roles to aid that effort.

Resist the impulse to reverse this process; in my experience, it would be a mistake to recruit a large and diverse board with the hope that it will have the coherence and discipline to draft the implementation plan. You already have buy-in on the concept from these groups, and IAFC, NGA, and NFPA are accepted as the project’s leaders. You’ll save enormous time and energy if you “democratize” the planning process after, rather than before, the creation of your strategic plan.

Conclusion
Big conferences and retreats usually mark the start of a process, rather than its ending – and this is no exception. The three convening organizations received what you asked for; we heard widespread support from a broad group of expert stakeholders for the concept of a national evacuation framework.

Now comes the hard part of making good on the promise that this conference suggested. I encourage you to move aggressively to sketch out a multi-year plan for creating and adopting a framework. Assign clear roles to key organizations and individuals, and assure that your work is guided by a realistic budget and timeline.

Like other big ideas, the national framework can only survive if it is championed by organizations willing to invest the resources to bring it to life. This project is off to a promising start, and I’m grateful for the chance to have been a part of it.
Appendix 1: Mass Evacuation
Conference Agenda
Hyatt Fair Lakes, Fairfax, VA
February 8-9, 2012

Wednesday, February 8, 2012

9:00 am  Welcome
Opening comments: Purpose of this meeting
- David G. Henry, National Governors Association
- David Nuss, National Fire Protection Association
- Ed Plaugher, International Association of Fire Chiefs

Paul Cooper, Facilitator
- Roles and expectations
- Preview agenda
- Meeting logistics
- Participant introductions

Keynote Address
U.S. Fire Administrator Ernest (Ernie) Mitchell, Jr.
The Importance of Building a Common National Framework for Mass Evacuation (Tentative title)

Mass Evacuation: A Primer
Presentation followed by Q&A
- Bob Fenton, Federal Emergency Management Administration (Tentative)

BREAK

Mass Evacuation: A 360-Degree View
Scenario-based activity and discussion. Participants analyze a mass evacuation scenario, providing insight from their perspective on how they have responded (or might respond in the future) to an evacuation.

Participants’ Experiences
Facilitated discussion

12:30 pm  Working Lunch
Presentation followed by Q&A
- Ben Bogardus, Assistant Professor, Quinnipiac University School of Journalism
Wednesday, February 8, 2012

Setting Standards
Presentations followed by Q&A
- Ashley Moore, Federal Emergency Management Administration
- Ken Willette, National Fire Protection Association

BREAK

Current Research and Approaches
Presentations followed by Q&A
- J. Eric Dietz and Ginny Stewart, Purdue University Homeland Security Institute
- Speaker To Be Determined, ESRI
- Stephan Parker, Transportation Research Board: *Regional Approaches*

Winding Down
- Preview tomorrow’s meeting
- Parking Lot issues, if any
- Logistics

Final Thoughts
*Ed Plaugher, International Association of Fire Chiefs*
*Key Takeaways from Today’s Discussion, and Thursday’s Call to Action*

5:00 pm Adjourn
5:15 pm Possible: Reception TBD

Thursday, February 9, 2012

9:00 am Welcome
- Review Wednesday’s progress
- Preview day’s agenda

Looking Ahead
Presentations followed by Q&A
- David Henry, National Governors Association: *Building a Common National Framework*
- Dave Driscoll, International Association of Fire Chiefs: *Regional Planning*

Feedback and Review
Facilitated discussion
Thursday, February 9, 2012

BREAK

Call to Action
Facilitated discussion: How can the participants in this room work together to create a national framework?

Winding Down
• Next steps
• Parking Lot issues, if any
• Logistics
• Final thoughts

1:00 pm Adjourn
Appendix 2: Brainstormed First Draft of National Evacuation Framework Principles and Components

- Includes a “why” or problem statement
- Consensus/buy-in from NGA ASHTO, IAFC, NFPA, etc.
- List of key stakeholders that should be involved in creating a framework
- Exists within current EM framework; does not contradict
- **Standardization/commonality (ex. Standardized/common terminology)**
- Scalability (size, event, jurisdiction, roles)
- Not just “mass” – should be scalable to large/small
- Supports a system of public/private best practices
- Recognizes relationships between evacuation/mass shelter
- Proves practices with data metrics, goals and accountability
- Includes citizen/community component
- Includes personal responsibility component
- Communication, civic engagement rollout (i.e., easy to understand, plain language, pictures, real-life examples, drama, etc.)
- Includes appendices & references to scholarly work
- Uses media to drive adoption
- Can be event-specific
- Includes volunteers, training, recruitment, management
- Builds community resiliency
- Sniff test – Drill & test the framework and revise
- **Must include mechanisms to keep it current**
- Methods for leaders to make informed choices (empower decision makers)
- Usable & useful
- What organizations do what: Roles & resources
- Must acknowledge whims of politics & markets
- Shelter in-place & quarantine
- Authoritative, codes, standards model
- Encourages local empowerment
- Flexible
- **Nationally developed & inclusive**
- Transparent process
- Pegged to metrics; measurable
- **Includes standards & policy statements**
- Work towards accreditation
- Includes tools, best practices & guidelines on preparation
- Framework can be formally adopted at the legislative level (put it into language to facilitate this)
- Addresses 360° life cycle
- Acknowledges where to send/receive evacuees
- Cross- jurisdictional
Linda:
Attached please find a listing of Key Points made during the Mass Evacuation Planning Conference hosted by NFPA, The National Governor’s Association and International Association of Fire Chiefs on February 8 and 9, 2012. The Conference Proceedings will not be available for several weeks, but this information highlights the nature and focus of discussion that occurred.

I direct your attention to the highlighted text on pages 9,10,13,17,19, and 20. These comment on the need for a standardized approach in planning for mass evacuations and how a properly constructed Standard can provide the needed guidance.

I will share the Conference Proceedings as soon as they are available.

Please contact me if you have any questions.

Ken

Kenneth R. Willette  
Division Manager, Public Fire Protection  
National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02169-7471  
Phone (617) 984-7299  
Fax (617) 984-7056  
kwillette@nfpa.org

Check out NFPA on social media...  
www.nfpa.org/socialmedia  
www.nfpa.org/blogs

kwillette@nfpa.org
Mass Evacuation Conference  
February 8-9, 2012  
Fairfax, VA  
Key Points

Welcome/Briefing  
David Henry, National Governor’s Association  
- Help our governors prepare for mass evacuation

David Nuss, National Fire Protection Association  
- Developing standards

Ed Plaugher, International Association of Fire Chiefs  
- Build upon Ready, Set, GO!  
- Define “GO!”

Keynote Address  
Ernest (Ernie) Mitchell, Jr., U.S. Fire Administrator  
- Reviewed various incidents over the years where mass evacuation had occurred  
- Found there was  
  - Confusion  
  - Things that went wrong  
  - We plan for the worst and hope for the best  
  - Effective planning and early efforts reduce the impact on people  
  - “If it’s predictable, it’s preventable”  
  - Following 911 our cities only started to expand networking with community partners  
  - We created our expert plans and hoped they would work  
- We must consider:  
  - Trust the fact that successful event efforts occur locally, perhaps not the right way  
  - We don’t want people impacted when it is “pre”  
  - Protect people when there is a known threat and keep citizens out of harm’s way  
  - There are those citizens who will leave on their own and those who won’t  
  - Don’t forget about pets and livestock  
  - How far is far enough for citizens to go?  
  - What are our neighbor’s evacuation plans?  
  - What is our re-entry plan?  
- How to communicate the message to the public  
  - How do we communicate to the media?  
  - Collaborating with the appropriate stakeholder is important  
  - Extreme planning brings resources together
The weakest link is strengthened
Extreme planning, team building, networking is important.
Limitations on transportation networks – need to better plan (number of citizens is far great than transportation provides)
How important is it to bring key players together?
Develop and publish framework for a successful evacuation
Encourage everyone to move forward – salute our efforts
Fire Chief may not be the incident commander but first responders need to focus around the fire chief
Fire chief and firefighters are underutilized
Some communities acknowledge that fire departments are a resource and people listen to them
Need to communicate with residents and help them understand the situation and how things will move forward prior to evacuation

Chief Mitchell offered FEMA’s support and assistance.

Donald “Doc” Lumpkins, Executive Director, Presidential Policy Directive-8 (PPD-8) Program Office (FEMA)
- PPD-8 includes public information warning
- Structured around national preparedness
- What happened to preparedness?
  - It’s how we get the plans in place
  - TLC’s are a little too tactical
  - With PPD-8 we’ve moved things up
  - As a nation, risks differ from state to state
  - Need flexibility to tie everything together
  - We’re required to have a set of new frameworks
- Risks drives FEMA’s work
- For more information on PPD-8, contact engagement@fema.dhs.gov for information
- Frameworks and PPD-8 are meant to be national doctrines on response that provide a base understanding
- National Response Framework (NRF) provides guidance
- Act of evolution – building on good work that has been done and what is being done
  - Building catastrophic planning
  - Frameworks (guidance, operational, support annexes)

Josh Dozor, Regional Catastrophic Planning, FEMA Response and Recover Directorate
- All hazards require planning
- 5 year plan - follows a 6 step process
- Structure around the 14 point capabilities
- A single annex plan
- Provide a better understanding of state and local plans and capabilities are
People need to trust in government
Utilize existing studies to not duplicate efforts
Provide the public with information and warning
Preparedness is how we create plans and procedures for evacuations
All risks and flexibilities need to be considered (don’t know which risk we’re planning for until after it happens)
Build a composite scenario
There are four National Frameworks that are in the works and required to be presented to President Obama by the end of June 2012
Risks is what drives FEMA
There are a lot of groups planning but need at a local level to connect the dots and make sure that we are all on the same page (decisions can be made at a local level, may impact the state)

Shawn Stokes and Cynthia Cox, IAFC
Mass Evacuation: 360 Degree View
- Draw from your input on what has worked, has not worked and what you want from evacuation
- Provided an incident
- Engage the audience
  - What should you consider?
  - What’s in the path of the wildfire?
  - Are there any gas lines in the path?
  - Need forecasting information
  - Need information on behavioral (evacuation preferences)
  - Need tools for Emergency Operations Center and for the public
  - Geographic Information System (GIS) platform to work on as a team
  - What is the historical framework?
  - What has the community previously experienced?
  - Lack of experience could truly affect the outcome
  - Discussing hurricanes in Florida is different than discussing it in Vermont
  - Need to communicate to the public
    - Should they be threatened?
    - Do we have to consider evacuation?
    - How do we communicate to people?
    - How do we put the fire out?
- Three (3) types of evacuation
  - Spontaneous
  - Suggested
  - Mandatory
Ground Rules

- 30,000 foot level –
- Looking to identify serious gaps that a framework will help rectify
- Coordinate response actions across all levels and functions of government is KEY
- What has and has not worked
- What would you do?

The Incident

- Medium sized city (100,000)
  - Within 40 miles of state border
  - Western U.S.
  - Naturally started on public lands
  - Federal, State and local resources already on fire
- Weather is red flag
  - High winds
  - Lots of opportunity for new starts throughout the region

Early Warning (Get Set)

- What should you consider?
- What’s worked in the past?
- Thoughts in the future?
- What are your policies, plans, procedures and tools for communicating among stakeholders?
  - Do we know who all our stakeholders are?
- What are your policies, plans, procedures and tools for communicating to the public?
- What about special needs?
  - How do you define “Special Needs?”
  - 20% disabilities
  - 12-15% children under age of 12
  - 15% or more is over 65 years of age
- We need to change the mindset and plan for all people in total
- Getting people ready to go when necessary to evacuation
- What are the flaws?
- Forecasting information (weather, in particular)
- Data on behavioral information with the public
- Tools both working the incident and for the public
- Work as a team (inoperability)
- Types of evacuations: Spontaneous; immediate and plan evacuation and planned evacuation

Evacuation (Go)

- What should you be considering?
- What’s worked in the past? What hasn’t?
  - To learn from those things that haven’t happened yet
  - Identify what did and didn’t work from hurricane perspective in Massachusetts
• Multi-state (VT, CT, MA and Manhattan)
• No high density population
• Used roads that weren’t built for large evacuations
• Local planning within the state (MA)
• Needed to have coordinated evacuation plans (routes not in conflict; traffic control; developed a directory of resources on state and local level)
• Sheltering demands available
• Regions are impacted rather than state-wide evacuation
• Social Media
  • Public emergency warning (cell phones, radio/television
  • How do you contact residents other than by cell phones?
  • Smart phones/social media
    • 30% of citizens have access to this line of communication.
    • How do you reach the rest?
    • How do you plan for cell phone towers and GPS satellites go down?
    • No cell phone signals going down?
    • Set up place for media
    • Go on radio/TV when citizens can go home
• Add a public sector
  • Hurricanes in Texas are handled differently than elsewhere
  • Connecticut gave staging area for repair vehicles
• Who has the authority to call for an evacuation?
  • Governor?
  • Mayor?
  • Etc.?

**Action Item:**
**Develop a set of principles to guide the multi-jurisdictional evacuation process**
• What would you do in the future?
• Have the stakeholders changed?
• Leverage best practices
• What are the zones?
• Engage a community of reliance to bring residents and others together
• Build on mutual aid
• What can regional and state do?
• Industrial Management Team (IMT)
• Crucial for local level (need to have a process)
• What other evacuation plans have been set up and carried on from that point?
• Wildland fires – this isn’t the right medium
  • Need to look at larger incidents (hurricanes)
**Repopulation**
- What should you be considering?
- What’s worked in the past?
- Thoughts for in the future?
- What’s your message to the public? How?
- Wildfire vs other natural and manmade events
  - Wildfire - we want residents to return quickly
  - Hazardous environment
- What do you do when people are forced to be homeless?
- At what point should the Governor become involved?
- It was suggested that the Governor’s guide should include a chapter on mass evacuation
- Public health involvement
  - When is it safe for citizens to return?
  - Is the air quality safe?

**Mr. Orlando Hernandez, NFPA**
Provided a scenario of an incident that began with a major accident at a nuclear power plant that affected 25,000 citizens. As the incident became involved, a detailed outline was available for review and comments from the attendees.

- The incident required city, county and state partners to participate in this exercise
- Relationships developed with local, county and state partners and from local venues
  - Media, gas stations, grocery store chain working on site
  - Local shelter and its capacity
    - What happens when there is a convention and the facility isn’t available for use?
    - Look for other available space - warehouses
- Who will serve as the Incident Commander?
- Which state and local department will you activate?
- What process will you use to activate state resources?
- The area being evacuated has approximately 150 registered sex offenders
  - According to State law, offenders do not have to register with local law enforcement unless they are staying in the area longer than 30 days.
- The proposed warehouse shelters have neither an operating fire alarm system nor a working fire sprinkler system
  - City ordinance does not allow a facility to be used for overnight accommodations unless it has a working sprinkler and fire alarm system
- From the environmental director’s view
  - How do you propose to dispose of the gray water from showers?
- Need to prepare 75,000 meals per day for evacuees
  - Who can prepare the meals?
How will meals be delivered?
Access to medications
  Form a relationship with local pharmacy so evacuees would have access to prescriptions
Approximately 2,000 household pets and 200 livestock require shelter
  Pre-arrangement with schools and stables to provide shelter
  How will you match up owners with pets and livestock?
    Picture of owner and pet attached to cages
Incident Command realizes there are relatives trying to locate displaced family members
  The NGO will not share evacuee registry with Local authorities
How should we handle inquiries?
Report of gang members gathering outside the shelter and confronting a rival gang
  Concern from parents about children’s safety
Shortage on medical manpower to cover the shelters
  Paramedics and EMT’s from the neighboring state willing to assist
What process do we have in place to hire nurses and doctors from other states to assist with care for the evacuees?
What reciprocity do we have for licensed medical professionals?
Public health department is required to have contacts for health care providers
  Medical volunteer(s) to track medicines
DMV required documentation in order to bring in out of state health care provider
  BWI Airport is owned/operated by DOT
Databases of volunteers
  Maximize resources of people who wanted to help
  Establish an on line site where volunteers can sign up to assist (can also provide information if they are a teacher, have nursery/day care experience, etc.) and identify when they would be available
Salvation Army
  Ability to gather, sort and distribute donated items
  Ability to request specific items (diapers, formula, request specific clothing sizes, etc)

Mass Evacuations
Professor Ben Bogardus, Quinnipiac University
Roles of the Media
  What does the media do?
    Primary means of contact with the public
    Provides up-to-the-minute information and warnings
    Can share information across platforms (TV, radio, internet)
    Live reports continuously before, during and after the disaster
Needs of the Media
  What does the media need?
• Access to evacuation plans before disasters strike
• Access to command centers
• Access to officials for in-person interviews
• Advance warning of news conferences
• A reliable and trusted way to get information (email, phone line, twitter account)
• Good information and good sound bites

Newsroom Contacts
• Newsrooms aren’t just reporters
• Assignment desk
• Producers
• News director / Assistant news director / Executive producers
• Ask for / exchange phone numbers ahead of time
• Have a known and reliable way to contact the media
  • Email address verified ahead of time
  • Official twitter account
  • Phone numbers where you can be reached
  • Identify the PIO as a point of contact

Case Study
• Hurricane Rita in Texas
  • Late September 2005, one month after Katrina
  • Came ashore early Saturday morning
  • Preparations began early
    • Tuesday: Houston’s Mayor and Harris County leaders urge people to pack up and leave early if they can
    • Early Wednesday: Houston’s mayor says, “Don’t wait. The time for waiting is over.”
    • Late Wednesday: Mayor backs off the statement telling people to “follow the news” to know if they’re in an evacuation zone
  • Thursday: Contra flow lanes opened (after 10 hours of preparation)
    • Travel time to Dallas: 24 to 36 hours
    • Travel time to San Antonio: 10 to 16 hours
  • Friday night / Saturday morning: Storm comes ashore east of Houston
  • Death toll:
    • 3 people killed in Texas (directly)
    • 23 nursing home evacuees killed
  • Aftermath: City studied how to better plan for evacuations
    • Media covered it at the time
    • Media covered it years later
• Lessons Learned
  • Have an evacuation plan, share it with the media and follow it
  • Don’t make “off the cuff” remarks. The media will run with it.
  • Make changes if necessary and alert the media
Mr. Kenneth Willette, NFPA

Setting Standards

- Is there a need for a standard on mass evacuation?
  - 1st responder safety
  - Hazmat response
- How do we take all this information and design a standard
  - Standards provide the benchmark we can use
  - Identify the benchmarks
- After doing an analysis, and with this addition of resources, we can get closer to achieving benchmarks
  - It levels the playing field
    - It’s a benchmark for our leaders Congressional, etc)
  - What did you see, what did you fear, why are you doing this?
  - What should the standard say?
    - How in depth should the standard be?
    - No lack of information
- Is there a role for standards in the discussion here today?

Federal Emergency Management Agency (FEMA)
Mr. Ashley Moore, FEMA

Standards & Technology Branch (NIC S&T)

- Provides standards, technology, and conformity approaches that integrates and leverages the capabilities needs of the whole community in support of National Resiliency efforts
- Mass Evacuation Standards and Best Practices
  - Post Hurricane Katrina, Rita and Ike
    - President Bush issued emergency declaration for 36 states to help
    - Non-mandated departures burdened evacuation routes and created fuel shortages
    - Criticism appeared to be weak, bureaucratic and confusing
    - Stronger language was used to convey the seriousness of the event
      Experience of gasoline shortages and gridlock influenced the way citizens were evacuated
    - Shadow evacuation consisted of citizens leaving the area without being told to do so
    - Hurricane Ike citizens were persuaded not to leave in non-evacuation zones which helped reduce shadow evacuations
- Human and Economic Impacts
  - Comparison of deaths, injuries and monetary loss for each of the hurricanes
- Legal Context
  - State statutes provided discretionary authority to the governor
• State and local officials suggested or required citizens leave homes and communities before certain catastrophes occurred
• Secretary of Homeland Security was provided detailed and comprehensive information regarding pre-disaster and post-disaster plans for the evacuation of citizens with special needs in emergencies
• Past Congressional Considerations
  • 9 attempts by Congress to reconsider federal policy options to fully integrate federal and state authorities through legislation
  • Identify populations who experienced difficulty evacuating
  • Incorporate these groups into evacuation plans
  • Anticipate potential problems in evacuation planning rather than use the lessons learned from past failure
• National Response Framework (Mass Evacuation Incident Annex)
  • States enact laws pertinent to evacuation
    • Local officials work with state officials to enforce those laws
  • National Response Framework (NRF) is administered by FEMA
    • Sets forth the roles and responsibilities of federal and non-federal entities after catastrophes overwhelm state or local governments
  • NRF (Mass Evacuation Incident Annex)
    • Provides an overview of mass evacuation functions, agency roles, responsibilities and guidelines for the integration of Federal, State, tribal and local support in the evacuation of large numbers in incidents requiring a coordinated Federal response
• Basic Implementation Process
  • Event
  • Implementation
  • Transition
  • Host
• Four Major Elements of Emergency Plans (NFPA Standard 1600)
  • Mitigation
    • Development of measures to reduce the likelihood of Damage in the event of a hazard or to lessen its impacts
  • Preparedness
    • Development of emergency plans and detailed operations plans that provide for a decision-making structure, key agency representation with well-specified roles, communications systems, training and frequent emergency drills, and plan maintenance and revisions
  • Response
Mobilization of first responders, provision of emergency support services at the disaster site, and ordering and carrying out of an evacuation if necessary

Recovery

Reestablishment of normal operations and return of evacuees to affected areas

Extracts from EOP References

Reference material extracted from EOP’s (ref. Various Nationwide Plan Reviews)

FEMA 196 Risks and Hazards: A State by State Guide

CPG 2-8-A Guide for Crisis Relocation Contingency Planning, Overview of Nuclear Civil Protection Planning, DOD/DCPA, January 1979


CPG 2-8C Guide for Crisis Relocation Contingency Planning

Operations Planning for Risk and Host Areas, DOD/DCPA, January 1979

CPGA 2-8-4 Prototype Reception/Care Plan to meet the welfare, shelter and related needs of populations affected by crisis relocation

CPG 2-8-14 Reception and Care Planning Guidance for Host Communities

Volume I – Overview

Volume II – Planning Steps and Instructions

Volume III – Planning Format

Volume IV – Tables of organization staff responsibilities

FEMA Doc Crisis Relocation Exercise Handbook

FEMA RR-9 Evacuation: An Assessment of Planning and Research

Standards, Entity Self-Assessment, and Certification: Conformity Programs

States that are broken down by region showing if they are Accredited, Not Accredited or Conditionally / Accredited

Gold – Accredited Green

(UT, AZ, CO, NM, NE, IA, MO, IL, IN, MI, OH, AR, MS, LA, TN, AL, GA, FL, SC, NC, VA, MD, NJ, PA, NY, MA, RI, VT, San Diego County (CA) and District of Columbia)
Red – Not Accredited
(HI, AK, OR, WA, NV, ID, MT, WY, ND, SD, MN, WI, KS, TX, KY, WV, DE, NH, ME, CT, City of Providence (RI))

Green - Conditionally / Accredited
(CA, OK, and Miami-Dade County (FL))

- Voluntary Consensus Standards (VCS)
- International VCS
  - Governments and Emergency Management Agencies have a duty to prepare to evacuate areas in readiness for major catastrophic incidents. Many have advanced risk-based plans and have exercised them to identify improvements. There is no template for the assessment of the plans for mass evacuation.
- National VCS
  - NFPA 1600 – Standard on Disaster/Emergency Management and Business Continuity Programs
  - EMAP – Emergency Management Standard 2010
  - ASTM E 54 Homeland Security Applications committee work (new guide for Emergency Preparedness of Private-Sector-Owned Public Assembly Venues)
  - NFPA 99 Health Care Facilities
  - NFPA 101 Life Safety Code (Facilities)
- Best Practices – National
  - ANSI, HSSP & NFPA; Health Care Industry; Pennsylvania Guide; NFPA; Harvard School of Public Health; Maine Train-the-Trainer Program; PEMA; Evacuation Planning & Implementation Guidebook
- Best Practices Tools – International
  - Additional tools that have established and proven approaches/frameworks which draws from international experience with Host Community Stakeholders
    - Vulnerability and Capacity Assessment
    - Community-Wide Vulnerability and Capacity Assessment (CVCA)
    - Participatory Vulnerability Analysis (PVA)
- Observations
  - Prior to Hurricane Katrina, Rita and Ike, evacuations were primarily a state and local responsibility
  - Because of lessons learned from these three events, federal, policy – NFA, now establishes the national standard of care
  - Federal legislation authorizing the return or relocation of
evacuees was enacted after Hurricane Katrina
- Congressed amended the Stafford Act to ensure transportation-dependent groups are included in state and local evacuation plans
- President’s platform of addressing the requirements of special-needs population in evacuation policy may deepen Federal involvement.

- **Mr. Moore believes a standard is appropriate**

J. Eric Dietz, PhD
**Director, Purdue Homeland Security Institute**
Associate Profession, Computer and Information Technology
and
Cliff Wojtalewicz
Managing Director, Purdue Homeland Security Institute

**Mission:** Aggressively grow interdisciplinary research to develop future leaders and Establish a policy that will enhance Homeland Security
**Vision:** Validating Homeland Security technology policy and practices Establish a Homeland Security career development pipeline Develop business security processes to protect critical infrastructure Be a chosen partner for Purdue and statewide faculty

Regional Hub Reception Center Project
- Regional HUB Reception Center (RHRC) Planning Guide
  - Procedures and processes to define roles and responsibilities of government, private sector, NGO’s in providing mass care functions
  - Guidelines for assessing capabilities and capacities of RHRC facilities
- RHRC Operational Plan Templates
  - Ensure consistency in development of RHRC operation plans
  - Measures ability of a facility to serve as an RHRC
- Regional Hub Reception Center Training Program
  - Planning guide training
  - RHRC Operations training
  - RHRC Just-in-time training
- Mass Care/Shelter Planning
  - Several natural, technological or man-made hazards that have and could again impact a significant portion of our population
  - Develop an operational framework to contend with a catastrophic incident
  - Up to one million people evacuate and 100,000 may need some form of shelter assistance
• Hub Centers/Spoke Shelters
  • Regional Hub Reception Centers (RHRC) will process and assign evacuees into appropriate pre-identified “Spoke Shelters” based on:
    • Shelter availability
    • Types and capabilities of facilities
    • Numbers and needs of evacuees
• RHRC (Capabilities/Services to include)
  • Intake and registration
  • First Aid/medical screening
  • Decontamination
  • Mental Health Care
  • Food/Water
  • Personal hygiene needs
  • Communications
  • Family reunification
  • Service/companion animal care
  • Temporary shelter until placement
  • Transportation to designated shelter facilities
• Regional Collaboration
  • Plan will be formulated as a Functional Annex to Regional Catastrophic Plan
  • Will not supersede local emergency plans
  • Will provide operational guidance that identifies available resources and capabilities
  • Builds regional coordination and collaboration in carrying out tasks
    • Identify local jurisdiction and Regional Mass Care Shelter POC
    • Local Mass Care Coordinator
    • Identify sites
    • Identify staff
    • Process and structure for coordination of immediate, mid & long-term Evacuee sheltering
    • Protocols and structure to enhance collaboration on critical resources
• Planning Considerations
  • Disasters are social events that leave some groups more vulnerable to impacts than others
  • Access and Functional Needs
  • Geriatrics
  • Pediatrics
• Evacuation Assembly Point (EAP)
  • Locally supported location where evacuees will be directed and assembled prior to significant relocation
  • EAP’s will provide the following services:
    • Initial evacuee processing (embarkation) and family assistance (to
include household animal operations)
- Limited respite (food, water, personal hygiene and short-term rest)
- Triage medical operations (medical operations, patient treatment, medical evacuation)
- Formal evacuation tracking may be initiated at EAP
- Evacuees will move from this site to a RHPC for shelter placement and other shelter services

- RCPGP Overview
  - Focuses on increasing catastrophic preparedness planning in high risk, high consequence urban areas
  - Focuses on planning and personnel rather than materials and equipment
  - Requires development of a Regional Catastrophic Planning Team (RCPT) to guide and manage the RCPGP effort for the site
  - Grant years funded from FY 2008 through FY 2011

- RCPGP Purpose
  - Intended to enhance regional preparedness and continuity of operations efforts. Urban areas must use these funds to employee regional approaches to overall preparedness to address catastrophic incidents and are encouraged to adopt regional response structures whenever appropriate.

Integrated Models for Evacuation
John Contestabile
Johns Hopkins University Applied Physics Lab

- Background / Project Overview
  - The Department of Homeland Security Science and Technology (DHS S&T) Infrastructure Protection & Disaster Management Division is focused on providing visual display of decision aides to Emergency Managers that harness Federal, State, Local and commercial information, as well as leverage appropriate technology options.
  - The initial capability being developed is a Real Time Evacuation Planning Model (RtePM)
    - The RtePM will evaluate vehicle traffic evacuation times in the event of a hurricane as well as nuclear power plants, wildland fires, dams, and hazardous materials incidents
    - The RtePM tool will be built in two phases:
      - Static Mode for planning evacuation
      - Dynamic Mode (more static mode development and dynamic exploration)
      - Evacuations never go well

- Goals
  - Development of a GIS-based evacuation tool that can be used to calculate an Estimated clearance time for any area drawn on a map
• Uses commonly available road network and demographic data to characterize area
• Sophisticated behavioral model a design goal
  • Ability to address shadow evacuations
  • Ability to model phased evacuation
  • Address multiday evacuations, time of day evacuation ordered, etc.
• Multi-purpose Evacuation tool
  • Large scale evacuations (hurricane) addressed in Pilot
  • Nuclear power plants
  • Chemical Stockpile Emergency Preparedness Program
  • Flood plans for dams
  • Hazardous materials incidents
  • Special events/sporting events with large crowds
• Census and Consensus Building
  • Focus Group
  • Stakeholders
  • End Users

Honorable Jim Geringer
John Nystrom, FEMA Account Manager
ESRI
• GIS is applied around the world to confront global challenges
• Mass evacuations have occurred in
  • Haiti,
  • Japan
  • U. S. (Katrina)
• Need a “living” evacuation guide
  • Collect and manage data
  • Identify vulnerabilities – mitigation requirements
  • Develop and implement preparedness plans
  • Establish and maintain situational awareness
• Supporting Emergency Management
  • Data Management
    • Collect and Fuse
    • Organize and Manage
    • Exchange and Collaborate
  • Field Mobility
  • Planning and Analysis
  • Situational Awareness
Stephen Parker  
Transportation Research Board  
Regional Approaches

Mission: To provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal.

- Transportation Modes & Disciplines Addressed by 200+ TRB Standing Committee
  - Critical Transportation Infrastructure Protection Committee
    - Shares research results from all sources and identifies research needs
  - Training, Education and Technology Transfer
    - Subcommittee of the Committee on Critical Transportation Infrastructure Protection
  - Emergency Evacuation Task Force
  - Safety and Security of Bridges and Structures Subcommittee
  - Aviation Security and Emergency Management Committee
- Communication with Vulnerable Populations: A Transportation and Emergency Management Toolkit
  - Objective
    - To develop a toolkit of communications strategies, policies, and practices for transportation agencies and emergency management agencies that focuses on communicating with vulnerable populations prior to, during, and after all-hazards emergencies.
- A Transportation Guide for All-Hazards Evacuation
  - Objective
    - To develop an all-hazards emergency evacuation guide for transportation and emergency management agencies that integrates the broad community of resources that are necessary to plan, train, exercise, and execute evacuations.

Thursday, February 9, 2012

Welcome:
- Reintroductions
- Review of Wednesday’s progress

Discussion: Is there a need for a national mass evacuation framework?
Overall, group consensus that there is a need for a mass evacuation framework, which considers:
  - Standardization/common metrics
  - Scalability (large/small incidents)
  - Politics, encourages local empowerment, but allows flexibility
  - Shelter in-place
  - Access existing plans
Additional key players who are not present:
- IACP
- Sheriff’s Association/Law Enforcement (Federal and local)
- Federal Highway Administration
- Department of Transportation
- State Emergency Managers
- NAC
- NACO
- NRC

Looking Ahead: Presentations by:
- Dave Driscoll, IAFC: Regional Planning
- David Henry, NGA: Building a Common National Framework

Dave Driscoll – Regional Planning
- Explained the success of FireScope, a taskforce put together by congress to work on common terminology, communications, mapping, etc.
- Provided a breakdown of an evacuation:
  - Go – Spontaneous, Immediate, Planned
  - Care – Complex or Simple (long-term/short-term)
  - Go Home – Water/utilities are back on
  - No Go Home – Not able to return home (home was destroyed, no place to return to)
- Related program: Ready, Set, Go (RSG) program (adopted by Wildland) was envisioned to be a multi-emergency program for people to get ready (hazmat, fire, etc.), “Go” was the activation.

David Henry - Building a Common National Framework
- Project falls under the Governors Homeland Security Advisors Council (GHSAC): Catastrophic Planning and Preparedness Committees.
- Spontaneous evacuation: no notice, poor communication to the public
- Large-scale (nationwide) evacuations occur on average every three weeks - Study by U.S. Nuclear Regulatory Commission (NRC)
- Major challenges:
  - Mass care
  - Leadership and communications
  - Citizen prep and resiliency
- October 2010 Workshop – 12 Associations and Partners
- All Hazards Consortium
- ESRI
- FEMA
- Federal Highway Administration
- George Washington University
- IACP
- IAFC
- JHU
- NGA
- Nuclear Regulatory Commission
- National Sheriff’s Association
- State Homeland Security
- Advisors and Emergency
- Management Directors
  From NJ, WV, MA

  • Common Model “Strawman”
    - Common policy guide
    - Timeline and model evacuation cycle
    - Template for crisis communications, MOU/MAAs and citizen preparedness
    - Model Field Operations Guide (FOG) or checklists
    - Open-ended appendix (respects state and local plans, assumptions and dependencies

  • Next steps: NGA is working to develop a Governors Guide for Evacuations (working group, convening, published by February 2013)

Feedback and Review: *Is there a need for a national framework? (document, standard, etc.)*

Framework Components:

- Standards with review/consensus from FEMA, NFPA & EMAP
- There are a lot of groups that should be involved. Example, EMAP has developed a process.
- NIMS is a template. How will the mass evacuation document mesh with NIMS and National Response Framework?
- CPG says that state and local governments should have an evacuation plan, but doesn’t explain how to develop one.
- Origins, definitions and approaches are ways to look at developing an evacuation. Need to think about codes.
- Standards are voluntarily accepted.
- Scope. Is it too much to focus on both mass evacuation and sheltering at the same time? 360 good idea, but potentially more feasible to focus on evacuation 180.

Key Characteristics of the Framework:

- Why or problem statement
- Consensus/buy-in from NGA & other organizations (ASHTO, IAFC, NFPA)
- List of key stakeholders that should be involved in creating a framework
- Exists within current EM framework
• **Standardization/commonality (ex. Standardized/common terminology)**
• Scalability (size, event, jurisdiction, roles)
• Not just “mass” – should be scalable to large/small
• Supports a system of best practices: public/private
• Recognizes relationships between evacuation/mass shelter
• Proves practices with data metrics, goals and accountability
• Includes citizen/community component
• Includes personal responsibility component
• Communication, civic engagement rollout (easy to understand, plain language, pictures, real-life examples, drama)
• Appendices & references to scholarly work
• Uses media to drive adoption
• Can be event specific
• Includes volunteers, training, recruitment, management
• Builds community resiliency
• Sniff test – Drill & test the framework and revise
• Keep it current
• Methods for leaders to make informed choices (empower decision makers)
• Usable & useful
• What organizations do what: roles & resources
• Whims of politics & markets
• Shelter in-place & quarantine
• Authoritative, codes, standards model;
• Encourages local empowerment
• Flexible
• Nationally developed & inclusive
• Transparent process
• Pegged metrics; measurable
• Standards & policy statements
• Work towards accreditation
• Includes tools, best practices & guidelines on preparation
• Framework is formally adopted at the legislative level (put into language to facilitate this)
• Addresses 360 life cycle
• Acknowledges where to send/receive evacuees
• Cross- jurisdictional

**Agreement from Group:** There was an agreement from the participants to:
• Support the creation of a national framework for evacuation.
• Help build a national framework for evacuation.

- It was stated that FEMA supports states and people who do evacuations. FEMA doesn’t see themselves as a lead on this project as they follow the states and become involved mainly when asked by the states.
Call to Action: *How can the participants in this room work together to create a national framework?*

Next Steps:
- Process to build a national framework
  - Assess existing plans
  - Create metric
  - Allow organizations to develop parts of framework

Parking Lot issues ?????????????

Logistics:
- IAFC, NFPA & NGA to lay out next steps

Final thoughts:
Thanks to everyone who was able to attend and contribute input to this process. This is a good start on a bottoms-ups approach.
Item 12-3-15
New Project Initiation Form
(To be completed by proponent of new project/document)

Additional pages may be attached if necessary.

a. Provide an explanation and any evidence of the need for the new project/document:

The use of respiratory protective equipment has continued to be utilized in increasingly diverse missions by personnel in law enforcement, military and additional non-structural firefighting applications. The current NFPA 1981, Standard on Open-Circuit Self Contained Breathing Apparatus (SCBA) for Emergency Services provides for an extensive level of protection for fire service applications but may be restrictive in allowing for the development of SCBA that could be used in a myriad of emergency response operations that do not involve structural fire fighting. A separate document may provide an opportunity to develop an SCBA that can be effectively deployed and efficiently used in operations that possibly require the creation of alternative requirements which may be complicated and mission-specific, thereby not allowing them to be addressed within the existing NFPA 1981 standard.

b. Identify intended users of the new document:

Potential users of the new document are law enforcement departments and agencies, hazardous material incident responders, military and defense organizations, and public and private communities.

Agencies that are potential users of the new document include the U.S. Department of Justice, the Technical Support Working Group (TSWG), Special Weapons and Tactics (SWAT) teams, the U.S. Department of Homeland Security, and state and provincial homeland security agencies.

c. Identify individuals, groups and organizations that should review and provide input on the need for the proposed new document; and provide contact information for these groups:

Federal Bureau of Investigation (FBI)
Technical Support Working Group (TSWG)
   Dr. Christina Baxter – baxterc@tswg.gov
U.S. Department of Justice
   Brian Montgomery – brian.montgomery@usdoj.gov
U.S. Department of Homeland Security
Special Weapons and Tactics Teams (SWAT)
National Association of Bomb Squad Commanders (NBSCAB)
International Association of Fire Fighters (IAFF)
International Association of Chiefs of Police (IACP)
Interagency Board (IAB)
U.S. Military
National Institute of Occupational Safety and Health (NIOSH)
State departments of homeland security

Third party testing organizations

Intertek
Safety Equipment Institute (SEI)
TRI Testing
Trace Analytics
Underwriters Laboratories (UL)
International Safety Equipment Association (ISEA)
Other Government Agencies:

U.S. Department of Health and Human Services
U.S. Department of the Army
U.S. Department of the Navy
U.S. Department of Agriculture
U.S. Department of Labor

Manufacturers:

Grace Industries, Incorporated, MD
Interspiro AB,
Tyco/Scott Health & Safety, NC
International Safety Instruments, Incorporated, GA
Draeger Safety, Incorporated, PA
Survivair, CA
Mine Safety Appliances Company, PA

d. Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new document, and what benefit they will receive by having this new document available:

All of the users, groups and organizations identified in (b) and (c).

In addition, this SCBA would be designed and suited for the specific needs of the groups mentioned for their specific applications. In addition, it would allow for these SCBAs to be certified and approved to Federal (NIOSH/CBRN) and NFPA standards in order to allow the use of money awarded through grants and other avenues which require that specific equipment meet recognized certification requirements.

e. Identify other related documents and projects on the subject both within NFPA and external to NFPA:


f. Identify the technical expertise and interest necessary to develop the document, and if the committee membership currently contains this expertise and interest:

The NFPA Technical Committee on Respiratory Protection Equipment currently has some of the technical expertise required, including familiarity with respirator use, testing and manufacture. Specialized knowledge of law enforcement requirements will be needed. Participation from these users has already been accomplished in the form of a task group. Additional input from law enforcement and various military and defense organizations, will also be sought and obtained.
g. Provide an estimate on the amount of time needed to develop the new document:

The technical committee will prepare a draft document to be presented to the Standards Council at its November 2012 meeting with TC and TCC ballot results. The goal would be to request to enter the Fall 2014 cycle, with a Public Input closing date of January 14, 2013. The estimate on the amount of time needed to develop and issue the new document is approximately 2-3 years.

h. Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new document:

There is currently committee work being performed on the NFPA 1981 Technical Committee on *Standard on Open-Circuit Self Contained Breathing Apparatus (SCBA) for Emergencies Services*, through the work of various committee task groups which may have a significant impact on the design, and testing of the SCBA. This information will be available to the members developing the new document.

**Please send your request to:**
Mary J. Maynard
NFPA
Codes and Standards Administration
1 Batterymarch Park
Quincy, MA 02169
Stds_admin@nfpa.org

**Dan Rossos**
TC Respiratory Protection Equipment
Fire and Emergency Services Protective Clothing and Equipment - Respiratory Protection Equipment

Current Committee Scope:
This Committee shall have primary responsibility for documents on respiratory equipment, including breathing air, for fire and emergency services personnel during incidents involving hazardous or oxygen deficient atmospheres. This Committee shall also have primary responsibility for documents on the selection, care, and maintenance of respiratory protection equipment and systems by fire and emergency services organizations and personnel.

NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services

Current Document Scope:
1.1 Scope. 1.1.1* This standard shall specify the minimum requirements for the design, performance, testing, and certification of new compressed breathing air open-circuit self-contained breathing apparatus (SCBA) and compressed breathing air combination open-circuit self-contained breathing apparatus and supplied air respirators (SCBA/SARs) and for the replacement parts, components, and accessories for these respirators. 1.1.2 This standard shall also specify the minimum requirements for the design, performance, testing, and certification of replacement parts, components, and add-on accessories for SCBA and combination SCBA/SARs certified as compliant to specific earlier editions of this standard. 1.1.3 This standard shall not specify requirements for other types of SCBA. 1.1.4* This standard shall not specify requirements for any accessories that could be attached to the certified product that are not certified by the National Institute for Occupational Safety and Health (NIOSH). 1.1.5 This standard shall not establish criteria for SCBA for water or underwater operations. 1.1.6 This standard shall not establish criteria for protection from ionizing radiation. 1.1.7 This standard shall not be construed as addressing all of the safety concerns associated with the use of compliant SCBA and combination SCBA/SARs. It shall be the responsibility of the persons and organizations that use compliant SCBA and combination SCBA/SARs to establish safety and health practices and to determine the applicability of regulatory limitations prior to use. 1.1.8 This standard shall not be construed as addressing all of the safety concerns, if any, associated with the use of this standard by testing facilities. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of SCBA and combination SCBA/SARs to establish safety and health practices and to determine the applicability of regulatory limitations prior to using this standard for any designing, manufacturing, and testing. 1.1.9 Nothing herein shall restrict any jurisdiction or manufacturer from exceeding these minimum requirements.
Linda, attached please find three documents related to the new project request on respiratory protection for non-structural fire fighting emergency response - the Minutes of two task group meetings, and the Minutes of the full TC meeting where the TC voted to ask the Council to approval a new, separate document.

Also, please note that the task group included the following members of the law enforcement community, NIJ, DOD, and the FBI. All task group members have indicated their full support of the project, and the Technical Committee on Respiratory Protection Equipment has indicated its intention to augment both the task group and the TC with members of the law enforcement, military, and tactical operations community.

- Rodney Colbert, Fairfax County Fire, Task Group Chairperson
- Gene Taitano, Fairfax County Police
- Heinz Ahlers, NIOSH
- Steve Sander, Safety Equipment Institute (SEI)
- Brian Montgomery, National Institute of Justice (NIJ)
- Beth Lancaster, Dept of Defense, US Marine Corp, Marine Corp Command System (DoD/USMC/MCSC)
- Christina Baxter, Dept of Defense, Technical Support Working Group (DoD/TSWG)
- Dave Bernzweig, Columbus Fire
- Mike Hoskings, FBI
- Ira Harkness, Dept of Defense, US Navy (DoD/USN)

Dave

David G. Trebisacci, CIH, CSP
Sr. Fire Protection Specialist
NFPA
1 Batterymarch Park
Quincy, MA 02269
Phone: (617) 984-7420
Fax: (617) 984-7056
dtrebisacci@nfpa.org
NFPA 1981 Task Group on Partitioning Standard into Core + Mission Specific Requirements

Meeting Minutes – 11 May 2011

Attendees:

- In Person:
  - Rodney Colbert, Fairfax County Fire, Task Group Chairperson
  - Gene Taitano, Fairfax County Police
  - Heinz Ahlers, NIOSH
  - Steve Sander, SEI
  - Brian Montgomery, NJ
  - Beth Lancaster, DoD/USMC/MCSC
  - Christina Baxter, DoD/TSWG

- On Conference Call
  - Dave Bernzweig, Columbus Fire
  - Mike Hoskins, FBI [Conference Call problems kept Mike from participating fully]
  - Ira Harkness, DoD/USN

Meeting Goal:

- Partition the NFPA 1981 SCBA standard into a core standard with mission specific requirements

Meeting Objectives:

- Determine the number and type of mission specific areas necessary to implement the change to an emergency services standard
- Address Chapter 6, Design Requirements, Chapter 7, Performance Requirements, and Chapter 8, Test Methods.

Actions

- Number of mission specific areas = 2
- Type of mission specific areas = firefighting and tactical response
- Chapter 6
  - 6.2.4: A note shall be added to the Tactical Response section (or in Annex materials) stating that an Audible Signal is not preferred for tactical law enforcement applications
  - 6.2.4.3: There will be a Tactical Response requirement that the EOSTI not be audible.
  - 6.2.4.5: Removed from CORE requirement. Maintain as a Firefighting Requirement.
  - 6.5.3: Remove from CORE requirement: Maintain as a Firefighting Requirement.
  - 6.5.4: Remove from CORE requirement: Maintain as a Firefighting Requirement.
  - All other sections within chapter 6 remain as Core elements
- Chapter 7
  - All other sections within chapter 7 remain as Core elements
• Chapter 8
  o 8.5.4.3.3: More information needed. This may be removed from the CORE Requirement and maintained in Firefighting Requirement. However, a similar test with a lower temperature range would then be required in the CORE document.
  o 8.5.5.5: More information needed. This may be removed from the CORE Requirement and maintained in Firefighting Requirement. However, a similar test with a lower temperature range would then be required in the CORE document.
  o 8.6.5.5: More information needed. This may be removed from the CORE Requirement and maintained in Firefighting Requirement. However, a similar test with a lower temperature range would then be required in the CORE document.
  o 8.6.5.7: More information needed. This may be removed from the CORE Requirement and maintained in Firefighting Requirement. However, a similar test with a lower temperature range would then be required in the CORE document.
  o 8.6.7: More information needed. This may be removed from the CORE Requirement and maintained in Firefighting Requirement. However, a similar test with a lower temperature range would then be required in the CORE document.
  o 8.7.5.1: Maintain in CORE Requirement. Change text to say “User” instead of “fire fighter”.
  o 8.11: The current Heat and Flame Test materials should be removed from CORE and moved to Firefighting Requirement. A separate requirement needs to be maintained for the CORE standard. More information is needed to determine a suitable end point for the tactical user.
  o 8.14.4.3: The specific gear cited will not be firefighting specific.
  o 8.18: Remove from CORE Requirement. Maintain as a Firefighting Requirement.
  o 8.23.4.2: The specific gear cited will not be firefighting specific.
  o 8.24: Remove from CORE Requirement. Maintain as a Firefighting Requirement.
  o All other sections remain as CORE Requirements.
  o Additional Testing Required
    ▪ Add a system-level test to determine the external visibility of HUD devices.
    ▪ Add a test for determining the “direction” of sound.
    ▪ Add a system-level test for determining the external level of noise produced by an SCBA. Determine how much higher than background is acceptable.

Based upon the notes captured above and within the associated spreadsheet, it was determined by the Task Group that dividing the standard into a core standard with two mission specific areas would be sufficient to meet the varying users’ requirements.

Next Steps:

1. Incorporate text changes into standard to show PROPOSED CHANGE.
2. Evaluate Chapters 1 – 5 and Annex Materials for potential changes.
3. Gather information for potential new tests and challenge levels.
Hello All,

I hope all of you are well, and have had a wonderful Thanksgiving.

I would like to discussed some proposed changes to NFPA 1981, captured in the attached draft document.

The Technical Committee on Respiratory Protection Equipment formed a Task Group to address the needs of the emergency services community within the structure of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services. The Task Group, with the assistance of representatives from the law enforcement, defense and hazardous materials response communities, determined that the current standard, with modifications, could be used to address Structural Firefighting and Tactical Response. The initial group gather by the 1981 Technical Committee has now been tasked to complete additional work on developing a final proposal that if time permits can be incorporated in the next standard. The TG therefore required bringing in the additional manufacturers from the NFPA 1981 Technical Committee to complete its work.

This draft document is being sent to the initial group and the manufacturers who are the primary representative on the TC committee. I am respectfully requesting that you are a designee of your choosing be assigned to the Task Group to assist with a review of the proposed changes and to ultimately provide recommendations and/or input which can be gathered for development of a proposal to be included in the standard.

The current proposal changes includes the incorporation of three new chapters within the NFPA 1981 framework to address Design Requirements, Performance Requirements and Test Methods for the Tactical Responder which represents all response elements with the exception of structural firefighting. This required a title change to Chapters 6 - Design Requirements for Fire Suppression, Chapter 7 - Performance Requirements for Fire Suppression and Chapter 8 Test Methods for Fire Suppression. The proposed new chapters in the standard are respectively Chapter 9 Design Requirements for Emergency Services, Chapter 10 - Performance Requirements for Emergency Services and Chapter 11 - Test Methods for Emergency Services. All attempts will be made to use as many of the same test methods as possible with different endpoints as appropriate to minimize the effects on the test community and the developers while providing respiratory protection suitable for non-structural firefighting operations.

I would like to point out and thank Dr. Baxter for the enormous amount of work she has completed to assist the TG, she is currently working writing language for the following new test methods (Our Chairman of the TC suggested that the manufactures would also be able to provide assistance and input with the following test paragraphs of the document).

New test methods to be developed are:
- 11.27 - A system-level test to measure the external visibility of a HUD device (Optional Test for HUD Visibility Test)

- 11.28 - A system-level test to determine the "direction" of sound produced from the device (Optional Test for Determination of Sound Level and Direction)

- Another consideration for Law Enforcement applications was a suggestion to develop a system-level test to determine the maximum level of external noise to be allowed when the SCBA is in operation.

I would like to thank the Task Group for their initial hard work. Our group had been tasked with seeking interest for these changes, determining the direction and the development of a proposal document which reflected an SCBA for use in non-structural firefighting applications. I would like to welcome the manufacturers as the new members of the Task Group, I am sure that any of the initial Task Group members would be available for questions and/or clarification. I am sure all are aware of the timeliness that is required for this to be included into the new standard; I look forward to speaking with all of you soon. There is a plan being considered to have a teleconference prior to our next TC meeting but please feel free to call or email me. My cell is 301-646-8732 and other numbers are below. Again thank you very much, and please take care.

Battalion Fire Chief R.V. Colbert
1ST Battalion, Charlie Division
HQ @ Engine Company 25 Quarters
1820 Wiehle Ave, Reston VA 20190
C 301-646-8732 | O 703-689-2157 | Duty Cell 571-221-1301
Email rodney.colbert@fairfaxcounty.gov
Personal Email rodney05014@comcast.net
Item 12-3-16
New Project Initiation Form  
(To be completed by proponent of new project/document)  
Additional pages may be attached if necessary.

a. Explain the Scope of the new project/document:


b. Provide an explanation and any evidence of the need for the new project/document:

NFPA 472 is currently used to certify personnel that respond to hazardous material operations. The problem is that NFPA 472 is not a professional qualifications document and is not written in JPR format for certifying agencies to use for certification. This has been an issue for years and a solution was drafted during the Professional Qualification “Now and Beyond Workshop” for Fire and Emergency Services held in April 2011. The participants all agreed that a new professional qualifications document should be developed to augment NFPA 472 and assist the certifying agencies in providing training and certification for personnel responding to hazardous materials incidents.

c. Identify intended users of the new project/document:

The intended users would be emergency response personnel, training and certifying agencies seeking minimum job performance requirements for specific levels of hazardous materials/weapons of mass destruction including awareness, operations, technician and incident commander levels and mission-specific competencies.

d. Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups:

All attendees of the Professional Qualification “Now and Beyond Workshop” for Fire and Emergency Services held in April 2011 have endorsed the proposed document. Those organizations and individuals are listed in the Workshop report.

e. Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available:

Persons or organizations whose responsible it is to response and mitigate incidents, training or certifying individuals involving response to hazardous materials and weapons of mass destruction incidents.

f. Identify other related documents and projects on the subject both within NFPA and external to NFPA:

Other related documents and projects related to the proposed document include:

- All NFPA Professional Qualification Project documents (18)
- All NFPA Personal Protective Equipment Project documents(12)
- NFPA 1500 – Standard on Fire Department Occupational Safety and Health Program
- NFPA – Fire Protection Handbook
- Occupational Health and Safety Administration – 1910.120
- FEMA documents related to all-hazards response and NIMS
- DOT – Research and Special Programs Administration – 49 CFR
- DOT – Emergency Response Guidebook
- Title 29, Code of Federal Regulations

g. Identify the technical expertise and interest necessary to develop the project/document, and if the
committee membership currently contains this expertise and interest:

NFPA 472 committee has the subject expertise in the proposed project. It would be beneficial for members from the ProQual committee participate to assist with the development of JPR’s.

| h. Provide an estimate on the amount of time needed to develop the new project/document: |
| In order for the new document to be prepared for entry into a revision cycle and approved by the Standards Council, it is estimated the initial draft would require not more than six months. Once the document enters a cycle, the document would be in process for approximately two years. |

| i. Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document: |
| Data and other information that already exist include but not limited to the NFPA Professional Qualifications Operations Manual which references the formatting of job performance requirements (JPRs). NFPA 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents is an extensive document that should be used towards the development of a professional qualifications document for hazardous materials/weapons of mass destruction incidents response for the fire service. NFPA – Hazardous Materials/Weapons of Mass Destruction Response Handbook would complement the technical requirements for the research of the proposed document. |

**Please send your request to:**

NFPA
Codes and Standards Administration

1 Batterymarch Park
Quincy, MA 02169

Stds_admin@nfpa.org
Rev. 10/09

**Signature:**

Name: **Greg G. Noll**

Affiliation: **Hillenbrand and Noll Associates**

(please print)
The Technical Committee on Hazardous Materials Response Personnel (HCZ-AAA) is requesting approval by the Standards Council to proceed with the **document title and scope** based on the following:

1) The Pro-Qual Now and Beyond Workshop Recommendations of April 13-14, 2011 **Reporting Structure for Hazmat Pro-Qual Requirements.** Re-align the scopes of applicable committees so that the existing NFPA Technical Committee on Hazardous Materials prepares a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels, to be processed through the Pro-Qual TCC for this document.

2) As established by the Standards Council at the August 2011 meeting recognizing HCZ-AAA Committee Scope: This Committee shall have primary responsibility for documents on the requirements for the professional qualifications, professional competence, training, procedures, and equipment for emergency responders to hazardous materials/weapons of mass destruction incidents.

The Technical Committee on Hazardous Materials Response Personnel (HCZ-AAA) is presenting the following for consideration by the Standards Council:

**Document Title:** NFPA 1072 Standard on Hazardous Materials/Weapons of Mass Destruction for Emergency Response Personnel Professional Qualifications

**Document Scope:** This standard identifies the minimum job performance requirements (JPRs) for Hazardous Materials/Weapons of Mass Destruction emergency response personnel.
November 3, 2011

Gregory G. Noll
Hildebrand & Noll Associates Inc.
1020 Stonemanor Drive
Lancaster, PA 17603

Dear Mr. Noll:

I am transmitting to you herewith the following action of the Standards Council (October 17-18, 2011):

The Council approved the request of the Chair of the Hazardous Materials Response Personnel Technical Committee (TC) to revise the scope of the Committee as follows:

**Approved Committee Scope:** This Committee shall have primary responsibility for documents on the requirements for professional qualifications, professional competence, training, procedures, and equipment for emergency responders to hazardous materials/weapons of mass destruction incidents.

Very truly yours,

Linda Fuller, Manager
Codes and Standards Administration

c:  K. Willette, T. McGowan, D. Baio, C. Cronin, C. Peterson, Y. Smith, S. Van Zandt
TC Hazardous Materials Response Personnel

11-10-9
Hildebrand and Noll Associates, Inc.
1020 Stonemanor Drive
Lancaster, PA 17603

"Emergency Planning and Response Consultants"

717-872-8542
717-872-8546 Fax
ggnoll@earthlink.net

September 21, 2011

Ms. Amy Cronin
Standards Council Secretary
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169

Dear Ms. Cronin:

As Technical Committee on Hazardous Materials Response Personnel (HMZ-AAA) Chair, I am requesting that the NFPA Standards Council consider the following change in the Committee Scope with the associated justification.

**Technical Committee on Hazardous Materials Response Personnel Committee Scope:** This Committee shall have primary responsibility for documents on the requirements for professional qualifications, professional competence, training, procedures, and equipment for emergency responders to hazardous materials/weapons of mass destruction incidents.

**Justification:** For several years, there has been an effort to incorporate and/or develop hazardous materials job performance requirements for fire fighters between NFPA 1001 and NFPA 472. Significant progress has been made over the past few months and a solution is within sight.

At the October 2010 Standards Council meeting:

The Council considered the request of the North American Fire Training Directors regarding a scope clarification between NFPA 472 and NFPA 1001 and a request to develop a new Professional Qualifications document on fire service hazardous materials responders. The Council voted to defer action on the requests at this time. The NFPA Staff has informed the Council that there has been a Professional Qualifications Summit proposed that will address the jurisdictional issues between these two committees, and it is anticipated that further information will be developed that will assist the Council in addressing the jurisdictional overlap of these two documents. The Council directs NFPA Staff to report back to the Council after the Summit at the August Council meeting.
In April 2011, the Pro-Qual Summit: Now and Beyond was convened in Dallas. The summit included members from all the Pro-Qual Technical Committees, Technical Committee Hazardous Materials Response Personnel and national fire service organizations. Many items were discussed, not the least of which was the main topic of hazardous materials. The Summit participants established the following recommendation relating to this topic:

**Reporting Structure for Hazmat Pro-Qual Requirements.** Re-align the scopes of applicable committees so that the existing NFPA Technical Committee on Hazardous Materials prepares a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels, to be processed through the Pro-Qual TCC for this document.

This recommendation was approved by the Standards Council at their August 2011 meeting:

The Council heard a report from NFPA Staff on the Professional Qualifications Summit that was convened to address the jurisdictional issues between Fire Fighter Professional Qualifications Technical Committee (TC) and the Hazardous Materials Response Personnel Technical Committee. The received the Report and has determined there is no specific action required from the Council at this time. The Council believes that the general approach that resulted from the Summit is acceptable with the exception of Item G of the Report, discussed below. Going forward, specific items requiring Council review and action should be brought to the Council as appropriate.

At this time, as Chair of the Technical Committee on Hazardous Materials Response Personnel (HCZ-AAA), I am respectfully requesting the Standards Council consideration this matter.

Respectfully submitted,

Gregory G. Noll, CSP
Chair
Technical Committee on Hazardous Materials Response Personnel
TO:        Ken Willette, Ken Holland, Tom McGowan

FROM:      Linda Fuller

DATE:      September 6, 2011

SUBJECT:   Jurisdictional Issues Between the Fire Fighter Professional Qualifications Technical Committee and the Hazardous Materials Response Personnel Technical Committee

I am transmitting to you herewith the following action of the Standards Council (August 8-11, 2011):

The Council heard a report from NFPA Staff on the Professional Qualifications Summit that was convened to address the jurisdictional issues between the Fire Fighter Professional Qualifications Technical Committee (TC) and the Hazardous Materials Response Personnel Technical Committee. The Council received the Report and has determined there is no specific action required from the Council at this time. The Council believes that the general approach that resulted from the Summit is acceptable with the exception of Item G of the Report, discussed below. Going forward, specific items requiring Council review and action should be brought to the Council as appropriate.

Item G of the Report requests that Technical Committee Chairs, who currently serve on the Technical Correlating Committee (TCC) with “limited voting” status, be appointed as full voting members. The Council must deny this request since the Regulations Governing Committee Projects (Regs) at Section 3.2.6 prohibits Technical Committee Chairs from serving as voting members of the Technical Correlating Committee. Thus, even Chairs’ current limited voting status on the TCC appears to be contrary to the Regs. In light of this, Item G will be forwarded to the Standards Council Membership Task Group to review the current “limited voting” status of the TC Chairs on the TCC and to recommend reappointment of TC Chairs as non-voting members in accordance with the Regs. The Council understands that the Item G recommendation was aimed at increasing the effectiveness of the TCC. The Council is requesting that the TCC consider, within the constraints of the Regs, whether there are other recommendations that it might make regarding structure or other items that would meet its needs and promote the effective functioning of the TCC. The Council will review any specific TCC requests as received.

c:        D. Baio, C. Cronin, P. Foley, C. Grant, B. Merrifield, C. Peterson, Y. Smith, S. Van Zandt

TC Fire Fighter Professional Qualifications Technical Committee
TC Hazardous Materials Response Personnel
TCC Professional Qualifications

Formerly Item 11-8-31
MEMORANDUM

TO: Secretary, Standards Council

FROM: Ken Willette, Program Manager; Ken Holland and Tom McGowan, Staff Liaisons

DATE: June 30, 2011

RE: Results of Pro-Qual Workshop and Impact on Professional Qualifications Project

Purpose
There are specific provisions of the Pro-Qual documents and associated programs that depend on continual harmonization and coordination. The Pro-Qual “Now and Beyond Workshop” for Fire and Emergency Services participants provided a variety of technical and procedural issues and questions on the future of the Pro-Qual Project. The purpose of the communication is to delineate the issues and recommend specific action by the Standards Council based on the Recommendations developed during the Pro Qual Workshop. This memo will:

1) Update on the status of the September 21, 2011 memo Re: Scope Conflict for Hazardous Materials Professional Qualifications Document to the Standards Council,
2) Present Workshop findings, and
3) Present staff recommendations for consideration by Standards Council

Background
The overarching goal of the Workshop was to establish a common understanding of how the individual elements, JPR’s, of the Pro-Qual system and the applicable organizational competency NFPA standards interact to provide best value to all of the Pro-Qual stakeholders. The workshop objectives were to:

• Briefly review the evolution, current status and anticipated direction of the professional qualification system;
• Identify the characteristics that provide best value to all stakeholders;
• Identify and prioritize the needs addressing the characteristics based on the best overall value; and
• Establish an action plan to provide guidance to the development of codes and standards to meet these needs.

There are eighteen separate standards and fifteen technical committees which are overseen by the Technical Correlating Committee on Professional Qualifications. It was recognized by our stakeholders that the infrastructure is well-developed and hope to see the evolution continue.

The Workshop was conducted over a day and a half and along with a review of the workshop goals, presentations on applicable baseline information were made. These were followed by three panel discussions, “Harmonizing Organizational and Individual Competencies”, “Recertification: Is it Needed and How do we Proceed”, and “Single and Multi Discipline Harmonization and Convergence”.

As stated in their September 21, 2010 memo to the Council, the North American Fire Training Directors (NAFTD) proposed a document in the Pro-Qual library was needed to address job performance requirements (JPRs) for fire service hazardous materials responders at several levels. Discussions between staff and the HCZ-AAA (TC on Hazardous Materials Response Personnel) and PQU-FFQ (TC on Fire Fighter Professional Qualifications) identified issues with the scope of each Technical Committee and under whose jurisdiction such a document would fall. Meetings between the parties continued and consensus on scope conflict persisted. Correlation of content between the TCs and the JPR language was met with apprehension by each TC as they questioned who had sufficient technical knowledge in hazardous materials response and who had sufficient resources to develop a JPR document. In researching these questions, Public Fire Protection Division Staff discovered several Pro-Qual documents and related NFPA organizational competency and training based documents also had scope conflict. To provide a mechanism to bring stakeholders together and seek input on how to address this, NFPA funded the Pro-Qual Summit and retained the Fire Protection Research Foundation to facilitate gathering input from the stakeholders and work towards a consensus report that would frame the issue and identify possible solutions. The goal was to provide a Report to the Standards Council for review and action as necessary to move beyond this issue and lay a stable foundation for the future of the Pro-Qual Project.

The Pro-Qual “Now and Beyond Workshop” for Fire and Emergency Services was held on April 13-14, 2011 in Irving, Texas to address professional qualifications used by the fire service and emergency response community.

The results of the workshop are available in the “Professional Qualifications “Now and Beyond Workshop” for Fire and Emergency Services Report. (Attached)

2) Workshop findings

Twenty key recommendations offer focus centered on defining jurisdictional scope of projects and document processing, recertification and requirements, training time, committee coordination, hazmat specific job performance requirements (JPR) information, terminology and a periodic review of Pro-Qual related issues for the Technical Committee and Technical Correlating Committee to consider. The Overall Summary of the Pro-Qual Now and Beyond Workshop Recommendations April 13-14, 2011 (Item 1).

3) Present staff recommendations that are specific for action by the Standards Council

Staff has reviewed the Workshop Recommendations (WR), and developed the following list for the Council’s review:

High Priority Recommendations to be initiated as soon as possible:

A. Workshop Recommendation 1 - Standardized TC and Document Scope Language -
   Provide standardized boiler-plate language for TC scopes and document scopes, and make available for all applicable TCs to minimize scope conflicts and creep; (Note the Pro-Qual Technical Correlating Committee has accepted responsibility to oversee this task)
B. *Workshop Recommendation 2 - Updated TC Scopes* - Direct applicable TCs to review their existing TC scopes and identify overlap concerns and propose revisions for review by the Standards Council to clarify jurisdictional boundaries. (Note: The PQ-TCC has accepted responsibility for this task)

C. *Workshop Recommendation 11- Hazmat Specific JPR Information in Current Revision Cycle* - Process the NFPA 472 and NFPA 1001 documents in their current revision cycles without hazmat specific JPR information; (Note: The respective Chairs are in agreement with this Recommendation)

D. *Workshop Recommendation 12 - New Hazmat Pro-Qual Requirements* - Continue to process current NFPA 1001 standard to reference NFPA 472 Awareness and Operations level requirements until such time as a new hazmat Pro-Qual standard is approved, preceding in as expeditious a manner as possible without sacrificing progress already established; (Note: The respective TC Chairs are in agreement with this Recommendation)

E. *Workshop Recommendation 13 - Reporting Structure for Hazmat Pro-Qual Requirements* - Re-align the scopes of applicable committees so that the existing NFPA Technical Committee on Hazardous Materials Response Personnel prepares a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels, and be processed through the Pro-Qual TCC. (Note: The Chair of NFPA 472 and the Pro-Qual TCC are in agreement with this Recommendation)

F. *Workshop Recommendation 17 - Inter-Committee Coordination* - Promote the continued use of task groups and other methods (i.e. extract policy) to facilitate harmonization between the Technical Committees responsible for scope overlap issues (e.g. NFPA 472 and NFPA 1001) to clearly align and coordinate the criteria in both documents to make sure all requirements will be consistent. Illustration of Proposed Action for Inter-Committee Coordination, April 2011 (Item 2).

G. *Workshop Recommendation 7 - Voting Status of TC Chairs on Pro-Qual TCC* - Improve the functionality of the Pro-Qual TCC by revising the “vote limited” status of the TC Chairs, to allow them to vote on issues except those directly pertaining to their assigned standards.

Intermediate Priority Recommendations to be initiated within next 12 to 24 months after further study and report back to the Council:

H. *Workshop Recommendation 4 - Review of Processing Options* - Review options for each new Pro-Qual project to improve processing efficiency and effectiveness without creating undue hardship on the established infrastructure. (Note: This is a reflection of Staff concern on managing the Pro-Qual project effectively if the project continues to grow horizontally)

I. *Workshop Recommendation 16 - Fire Service Advisory Committee* - Establish an umbrella entity for correlation and on-going harmonization at a higher level than what currently exists for the Pro-Qual TCC (i.e. similar to the HRBSAC and DARAC advisory committees).
If the Standards Council accepts the Workshop Report and endorses the prioritized Recommendations listed as items A thru I, it will provide clear guidance to staff, the TCC on Professional Qualifications and Technical Committees connected with the Pro-Qual Project for a new path forward in harmonizing Professional Qualification, Organizational Competency, and Training documents.

**Endorsements**
Ken Willette and Tom McGowan attended an informal meeting of the NFPA Technical Committee on Hazardous Materials Response Personnel in Baltimore, MD on May 20, 2011. At that meeting staff highlighted the results of the workshop and shared the twenty Workshop Recommendations. Through the ensuing discussion, TC members stated their support in moving forward based on the Workshop Recommendations. Several members expressed relief that their TC would develop the HazMat JPR’s and this issue would be put to rest.

Ken Holland, Tom McGowan and Ken Willette provided a similar presentation to the Technical Correlating Committee on Professional Qualifications on June 11, 2011 in Boston, MA. After discussion, the TCC voted to endorse the Workshop Report and Recommendations, and this is reflected in the minutes of the meeting. As noted in the prioritized recommendation list, the TCC has accepted responsibility for several tasks and is ready to begin work as soon as possible.

The North American Fire Training Directors were represented at the Pro Qual Workshop and at the June 11 Technical Correlating Committee meeting. At each meeting, they expressed their support for the Workshop Recommendations and belief the actions that follow will address the concerns stated in their September 21, 2010 letter to the Council.

**Closing**
Based on the recommendations and actions of the Standards Council, the PFP and the Pro-Qual Project stands ready to fulfill the needs of the NPFA mission for a fire safe public and the safety of the fire service and emergency response community.
PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
for
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011

Workshop hosted by:
National Fire Protection Association

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12 May 2011
The fire service and other emergency responders in North America have a well-developed infrastructure to address professional qualifications (Pro-Qual). A key part of this infrastructure are the multiple codes and standards that form the basis for training and professional competency for local, state, provincial, and federal fire protection and public safety personnel.

The NFPA Pro-Qual Project is responsible for eighteen separate standards that directly address specific Pro-Qual subjects. This topic is also addressed directly and indirectly by several other NFPA committee projects. The specific provisions of these documents, as well as programs that depend on them, are continually facing harmonization and coordination challenges. A vision expressed by interested stakeholders is that these challenges are addressed in the continued evolution of the professional qualification infrastructure.

To address these issues and to clarify this vision, a one and one-half day workshop was held on 13-14 April 2011 in Irving, Texas. The workshop was hosted by NFPA with support for administration, implementation and documentation provided by the Fire Protection Research Foundation (FPRF). This report provides the documentation of this workshop.

The goal of this interactive workshop was to establish a common understanding of how the individual elements of the Pro-Qual system and the applicable NFPA Standards (and related documents) interact to provide best value to all of the Pro-Qual stakeholders. The workshop objectives were:

- Briefly review the evolution, current status and anticipated direction of the professional qualification system;
- Identify the characteristics that provide best value to all stakeholders;
- Identify and prioritize needs addressing the characteristics based on the best overall value; and
- Establish an action plan to provide guidance to codes & standards to meet these needs.

Twenty key recommendations have resulted from this workshop. These twenty key points represent a compilation of all the recommendations brought forward. The following is a summary of these twenty key recommendations (taken from Table 5-3 of this report):

<table>
<thead>
<tr>
<th>Issue Category</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC/TCC Scopes</td>
<td>Standardized TC and Document Scope Language. Provide standardized boiler-plate language for TC scopes and document scopes, and make available for all applicable TCs to minimize scope conflicts and creep.</td>
</tr>
<tr>
<td></td>
<td>Updated TC Scopes. Direct applicable TCs to review their existing TC scopes and confirm they are (1) okay with regard to overlap concerns or (2) propose revisions for review by the Standards Council to clarify jurisdictional boundaries.</td>
</tr>
<tr>
<td></td>
<td>Model Scoping Approach. Institute a model/template for overlap issues, based on the approach</td>
</tr>
<tr>
<td>Issue Category</td>
<td>Recommendation</td>
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<td>----------------</td>
</tr>
<tr>
<td>Document Processing</td>
<td>used to address hazardous materials.</td>
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<tr>
<td>4</td>
<td><strong>Review of Processing Options.</strong> Review options within each project to improve processing efficiency and effectiveness without creating undue hardship on the established infrastructure.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Revision Cycle Coordination.</strong> Coordinate the revision cycles of applicable standards to facilitate co-processing and overlap between different committee projects during document processing, with the intent to promote harmony and consistency (e.g. NFPA committee-weeks-model).</td>
</tr>
<tr>
<td>6</td>
<td><strong>TC Member Participation.</strong> Clarify with the Chairs of the applicable TCs and TCC the process to work with Staff to ensure Standards Council policies for TC member participation are monitored and enforced by annual reporting to the Standards Council.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Voting Status of TC Chairs on Pro-Qual TCC.</strong> Improve the functionality of the Pro-Qual TCC by revising the “vote limited” status of the TC Chairs, to allow them to vote on issues except those directly pertaining to their assigned standards.</td>
</tr>
<tr>
<td>General Content</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>Document Titles.</strong> Review and update the titles of standards to accurately represent the scope and content, not only of the standard itself but also the overall project (in the case of large projects).</td>
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<tr>
<td>9</td>
<td><strong>Training Time Guidance.</strong> Consider providing guidance on making an assessment of required training times based on JPRs to implement their competencies.</td>
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<tr>
<td>10</td>
<td><strong>Similar Topics Across Multiple Standards.</strong> Examine ProQual standards for mutual exclusivity of certain technical topics to better coordinate requisite levels (e.g. foam is taught in multiple levels in various standards and which involves the same JPRs).</td>
</tr>
<tr>
<td>Specific Content</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><strong>Hazmat Specific JPR Information in Current Revision Cycle.</strong> Process the NFPA 472 and NFPA 1001 documents in their current revision cycles without hazmat specific JPR information.</td>
</tr>
<tr>
<td>12</td>
<td><strong>New Hazmat Pro-Qual Requirements.</strong> Continue to process current NFPA 1001 standard to reference NFPA 472 Awareness and Operations level requirements until such time as a new hazmat Pro-Qual standard is approved, preceding in as expeditious a manner as possible without sacrificing progress already established.</td>
</tr>
<tr>
<td>13</td>
<td><strong>Reporting Structure for Hazmat Pro-Qual Requirements.</strong> Re-align the scopes of applicable committees so that the existing NFPA Technical Committee on Hazardous Materials prepares a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels, to be processed through the Pro-Qual TCC for this document.</td>
</tr>
<tr>
<td>14</td>
<td><strong>Recertification Impact Assessment.</strong> Fully assess the impact of recertification on organizations responsible for accreditation and certification (e.g. ProBoard, IFSAC, etc) prior to any proposed implementation.</td>
</tr>
<tr>
<td>15</td>
<td><strong>Recertification Based on Expiration Date.</strong> Instead of requiring recertification, consider an alternative approach of implementing an expiration date on current certifications.</td>
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<tr>
<td>General</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td><strong>Fire Service Advisory Committee.</strong> Establish an umbrella entity for correlation and on-going harmonization at a higher level than what currently exists for the Pro-Qual TCC (i.e. similar to the HRBSAC and DARAC advisory committees).</td>
</tr>
<tr>
<td>17</td>
<td><strong>Inter-Committee Coordination.</strong> Promote the continued use of task groups and other methods (i.e. extract policy) to facilitate harmonization between the Technical Committees responsible for scope overlap issues (e.g. NFPA 472 and NFPA 1001) to clearly align and coordinate the criteria in both documents to make sure all requirements will be consistent.</td>
</tr>
<tr>
<td>18</td>
<td><strong>Needs Assessment and Sunset Policy.</strong> Establish a protocol for a needs assessment to clarify the basis for retiring documents through a sunset policy (e.g. every 10 years).</td>
</tr>
<tr>
<td>19</td>
<td><strong>Terminology.</strong> Clarify the terminology used throughout all documents that are directly or indirectly addressing Pro-Qual related requirements.</td>
</tr>
<tr>
<td>20</td>
<td><strong>Periodic Review of Pro-Qual Related Issues.</strong> Consider establishing an on-going or periodic review process of Pro-Qual related issues, similar to the activities addressed by this workshop.</td>
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</tbody>
</table>
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ACKNOWLEDGEMENTS

The planning for this Workshop has been guided with the support of a Planning Committee composed of: Rich Duffy (IAFF), Steve Edwards (NAFTD), Ken Holland (NFPA Staff, former ProQual Staff Liaison), Pat Marlatt (TC Chair on FF ProQual), Tom McGowan (NFPA Staff, current ProQual Staff Liaison), Clayton Moorman (IFSAC), Greg Noll (TC Chair for Hazardous Materials Response Personnel), Bill Peterson (TCC Chair for ProQual project), Fred Piechota (ProBoard), Chris Riley (IAFC), Bryant Stiles (NVFC), and Ken Willette (NFPA Staff, Public Fire Protection Division Manager). In addition to their input with planning aspects of the workshop, they also provided an active role in its implementation as presenters, panelists and facilitators. Their guidance and direction has been a valuable contribution to the success of the workshop and is genuinely appreciated.
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Figure 3-1: Organizational Chart of Professional Qualification Documents
Figure 3-2: Evolution of the NFPA Pro-Qual Project
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Table 1-1: Summary of the Standards Addressed by the NFPA Professional Qualifications Project
Table 1-2: Examples of Standards Coordination Issues
Table 3-1: Summary of Workshop Presentations
Table 4-1: Overview of Workshop Panel Discussions
Table 5-1: Summary of Day-One Key Points
Table 5-2: Proposed Action Items for Inter-Committee Coordination
Table 5-3: Overall Summary of Workshop Recommendations
1) BACKGROUND AND WORKSHOP OVERVIEW

This report summarizes a day and one-half workshop held on 13-14 April 2011 in Irving, Texas to address professional qualifications (Pro-Qual) used by the emergency response community. The workshop was hosted by NFPA with support for administration, implementation and documentation provided by the Fire Protection Research Foundation (FPRF). The FPRF is an affiliate of the NFPA that focuses on research-related topics.

Multiple existing codes and standards form the basis for training and professional competency for local, state, provincial, and federal fire protection and public safety personnel throughout North America. These documents are widely used in multiple venues, such as, for example, several being adopted by the Department of Homeland Security to qualify individuals involved in a wide range of national security activities. Table 1-1 provides a summary of the eighteen standards within the NFPA Pro-Qual Project, administered by the Pro-Qual Technical Correlating Committee and fifteen separate Technical Committees in the Pro-Qual project.

Table 1-1: Summary of the Standards Addressed by the NFPA Professional Qualifications Project
In addition to the eighteen standards indicated in Table 1-1, multiple other NFPA standards are directly or indirectly addressing professional qualification related topics. These other standards are not handled by the Pro-Qual project and instead are administratively handled by other NFPA Technical Committees. Three of these in particular are noteworthy because they provide accreditation requirements similar to the eighteen standards in the Pro-Qual project. These three documents are:

- **NFPA 1521, Standard for Fire Department Safety Officer**

NFPA 472 and NFPA 473 are maintained by the NFPA Technical Committee on Hazardous Materials Response Personnel and NFPA 1521 is assigned to the NFPA Technical Committee on Fire Service Occupational Safety and Health. The specific details of these documents, as well as programs that depend on them are continually facing harmonization and coordination challenges. Addressing these challenges speaks to the vision of how interested stakeholders hope to see the continual evolution of the professional qualification infrastructure. Table 1-2 summarizes examples of the coordination issues between documents within and outside of the current Pro-Qual Project. Further details on these documents are included in Annex C.

### Table 1-2: Examples of Standards Coordination Issues

<table>
<thead>
<tr>
<th>Designation</th>
<th>Document Title</th>
<th>Designation</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization Based Documents</strong></td>
<td></td>
<td><strong>Individual Based Documents</strong></td>
<td></td>
</tr>
<tr>
<td>NFPA 405</td>
<td>Reoccurring Proficiency of Airport Fire Fighters</td>
<td>NFPA 1003</td>
<td>Airport Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 472</td>
<td>Hazardous Materials/Weapons of Mass Destruction Professional Qualifications</td>
<td>---</td>
<td>(no equivalent Pro-Qual document)</td>
</tr>
<tr>
<td>NFPA 600</td>
<td>Industrial Fire Brigade</td>
<td>NFPA 1081</td>
<td>Industrial Fire Brigade Member Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 921</td>
<td>Guide for Fire and Explosion Investigations</td>
<td>NFPA 1033</td>
<td>Professional Qualifications for Fire Investigator</td>
</tr>
<tr>
<td>NFPA 1143</td>
<td>Wildland Fire Management</td>
<td>NFPA 1051</td>
<td>Wildland Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1403</td>
<td>Live Fire Training Evolutions</td>
<td>NFPA 1001</td>
<td>Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1404</td>
<td>Respiratory Protection Training Program</td>
<td>NFPA 1001</td>
<td>Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1405</td>
<td>Land Based FF Responding to Marine Vessel Fires</td>
<td>NFPA 1005</td>
<td>Marine Fire Fighting for Land-Based Fire Fighters</td>
</tr>
<tr>
<td>NFPA 1410</td>
<td>Training for Initial Emergency Scene Operations</td>
<td>NFPA 1001</td>
<td>Fire Fighter Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1451</td>
<td>Vehicle Operations Training Program</td>
<td>NFPA 1002</td>
<td>Fire Apparatus Driver/Operator Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1521</td>
<td>Standard for Fire Department Safety Officer</td>
<td>---</td>
<td>(no equivalent Pro-Qual document)</td>
</tr>
<tr>
<td>NFPA 1561</td>
<td>Emergency Services Incident Management System</td>
<td>NFPA 1026</td>
<td>Incident Management Personnel Professional Qualifications</td>
</tr>
<tr>
<td>NFPA 1670</td>
<td>Operations and Training for Technical Search and Rescue Incidents</td>
<td>NFPA 1006</td>
<td>Technical Rescuer Professional Qualifications</td>
</tr>
</tbody>
</table>
The goal of this workshop has been to establish a common understanding of how the individual elements of the Pro-Qual system and the applicable NFPA Standards (and related documents) interact to provide best value to all of the Pro-Qual stakeholders. Achieving this goal has involved the following workshop objectives through an interactive approach involving workshop participants:

- Briefly review the evolution, current status and anticipated direction of the professional qualification system;
- Identify the characteristics that provide best value to all stakeholders;
- Identify and prioritize needs addressing the characteristics based on the best overall value; and
- Establish an action plan to provide guidance to codes & standards to meet these needs.

The challenges of this topic are somewhat unique. The concepts herein addressing professional qualifications involve certification and accreditation issues and tend to be more abstract than other topics often addressed by workshops of this type (e.g. clarifying fire protection needs for a particular type of application). The current Pro-Qual infrastructure is relatively well evolved, resulting in multiple stakeholders having significant short-term and long-term interests. Additional information and an overview of fire service and emergency responders training and education are provided in Annex H.

Multiple NFPA Technical Committees are involved with different aspects of professional qualifications, and their focus and interests are not always well-coordinated. This concern involves jurisdictional scope issues, and thus this is a topic of interest to the NFPA Standards Council based on the need to properly coordinate the scopes of impacted NFPA Technical Committees. Specifically, this is an item for review at the upcoming August 2011 meeting of the NFPA Standards Council.
2) WORKSHOP VENUE AND ATTENDANCE

This one and a half day workshop was held from 8:00 am to 6:00 pm on Wednesday 13 April 2011 and from 8:00 am to 12:00 noon on Thursday 14 April 2011. In addition the attendees had a group dinner at the end of the first day. The workshop agenda and expanded program is included in Annex A.

The event was held at the Doubletree DFW North located at 4441 W. John Carpenter Freeway, Irving Texas, on the edge of the Dallas Fort Worth International Airport. As a notation for the record, some of the handouts and other documentation (e.g. Annex G) indicate the host facility as the “Wyndham DFW Airport North”, and this is due to the host hotel unexpectedly changing its name to “Doubletree DFW North” approximately two weeks before the workshop.

The venue planned for the workshop was composed of the four basic components. The first morning was dedicated to background review and assuring that all attendees were fully in-tune with critical concepts, and the challenges and concerns of the overall workshop issues. The balance of the workshop during the afternoon of the first day and morning of the second day was committed to an exhaustive discussion of these issues, and clarifying recommended steps to move forward that would be most beneficial for all parties.

Specifically, the four main parts of the workshop programs (as indicated in the expanded program in Annex A) were:

1) Call the workshop to order with (a) workshop welcome, (b) self-introductions, (c) review of the logistics, and (d) review of goals and objectives;
2) Address the overall topic in plenary session with background presentations;
3) Consider certain key specific issues in plenary session led by three separate discussion panels; and
4) Separate workgroup discussions that would address a defined set of questions and report back to the full group in plenary session.

The attendees for the workshop were invited from a wide range of interest backgrounds, and the final attendance list is included in Annex H. Due to logistics and space availability the workshop was limited to approximately forty attendees. In addition to the Chairs of the Pro-Qual TCC and TCs, the Chairs of multiple other affected NFPA Technical Committees were invited, as well as representatives from key fire and emergency services organizations impacted by these issues.
3) WORKSHOP PRESENTATIONS

Of the four main parts of the workshop, the first and second parts provided the attendees with key background information to facilitate awareness of the issues and improve dialogue. This section describes these activities in further detail.

First, the workshop opened with a review of logistics and self-introductions led by Casey Grant. Ken Willette provided a formal welcome and reviewed the workshop goals, objectives and baseline information. Multiple handouts were provided electronically to the attendees prior to the workshop, and these were reviewed in detail. Key handouts are included here in Annex A through I.

Illustrations and tables were reviewed in detail during the initial workshop presentations, and several of these were continually referenced throughout the workshop and rose in stature as key instruments of summary information. Of particular note are the “Standards Comparison Matrix” included in Annex B and the “Comparison of Individual and Organizational Based Competencies” included in Annex C. Also noteworthy is Figure 3-1: Organizational Chart of Professional Qualification Documents, which provides a single clear overview of the Pro-Qual project and other related NFPA documents outside of the project.

![Figure 3-1: Organizational Chart of Professional Qualification Documents](image-url)
The second main part of the workshop program was intended to provide a consistent understanding and appreciation for the background on this overall topic. This involved four presentations, each approximately 20 minutes in duration. The applicable presentations and their associated handouts are included herein in Annexes D, E, and F. These four presentations and their presenters are summarized in Table 3-1.

**Table 3-1: Summary of Workshop Presentations**

<table>
<thead>
<tr>
<th>Annex</th>
<th>Presentation Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>History of Professional Qualification Project</td>
<td>Doug Forsman (former Pro-Qual TCC Chair, former Standards Council member, former Board of Directors member)</td>
</tr>
<tr>
<td>E</td>
<td>Job Performance Requirement (JPR) Development</td>
<td>Bill Peterson (current Pro-Qual TCC Chair, former Standards Council member)</td>
</tr>
<tr>
<td>F</td>
<td>Standards Council Governance</td>
<td>Casey Grant (former Standards Council Secretary)</td>
</tr>
<tr>
<td>---</td>
<td>Overview of Issues of Debate</td>
<td>Ken Willette (Manager of NFPA Public Fire Protection Division)</td>
</tr>
</tbody>
</table>

Doug Forsman provided a historical background of how the fire and emergency services professional qualifications have evolved to their current status. His presentation was based on his years of direct participation with this project, including having previously served as the Chair of the Pro-Qual Technical Correlating Committee. Handouts and his presentation are included in Annex D.

![ProQual Standards Making Development Process Evolution](image)

**Figure 3-2: Evolution of the NFPA Pro-Qual Project**

Issues addressed by Doug included: the activities of the Joint Council (of national fire service organizations, circa 1970); the new era of organization (1990 to present); benchmarks along the way (1990 to present); development of JPRs; and a higher education nexus. Two useful illustrations that summarize the history of the NFPA Professional Qualification’s project are included in Figure 3-2, Evolution of the NFPA Pro-Qual Project and Figure 3-3: Chronology of NFPA Pro-Qual Documents.
Bill Peterson presented an overview of Job Performance Requirements (JPRs) to the group, since this is a critical instrument used within today's professional qualification system. Handouts and his presentation are included in Annex E. Issues he addressed included: goal of JPR development; role of committee; job task analysis process; component of a JPR (i.e. task, given, so that); task statement; written in behavioral terms; performance levels; selecting the action verb; writing the task statement; sample JPR; requisite knowledge; use of annex notes; developing training materials using JPRs; using JPRs for training; and quality control issues.

![Figure 3-3: Chronology of NFPA Pro-Qual Documents](image)

The presentation by Bill provided a useful overview of the development and implementation of JPRs, as well as a review of the mechanics of how they work. Two illustrations used during his presentation are included here that provide additional background on the JPR concept. These are Figure 3-4: Components of a JPR, and Figure 3-5: Performance Levels Used in JPR Development.

![Figure 3-4: Components of a JPR](image)
The Peterson presentation prompted several questions and comments from the attendees, and this resulted in an involved group discussion. The following are examples of these questions:

- How is the JPR concept used in other professions (e.g. aviation)?
- How are these NFPA JPRs used beyond the fire service, such as with industry?
- What are the additional check and balances in today’s system?
- How is the current system policed?
- What is the process for a needs assessment for new proposed standards, and how do we evaluate existing standards and ultimately retire/sunset those no longer needed?
- Are we comfortable that we are properly focused on minimum requirements, for any level?
- How do we maintain “objective” performance requirements, to assure JPRs are written broad enough to provide flexibility?

Casey Grant presented background on the NFPA codes and standards making process in his presentation on “Standards Council Governance”. He provided an overview of the overall process and focused on the key governing bodies, most notably the Technical Committees that serve as the primary consensus bodies, and the Standards Council. He emphasized the Standards Council critical role of approving TC scopes and thus their direct interest in this workshop because of jurisdictional scope issues.
Clarification was provided on important Council policies that should be considered in this situation and which may serve as useful tools for harmonizing issues, including the Policy on Jurisdictional Scopes and the Extract Policy. Examples were provided of how other large projects are handled in the NFPA systems (e.g. projects handling NFPA 13, 72, 70, 101, and 5000) and how they operate. A novel approach that has been effectively used for the multiple committees handling NFPA 101 and NFPA 5000 is the ‘two-hatted’ committee concept, where the same committee is individually responsible for similar requirements in these two separate code projects.

This discussion included a focus on how these other large NFPA projects manage their multiple documents. Generally, they have one critical logistical difference: they tend to have one single central code in addition to several small satellite standards. It was noted that the current Pro-Qual project, with eighteen separate standards of relatively equal stature, has far more individual standards under a Technical Correlating Committee structure than any other NFPA project.

Questions from the attendees provoked further discussion on the concept of possible document consolidation. Strong points were made on the well-established characteristics of the current infrastructure. For example, having the individual standards revised on an individual basis rather than all at once is critical to managing the workload of state fire training agencies, textbook publishers, and others directly using this information. The discussion indicated that efforts going forward to address document consolidation will need to balance the impact on the established infrastructure with the need to alleviate multiple logistics issues that can be onerous on committee volunteers and staff alike.

Grant acknowledged that combining standards can be a significant undertaking, and requires a master plan proposed by the Technical Correlating Committee to the Standards Council. This type of initiative is sometimes handled in multiple phases over several revision cycles due to the complexity of the task.

The final presentation during the session of the workshop program providing background information was by Ken Willette. He addressed issues that related to the preparation of the Panel Discussions that were about to follow. Details are addressed in the following section of this report.
4) SUMMARY OF PANEL DISCUSSIONS

The third main part of the workshop program was the Panel Discussions. The purpose of these Panel Discussions was to focus on several specific topics that were perceived to be points of ongoing debate and future planning.

The Panel Discussions were immediately preceded by a presentation from Ken Willette on the “Overview of Issues of Debate”, which provided useful clarification for the background and reasoning for addressing the three Panel sub-topics. These sub-topics are summarized in Table 4-1, Overview of Workshop Panel Discussions.

<table>
<thead>
<tr>
<th>Panel Title</th>
<th>Facilitator</th>
<th>Panelists</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Organizational &amp; Individual Competencies</td>
<td>Ken Willette</td>
<td>Steve Edwards, Casey Grant, Greg Noll, Mike Wieder</td>
</tr>
<tr>
<td>B1 Recertification: Is it Needed?</td>
<td>Tom McGowan</td>
<td>Kirby Kiefer, Marc Revere, Jim Ridley, Bryant Stiles</td>
</tr>
<tr>
<td>B2 Recertification: How to Proceed?</td>
<td>Tom McGowan</td>
<td>Steve Austin, Dave Bryson, Dave Couvelha, Fred Piechota</td>
</tr>
<tr>
<td>C Single &amp; Multi Discipline</td>
<td>Ken Holland</td>
<td>Christina Baxter, Ernest Grant, Larry Preston, Charles Wright</td>
</tr>
</tbody>
</table>

During Ken’s opening presentation he provided clarification that the issue being addressed by Panel A on “Organizational Competencies and Individual Competencies” has worked its way up to the attention of the Standards Council and is on their agenda for their upcoming August 2011 meeting. Over time, the details of concern on this topic have been addressed with a vertical focus, and a question before the group is how best to harmonize the details on a horizontal level.

Ken’s opening presentation also introduced the issues for Panels B and C on “Recertification” and “Single & Multi Discipline”. These are not new issues and are being addressed more in the context of establishing a vision for the future. For recertification, the questions before the group are: how does this fit within the current infrastructure, is it needed, and how should it be addressed assuming it is needed. The single & multi discipline issue seeks to clarify the approach of fire-service-only in contrast to addressing other professionals within the emergency responder framework.

Panel A: “Organizational Competencies and Individual Competencies”
Panel A on “Organizational Competencies and Individual Competencies” had some of the more controversial and polarized points of discussion. The needs of certain NFPA Technical Committees to address organizational competencies within their documents (e.g. NFPA 472 and
473) have led to an overlap of certain professional qualification requirements with the Pro-Qual standards (e.g. NFPA 1001).

Today’s emergency responder landscape is composed of organizational and individual competency needs. An illustration describing this landscape, and recognizing the requisite skills, knowledge and abilities required to complete the emergency response mission, is offered by Figure 4-1, Overview of Global Professional Requisite Skills, Knowledge, and Abilities.

The debate over how to address organizational and individual competencies, and who should be responsible for these requirements, is partly driven by the need to broadly address all emergency responders required to mitigate complex emergency situations. An example is a hazardous materials event, which might require technical experts from multiple agencies and organizations. The “organizational” capabilities required to successfully handle a hazardous materials event are important for documents such as NFPA 472 and NFPA 473.

However, in addressing their organizational needs, these other NFPA activities outside the NFPA Pro-Qual Project are also addressing individual competencies. This is indicated as resulting in confusion and hardship among stakeholders dependent on the current Pro-Qual infrastructure, such as those who ultimately implement the requirements through certification (e.g. ProBoard & IFSAC), as well as end-user delivery organizations of training materials (e.g. NAFTD).

The Panel A discussion included questions as to which consensus bodies should have ultimate responsibility for the range of applicable requirements, and various concepts were mentioned.
that might serve as useful tools to allow forward progress in resolving differences (e.g. Extract Policy). Despite the differences of opinion on this sub-topic, the participants of Panel A agreed on certain points such as the overall status of the current Pro-Qual infrastructure, which, while not perfect, has evolved quite far and is better than what is used by some other professions.

**Panel B: “Recertification”**
Panel B addressed the concept of recertification for fire and emergency services. Two separate panels (i.e. Panel B1 and Panel B2) addressed this in two distinct steps based on the questions of: is it needed; and if yes, how to proceed. The current infrastructure does not require certification (and recertification), and this is a significant conceptual consideration for future development of the Pro-Qual system.

The combined discussion of Panels B1 and B2 clarified a general mindset that recertification is desirable, noting that other established professional qualification systems utilize recertification (e.g. EMS, aircraft pilots, etc). However, discussion on its implementation yielded indication that it will result in multiple new challenges on the existing established infrastructure, and dealing with these challenges is potentially daunting. It was noted that certification itself is not uniformly mandated, and this should be more collectively embraced before requiring recertification.

**Panel C: “Single and Multi Discipline”**
The discussion on Panel C was conceived with the thinking that this, like the Panel B discussion, was another topic of future consideration based on managing the evolution of the current Pro-Qual system. However, as the panel addressed the concerns it became apparent that this issue is inherently intertwined with the Panel A debate on “Organizational Competencies and Individual Competencies”.

In the simplest of terms, the root question is whether the focus of today’s professional qualification system should be exclusively on the fire service (i.e. single discipline) or if it should address both the fire service and other closely related professionals (i.e. multi discipline). Panel discussion indicated that the personality of today’s Pro-Qual project has evolved such that arguably it is not clear on this topic. For example, from the perspective of the TCC on Professional Qualifications the project is relatively expansive, based on the TCC title and TCC scope that does not restrict it to the fire service, while on the other hand some of their responsible Technical Committees and standards are fire service centric according to their TC titles and/or TC scopes.

Further panel discussion indicated that certain job tasks bring focus to this philosophical question of single and multi discipline. Perhaps among the most noteworthy examples is the topic of hazardous materials. This is a key philosophical underpinning of the current debate between the Technical Committee on Hazardous Materials and the Pro-Qual Project. By their very nature, incidents involving hazardous materials are complex events, and its not unusual for them to require multiple emergency responders beyond only the fire service. It was indicated that a need exists to address professional qualification on an organizational level as well as an
individual level, to properly address organizational capabilities as well as individual competencies.

The fourth main part of the workshop program was based on separate workgroup discussions. However, the purpose of the separate workgroup discussions was to promote improved individual feedback by all attendees, and as the morning of the first day proceeded it was clear the attendees were highly engaged and providing significant feedback in the full plenary session. As a result, following the Panel discussions the attendees never separated into the three planned workgroups, and instead addressed the primary questions and concerns as a single collective body. This adjustment to the workshop venue appeared to serve the best interest of the attendees and functioned effectively.
5) **WORKSHOP CLOSING DISCUSSION AND SUMMARY OBSERVATIONS**

The Panel discussions concluded during the afternoon of the first day and was followed by intense discussion involving all attendees. This continued throughout the remainder of day one and for most of the morning of day two.

**Review of Day-One Discussions**

To stimulate the discussion on the morning of the second day, Staff presented a re-cap of the key points from the Day-One discussions. This information is presented in Table 5-1: Summary of Day One Key Points.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Standardized TC and Document Scope Language</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>Confirm/Revise TC Scopes</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>Document Titles</strong></td>
</tr>
<tr>
<td>4</td>
<td><strong>TC Member Participation</strong></td>
</tr>
<tr>
<td>5</td>
<td><strong>TC Chair Vote Limited Status on TCC</strong></td>
</tr>
<tr>
<td>6</td>
<td><strong>Inter-Committee Coordination</strong></td>
</tr>
</tbody>
</table>

The intent is that they would be initiated and/or facilitated by Staff in support of the applicable TCs and TCC(s) where appropriate, and subject to approval by the Standards Council as needed.

**Organizational Capabilities and Individual Competencies**

During the Day Two wrap-up discussion, the first five of these six items were collectively embraced by the attendees. The sixth item provoked further intense debate. Additional discussion yielded the three proposed action items. These are summarized in Table 5-2, Proposed Action Items for Inter-Committee Coordination.

To get a sense of the attendees on these three considerations, a straw poll was taken to clarify general support for each. In doing so, it was noted that although the attendees were generally representative of the various stakeholders, the group was not balanced by interest, committee representation, or any other relative criterion. The straw poll proceeded with this understanding, and recognized the poll was intended to simply establish a general sense of the
workshop participants (and further, that changes to the codes and standards process requires consideration by the TCs, TCC and Standards Council). The straw poll indicated the majority of attendees were supportive of consideration (a1) and (a2), and similarly a majority was supportive of consideration (b) with the understanding this would be for Awareness, Operations, Technician levels, and Incident Commander. It was agreed that these proposed action items should proceed in as expeditious a manner as possible, without sacrificing progress already established.

Table 5-2: Proposed Action Items for Inter-Committee Coordination

<table>
<thead>
<tr>
<th>Proposed Action Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a1</strong></td>
</tr>
<tr>
<td>Current NFPA 472 and NFPA 1001 standards should go forward without hazmat specific JPR information.</td>
</tr>
<tr>
<td><strong>a2</strong></td>
</tr>
<tr>
<td>Current NFPA 1001 standard should continue to reference NFPA 472 Awareness and Operations level requirements until such time as a new hazmat Pro-Qual standard is approved, preceding in as expeditious a manner as possible without sacrificing progress already established.</td>
</tr>
<tr>
<td><strong>b</strong></td>
</tr>
<tr>
<td>The applicable TCs should have their scopes revised, with the existing NFPA TC on Hazardous Materials scope re-aligned to prepare a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels. This will also be processed through the Pro-Qual TCC. The following proposed revised-scopes for the two directly affected Technical Committees are offered to support this approach:</td>
</tr>
<tr>
<td>• TC Scope for PQU-FFQ (responsible for NFPA 1001): This Committee shall have primary responsibility for documents on professional competence required of fire fighters.</td>
</tr>
<tr>
<td>• TC Scope for HCZ-AAA (responsible for NFPA 472): This Committee shall have primary responsibility for documents on the requirements for the professional competence, professional qualifications, training, procedures, and equipment for emergency responders to hazardous materials incidents.</td>
</tr>
</tbody>
</table>

Additional discussion indicated that this approach should proceed in the most expeditious manner. Further, this approach could serve as a model for the other NFPA projects that have or potentially may have overlap with the Pro-Qual Project. A visual model of this approach is provided in Figure 5-1, Illustration of Proposed Action Items for Inter-Committee Coordination.

Figure 5-1: Illustration of Proposed Action Items for Inter-Committee Coordination
Recertification

The other summary issues from the earlier Panel Discussions were discussed to capture all the various issues of concern. The next topic of focus by the group during the closing discussions was on recertification.

The current infrastructure is relatively well-established, and if recertification is introduced it raises questions on how to best minimize the alterations that will be required. Thoughts were expressed that prior to trying to address recertification, more widespread and consistent implementation of certification is required via the existing system at the State and local level. An illustration of the recertification discussion from the previous day was provided by Staff, and this is illustrated in Figure 5-2: Summary of Discussion on Recertification.

![Figure 5-2: Summary of Discussion on Recertification](image)

The group engaged in discussion with a focus on bullets 4 and 5 in Figure 5-2. It was acknowledged that for documents that address maintenance of skills, the intent would be to consider adding recertification (currently the Pro-Qual TCC requires all documents to have a skills maintenance requirement). It was indicated that recertification is a significant issue and should be addressed by the TCC with direction to the TCs. The resulting discussion yielded the following key points:

- The Pro-Qual TCC should directly address this issue.
- Be sensitive to the impact on accreditation and certification, and work directly with ProBoard and IFSAC Boards on this issue.
- Clarify the terminology on this specific issue (e.g. certification, credential, license, etc).
- An alternative approach is to indicate an expiration date on current certifications, rather than require recertification.

Single and Multi Discipline Harmonization and Convergence

The third of the three earlier Panel Discussions addressed single- and multi discipline harmonization and convergence. The previous day’s discussion had led full circle back to the other discussion on organizational and individual competencies. Figures 5-3 and 5-4 provide a
summary presented by Staff on the earlier discussion on single- and multi discipline”. The information in these figures was further refined based on subsequent discussion by the attendees.

Figure 5-3: Summary of Discussion on Single and Multi Discipline

Among the various additional details discussed by the group, the key point expressed by the attendees was to emphasize the need for the single and multi discipline issue to be philosophically clarified at the highest levels of management and leadership within NFPA. This would provide useful guidance for the TCC and applicable TCs as they further address this subject. It was noted that a definition of “multi discipline” is not obvious and is not uniformly understood between committees. For example, “multi discipline” is interpreted by some committees as multiple areas of the fire service (e.g. NFPA 1031 for fire inspector & plans examiner, or NFPA 1035 for life safety educator, public information officer & juvenile firesetter intervention specialist), as compared to those that deal with multiple disciplines on a broader scale (e.g. NFPA 472 for fire services, emergency medical services, law enforcement, emergency managers, etc, or NFPA 1061 for telecommunicators) of which the fire service is one element.

Figure 5-4: Summary of Discussion on Single and Multi Discipline (continued)
Other Issues Raised by Attendees

As the workshop was in its closing stages, the group was asked for any other issues of importance that should be noted, and for clarification of any issues already discussed. This yielded the following key points:

- Provide a needs assessment that readdresses all documents based on a sunset policy, i.e. every 10 years (expanding on the current TCC requirement that all standards have a job/task analysis at the start of every revisions cycle to ensure that they are still relevant).
- Consider approach to address hazardous materials as a model/template for other overlap issues.
- Consider co-locating and/or co-processing documents so that there is overlap during the document processing to encourage cross-pollination.
- Consider an umbrella entity for correlation and on-going harmonization at a higher level than what currently exists for the Pro-Qual TCC, similar to the HRBSAC and DARAC advisory committees.
- Better coordinate the revision cycles of all applicable documents, e.g. NFPA committee-weeks-model.
- Review processing options within each project to clarify the most efficient and effective arrangement that also minimizes potential adverse impact on the established infrastructure.
- Clarify requiring Pro-Qual TCs making an assessment of required training times based on JPRS to implement their competencies (possibly as annex guidance).
- In standards process, ProQual standards should be examined and assessed for mutual exclusivity to remove redundancy from prerequisite levels. For example, foam is taught in multiple levels in various standards and which involves the same JPRs.
- Need to address the problem of TC Chairs not being able to vote in the Pro-Qual TCC on issues other than those directly related to their respective standards.
- Need this review process stimulated by this workshop done on a regular basis.

In summary, the key points from this workshop are consolidated in Table 5-3, Overall Summary of Workshop Recommendations. This represents a compilation of all the recommendations brought forward as a result of this workshop. For convenience, the twenty recommendations shown are grouped into five main categories of:

- TC/TCC Scopes;
- Document Processing;
- General Content;
- Specific Content; and
- General
Table 5-3: Overall Summary of Workshop Recommendations

<table>
<thead>
<tr>
<th>Issue Category</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC/TCC Scopes</td>
<td>1 Standardized TC and Document Scope Language. Provide standardized boiler-plate language for TC scopes and document scopes, and make available for all applicable TCs to minimize scope conflicts and creep.</td>
</tr>
<tr>
<td></td>
<td>2 Updated TC Scopes. Direct applicable TCs to review their existing TC scopes and confirm they are (1) okay with regard to overlap concerns or (2) propose revisions for review by the Standards Council to clarify jurisdictional boundaries.</td>
</tr>
<tr>
<td></td>
<td>3 Model Scoping Approach. Institute a model/template for overlap issues, based on the approach used to address hazardous materials.</td>
</tr>
<tr>
<td>Document Processing</td>
<td>4 Review of Processing Options. Review options within each project to improve processing efficiency and effectiveness without creating undue hardship on the established infrastructure.</td>
</tr>
<tr>
<td></td>
<td>5 Revision Cycle Coordination. Coordinate the revision cycles of applicable standards to facilitate co-processing and overlap between different committee projects during document processing, with the intent to promote harmony and consistency (e.g. NFPA committee-weeks-model).</td>
</tr>
<tr>
<td></td>
<td>6 TC Member Participation. Clarify with the Chairs of the applicable TCs and TCC the process to work with Staff to ensure Standards Council policies for TC member participation are monitored and enforced by annual reporting to the Standards Council.</td>
</tr>
<tr>
<td>General Content</td>
<td>7 Voting Status of TC Chairs on Pro-Qual TCC. Improve the functionality of the Pro-Qual TCC by revising the “vote limited” status of the TC Chairs, to allow them to vote on issues except those directly pertaining to their assigned standards.</td>
</tr>
<tr>
<td></td>
<td>8 Document Titles. Review and update the titles of standards to accurately represent the scope and content, not only of the standard itself but also the overall project (in the case of large projects).</td>
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<td></td>
<td>9 Training Time Guidance. Consider providing guidance on making an assessment of required training times based on JPRS to implement their competencies.</td>
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<tr>
<td></td>
<td>10 Similar Topics Across Multiple Standards. Examine ProQual standards for mutual exclusivity of certain technical topics to better coordinate requisite levels (e.g. foam is taught in multiple levels in various standards and which involves the same JPRs).</td>
</tr>
<tr>
<td>Specific Content</td>
<td>11 Hazmat Specific JPR Information in Current Revision Cycle. Process the NFPA 472 and NFPA 1001 documents in their current revision cycles without hazmat specific JPR information.</td>
</tr>
<tr>
<td></td>
<td>12 New Hazmat Pro-Qual Requirements. Continue to process current NFPA 1001 standard to reference NFPA 472 Awareness and Operations level requirements until such time as a new hazmat Pro-Qual standard is approved, preceding in as expeditious a manner as possible without sacrificing progress already established.</td>
</tr>
<tr>
<td></td>
<td>13 Reporting Structure for Hazmat Pro-Qual Requirements. Re-align the scopes of applicable committees so that the existing NFPA Technical Committee on Hazardous Materials prepares a hazmat Pro-Qual standard that is JPR based, including but not limited to Awareness, Operations, Mission Specific Operations, Technician, and Incident Commander levels, to be processed through the Pro-Qual TCC for this document.</td>
</tr>
<tr>
<td></td>
<td>14 Recertification Impact Assessment. Fully assess the impact of recertification on organizations responsible for accreditation and certification (e.g. ProBoard, IFSAC, etc) prior to any proposed implementation.</td>
</tr>
<tr>
<td></td>
<td>15 Recertification Based on Expiration Date. Instead of requiring recertification, consider an alternative approach of implementing an expiration date on current certifications.</td>
</tr>
<tr>
<td>General</td>
<td>16 Fire Service Advisory Committee. Establish an umbrella entity for correlation and on-going harmonization at a higher level than what currently exists for the Pro-Qual TCC (i.e. similar to the HRBSAC and DARAC advisory committees).</td>
</tr>
<tr>
<td>Issue Category</td>
<td>Recommendation</td>
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</tr>
<tr>
<td>17</td>
<td><strong>Inter-Committee Coordination.</strong> Promote the continued use of task groups and other methods (i.e. extract policy) to facilitate harmonization between the Technical Committees responsible for scope overlap issues (e.g. NFPA 472 and NFPA 1001) to clearly align and coordinate the criteria in both documents to make sure all requirements will be consistent.</td>
</tr>
<tr>
<td>18</td>
<td><strong>Needs Assessment and Sunset Policy.</strong> Establish a protocol for a needs assessment to clarify the basis for retiring documents through a sunset policy (e.g. every 10 years).</td>
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<tr>
<td>19</td>
<td><strong>Terminology.</strong> Clarify the terminology used throughout all documents that are directly or indirectly addressing Pro-Qual related requirements.</td>
</tr>
<tr>
<td>20</td>
<td><strong>Periodic Review of Pro-Qual Related Issues.</strong> Consider establishing an on-going or periodic review process of Pro-Qual related issues, similar to the activities addressed by this workshop.</td>
</tr>
</tbody>
</table>

The workshop adjourned with thanks provided to all participants.
ANNEX A

WORKSHOP AGENDA

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
Background: Multiple existing codes and standards form the basis for training and professional competency for local, state, provincial, and federal fire protection and public safety personnel throughout North America. These documents are widely used in multiple venues, such as, for example, several being adopted by the Department of Homeland Security to qualify individuals involved in a wide range of national security activities. The specific details of these documents, as well as programs that depend on them are continually facing harmonization and coordination challenges. Addressing these challenges speaks to the vision of how interested stakeholders hope to see the continued evolution of the professional qualification infrastructure.

Workshop Goal and Objectives: This meeting will seek to establish a common understanding of how the individual elements of the fire service professional qualifications system and the applicable NFPA Standards and related documents interact to provide best value to all of the professional qualifications stakeholders. This will be accomplished through an interactive approach involving interested stakeholders that will focus on the following workshop objectives:

- Briefly review the evolution, current status and anticipated direction of the pro-qual system;
- Identify the characteristics that provide best value to all stakeholders;
- Identify and prioritize needs addressing the characteristics based on the best overall value; and
- Establish an action plan to provide guidance to codes & standards to meet these needs.

Workshop Format: The following format and agenda is planned for this workshop:

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>8:00 am, Day1</td>
<td>Day 1 Welcome and Introductions</td>
</tr>
<tr>
<td>8:15 am, Day1</td>
<td>Presenters 1) Review of Workshop Goal, Objectives, and Deliverables</td>
</tr>
<tr>
<td>8:30 am, Day1</td>
<td>Presenters 2) Presentations on Applicable Baseline Information</td>
</tr>
<tr>
<td>10:00 am, Day1</td>
<td>Panelists / All Participants 3) Panel Discussions of Key Issues</td>
</tr>
<tr>
<td>2:00 pm, Day1</td>
<td>Workgroups 4) Workgroup Discussions of Key Issues</td>
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<tr>
<td>4:00 pm, Day1</td>
<td>All Participants 5) Workgroup Reports and Plenary Discussion</td>
</tr>
<tr>
<td>6:00 pm, Day1</td>
<td>Recess for Day</td>
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<tr>
<td>8:00 am, Day2</td>
<td>Day 2 Welcome</td>
</tr>
<tr>
<td>8:15 am, Day2</td>
<td>Presenters / All Participants 6) Summary of Day1 Results &amp; Framing of Day2 Discussion</td>
</tr>
<tr>
<td>8:30 am, Day2</td>
<td>Workgroups 7) Workgroup Discussions on Day1 Findings</td>
</tr>
<tr>
<td>10:00 am, Day2</td>
<td>All Participants 8) Workgroup Reports and Plenary Discussion</td>
</tr>
<tr>
<td>11:00 am, Day2</td>
<td>Presenters / All Participants 9) Discussion of Next Steps</td>
</tr>
<tr>
<td>11:30 am, Day2</td>
<td>Presenters / All Participants 10) Plenary Review and Closing Remarks</td>
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<tr>
<td>12:00 pm, Day2</td>
<td>Adjourn</td>
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Further Information: Attendance is based on invitation only due to space limitations. Attendees will be expected to be familiar with materials provided beforehand to make the most efficient use of limited time. If you are interested in participating or would like more information, please contact cgrant@nfpa.org no later than 18 February 2011. After the Workshop a report of the results will be available for interested parties.
# Professional Qualifications: Now and Beyond  
Fire and Emergency Services Professional Qualifications Workshop

**Location:** Wyndham DFW Airport North, 4441 W. John Carpenter Freeway, Irving TX  
**Workshop Dates:** 13-14 April 2011  
(Flyer Last Updated: 5 April 2011; subject to update)

## Expanded Program

<table>
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<tr>
<th>Time</th>
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<tr>
<td><strong>Day1 Welcome and Introductions</strong></td>
<td>8:00 am, Day1</td>
</tr>
<tr>
<td>1)</td>
<td>Review of Workshop Goal, Objectives, and Deliverables (Ken Willette and Staff)</td>
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<tr>
<td>2)</td>
<td>Presentations on Applicable Baseline Information (20 minute presentations)</td>
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<tr>
<td></td>
<td>History of ProQual Project (Doug Forsman)</td>
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<td>JPR Development (Bill Peterson)</td>
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<td>Standards Council Governance (Casey Grant)</td>
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<td>Overview of Issues of Debate (Ken Willette)</td>
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<td></td>
<td>• Organizational &amp; Individual Competencies • Recertification, • Single &amp; Multi Discipline</td>
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<tr>
<td>Break</td>
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<tr>
<td>3)</td>
<td>Panel Discussions of Key Issues (55 minutes per Issue) (Panelists / All Participants)</td>
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<tr>
<td>A)</td>
<td>Harmonizing Organizational &amp; Individual Competencies (Facilitator: Ken Willette)</td>
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<td></td>
<td>(Panel: Steve Edwards, Casey Grant, Greg Noll, Jim Podolske, Mike Wieder)</td>
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<td>B)</td>
<td>Recertification: Is it Needed and How to Proceed? (Facilitator: Tom McGowan)</td>
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<td></td>
<td>(Panel on &quot;Is it Needed?&quot;: Kirby Kiefer, Marc Revere, Jim Ridley, Bryant Stiles, Marc Tonnacliff)</td>
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<td>(Panel on &quot;How to Proceed!&quot;: Steve Austin, Dave Bryson, Dave Couvelha, Fred Piechota)</td>
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<td>C)</td>
<td>Single &amp; Multi Discipline Harmonization &amp; Convergence (Facilitator: Ken Holland)</td>
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<td>(Panel: Christina Baxter, Ernest Grant, Larry Preston, Charles Wright)</td>
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<td>Lunch</td>
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<td>4)</td>
<td>Workgroup Discussions of Key Issues (Workgroups)</td>
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<tr>
<td>5)</td>
<td>Workgroup Reports and Plenary Discussion (All Participants)</td>
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<tr>
<td>Recess for Day</td>
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<tr>
<td>Day 2 Welcome</td>
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<tr>
<td>6)</td>
<td>Summary of Day1 Results &amp; Framing of Day2 Discussion (All participants, led by Ken Willette and Staff)</td>
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<tr>
<td>7)</td>
<td>Workgroup Discussions on Day1 Findings (Workgroups)</td>
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<tr>
<td>Break</td>
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<td>8)</td>
<td>Workgroup Reports and Plenary Discussion (All Participants)</td>
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<td>9)</td>
<td>Discussion of Next Steps (Presenters / All Participants)</td>
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<tr>
<td>10)</td>
<td>Plenary Review and Closing Remarks (Presenters / All Participants)</td>
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<td>Adjourn</td>
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</tbody>
</table>
ANNEX B

STANDARDS COMPARISON MATRIX

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
<table>
<thead>
<tr>
<th>Doc Number / TC Acronym / Edition / Rev Cycle</th>
<th>Document Title</th>
<th>Committee Scope</th>
<th>Document Scope</th>
<th>Source Documents</th>
<th>ProBoard Related Certifications</th>
<th>IFSAC Related Certifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Qualifications Technical Correlating Committee (all Pro Qual Docs)</td>
<td>Fire Service Professional Qualifications Accreditation and Certification Systems</td>
<td>Responsible for documents on (1) procedures for fire service personnel certification to NFPA Professional Fire Service Qualifications Standards of other standards adopted by the authority having jurisdiction, and (2) procedures for accrediting national, state, provincial, and local jurisdictions as certifying entities for NFPA Professional Fire Service Qualifications Standards of other standards adopted by the AHJ</td>
<td>Establishes the minimum criteria for accrediting bodies, assessment and validation of the process used to certify fire and related emergency response personnel to professional qualifications and non-engineering, fire-related, academic, degree-granting programs offered by institutions of higher education</td>
<td>NFPA 472 HMWMD Response Personnel NORP1001 Fire Fighter NORP1002 Driver/Operator NORP1003 ARFI NORP1006 Rescue Technician NORP1021 Fire Officer NORP1031 Fire Inspector/Plan Examiner NORP1033 Investigator NORP1035 FLSE, PIO, JFIS NORP1041 Fire Service Instructor NORP1051 Wildland Fire Fighter NORP1061 Telecommunicator NORP1071 Emergency Vehicle Technician NORP1081 Industrial Fire Brigade NORP1500 Occupational Safety &amp; Health NORP1521 Safety Officer</td>
<td>• Fire Fighter I • Fire Fighter II • Fire Fighter I/II • Fire Fighter III</td>
<td>• Fire Fighter I • Fire Fighter II • Alternative Standard Ontario Office of the Fire Marshal Fire Services Fire Fighter</td>
</tr>
<tr>
<td>NFPA 1000</td>
<td>Fire Fighter Professional Qualifications</td>
<td>Responsible for documents on professional competence required of the firefighters</td>
<td>Identifies the minimum job performance requirements (JPRs) for career and volunteer firefighters whose duties are primarily structural in nature</td>
<td>NFPA 472 HMWMD Response Personnel NORP1000 Certification/Accreditation NORP1002 Driver/Operator NORP1021 Fire Officer NORP1031 Fire Inspector/Plan Examiner NORP1061 Telecommunicators NORP1403 Live Fire Training Evolutions NORP1404 Respiratory Protection Training Program NORP1500 Occupational Safety &amp; Health NORP1582 Occupational Medical Prog NORP1710 Organization/Deployment of Fire Suppression Operations - Career NORP1962 Hose, Couplings, Nozzles Manual on Uniform Traffic Control Devices, DOT 29 CFR 1910.120 – HAZWOPER</td>
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<tr>
<td>NFPA 1005 PQU-FFQ 2007 F2011</td>
<td>Marine Fire Fighting for Land-Based Fire Fighters</td>
<td>Responsible for documents on professional competence required of the firefighters</td>
<td>Identifies the minimum job performance requirements (JPRs) for land-based fire fighters responsible for firefighting operations aboard</td>
<td>NFPA 1000 Certification/Accreditation NFPA 1001 Fire Fighter NFPA 1002 Driver/Operator NFPA 1031 Fire Inspector/Plan Examiner NFPA 1081 Industrial Fire Brigade NFPA 1500 Occupational Safety and Health NFPA 1405 Land Based FF responding to Marine Vessel Fires</td>
<td>• Marine Fire Fighter I • Marine Fire Fighter II</td>
<td>• Marine Fire Fighter I • Marine Fire Fighter II</td>
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<tr>
<td>Doc Number / TC Acronym / Edition / Rev Cycle</td>
<td>Document Title</td>
<td>Committee Scope</td>
<td>Document Scope</td>
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<td>NFPA 1021</td>
<td>PQU-FOF</td>
<td>2009</td>
<td>A2013</td>
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<tr>
<td>Fire Officer Professional Qualifications</td>
<td>Responsible for documents on professional competence required of fire service officers</td>
<td>Identifies the minimum job performance requirements necessary to perform the duties of a fire officer and specifically identify four levels of</td>
<td>NFPA 1000 Certification/Accreditation NFPA 1001 Fire Fighter NFPA 1002 Driver/Operator NFPA 1031 Fire Inspector/Plan Examiner NFPA 1033 Fire Investigator NFPA 1041 Fire Service Instructor NFPA 1521 Safety Officer NFPA 1600 Disaster/Emergency Management and Business</td>
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<tr>
<td>Protocol AIHA Decontamination for Hazardous Materials Emergency Timothy Henry</td>
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</table>
|                              |               |                | specifically identifying the job performance requirements necessary to perform as a fire inspector or a plan examiner | NFPA 11 Low, Medium and High Foam  
NFPA 12 Carbon Dioxide  
Extinguishing  
NFPA 12A Halon 1301  
NFPA 17 Dry Chemical  
Extinguishing  
NFPA 25 Inspection, Testing, Maintenance of Water-Based Fire Protection Systems  
NFPA 72 National Fire Alarm Code  
NFPA 1021 Fire Officer  
NFPA 1033 Fire Investigator  
NFPA 1035 FSLSE, PIO, JFIS  
NFPA 2001 Clean Agent Fire Extinguishing Systems  
Guidance Document for Incorporating Risk Concepts Into NFPA Codes and Standards  
| NFPA 1033 PQU-FIV 2009 A2013 | Professional Qualifications for Fire Investigator | Responsible for documents on professional competence required of fire investigators | Identify the professional level of job performance requirements for fire investigators | NFPA 472 HMWMD Response Personnel  
NFPA 921 Guide for Fire and Explosion Investigations  
Fire Protection Handbook  
ASTM E 620 Practice on Reporting Opinions of Scientific or Tech Experts  
ASTM E 678 Practice for the Evaluation of Technical Data  
IAAI Fire Investigator Safety Checklist  
IFSTA Hazardous Materials for Fire and Explosion Investigators: Guidelines and Procedures  
IFSTA Safety and Health Guidelines for Fire and Explosion Investigators Safety at Scenes of Fire and Related Incidents Munday | Fire Investigator | Fire Investigator |
| NFPA 1035 PQU-PFE 2007 F2014 | Professional Qualifications for Fire and Life Safety Educator, Public Fire Educator and Juvenile Firesetter Intervention Specialist | Responsible for documents on professional competence of public fire educators, public information officers, and juvenile firesetter educators | Identifies the levels of professional performance required for public fire and life safety educators, public information officers, and juvenile firesetter intervention specialists | NFPA 1000 Certification/Accreditation  
NFPA 1002 Driver/Operator  
NFPA 1031 Fire Inspector/Plan Examiner  
Preventing Childhood Emergencies: A Guide to Developing Effective Injury Prevention Initiatives  
Injury Prevention and Control for Children and Youth  
Community Education Leadership  
The National Juvenile Firesetter/Arson Control and Prevention Program  
IFSTA Fire and Life Safety Educator  
IFSTA FSLSE Resource Kit  
Intervention, Resource Materials: FIRE Solutions, Inc  
Legal Issues in Child Abuse and Neglect | Public Fire and Life Safety Educator I  
Public Fire and Life Safety Educator II  
Public Fire and Life Safety Educator III  
Public Information Officer  
Juvenile Firesetter Intervention Specialist I  
Juvenile Firesetter Intervention Specialist II | Public Fire and Life Safety Educator I  
Public Fire and Life Safety Educator II  
Public Fire and Life Safety Educator III  
Public Information Officer  
Juvenile Firesetter Intervention Specialist I  
Juvenile Firesetter Intervention Specialist II |
<table>
<thead>
<tr>
<th>Doc Number / TC Acronym / Edition / Rev Cycle</th>
<th>Document Title</th>
<th>Committee Scope</th>
<th>Document Scope</th>
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<th>ProBoard Related Certifications</th>
<th>IFSAC Related Certifications</th>
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</thead>
<tbody>
<tr>
<td>NFPA 1041 PQU-FSI 2007 F2011</td>
<td>Fire Service Instructor Professional Qualifications</td>
<td>Responsible for documents on professional competence required of fire service instructors</td>
<td>Identifies minimum job performance requirements (JPRs) for fire service instructors</td>
<td>NFPA 1500 Certification/Accreditation NFPA 1002 Driver/Operator NFPA 1401 Recommended Practice for Fire Service Training Reports and Records NFPA 1403 Live Fire Training Evolutions</td>
<td>• Fire Service Instructor I</td>
<td>• Fire Service Instructor I</td>
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<td>• Fire Service Instructor II</td>
<td>• Fire Service Instructor II</td>
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<td>• Fire Service Instructor III</td>
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<td>• Alternative Standard Ontario Office of the Fire Marshal Fire Training Officer</td>
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<tr>
<td>NFPA 1051 PQU-WSP 2007 F2011</td>
<td>Wildland Fire Fighter Professional Qualifications</td>
<td>Responsible for documents on professional qualifications for personnel engaged in wildland fire management</td>
<td>Identify the minimum job performance requirements (JPRs) for wildland fire duties and responsibilities</td>
<td>NFPA 472 HMWMD Response Personal NFPA 1001 Fire Fighter NFPA 1002 Driver/Operator NFPA 1021 Fire Officer NFPA 1033 Fire Investigator NFPA 1035 FSLE, PIO, JFIS NFPA 1143 Wildland Fire Management NFPA 1144 Protection for Life and Property from Wildfire NFPA 1500 Occupational Safety and Health NFPA 1561 Emergency Services IMS NFPA 1582 Occupational Medical Program NFPA 1977 Protective Clothing and Equipment for Wildland Fire Fighting Refer to various NWCG handbooks, pamphlets, training packages</td>
<td>• Wildland Fire Fighter I</td>
<td>• Wildland Fire Fighter I</td>
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<td>• Wildland Fire Fighter II</td>
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<td>• Wildland Fire Officer I</td>
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<td>• Wildland/Urban Interface Protection Specialist</td>
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<td>NFPA 1061 PQU-PST 2007 F2011</td>
<td>Professional Qualifications for Public Safety Telecommunica tor</td>
<td>Responsible for documents on the professional qualifications for public safety dispatchers</td>
<td>Identifies the minimum job performance requirements for public safety telecommunicators</td>
<td>NFPA 601 Security Services in Fire Loss Prevention NFPA 1000 Certification/ Accreditation NFPA 1002 Driver/Operator NFPA 1221 Installation, Maintenance and Use of Emergency Services Communications Systems NFPA 1561 Emergency Services IMS</td>
<td>• Public Safety Telecommunicator I • Public Safety Telecommunicator II • Public Safety Telecommunicator III</td>
<td>• Public Safety Telecommunicator I • Public Safety Telecommunicator II • Public Safety Telecommunicator III</td>
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<tr>
<td>NFPA 1081 PQU-IFB 2007 A2011</td>
<td>Industrial Fire Brigade Member Professional Qualifications</td>
<td>Responsible for documents on the professional competence required for personnel who participate as members of industrial fire brigades</td>
<td>Identifies the minimum job performance requirements (JPRs) necessary to perform the duties as a member of an organized industrial fire brigade providing services at a specific facility or site</td>
<td>NFPA 10 Portable Fire Extinguishers NFPA 14 Installation of Standpipe and Hose NFPA 472 HMWMD Response Personnel NFPA 600 Industrial Fire Brigade NFPA 1000 Certification/Accreditation NFPA 1002 Driver/Operator NFPA 1021 Fire Officer NFPA 1031 Fire Inspector/Plan Examiner NFPA 1403 Live Fire Training NFPA 1404 Respiratory Protection Training NFPA 1500 Occupational Safety &amp; Health NFPA 1521 Safety Officer NFPA 1561 Emergency Services IMS NFPA 1582 Occupational Medical Program NFPA 1620 Recommended Practice for Pre-Incident Planning NFPA 1961 Fire Hose</td>
<td>• Incipient Industrial Fire Brigade Member • Advanced Exterior Industrial Fire Brigade Member • Interior Structural Industrial Fire Brigade Member • Industrial Fire Brigade Leader • Advanced Exterior/Interior Structural Fire Brigade Member</td>
<td>• Incipient Industrial Fire Brigade Member • Advanced Exterior Industrial Fire Brigade Member • Interior Structural Industrial Fire Brigade Member • Industrial Fire Brigade Leader</td>
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<td>NFPA 1091 PQU-TCM Initial Initial</td>
<td>Professional Qualifications for Traffic Control Incident Management</td>
<td>Responsible for documents on the professional competence required for personnel who participate as traffic control personnel</td>
<td>Identifies the minimum job performance requirements (JPRs) for career and volunteer fire fighters necessary to perform the duties of traffic control personnel and specifically identify four levels of progression</td>
<td>NFPA 1962 Hose, Couplings, Nozzles NFPA 1710 Organization/Deployment of Fire Suppression Operations – Career 29 CFR 1910.120 HAZWOPER 29 CFR 1910.134 Respiratory Protection 29 CFR 1910.156 Subpart L Fire Brigade</td>
<td>• Health and Safety Officer • Incident Safety Officer, Fire Suppression • Incident Safety Officer, Emergency Medical Service Operations • Incident Safety Officer, Hazardous Materials Operations • Incident Safety Officer, Technical Rescue</td>
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<tr>
<td>NFPA 472 HCZ-AAA 2008 A2012</td>
<td>Hazardous Materials/Weapons of Mass Destruction Professional Qualifications</td>
<td>Responsible for documents on the requirements for the professional competence, training, procedures, and equipment for identifying hazardous materials</td>
<td>Identify the minimum levels of competence required by responders to emergencies involving hazardous materials</td>
<td>NFPA 11 Low, Medium, High Expansion Foam NFPA 25 Inspection, Testing, Maintenance of Water-Based Fire Protection Systems NFPA 30 Flammable and Combustible Liquids Code NFPA 58 Liquefied Petroleum Gas</td>
<td>• Competencies for the First Responder at the Awareness Level • Competencies for the First Responder at the Operational Level</td>
<td>• Competencies for the First Responder at the Awareness Level • Competencies for the First Responder at the Operational Level</td>
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<td>emergency responders to hazardous materials incidents</td>
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<td>materials/weapons of mass destruction (WMD), Apply to any individual or member of any organization who responds to hazardous materials/WMD incidents, Cover the competencies for awareness level personnel, operations level responders, hazardous materials technicians, incident commanders, hazardous materials officers, hazardous materials safety officers, and other specialist employees</td>
<td>NFPA 306 Control of Gas Hazards on Vessels</td>
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<td>NFPA 600 Industrial Fire Brigade</td>
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<td>NFPA 704 Identification of the Hazards of Materials for Emergency Response</td>
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<td>NFPA 1405 Land-Based Fire Fighters Who Respond to Marine Vessels</td>
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<td>NFPA 1951 Protective Ensembles for Technical Rescue</td>
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<td>NFPA 1994 Protective Ensembles for First Responders to CBRN Terrorism Incidents</td>
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<td>Fire Protection Handbook Chapter 9</td>
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<td>Emergency Response Guidebook DOT 18 USC Section 2332a Use of Weapons of Mass Destruction 29 CFR 1910.120 HAZWOPER</td>
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<td>NFPA 473 HCZ-AAA 2008 A2012</td>
<td>EMS Personnel Responding to Hazardous Material/Weapons of Mass Destruction Professional Qualifications</td>
<td>Responsible for documents on the requirements for the professional competence, training, procedures, and equipment for emergency responders to hazardous materials incidents</td>
<td>Identifies the levels of competence required of emergency medical services (EMS) personnel who respond to incidents involving hazardous materials or weapons of mass destruction (WMD). It especially covers the requirements for basic life support and advanced life support personnel in the pre-hospital setting</td>
<td>NFPA 11 Low, Medium, High Expansion Foam NFPA 30 Flammable and Combustible Liquids Code NFPA 58 Liquefied Petroleum Gas Code NFPA 472 HMWMD Response Personnel NFPA 704 Identification of the Hazards of Materials for Emergency Response NFPA 1651 Emergency Services IMS NFPA 1681 FD Infection Control Program NFPA 1991 Vapor-Protective Ensembles for Hazardous Materials Emergencies NFPA 1992 Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies Emergency Response Guidebook DOT 18 USC Section 2332a Use of Weapons of Mass Destruction Various publications from ACC, API, IMO, NRT, US Government and et.al.</td>
<td>• Competencies for the Technician with a Cargo Tank Specialty • Competencies for the Technician with an Intermodal Tank Specialty • Competencies for the Technician with a Marine Tank Vessel Specialty • Competencies with Operations and PPE • Competencies with Awareness &amp; Ops &amp; Product Control • Competencies with Operations and Product Control • Competencies with Awareness and Operations and All Mission Specific</td>
<td>• Competencies for Haz Mat/WMD BLS Responder • Competencies for Haz Mat/WMD ALS Responder • Competencies for Haz Mat/WMD BLS Responder • Competencies for Haz Mat/WMD ALS Responder</td>
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ANNEX C

COMPARISON OF INDIVIDUAL AND ORGANIZATIONAL BASED COMPETENCIES

PROFESSIONAL QUALIFICATIONS

“NOW AND BEYOND WORKSHOP”

FOR

FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
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<tr>
<td>Professional Qualifications Technical Correlating Committee PQU-AAC</td>
<td>Responsible for the management of the NFPA Professional Qualifications Project and documents related to professional qualifications for the fire service, public safety and related personnel.</td>
</tr>
<tr>
<td>NFPA 1000 PQU-ACF Fire Service Professional Qualifications Accreditation and Certification Systems 2011</td>
<td>Responsible for documents on (1) procedures for fire service personnel certification to NFPA Professional Fire Service Qualifications Standards of other standards adopted by the authority having jurisdiction, and (2) procedures for accrediting national, state, provincial, and local jurisdictions as certifying entities for NFPA Professional Fire Service Qualifications Standards of other standards adopted by the authority having jurisdiction.</td>
</tr>
<tr>
<td>NFPA 1001 PQU-FFQ Fire Fighter Professional Qualifications 2008</td>
<td>Responsible for documents on professional competence required of the firefighters.</td>
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<tr>
<td>NFPA 1404 FIIY-AAA Respiratory Protection Training Program 2006</td>
<td>Contains minimum requirements for the training component of the Respiratory Protection Program found in NFPA 1500, Standard on Fire Department Occupational Safety and Health Program.</td>
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<tr>
<td>Doc # / Committee / Title / Year</td>
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<td><strong>Initial Emergency Scene Operations 2010</strong></td>
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<td><strong>Initial Emergency Scene Operations 2010</strong></td>
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<td><strong>NFPA 1002 PQU-FFQ Fire Apparatus Driver/Operator Professional Qualifications 2009</strong></td>
<td>Responsible for documents on professional competence required of fire fighters.</td>
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<tr>
<td><strong>NFPA 1003 PQU-FFQ Airport Fire Fighter Professional Qualifications 2010</strong></td>
<td>Responsible for documents on professional competence required of fire fighters.</td>
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<tr>
<td><strong>NFPA 1005 PQU-FFQ Marine Fire</strong></td>
<td>Responsible for documents on professional competence required of fire fighters.</td>
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<tr>
<td>Fighting for Land-Based Fire Fighters 2007</td>
<td>Responsible for documents on the professional qualifications for fire service and related personnel who will perform rescue operations.</td>
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<tr>
<td>NFPA 1006 PQU-RES Technical Rescuer Professional Qualifications 2008</td>
<td>Establishes the job performance requirements necessary for fire service and other emergency response personnel who perform technical rescue operations.</td>
</tr>
<tr>
<td>NFPA 1021 PQU-FOF Fire Officer Professional Qualifications 2009</td>
<td>Responsible for documents on professional competence required of fire service officers.</td>
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<tr>
<td>NFPA 1026 PQU-ICM Incident Management Personnel Professional Qualifications 2009</td>
<td>Responsible for documents on the professional competence required of personnel performing roles within an all-hazard incident management system.</td>
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<tr>
<td>NFPA 1031 PQU-FIS Professional Qualifications for Fire Inspector and Plan Examiner 2009</td>
<td>Responsible for documents on professional competence required of fire inspectors.</td>
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<td>NFPA 1035</td>
<td>Responsible for documents on professional competence</td>
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<td>PQU-PFE</td>
<td>Professional Qualifications for Fire and Life Safety Educator, Public Fire Educator and Juvenile Firesetter Intervention Specialist</td>
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<td>NFPA 1037</td>
<td>Responsible for documents on professional competence</td>
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<td>PQU-FMA</td>
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<td>NFPA 1041</td>
<td>Responsible for documents on professional competence</td>
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<td>PQU-FSI</td>
<td>Fire Service Instructor Professional Qualifications</td>
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<td>NFPA 1051 PQU-WSP Wildland Fire Fighter Professional Qualifications 2007</td>
<td>Responsible for documents on professional qualifications for personnel engaged in wildland fire management.</td>
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<td>NFPA 1061 PQU-PST Public Safety Communicator 2007</td>
<td>Responsible for documents on the professional qualifications for public safety dispatchers.</td>
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<td>NFPA 1071 PQU-EVM Emergency Vehicle Technician Professional Qualifications 2011</td>
<td>Responsible for documents on professional qualifications required of personnel engaged in the diagnosis, maintenance, and repair of systems and components that are unique to emergency response vehicles.</td>
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<td>NFPA 1081 PQU-IFB Industrial Fire Brigade Member Professional Qualifications 2007</td>
<td>Responsible for documents on the professional competence required for personnel who participate as members of industrial fire brigades.</td>
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<td>Responsible for documents on the professional competence required for personnel who participate as traffic control personnel.</td>
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1-1.4 This standard shall not apply to medical response, confined space rescue response, and hazardous material response activities.
ANNEX D

HISTORY OF PROFESSIONAL QUALIFICATIONS PROJECT

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
History of ProQual Documents

In 1971, the Joint Council of National Fire Service Organizations (JCNFSO) created the National Professional Qualifications Board (NPQB) for the fire service to facilitate the development of nationally applicable performance standards for uniformed fire service personnel. On December 14, 1972, the Board established four Technical Committees to develop those standards using the National Fire Protection Association (NFPA) standards-making system. The initial committees addressed the following career areas: fire fighter, fire officer, fire service instructor, and fire inspector and investigator.

The various levels of achievement in the standards were to build on each other within a strictly defined career ladder. In the late 1980s, revisions of the standards recognized that the documents should stand on their own merit in terms of job performance requirements (JPRs) for a given field. Accordingly, the strict career-ladder concept was abandoned, except for the progression from fire fighter to fire officer.

In 1990, responsibility for the appointment of professional qualifications committees and the development of the professional qualifications standards were assumed by the NFPA. The Correlating Committee on Professional Qualifications was appointed by the NFPA Standards Council in 1990 and assumed the responsibility for coordinating the requirements of all of the Professional Qualifications documents.

From 1997 onward, JPR format was used to be consistent with the other standards in the Professional Qualifications Project. Each JPR consists of the task to be performed; the tools, equipment, or materials that must be provided to successfully complete the task; evaluation parameters and/or performance outcomes; and lists of requisite knowledge and skills one must have to be able to perform the task.

- **NFPA 1001**
  - Adopted by the Association in November 1974 as part of the four original standards.
  - 2008: A complete revision was done to include: a skills maintenance requirement was added, specific knot-tying requirements were deleted and replaced with those required by the authority having jurisdiction, the inspection and public education requirements were moved.

- **NFPA 1002**
  - Adopted by the Association in 1976.
  - 2009: The purpose and scope were re-written, the term “certification” was replaced with “qualifying”, and a “skills maintenance” section was added.

- **NFPA 1003**
  - Adopted by the Association in 1978.
  - 2005: The required experience for an airport firefighter was raised to require Fire Fighter II minimum.

- **NFPA 1004**
  - Standards Council established the Technical Committee in 1984.
  - Only published in one edition (1985) and was not incorporated into any other standards.
  - 1990: The Standard was withdrawn and is no longer used.
- **NFPA 1005**
  - Originated in July 2000 when the Standards Council received a letter from the Department of Defense (DoD), requesting consideration for a new project on shipboard firefighting for land based units.
- **NFPA 1006**
  - Standards Council established the Technical Committee in 1994 to specify job requirements both for general and specific technical rescue applications.
  - 2008: Swiftwater, Ice, and Surf Rescue chapters were added, and Subterranean was divided into Mines & Tunnels and the other Caves. Addition of Level I & II.
- **NFPA 1021**
  - Standards Council established the Technical Committee in December 1972 as part of the four original standards.
  - NFPA adopted the standard in July 1976.
  - 1992: Reduced levels of progression to four levels.
  - 2009: Changed “certification” to “qualification”, revised scope, and added skill maintenance requirements.
- **NFPA 1026**
  - Originated in August 2000 when the standards council received a letter from the National Fire Service Incident Management System Consortium.
  - Scope and need for the project was verified in 2001 and 2002 Task group meetings.
  - Standards Council approved project in July 2003.
- **NFPA 1031**
  - Standards Council established the Technical Committee in December 1972 as part of the four original standards which was adopted by the NFPA in May 1977.
  - 1986: Developed separate documents for each job function in the original NFPA 1031 (Fire Inspector, Investigator, Fire Prevention Education Officer).
  - 2009: Complete revision according to TCC to provide ProQual consistency.
- **NFPA 1033**
  - Standards Council established the Technical Committee in December 1972 as part of the four original standards which was adopted by the NFPA in May 1977.
  - 1986: Joint Council directed the committee to create separate standards for each job.
  - 2009: The Technical Committee added an explanatory annex to the scope to clarify the inclusion of vehicles, outside, and other non-structural fires. Also added skills maintenance section.
- **NFPA 1035**
  - Standards Council established the Technical Committee in December 1972 as part of the four original standards which was adopted by the NFPA in May 1977.
o 1986: Joint Council directed the committee to create separate standards for each job.
  o 2000: New chapters were added for Public Information Officer, Juvenile Firesetter Intervention Specialist I & II.

- NFPA 1037
  o Standard Council approved the project in October 2001 as requested by the International Fire Marshals Association.

- NFPA 1041
  o Standards Council established the Technical Committee in December 1972 as part of the four original standards.
  o 1975: Separated into four distinct levels of instructor responsibilities: 1) to teach, 2) to develop teaching material, 3) to supervise teaching staff and program, and 4) to manage, budget, and implement the program.
  o 1976: This standard was first issued then revised in 1981 and 1987.
  o 1996: Standard was revised into JPRs based on complete job task analysis to focus more on instructor and developer rather than management aspects.
  o 2007: The Standard was updated for ProQual consistency.

- NFPA 1051
  o Standards Council established the Technical Committee in 1991.
  o 2002: The Technical Committee changed the purpose, scope, and completely revised the document to include suppression and pre-suppression activities, removed Wildland Fire officer I & II, Wildland firefighter III & IV, and added Wildland/Urban Interface Coordinator and Specialist.

- NFPA 1061
  o 2002: Updated JPRs, requisite knowledge, and requisite skills.
  o 2007: Revised Chapters and terminology and added Public Safety Telecommunicator III regarding the command post at a large incident.

- NFPA 1071
  o Standards Council established the Technical Committee in 1995 at the request of the Maintenance section of the International Association of Fire Chiefs.

- NFPA 1081
  o Standards Council approved the Technical Committee in 1996.
  o 2007: Complete revision of document including editorial changes to JPRs, requisite knowledge, requisite skill statements, and site-specific requirements.

- NFPA 1091
  o While the Standards Council approved the formation in August 2010, the document is still in the draft development stage.
PROFESSIONAL QUALIFICATIONS FOR THE FIRE SERVICE

A Brief and Uncomplicated History

Joint Council of National Fire Service Organizations (circa 1970)
- NFPA
- IAFC
- IAFF
- IFSTA
- ISFSI
- FMANA
- IAAI
- NABPFF
- NVFC
- State Training Directors

National Professional Qualifications System (1972 – 1989)
- Standards Committees
  - 1001, 1021, 1031, 1041
- National Certificates
- Accredit Certifiers
- Establish Pro Board

NEW ERA OF ORGANIZATIONS (1990 +)
- NBFSPQ
  - NFPA, IAFC, IAAI, NASFM & NAFTD
- Accreditation, Certificates and Forums
- IFSAC
- User agencies
- Accreditation, Certificates and Forums
- NFPA TCC
- Balanced committees, Correlation and Review

BENCHMARKS ALONG THE WAY (1990 TO PRESENT)
- Job Performance Requirements
- Measurable provisions
- New Standards
- Establishing need
- Higher Education Nexus
  - IFSAC Degree Assembly
- Old issues
- New issues

THANKS TO NFPA RESEARCH FOUNDATION
- HISTORY IS A TEACHER NOT A LIMITER
- WORK HARD AND KEEP AN OPEN MIND
ANNEX E

OVERVIEW OF JPR DEVELOPMENT

PROFESSIONAL QUALIFICATIONS

“NOW AND BEYOND WORKSHOP”

FOR

FIRE AND EMERGENCY SERVICES

IRVING, TEXAS

13-14 APRIL 2011
Overview: Job Performance Requirements

Job Performance Requirements (JPRs) are principal to the National Fire Protection Association (NFPA) Professional Qualifications (ProQual) standards. It is recognized that JPRs benchmark a framework for the fire service and others who endorse the use of NFPA professional qualifications standards. JPRs enhance professionalism, organizational growth and development, and standardization of practices.

NFPA is responsible for the standards development process. Technical Committees (TC) are responsible for the content of the ProQual Standards and JPR methodology. NFPA relies on public input, openness, consensus and balance to establish a ProQual document representative of the duties and responsibilities for the various positions and levels. The JPRs are primarily used for training design and evaluation, certification and accreditation, measuring and critiquing on-the-job performance, defining hiring practices, and setting organizational policies, procedures, and goals. The ProQual standards and JPRs are minimum knowledge and skill proficiencies established by peers of the fire service and consent entity members which comprise a TC.

Components of a JPR

The JPR is the assembly of three critical components:

1. Task that is to be performed - brief statement of what the person is to accomplish
2. Tools, equipment, or materials that must be provided to successfully complete the task - listing of items allows the performer and evaluator to know what must be provided in order to complete the task
3. Evaluation parameters and/or performance outcomes - defines expectation of performance required and promotes consistency in evaluation by reducing the variables

JPR contains requisite knowledge and skills. Requisite knowledge and skills are the foundation for task performance. These are the necessary knowledge and skills one must have prior to being able to perform the task.

Sample JPR 1.
The Fire Fighter I shall ventilate a pitched roof, given an ax, a pike pole, an extension ladder, and a roof ladder, so that a 1.22 m × 1.22 m (4 ft × 4 ft) hole is created, all ventilation barriers are removed, ladders are properly positioned for ventilation, and ventilation holes are correctly placed.

(A) Requisite Knowledge. Pitched roof construction, safety considerations with roof ventilation, dangers associated with improper ventilation, knowledge of ventilation tools, effects of ventilation on fire growth, smoke movement in structures, signs of backdraft, and knowledge of vertical and forced ventilation.

(B) Requisite Skills. Ability to remove roof covering; properly initiate roof cuts; use pike pole to clear ventilation barriers; use ax properly for sounding, cutting, and stripping; position ladders; and climb and position self on ladder.

Sample JPR 2.
The Fire Investigator shall interpret burn patterns, given standard equipment and tools and some structural/content remains, so that each individual pattern is evaluated with respect to the burning characteristics of the material involved.
(A) **Requisite Knowledge.** Knowledge of fire development and the interrelationship of heat release rate, form, and ignitibility of materials.

(B) **Requisite Skills.** Ability to interpret effects of burning characteristics on different types of materials.

**Linking JPRs and Instructional Objectives**

JPRs state what is necessary to perform the task(s) on the job. Instructional objectives are used to identify what students must do at the end of a training session and are stated in behavioral terms that are measurable in the training environment. Requisite skills and knowledge should be converted into enabling objectives. Enabling objectives assist in defining the course content. The course content would include each of the requisite knowledge and skills.
Job Performance Requirement (JPR) Development

Professional Qualifications: Now and Beyond
April 13-14, 2011
Dallas, Texas

Goal of JPR Development
To develop job performance requirements (JPRs) in a clear and concise manner so that individuals recognized as knowledgeable in a particular NFPA Professional Qualification Standard can be evaluated on their ability to successfully perform essential job tasks.

Committee Responsibility
• Conduct a Job Task Analysis
• Use the correct format for JPRs
• Include measurable requirements
• Committee intent clear to end user

Role of Committee
• Conduct a complete Task Analysis
• Develop JPRs using standard format
• Consider end user when developing JPRs
  – Complete list of requisites
  – Provide measurable evaluation criteria

Job Task Analysis Process
• Determine precisely what a person does in a specific job
• Results in detailed description the activities performed on the job
• Develop relevant job tasks
• Organize tasks into primary areas of responsibility
• Utilize Job Inventory Worksheet

Components of a JPR
1. Task
   What
   Action Verb
2. Given
   Provided items to accomplish task
3. So That (Standard)
   How performance of task is evaluated

Committee:
Duty: Regional Operations
1. TASK
   Action Verb
2. Given
   Provided items to accomplish task
3. So That
   The building is cleared of debris and the contents are protected from additional damage

Attachment 12-3-16
Page 68 of 114
Task Statement

- Behavioral terms (action verb)
- Describes clearly the action or activity to be performed
- Verb selection defines performance level of task

Selecting the Action Verb

- Should describe mental and physical skills needed to perform task
- Level of performance is determined by verb selection
- Select best verb to describe task

Writing Task Statement

- Be Brief
- Be Precise
- Use consistent language
- Avoid qualifiers – accurately, correctly, safely

Sample JPR

5.3.16* Extinguish incipient Class A, Class B and Class C fires, given a selection of portable fire extinguishers, so that the correct extinguisher is chosen, the fire is completely extinguished and correct extinguisher-handling techniques are followed.

Requisite Knowledge

- (a) Requisite Knowledge: The classifications of fire; and portable extinguisher types, rating systems, risks associated with each class of fire, operating methods and limitations.
Requisite Skills

(b) Requisite Skills: The ability to operate portable fire extinguishers, approach fire with portable fire extinguishers, select an appropriate extinguisher based on the size and type of fire and safely carry portable fire extinguishers.

Annex Note

A.5.3.16 The Fire Fighter I should be able to extinguish incipient Class A fires such as wastebaskets, small piles of pallets, wood or hay; Class B fires of approximately 9 ft$^2$ (0.84 m$^2$); and Class C fires where the electrical equipment is energized.

Developing Training Materials Using JPRs

- Define training objective
- Identify applicable document and resource materials
- Develop lesson plans with enabling objectives

Using JPRs for Training

- Converted into lessons or objectives
  - Audience
  - Behaviors
  - Conditions
  - Degrees for evaluating
- Requisite Skills and Knowledge Lists
  - Become enabling objectives
  - Enabling objectives help define course content

Quality Control Issues

- Did the committee conduct a job task analysis?
- Are the JPRs in the correct format?
- Are the requirements measurable?
- Is the intent of the committee clear to the end user?

From Standards to Effective Training

- Assists with creating performance checklists
- Includes each item from JPR “So That” list
- Identifies critical items for competency
- Determines the evaluation passing score
JPR Development

• Thanks for your attention!
ANNEX F

BACKGROUND ON
STANDARDS COUNCIL GOVERNANCE

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
Standards Council Governance

The Big Picture

The Participants
- (The public)
- ~75,000 Members
- 1) Board of Directors
  - Approximately 23 members
  - Elected by Membership
- 2) Standards Council
- 3) Technical Committees
  - (NFPA Staff)

Technical Committees
- "Consensus bodies" in system
- Typical maximum size of 30
- Overall; ~7,000 Volunteers
- ~235 Technical Committees, balanced by interest categories
- ~300 Codes & Standards

Standards Council
- 13 Members
- Appointed by Board
- Responsibilities:
  - A) Adjudicate Appeals
  - B) Issue documents & TIAs
  - C) Appoint Committee Members
  - D) Assign Committee Scopes
- Typically meet 3 times/year

Committee Scopes
- Approved by Standards Council
- Ideally: They should clearly delineate the responsibilities between Technical Committee Projects
- Tools to Assist:
  - "Jurisdictional Scope Policy"
  - "Extract Policy"
Governance Issues

- Balance of:
  - Consensus Body Administration
  - Extensive Public Input
    - 1) Proposal
    - 2) Comments
    - 3) Annual/Fall Meeting
    - 4) SC Issuance (Appeals)

- ~Two Year Revision Cycle
- Documents Revised every 3 – 5 Years (per ANSI requirements)

Governance Issues

TCCs and TCs

- Correlating Role of TCC
- Role of TCs: Primary Technical Consensus Body

Governance and Document Management

- Other Large NFPA Projects
  - Concept: Single Document Approach
    - NFPA 13, NFPA 70, NFPA 72, NFPA 85, NFPA 101/5000, NFPA 1971
  - Trend has been to combine documents
  - Separate individual standards are NOT PREFERRED!
    - Reason: Burden on entire system, i.e. volunteers, staff, Standards Council
  - Concept: Two-Hatted Technical Committees
    - Example; NFPA 101/5000
Governance and Document Management

Next Steps

What is needed for the future?

- Define Terminology
- Define Technical Details and Clarify Jurisdictional Responsibilities

Consider:

- Extract Policy
- Single vs. Multiple Document Approach
- Other (e.g. Two-Hatted TCs)

National Fire Protection Association

ProQual Workshop
13-14 April 2011; Irving, Texas
ANNEX G

PROPOSED WORKGROUP QUESTIONS

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
Each of the working groups should individually address the following set of specific topics/questions, and report back to the whole group:

1) General
   a) **Key Topics.** This workshop has identified three key areas for focused discussion (1-Organizational & Individual Competencies, e.g. NFPA 472 & NFPA 1001; 2-Recertification; and 3-Single & Multi Discipline). Are there others, and what is the priority of all these issues?

   b) **Today's Infrastructure.** What needs to be addressed or is missing in today's infrastructure to assure the necessary credentials for emergency responders (e.g. recertification, etc)?

   c) **Other Approaches.** Are there other professions, methods, or jurisdictions that use a different infrastructure model that should be considered (e.g. military, maritime, aviation, other countries, etc)?

2) Current Issues
   a) **Current Status.** What is the single most important strength of today's infrastructure? What is the weakness that presents the greatest challenge?

   b) **Points of Commonality.** How are individual competencies and organizational competencies used and how do they intersect (i.e. what are their points of commonality)?

   c) **Scoping.** How should the scope be defined for individual competencies and organizational competencies, and how do they relate to single and multi discipline?

   d) **Responsibilities.** Who should be assigned responsibility for which critical aspects, and will changes be needed (e.g. membership) to properly handle these critical aspects?

3) Future Issues
   a) **Knowledge Gaps.** What areas of expertise need to be enhanced or addressed, and in what priority?

   b) **Logistical Approaches.** What approaches or directions should be considered to assure a vibrant future for emergency responder professional qualifications (e.g. addressing new topics, consolidating standards, etc)?

   c) **Optimum infrastructure.** Describe the optimum infrastructure arrangement in 10 or 20 years.
ANNEX H

OVERVIEW OF
FIRE SERVICE TRAINING AND EDUCATION

PROFESSIONAL QUALIFICATIONS
“NOW AND BEYOND WORKSHOP”
FOR
FIRE AND EMERGENCY SERVICES

IRVING, TEXAS
13-14 APRIL 2011
Overview of Fire Service Training and Education

There are an estimated 1.1 million fire fighters in the United States today. This estimate is based on a sample survey with a confidence level associated with each estimate, and does not include certain fire fighter constituency groups such as industrial fire departments and federal fire departments.

Approximately 75 percent of these fire fighters serve as volunteers with the remainder serving as career fire fighters. As expected, the more populated jurisdictions are protected primarily by career fire fighters while rural areas are protected primarily by volunteer fire fighters. Some fire departments are a mix of career and volunteer fire fighters in what are considered combination fire departments.

This section covers the preparation and process infrastructure utilized by fire fighters to perform their duties, with a focus on how they prepare for handling emergencies such as those involving electric and hybrid electric vehicles. A review is provided on what is typically included in fire service training and education programs, as well as an overview of fire service standard operating procedures and guidelines commonly used by fire fighters.

Defining the Profession of Fire Fighting

Fire fighters face a bewildering spectrum of possible emergency events. As a result they are generalists in their core knowledge and acquire specialized additional skills to handle certain duties.

Fire service personnel require skills that are already adequately learned and ready to be used before an emergency occurs. Beyond the obvious hazards associated with fireground operations, the duties of a fire fighter include the need for training on additional topics commonly shared with other professions. Examples include bio-hazards associated with handling of victims requiring emergency medical services, and transportation safety relating to the hazards of large mobile fire apparatus.

Fire service training and education is a critical part of the activities addressed by fire fighters. It is not uncommon for fire fighters to be in a situation where their own personal survival depends on this training and education, and they are continually subjected to learning on a wide range of important topics. For all topics of interest to fire service emergency responders, an on-going need exists for updated, accurate, consistent, readily understandable training information.
What distinguishes a fire fighter from someone who is not a fire fighter? Most obvious is an individual’s formal relationship (e.g., employment or membership) with a recognized fire service organization. Equally important, however, is the individual’s training and education that qualifies them to adequately perform the tasks expected of a fire fighter.

To be “qualified by training and examination” are critical defining characteristics for today’s fire service. Among the various definitions of fire fighter in the common literature, the following reflects the baseline importance of qualification by training and examination:

“Fire Fighter: An individual qualified by training and examination to perform activities for the control and suppression of unwanted fires and related events”

Fire fighter professional qualifications are key to defining the profession of fire fighting. Standards that set baseline requirements have been subject to ongoing enhancements for decades (as exemplified by documents such as NFPA 1961, Standard on Fire Hose, which was first issued in 1898, or NFPA 1410, Standard on Training for Initial Emergency Scene Operations, first issued in 1966).

![Figure H-1: Types of Fire Fighters, According to NFPA Professional Qualification Standards](attachment://image)

Of particular interest for addressing fire fighter performance is the set of 18 NFPA standards addressing fire fighter professional qualifications. These documents are summarized in Figure H-1, and they clarify fire fighting disciplines and establish required levels of knowledge that can be used for training and other purposes.
The fire service operates as a quasi-military type organization, with the need for potentially large numbers of fire service members to be quickly deployed to handle complicated emergencies. Further, efficient and effective handling of the event is necessary to minimize danger to life and property, which means that there is normally very little time to implement mitigating action.

Table H-1: Examples of Fire Fighting Disciplines and Training Levels

<table>
<thead>
<tr>
<th>FIRE FIGHTING DISCIPLINE</th>
<th>EXAMPLES OF LEVELS</th>
<th>NFPA STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Fire Fighter</td>
<td>Pumper; Aerial, Tiller; ARFF; Mobile Water Supply; Wildland</td>
<td>1003</td>
</tr>
<tr>
<td>Driver/Operator</td>
<td></td>
<td>1002</td>
</tr>
<tr>
<td>EMS HazMat</td>
<td>Health/Safety Officer; Incident Safety Officer; ISO-Fire Suppression; ISO – EMS Operations; ISO – HazMat Operations;</td>
<td>473</td>
</tr>
<tr>
<td>Fire Department Safety Officer</td>
<td>I, II</td>
<td>1521</td>
</tr>
<tr>
<td>Fire Fighter</td>
<td>I; II</td>
<td>1001</td>
</tr>
<tr>
<td>Fire Inspector</td>
<td>I; II; III; Plans Examiner</td>
<td>1031</td>
</tr>
<tr>
<td>Fire Investigator</td>
<td></td>
<td>1033</td>
</tr>
<tr>
<td>Fire Officer</td>
<td>I; II; III; IV</td>
<td>1021</td>
</tr>
<tr>
<td>Fire Service Instructor</td>
<td>I; II; III</td>
<td>1041</td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td>Awareness; Operations; Technician; Incident Commander; Branch Safety Officer; Private Sector Specialist A, B, C; Tech w/Tank Car Specialty, Tech w/Cargo Tank Specialty; Tech w/Intermodal Tank Specialty; Tech w/ Flammable Gases Bulk Storage Specialty; Tech w/ Flammable Liquids Bulk Storage Specialty</td>
<td>472</td>
</tr>
<tr>
<td>Industrial Fire Brigade</td>
<td>Incipient; Advanced Exterior; Interior Structural; Advanced Structural; Leader</td>
<td>1081</td>
</tr>
<tr>
<td>Marine Fire Fighter</td>
<td>I, II</td>
<td>1005</td>
</tr>
<tr>
<td>Public Fire &amp; Life Safety Educator</td>
<td>I; II; III; Public Information Officer; Juvenile Firesetter Intervention Specialist</td>
<td>1035</td>
</tr>
<tr>
<td>Public Safety Telecommunicator</td>
<td>I; II</td>
<td>1061</td>
</tr>
<tr>
<td>Rescue Technician</td>
<td>Rope; Confined Space; Trench; Structural Collapse; Surface Water; Vehicle &amp; Machinery</td>
<td>1006</td>
</tr>
<tr>
<td>Wildland Fire Fighter</td>
<td>I, II</td>
<td>1051</td>
</tr>
</tbody>
</table>

As a result, multiple specialized fire fighting disciplines have evolved to address certain tasks and duties as defined by the level of training and education they receive. Table H-1 summarizes examples of fire fighting disciplines and the standardized levels to which fire fighters can be qualified.

The last several years has seen a more widespread use of these standards, partly because five (NFPA 1000, 1001, 1002, 1006, and 1021) are among the 27 NFPA standards adopted as national preparedness standards by the U.S. Department of Homeland Security. Each year
DHS distributes millions of dollars in aid through their “Assistance to Firefighters Grant” (AFG) to U.S. fire departments, which is administered by the U.S. Federal Emergency Management Agency (FEMA). A prerequisite for applying for this support is conformance to these DHS national preparedness standards. The 19,791 applications requesting more than $3.1 billion in AFG grants in 2009 indicate the level of activity in this DHS/FEMA program.212

Training versus Education

In today’s fire service the terms training and education are sometime used synonymously; however, they have different meanings.213 While both refer to the transfer of information from a body of knowledge to a recipient, each has a different focus on the purpose and details of the information transfer methodology.

Training is an exercise in focused learning, and refers to the exchange of specific information intended to enhance the proficiency of a particular skill. An example of training is a fire fighter class that teaches the skills necessary for certification at the “Awareness Level” for a hazardous materials incident. Training is more applicable to specific emergency events such as handling a motor vehicle accident.

In contrast, education refers to broad-based learning, with the intent of providing a foundation of general knowledge that supports efficient analytical techniques for effective problem solving. An example is a college degree in business administration, which will provide a fire service officer with the skill set needed to manage a large city fire department.

In general, the technical content for fire service training is well-established and addresses a wide range of topics faced by fire fighters. Much of this is captured in the mainstream literature and national standards (e.g., NFPA standards) addressing a wide range of fire fighting tasks, equipment, and other fire service detail. Some of this information has been developed and refined in various arenas for decades.

Specifically, multiple sources of training materials are available that extensively address useful content on the topic of motor vehicle emergencies. These training materials can be readily adapted and used directly by members of the fire service and other emergency responders. A wide assortment of broadly developed training materials and guidance materials are available that provide support. This includes, for example, the training manuals provided by the International Fire Service Training Association (since 1932), fire service training materials provided by Jones and Bartlett Publishers, and various books and publications provided through Delmar Learning.214,215,216

The Fire Service Training Infrastructure

Fire departments are the basic organizations used by fire fighters to deliver their services. These can range from a small volunteer fire department in rural areas, to large fire departments with all career personnel protecting a major metropolitan city. Training will also depend on the
specific hazards within the protected jurisdiction, such as the difference between an industrial district and a bedroom community.

Fire departments, regardless of their size or type, have two distinct sources for their training needs: (1) training programs that originate and operate internally within the organization, and (2) those that originate and operate externally. Figure H-2 illustrates the two basic sources of training information and materials for the fire service.

![Figure H-2: Types of Training Sources](image)

The extent of internal training sources depends on the available resources of the particular fire department, and as a result, these internal sources tend to be more extensive and sophisticated for larger fire departments (e.g., large city or county fire departments). These larger fire departments generally have their own dedicated training divisions as well as training facilities (i.e., training academy), and are able to effectively handle recruit training and in-service training. Specialized training may be offered for specific duties such as fire apparatus operators, incident commanders, or safety officers. They may also offer specialized courses like those intended for duties beyond the front-line emergency responders, such as fire investigators, fire prevention and inspection personnel (i.e., permitting officials), and public fire and life safety educators.

Multiple external sources of training information and materials are available from a number of sources. These are available to directly support the many fire departments (and especially smaller departments) with limited resources for training. In addition, they also help to supplement and support larger fire departments with their own training departments, and while doing so promote general consistency throughout the fire service. In some cases, regional training centers fulfill internal training needs despite their external characteristics, and these may be operated at the county or state level, or simply by multiple fire service organizations joining together for this purpose. Figure H-3 provides an overview of fire service
training, from the perspective of the external sources that directly influence today’s fire service training.

State governments are a key external resource for fire departments, and many states have designated an official agency to provide statewide training for fire and emergency personnel. Similarly but at a higher level, the federal government provides important support through the National Fire Academy and other resources. Depending on the legislative and funding arrangements in a particular state or region, certain colleges and universities may serve as centers for fire service training, with or without the involvement of their respective state agency. Supporting these training programs is a group of national fire service organizations and private training service organizations that provide valuable components for the fire service training infrastructure.

State training agencies and state training directors are central players in the fire service training infrastructure. Training directors sometimes report to the state fire marshal in each state, and many states operate a statewide training academy. In addition, many also coordinate the training materials and curriculums used throughout the state. In some states fire departments within the state are required to mandatorily use this information and material, and in others they can voluntarily utilize it as they deem appropriate.
Independent public and private training programs that exist within the state often work in coordination with state training programs. These may include the fire service training activities of regional fire districts, large city fire departments, colleges and universities, and other public or private fire service training programs. The relationships among these entities vary significantly from state to state. For example, one state may not have a dedicated state fire training academy and instead have multiple separate but similar training programs throughout the state in conjunction with the state community college system. Elsewhere there may be a state training academy, but the large city fire departments use their own training resources and do not participate in the state programs.

On a national level, several key programs, activities and initiatives feed into the multitude of fire service training activities found at the local and state levels. An example is the National Fire Academy that assists state and local organizations with curriculum development and the national promotion of technical training content. Important baseline requirements are set by the applicable standards that manage the training content and provide a level of agreement on the applicable professional qualifications. These baseline requirements are effectively implemented through accreditation and certification processes.

**Administering Qualifications for the Fire Service**

Fire fighting as a profession has been recognized for centuries among various civilizations. It was not until more recently, however, that its professional status has become more distinctly defined, with the development of standardized baseline requirements and the implementation and quality assurance process that supports the use of these requirements.

Starting in 1974, NFPA’s professional qualifications standards began to appear, becoming increasingly used by state agencies responsible for fire service training in the years since. The use of national standards for fire fighter professional qualifications is a concept that political leaders have been able to widely support, and the appearance of these documents has independently coincided with a general rise in funding and recognition for state fire service training programs.217

As a result, most states utilize these standards as the defining measure of professional qualifications for fire fighters. However, certification programs in many states are voluntary, and states often do not have mandatory minimum qualifications requirements for fire service personnel.

The baseline requirements included in national standards provide a foundation for fire fighter professional qualifications, but how these are applied is equally important. To achieve consistent implementation, the processes of accreditation, certification, and degree granting have evolved. The organizations that administer these training and educational programs are known as accrediting bodies, certifying entities, and degree-granting entities, respectively. These are summarized in Figure H-4, which provides an overview of the entities that accredit, certify, and grant degrees.
As further explanation, accreditation refers to enabling oversight (within a recognized framework that measures and assures quality implementation), bestowed upon another organization. Once accredited, that organization will in turn provide certifications and/or grants degrees to individuals. The following are definitions for accredit, certification, and degree:

"Accredit. To give official authorization to or to approve a process or procedure to recognize as conforming to specific criteria, and to recognize an entity as maintaining standards appropriate to the provision of its services." [220]

"Certification. An authoritative attestation; specifically, the issuance of a document that states that an individual has demonstrated the knowledge and skills necessary to function in a particular fire service professional field." [221]

"Degree. A formal recognition of completion of a prescribed program of study at the postsecondary level." [222]

Annex H References


214) “About Us”, International Fire Service Training Association”, Stillwater OK, Website: [imis-ext.osufpp.org/imispublic/Content/NavigationsMenu/AboutUs/Our75YearHistory/default.htm](http://imis-ext.osufpp.org/imispublic/Content/NavigationsMenu/AboutUs/Our75YearHistory/default.htm), cited: 3 August 2009


216) DELMAR CENGAGE Learning, Florence KY, Website: [www.delmarlearning.com](http://www.delmarlearning.com), cited: 17 August 2009


218) NFPA 1000, *Standard for Fire Service Professional Qualifications Accreditation and Certification Systems*, National Fire Protection Association, Quincy MA, section 3.3.2 through 3.3.6, 2006 edition


ANNEX I

WORKSHOP ATTENDEE LIST

PROFESSIONAL QUALIFICATIONS

"NOW AND BEYOND WORKSHOP"

FOR

FIRE AND EMERGENCY SERVICES

IRVING, TEXAS

13-14 APRIL 2011
<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Interest / Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephen Austin</td>
<td>ProQual TC Chair</td>
<td>(PQU-TCM)</td>
</tr>
<tr>
<td>Christina Baxter</td>
<td>TSWG Rep</td>
<td></td>
</tr>
<tr>
<td>Glenn Benarick</td>
<td>FSOSH TC Chair,</td>
<td>Former Standards Council Member</td>
</tr>
<tr>
<td>Dave Bryson</td>
<td>FICEMS/NHSTA Rep</td>
<td></td>
</tr>
<tr>
<td>Eddie Buchannan</td>
<td>ISFSI Rep</td>
<td></td>
</tr>
<tr>
<td>Richard Carlson</td>
<td>ProQual TC Chair</td>
<td>(PQU-FIS)</td>
</tr>
<tr>
<td>Donald Cooper</td>
<td>TC Chair (TEC-AAA,</td>
<td>Tech Rescue</td>
</tr>
<tr>
<td>Dave Couvelha</td>
<td>IFSAC Rep</td>
<td>designated by IFSAC</td>
</tr>
<tr>
<td>Jim Crawford</td>
<td>ProQual TC Chair</td>
<td>(PQU-FMA), former member of Standards Council</td>
</tr>
<tr>
<td>Rich Duffy</td>
<td>IAFF Rep, Workshop</td>
<td>Steering Committee</td>
</tr>
<tr>
<td>Steve Edwards</td>
<td>NAFTD Rep, Workshop</td>
<td>Steering Committee, MFRI Director</td>
</tr>
<tr>
<td>Bob Finley</td>
<td>FDSOA Rep</td>
<td></td>
</tr>
<tr>
<td>Doug Forsman</td>
<td>Former ProQual TCC</td>
<td>Chair, NFPA Standards Council, &amp; NFPA Board</td>
</tr>
<tr>
<td>Ernest Grant</td>
<td>ProQual TC Chair</td>
<td>(PQU-PFE), Member NFPA Board of Directors</td>
</tr>
<tr>
<td>Casey Grant</td>
<td>Fire Protection</td>
<td>Research Foundation Staff</td>
</tr>
<tr>
<td>Todd Haines</td>
<td>At-large fire</td>
<td>service rep, Dallas/Fort Worth International Airport</td>
</tr>
<tr>
<td>Kirk Hankins</td>
<td>IAAI Rep on TCC</td>
<td></td>
</tr>
<tr>
<td>Edward Hawthorne</td>
<td>ProQual TC Chair</td>
<td>(PQU-IFB)</td>
</tr>
<tr>
<td>Ken Holland</td>
<td>NFPA Public Fire</td>
<td>Protection Division</td>
</tr>
<tr>
<td>Bob Ingram</td>
<td>Interagency Board</td>
<td>(IAB) Rep</td>
</tr>
<tr>
<td>Alan Joos</td>
<td>IFSAC Rep on ProQual TCC</td>
<td></td>
</tr>
<tr>
<td>Kirby Kiefer</td>
<td>USFA NFA</td>
<td>Representative</td>
</tr>
<tr>
<td>Jacklyn Kilby-Richards</td>
<td>ProQual TC Chair</td>
<td>(PQU-PST)</td>
</tr>
<tr>
<td>Holly Mann</td>
<td>At-large fire</td>
<td>service rep, National Integration Center Rep</td>
</tr>
<tr>
<td>Pat Marlatt</td>
<td>ProQual TC Chair</td>
<td>(PQU-FFQ), Workshop Steering Committee</td>
</tr>
<tr>
<td>Tom McGowan</td>
<td>NFPA Public Fire</td>
<td>Protection Division, and ProQual Staff Liaison</td>
</tr>
<tr>
<td>Brian Merrifield</td>
<td>Fire Protection</td>
<td>Research Foundation Staff</td>
</tr>
<tr>
<td>Jerry Naylis</td>
<td>ProQual TC Chair</td>
<td>(PQU-FIV)</td>
</tr>
<tr>
<td>Greg Noll</td>
<td>TC Chair (HCZ-AAA,</td>
<td>HazMat), Workshop Steering Committee</td>
</tr>
<tr>
<td>Jeanne Pashalek</td>
<td>IAWFES Rep</td>
<td></td>
</tr>
<tr>
<td>Bill Peterson</td>
<td>ProQual TCC Chair</td>
<td>Training TC Chair, Workshop Steering Committee</td>
</tr>
<tr>
<td>Fred Piechota</td>
<td>ProBoard Rep,</td>
<td>Workshop Steering Committee</td>
</tr>
<tr>
<td>Lawrence Preston</td>
<td>ProQual TC Chair</td>
<td>(PQU-FOF)</td>
</tr>
<tr>
<td>Marc Revere</td>
<td>IAFC Rep (alt to</td>
<td>Chief Chris Riley</td>
</tr>
<tr>
<td>James Ridley</td>
<td>IAFF Rep, Director</td>
<td>of IAFF HazMat/WMD Training Dept</td>
</tr>
<tr>
<td>Bryant Stiles</td>
<td>NVFC Rep, Workshop</td>
<td>Steering Committee, Div Director KY State Fire Rescue Training</td>
</tr>
<tr>
<td>Jim Stumpf</td>
<td>ProQual TC Chair</td>
<td>(PQU-WSP)</td>
</tr>
<tr>
<td>Michael Wieder</td>
<td>ProQual TC Chair</td>
<td>(PQU-ICM)</td>
</tr>
<tr>
<td>Ken Willette</td>
<td>NFPA Public Fire</td>
<td>Protection Division</td>
</tr>
<tr>
<td>Charles Wright</td>
<td>HazMat TC Member,</td>
<td>NFPA 472 Task Group for JPRs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TO:        Ken Willette
FROM:    Linda Fuller
DATE:     October 25, 2010
SUBJECT: Scope Clarification between NFPA 472 and NFPA 1001

---------------------------------------------------------------------------------------------------------------------

I am transmitting to you herewith the following action of the Standards Council (October 19-20, 2010):

The Council considered the request of the North American Fire Training Directors regarding a scope clarification between NFPA 472 and NFPA 1001 and a request to develop a new Professional Qualifications document on fire service hazardous materials responders. The Council voted to defer action on the requests at this time. The NFPA Staff has informed the Council that there has been a Professional Qualifications Summit proposed that will address the jurisdictional issues between these two committees, and it is anticipated that further information will be developed that will assist the Council in addressing the jurisdictional overlap of these two documents. The Council directs NFPA Staff to report back to the Council after the Summit at the August Council meeting.

c:  R. Mason (NAFTD), D. Trebisacci, K. Holland, S. VanZandt, E. Carroll, C. Peterson
    TC Fire Fighter Professional Qualifications (PQU-FFQ)
    TC Hazardous Materials Response Personnel (HCA-AAA)

10-10-18
MEMORANDUM

TO: Secretary, Standards Council

FROM: Ken Willette, Division Manager Public Fire Protection

DATE: September 27, 2010

SUBJECT: Scope Conflict for Hazardous Materials Professional Qualifications Document

The North American Fire Training Directors (NAFTD) have been pursuing a document in the Professional Qualifications library of documents that would state in Job Performance Requirement (JPR) language the skills required for fire service hazardous materials responders at the awareness, operations, and technician level.

To this end, NAFTD, following the direction communicated to them by then Standards Council Secretary, Milosh Puchovsky, via letter on February 28, 2008, submitted a request to the Technical Committee on Hazardous Materials Response Personnel, (HCZ-AAA), that a standalone document in JPR language be considered during the revision cycle, (Annual 2012), of NFPA 472, Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents.

Secretary Puchovsky also directed the Hazardous Materials Response TC and the Technical Committee on Fire Fighter Professional Qualifications (PQU-FFQ, NFPA 1001 TC) to work on a possible solution to address the NAFTD request. A task group comprised of members of the Hazardous Materials Response TC and the Fire Fighter Professional Qualifications TC has been meeting since August 18, 2009 to create a set of Job Performance Requirements (JPRs) for fire service hazardous materials Operations Level Responders. The JPRs that have been produced by the task group will be on the Hazardous Materials Response TC agenda for discussion at a pre-ROP meeting on November 3-4, 2010.

At a recent meeting the of the Fire Fighter Professional Qualifications TC, a voice vote was conducted on whether or not there should be a standalone document addressing Hazardous Materials Response or Fire Fighters within the
Professional Qualifications project or if it should be contained within NFPA 472. The result of the voice vote, as noted in the meeting minutes of the July 14th, 2010 meeting, was unanimous in that it should be a standalone document as part of the Professional Qualifications project. The committee is aware of the continued work to resolve this issue between the Hazardous Materials Response TC and the NAFTD through a collaborative task group compiled of members from each technical committee. The Fire Fighter Professional Qualifications TC has chosen to follow this issue through the process and become engaged in it at the appropriate time.

After staff review, it was concluded the proposal submitted by NAFTD was not a proposal, but was a request for a new project. On August 27, 2010, Ken Holland and I met with the chairs of the Hazardous Materials Response and Fire Fighter Professional Qualifications TC, and two representatives of the NAFTD to discuss the matter. This turned out to be a very passionate discussion, with NATFD expressing deep concern over the lack of a Professional Qualifications document addressing hazardous materials response and the chairs of each TC expressing deep concern over where a professional qualifications document would reside, and the challenges each technical committee faced in trying to be the custodian of such a document.

Consensus was reached that it was beyond the scope of either committee to answer if a professional qualifications document was needed and it was not clear as to where a professional qualifications document would reside if approved.

The NATFD, following this discussion and with staff assistance, has withdrawn its proposal to the Hazardous Materials Response TC and submitted a Request for a New Project to the Council. In a parallel track, staff has suggested the draft document prepared by the Hazardous Materials Response /Fire Fighter Professional Qualifications task group be submitted as a committee or public proposal to the Hazardous Materials Response TC, to allow that committee to process the draft and develop a public record of comment and deliberation that conforms to the NFPA process.

As these actions play out, they do not address the matter of conflicting scopes, which the Council will need to consider in moving forward. The exact wording of the TC and Document Scopes can be found in Attachment A. The best way to summarize the conflict is that none of these scopes include jurisdiction for developing JPR for fire service hazardous materials response. While the Fire Fighter Professional Qualifications TC is well versed in writing JPR language for
firefighter’s whose duties are primarily structural in nature, it does not see itself as possessing the body of knowledge necessary to develop JPR language for hazardous materials response and is concerned with including such language in 1001 would have other detrimental impacts to its use by the fire service. The Hazardous Materials Response TC is well versed in writing competencies for hazardous materials response for a wide spectrum of emergency responders, non fire service included, but it does not see itself as possessing the level of knowledge to develop JPR’s specific for the fire service, and has a strong concern that a standalone document might negatively impact the status of 472 in the greater response community.

Against this backdrop, if either TC accepted the responsibility to include JPR language addressing hazardous materials response, there is no mechanism to correlate the content between the TC’s, other than a mutual understanding. Such an understanding does not look likely.

In closing, the action of the NATFD in requesting a new project and the resulting discussion between the Hazardous Materials Response TC and Fire Fighter Professional Qualifications TC has brought to light a scope conflict issue which upon further review by staff, was found to exist between several sets of documents. A similar situation exists in regards to NFPA 600, Industrial Fire Brigades and 1081, Industrial Fire Member Professional Qualifications; NFPA 1670, Operations and Training for Technical Search and Rescue Incidents; and NFPA 1405, Land Based Firefighters Who Respond to Marine Vessel Fires and 1005, Marine Firefighting for Land-Based Firefighters. It is reasonable to expect the correlation issue will emerge at some point and the time spent by the Council in careful consideration of the NATFD request and ancillary correlation issues will be useful in establishing a precedent for future use. To assist the Council, a request has been submitted in the 2011 Public Fire Protection Budget to conduct a Summit in the first quarter of 2011 to seek input from stakeholders and work towards a consensus report that will frame the issue and identify possible solutions. The goal would be for a Summit Report to be available to the Council as soon as possible, but not earlier then April of 2011, for its review as it considers moving forward.
ATTACHMENT A: Document and TC Scopes

472 Document Scope:

1.1 Scope. 1.1.1* This standard shall identify the minimum levels of competence required by responders to emergencies involving hazardous materials/weapons of mass destruction (WMD). 1.1.2 This standard shall apply to any individual or member of any organization who responds to hazardous materials/WMD incidents. 1.1.3 This standard shall cover the competencies for awareness level personnel, operations level responders, hazardous materials technicians, incident commanders, hazardous materials officers, hazardous materials safety officers, and other specialist employees. A.1.1.1 Outside the United States, hazardous materials might be called dangerous goods (see Annex H). Weapons of mass destruction (WMD) are known by many different abbreviations and acronyms, including CBRNE (chemical, biological, radiological, nuclear, explosive), B-NICE (biological, nuclear, incendiary, chemical, explosive), COBRA (chemical, ordinance, biological, radiological agents), and NBC (nuclear, biological, chemical).

472 Committee Scope:

This Committee shall have primary responsibility for documents on the requirements for the professional competence, training, procedures, and equipment for emergency responders to hazardous materials incidents.

1001 Document Scope:

1.1 Scope. This standard identifies the minimum job performance requirements (JPRs) for career and volunteer fire fighters whose duties are primarily structural in nature.

1001 Committee Scope:

This Committee shall have primary responsibility for documents on professional competence required of fire fighters.
Good Day:


We also hereby withdraw the NFPA Document Proposal Form submitted electronically on May 14, 2010 and was logged in on May 15, 2010 by Ms. Nancy Walker.

Thank you, should there be any questions please refer them to me at the contact information below or to Director Steve Edwards at:
Steven T. Edwards, Director
Maryland Fire and Rescue Institute
University of Maryland
College Park, MD 20742
301.226.9960 Fax 301.314.1497
1.800.ASK.MFRI
sedwards@mfri.org

Thanks again...Rick Mason

PERFECTION IS OUR GOAL...EXCELLENCE WILL BE TOLERATED!

Richard A. Mason, CFO, MIFireE
Director
NH Division of Fire Standards & Training and Emergency Medical Services
33 Hazen Drive (mailing)
98 Smokey Bear Blvd. (Shipping)
Concord, New Hampshire 03305

Voice: (603) 223-4220
Fax: (603) 271-1091
Mobile: (603) 419-9459
Web site: www.nh.gov/safety/divisions/fstems (PLEASE VISIT!!)

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Please consider the environment - do you really need to print this e-mail? Thanks!
**New Project Initiation Form**

*(To be completed by proponent of new project/document)*

*Additional pages may be attached if necessary.*

<table>
<thead>
<tr>
<th>a.</th>
<th>Explain the Scope of the new project/document:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The development of a new Professional Qualification (Pro-Qual) Standard titled <em>Standard for Fire Service Hazardous Materials Professional Qualifications.</em> This Standard would certify fire service personnel to the Awareness, Operational, and Technician Hazardous Materials Responder levels.</td>
</tr>
</tbody>
</table>

**PLEASE SEE ATTACHED POSITION PAPER.**

<table>
<thead>
<tr>
<th>b.</th>
<th>Provide an explanation and any evidence of the need for the new project/document: The NFPA has a model for operational and training/educational standards:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• NFPA 600 Standard on Industrial Fire Brigades and NFPA 1081 Standard for Industrial Fire Brigade Member Professional Qualifications; and</td>
</tr>
<tr>
<td></td>
<td>• NFPA 1670 Standard on Operations and Training for Technical Search and Rescue and NFPA 1006 Standard for Technical Rescuer Professional Qualifications</td>
</tr>
<tr>
<td></td>
<td>NFPA 472 Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents is an operational standard that is also used as a Pro-Qual Standard, but is not consistent with the Job Performance Objectives (JPR) format of Pro-Qual standards.</td>
</tr>
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<table>
<thead>
<tr>
<th>c.</th>
<th>Identify intended users of the new project/document:</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>North American Fire Training Directors (NAFTD) who trains and certifies more than 1-million fire service personnel annually in both the U.S.A. and Canada who unanimously support this request at their annual meetings in both 2009 and 2010.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d.</th>
<th>Identify individuals, groups and organizations that should review and provide input on the need for the proposed new project/document; and provide contact information for these groups:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• NAFTD, c/o Richard Mason, Past President, NH Fire Training, 33 Hazen Drive, Concord, NH 03305  O: 603-223-4220</td>
</tr>
<tr>
<td></td>
<td>• International Fire Service Accreditation Congress, c/o Tim Bradley, Past Chair, 322 Chapanoke Road, Suite 200, Raleigh, NC 27603  O: 919.661.5880</td>
</tr>
<tr>
<td></td>
<td>• ProBoard Fire Service Professional Qualifications System, Fredrick W. Piechota Jr., COA Chairman, PO Box 205, Monson, MA 01057  O: 413-267-5140</td>
</tr>
<tr>
<td></td>
<td>• Other agencies charged with the certification of fire service personnel</td>
</tr>
<tr>
<td></td>
<td>• The Fire Service Publishers (i.e. Jones &amp; Bartlett, IFSTA, etc.) would benefit with having a standard in the JPR format.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e.</th>
<th>Identify individuals, groups and organizations that will be or could be affected, either directly or indirectly, by the proposed new project/document, and what benefit they will receive by having this new document available:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>See the list above who all would be affected by this new document in a very good way...it would establish a Pro-Qual Standard to train and certify fire service personnel in Hazardous Materials response which is consistent with every other standard that we train and certify with...including being written in the JPR format.</td>
</tr>
<tr>
<td></td>
<td>The existing NFPA 472 committee would be affected as well.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>f.</th>
<th>Identify other related documents and projects on the subject both within NFPA and external to NFPA:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/A</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>g.</th>
<th>Identify the technical expertise and interest necessary to develop the project/document, and if the committee membership currently contains this expertise and interest:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A similar structure as the NFPA 472 committee, however with a smaller amount of vendors and increased amount of educators and instructors.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>h.</th>
<th>Provide an estimate on the amount of time needed to develop the new project/document:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I do not have an idea of this time frame...I would presume more than a year.</td>
</tr>
</tbody>
</table>
|   | Comment on the availability of data and other information that exists or would be needed to substantiate the technical requirements and other provisions of the proposed new project/document:
|   | Most data needed would be from the NFPA 472 standard and committee (as adjusted in "box g.") and expertise in establishing teaching objectives and JPRs. |

Please send your request to:

NFPA
Codes and Standards Administration
1 Batterymarch Park
Quincy, MA 02169
Stdss_admin@nfpa.org
Rev. 10/09

Signature: [Signature]

Name: Richard A. Mason
(please print)

Affiliation: Past President & Board Member, NAFTD

The North American Fire Training Directors (NAFTD) is an international organization that promotes the common interests of providing a quality fire training and educational experience for firefighters. With membership comprised of State Fire Training Directors of each of the fifty states and all Canadian provinces and territories, NAFTD members serve as the primary point of contact for fire training and education conducted across the United States and Canada. State fire training systems are typically based in a university or a state government entity such as the state fire marshal’s office or state fire commission.

Each year the NAFTD membership provides training to over one million firefighters ranging from basic entry level fire fighting instruction to professional development courses for chief fire officers. Many NAFTD members offer certification programs in conjunction with course deliveries. In addition to coordinating and delivering their own training programs the NAFTD works in concert with the National Fire Academy (NFA) and the United States Fire Administration to provide training to over 80,000 fire service students. As the face of the National Fire Academy within each state, we maintain the quality of instruction and high standards already established by both the National Fire Academy and the state fire training system.

Recognized by other major fire service organizations and governmental entities and legislators as key stakeholders, the North American Fire Training Directors organization is often sought out as a source of input, information and resource on fire service related issues and policy. In this regard we wish to request that the National Fire Protection Association (NFPA) establish a “Standard for Fire Service Hazardous Materials Professional Qualifications.”

The proposed Standard for Fire Service Hazardous Materials Professional Qualifications would compliment and support the outstanding work of the NFPA 472 Technical Committee on NFPA 472 Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents. Unfortunately, since there is no corresponding Professional Qualification Standard with respect to hazardous materials response it is very difficult to properly and consistently test and evaluate the students who are trained NFPA 472 standards. This is the collective opinion of the North American Fire Training Directors as well as the National Professional Qualifications Board (NPQB) and the International Fire Service Accreditation Congress (IFSAC). All of these organizations have voted to support the creation of a “Standard for Fire Service Hazardous Materials Professional Qualifications.” So in essence the organization that instructs the majority of fire service students and the organizations that provide national certification are in full agreement as to the need for this standard.
The essential element that is missing from the current system regarding hazardous materials is the ability to fairly and consistently test student competence. The professional qualifications standards are built upon the application of appropriate job performance requirements (JPR’s). Job performance requirements are a written statement that describes a specific job task, lists the items necessary to complete the task, and defines measurable or observable outcomes and evaluation for a specific task. This is the method used to construct the professional qualifications series and is what is missing regarding hazardous materials. In essence, each jurisdiction is assuming or developing independent exams and evaluations to test competence to NFPA 472, so the consistency required for a national standard is nonexistent. This is the crux of the current situation and the main issue that requires a solution.

The obvious solution to this issue is the NFPA to following its standard practice and create a professional qualifications standard to provide for the appropriate JPR’s and allow all jurisdictions that test and certify firefighters to have a standard document and scope of practice to work from.

The National Fire Protection Association has a model which is utilized in at least two circumstances in its current standards:

- **NFPA 600 Standard on Industrial Fire Brigades** which has a scope of identifying the minimum requirements for organizing, operating, training, and equipping industrial fire brigades.
- **NFPA 1081 Standard for Industrial Fire Brigade Member Professional Qualifications** which has a scope of identifying job performance requirements (JPRs) necessary to perform duties as a member of an organized industrial fire brigade.
- **NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents** which has a scope of identifying and establishing the functional capability for conducting operations at technical search and rescue incidents.
- **NFPA 1006 Standard for Technical Rescuer Professional Qualifications** which has a scope of establishing the minimum requirements necessary for fire service and other emergency response personnel who perform technical rescue operations.

The common theme is having an operational standard which would have a sister professional qualifications standard. This seems to both make sense and has proven to be very successful. The Pro-Board in its mission relating to accreditation “accredits fire service training agencies that use the National Fire Protection Association’s professional qualification standards.”
This is true except when relating to the professional qualification of hazardous materials/weapons of mass destruction standards:

- NFPA 472 Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, and NFPA 473 Standard for Competencies of EMS Personnel responding to Hazardous Materials/Weapons of Mass destruction Incident, both have a scope of identifying the minimum level of competence required by responders to emergencies involving hazardous materials and weapons of mass destruction. These are not written in the typical JPR format utilized in the Professional Qualifications Standards developed under the guidance of the Standards Council.

The purpose of this communication is to initiate the process to develop a professional qualification standard (in the 1000 series of the NFPA Codes) that would become a sister standard to NFPA 472 and NFPA 473, written in the JPR format as the other related standards. This would include the levels of hazardous materials awareness, operations, and technician. The scope of this standard would be solely intended for the fire service and not other audiences that may use NFPA 472.

NAFTD would diligently work with a Task Force under your supervision including members of the NFPA 472 & NFPA 1001 committees to address this issue. NAFTD feels that this would bring continuity to the standards making process, which we feel would eliminate the one exception for accreditation to the professional standards, and that this enhancement would be easier to follow for our constituents...the approximate one million firefighters we train and certify every year.

Our Board and Membership stands ready to assist in any manner possible through this process. Thank you for your time and actions regarding this request.

Sincerely,

Eriks Gabliks, President
North American Fire Training Directors
Minutes

JPR Working Group
MFRI
November 12, 2009

1. The meeting was called to order at 10:00 a.m. on November 12, 2009.

2. Self-introductions were made. Those in attendance were Steve Edwards, Kenn Fontenot, Bruce Kelly, Pat Marlatt, Leslie Miller, Greg Noll, Larry Preston, Glen Rudner, Chris Tracy, and NFPA staff Ken Holland and Dave Trebisacci.

3. The Working Group established Greg Noll and Pat Marlatt as co-chairs.

4. The Working Group continued its review of the draft of goals and proposed JPRs for the Awareness and Operations Levels of NFPA 472 from Leslie Miller.

5. The Working Group established the following official statements:

   • The NFPA 472, 1001 and 1021 technical committees are jointly developing JPRs to meet the requirements of NFPA 472 Operations Level for the fire service

   • A draft of the document will be shared for review with the appropriate technical committees in the second quarter of 2010

6. The next meeting of the Working Group will be via web conference on December 8, 2009 at 11:00 a.m. ET. Dave Trebisacci and Leslie Miller will coordinate this meeting, and send participant instructions to the Working Group prior to the meeting.

7. The meeting was adjourned at 3:00 p.m. on November 12, 2009.

Respectfully submitted by Dave Trebisacci, NFPA Staff
NFPA® 472 Awareness, Ops Core, and Mission-Specific PPE and Product Control Proposed JPRs

Awareness Level – Proposed JPRs

Awareness Level JPR #1

Recognize indicators of hazardous materials/WMD incidents, given a hazardous materials/WMD incident, reporting procedures, and an assignment, so that the correct nature of the incident and materials involved are identified, correct information is transmitted to the appropriate authority, and the area is secured.

(A) **Requisite Knowledge.** Occupancy and locations, container shapes, placards and labels, markings and colors, shipping documents and safety data sheets, sensory clues indicating the presence of hazardous materials/WMD; procedures for reporting the potential presence of hazardous materials/WMD; and methods to secure the area. *add annex item including indicators of terrorist attacks and other potentials*

(B) **Requisite Skills.** Ability to recognize the potential presence of hazardous materials/WMD, transmit that information to their supervisor, and secure the area.

For Committee Reference Only:

**OSHA says Awareness-level responders must have:**
- The ability to recognize the presence of hazardous substances in an emergency. 1910.120(q)(6)(i)(C)
- The ability to identify the hazardous substances, if possible. 1910.120(q)(6)(i)(D)
- An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook. 1910.120(q)(6)(i)(E)
- The ability to realize the need for additional resources, and to make appropriate notifications to the communication center. 1910.120(q)(6)(i)(F)

**NFPA® 472 says that Awareness-level personnel must be able to:**
- Detect the presence of hazardous materials/WMD
- Survey a hazardous materials/WMD incident from a safe location to identify the name, UN/NA identification number, type of placard, or other distinctive marking applied for the hazardous materials/WMD involved
- Implement actions consistent with the emergency response plan, the standard operating procedures, and the current edition of the Emergency Response Guidebook
- Initiate the notification process
Awareness Level JPR #2

Collect information about the materials involved in a potential hazardous materials incident, given a hazardous materials/WMD incident, UN DOT hazard class information, a safety data sheet (SDS), the Emergency Response Guidebook, and an assignment, so that the material involved is correctly identified, and potential hazards are identified.

(A) **Requisite Knowledge.** Awareness and use of the Emergency Response Guidebook, safety data sheets, and UN DOT hazard class information.

(B) **Requisite Skills.** Ability to collect information about potential hazardous materials and use reference documents to identify the materials, their hazards, and recommended protective actions.

For Committee Reference Only

OSHA says Awareness-level responders must have:
- An understanding of what hazardous substances are, and the risks associated with them in an incident. 1910.120(q)(6)(i)(A)
- An understanding of the potential outcomes associated with an emergency created when hazardous substances are present. 1910.120(q)(6)(i)(B)

NFPA® 472 says that Awareness-level personnel must be able to:
- Collect hazard information from the current edition of the Emergency Response Guidebook
- Initiate protective actions

Operations-Level Core Competencies – Proposed JPRs

Operations-Level Core JPR #1

Collect basic hazard and risk information, given a hazardous materials/WMD incident, safety data sheet, Emergency Response Guidebook, information provided by CHEMTREC/CANUTEC/SETIQ, and an assignment, so that the containers and materials involved are correctly identified, the likely behavior and potential harm of the material is recognized.

(A) **Requisite Knowledge.** Knowledge of the behavior of hazardous materials, knowledge of how hazardous materials cause harm, knowledge of how to collect hazard and response information from safety data sheets; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts, and use of the Emergency Response Guidebook to estimate the scope of the incident.
(B) **Requisite Skills.** Ability to identify the containers and materials involved, determine if these materials have been released, recognize their potential behavior and harm, and collect hazard and response information from safety data sheets; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts.

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OSHA says Ops-level responders must have:
- An understanding of basic hazardous materials terms. 1910.120(q)(6)(ii)(C)
- Knowledge of the basic hazard and risk assessment techniques. 1910.120(q)(6)(ii)(A)

NFPA® 472 says that Ops-level responders must be able to:
- Collect hazard and response information from MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts
- Survey a hazardous materials/WMD incident to identify the containers and materials involved, determine whether hazardous materials/WMD have been released, and evaluate the surrounding conditions
- Predict the likely behavior of a hazardous material/WMD and its container
- Estimate the potential harm at a hazardous materials/WMD incident

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**Operations-Level Core JPR #2**

Perform scene control operations, given a hazardous materials/WMD incident, the tools and equipment readily available to engine companies, standard operating procedures, and an assignment, so that hazard control zones are established, nearby persons are protected, appropriate levels of PPE are used, safety procedures are followed, and evidence is preserved.

(A) **Requisite Knowledge.** Knowledge of scene control operations, hazard control zones, safety procedures, standard operating procedures, levels of PPE, measures to protect the public (evacuation, shelter-in-place), and preservation of criminal evidence.

(B) **Requisite Skills.** Ability to perform scene control operations, use assigned tools and equipment, follow safety procedures, and preserve evidence.

---

OSHA says Ops-level responders must:
- Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.

NFPA® 472 says that Ops-level responders must be able to:
- Describe the response objectives for the hazardous materials/WMD incident
- Describe the response options available for each objective
- Determine whether the personal protective equipment provided is appropriate for implementing each option.
- Develop a plan of action including safety considerations
- Establish means of evidence preservation where criminal or terrorist acts are suspected
- Initiate an incident command system (ICS) for hazardous materials/WMD incidents
- Perform tasks assigned as identified in the incident action plan
- Evaluate the status of the actions taken in accomplishing the response objectives
- Communicate the status of the planned response

Operations-Level Core JPR #3

Perform emergency decontamination procedures at a hazardous material incident, given an individual contaminated by a hazardous material that can be decontaminated by firefighters in firefighting PPE with equipment readily available to engine companies, standard operating procedures, and an assignment, so that exposures are protected, hazards are avoided, and the victim is decontaminated.

(A) **Requisite Knowledge.** Knowledge of contamination and decontamination, tools and equipment used for emergency decontamination, standard operating procedures, and emergency decontamination procedures.

(B) **Requisite Skills.** Ability to perform emergency decontamination.

For Committee Reference Only

OSHA says Ops-level responders must:
- Know how to implement basic decontamination procedures. 1910.120(q)(6)(i)(F)

NFPA® 472 says that Ops-level responders must be able to:
- Describe emergency decontamination procedure
- Establish and enforce scene control procedures including control zones, emergency decontamination, and communications
- Demonstrate emergency decontamination

Operations-Level Mission-Specific Competencies – Proposed JPRs

**Mission-Specific Personal Protective Equipment JPR**

Perform a mission specific task, given the personal protective equipment provided by the AHJ, a hazardous material/WMD incident, standard operating procedures, and a site safety and control plan, so that proper personal protective equipment is selected for the task, donned, worked in,
doffed, and the incident terminated by completing the reports and documentation pertaining to personal protective equipment.

(A) **Requisite Knowledge.** Knowledge of PPE including respiratory protection, structural firefighter protective clothing, and chemical protective clothing; knowledge of how to select and use the proper personal protective equipment provided by the AHJ; knowledge of the limitations of PPE; knowledge of standard operating procedures, site safety and control plans, and termination procedures.

(B) **Requisite Skills.** Ability to don, work in, and doff the PPE provided by the AHJ* and read site safety and control plans.

*Appendix item – This is determined by the AHJ who must provide PPE and training for what is used; this can be just structural firefighting PPE and/or different levels of CPC

For Committee Reference Only

**OSHA says Ops-level responders must:**
- Know how to select and use proper personal protective equipment provided to the first responder operational level. 1910.120(q)(6)(i)(B)
- An understanding of the relevant standard operating procedures and termination procedures. 1910.120(q)(6)(ii)(f)

**NFPA® 472 says that Ops-level responders must be able to:**
- Plan a response within the capabilities of personal protective equipment provided by the AHJ in order to perform mission specific tasks assigned
- Implement the planned response consistent with the standard operating procedures and site safety and control plan by donning, working in, and doffing personal protective equipment provided by the AHJ
- Terminate the incident by completing the reports and documentation pertaining to personal protective equipment

**Mission-Specific Product Control JPR #1**

Perform product control operations at a hazardous material incident, given an uncontrolled release of a hazardous materials product that can be controlled by firefighters in firefighting PPE, with tools and equipment readily available to engine companies, standard operating procedures, and an assignment, so that exposures are protected, hazards are avoided and/or minimized, and the product is controlled.

(A) **Requisite Knowledge.** Knowledge of product control operations including absorption, adsorption, damming, diking, dilution, diversion, retention, remote valve shutoff, and vapor dispersion; knowledge of standard operating procedures; and knowledge of tools and equipment for product control.
(B) **Requisite Skills.** Ability to perform product control procedures determined by the AHJ.

For Committee Reference Only

*Note: JPRs typically avoid redundancy, so items like following SOPs and site safety plans will not be repeated. 3.1.1 is general SOP competency.*

**OSHA says Ops-level responders must:**
- Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit. 1910.120(q)(6)(i)(D)

**NFPA® 472 says that Ops-level responders must be able to:**
- Describe the control options available to the operations level responder.
- Implement the planned response to a hazardous materials/WMD incident.

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**Mission-Specific Product Control JPR #2**

Perform product control operations at a flammable liquid spill/fire, given firefighting PPE, an appropriate extinguishing agent, with tools and equipment readily available to engine companies, an emergency response plan and/or standard operating procedures, and an assignment, so that hazards are avoided and/or minimized, the proper application technique is utilized, exposures are protected, and the spill/fire is controlled or extinguished.

(A) **Requisite Knowledge.** Knowledge of how to perform product control operations at a flammable liquid spill/fire.

(B) **Requisite Skills.** Ability to apply class B foam to a flammable liquid spill or fire.

For Committee Reference Only

*Note: Flammable liquid fires and foam are covered extensively in 1001 Firefighter I, 4.3.1*

**NFPA® 472 says that Ops-level responders must be able to:**
- Describe the control options available for flammable liquid incidents.
- Implement the planned response to a hazardous materials/WMD incident.

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**Mission-Specific Product Control JPR #3**

Perform product control operations at a flammable gas release/fire, given firefighting PPE, with tools and equipment readily available to engine companies, an emergency response plan and/or...
standard operating procedures, and an assignment, so that hazards are avoided and/or minimized, the proper control technique is utilized, exposures are protected, and the release/fire is controlled.

(A) **Requisite Knowledge.** Knowledge of how to perform product control operations at a flammable gas release/fire.

(B) **Requisite Skills.** Ability to perform product control procedures at a flammable gas release/fire.

*For Committee Reference Only*

*Note: Flammable gas fires are covered extensively in 1001 Firefighter II, 6.3.3*

NFPA® 472 says that Ops-level responders must be able to:
- Describe the control options available for flammable gas incidents.
- Implement the planned response to a hazardous materials/WMD incident.
Minutes
JPR Working Group
Quincy, MA
August 18, 2009

1. The meeting was called to order at 10:00 a.m. on August 18, 2009.

2. Self-introductions were made. Those in attendance were Kenn Fontenot, Gordon Henderson, Pat Marlatt, Leslie Miller, Greg Noll, Chris Tracy and NFPA staff Ken Holland and Dave Trebisacci.

3. NFPA 472 Chair Greg Noll provided a historical perspective from his technical committee.

4. NFPA 1001 Chair Pat Marlatt provided the perspective from his technical committee.

5. NFPA 472 TC member Leslie Miller introduced her draft of goals and proposed JPRs for the Operations Level of NFPA 472. The Working Group reviewed this document and made changes to the JPRs (please see attached updated document).

6. During the Working Group’s review of the draft, the following topics were discussed:

   • OSHA has ruled that fire fighters (FF I) must be trained to the Operations Level of NFPA 472

   • A new section of NFPA 472 should be created to contain the JPRs for the Operations Level for the fire service

   • The Working Group should ultimately submit their draft JPRs in the form of a public proposal to the NFPA 472 TC

   • Work should continue on revising the JPRs in the draft with participation and input from the Technical Committee on Fire Officer Professional Qualifications (NFPA 1021)
7. Going forward, the Working Group outlined the following items:

- Ken Holland, Kenn Fontenot, Gordon Henderson and Pat Marlatt will contact the NFPA 1021 TC to identify potential Working Group members

- Working Group members who will be representing NFPA 1021 should be submitted to Ken Holland and Dave Trebisacci by September 15, 2009

- After NFPA 1021 members have been identified, Dave Trebisacci will canvass the Working Group for availability for a one-day face-to-face meeting in November or December of this year.

8. The meeting was adjourned at 3:00 p.m. on August 18, 2009.

Respectfully submitted by Dave Trebisacci, NFPA Staff
February 28, 2008

Mr. Richard A. Mason
President
North American Fire Training Directors
PO Box 80065
Washington, DC 20018

Mr. Mason,

This letter is in response to your correspondence of February 1, 2008 to James Pauley, Chair of NFPA’s Standards Council in which you request that NFPA initiate the process to develop a professional qualification standard (in the “1000 series” of the NFPA Codes) that would become a companion standard to NFPA 472, Standard on Competence of Responders to Hazardous Materials / Weapons of Mass Destruction Incidents, and NFPA 473, Standard for Competencies of EMS Personnel Responding to Hazardous Materials / Weapons of Mass Destruction Incidents. You further request the new “1000 series” standard be written in the Job Performance Requirements (JPR) format as are other related NFPA standards in the “1000 series”. You also seem to suggest that NFPA 472 and NFPA 473 be re-written as operations standards, with the professional qualifications provisions currently in these two documents being moved to the new “1000 series” document.

Within the context of NFPA codes and standards making process, your request first needs to be considered and acted upon by the Technical Committee (TC) on Hazardous Materials Response Personnel which has been assigned, by the Standards Council, primary responsibility for documents on the requirements for the professional competence, training, procedures and equipment for emergency responders to hazardous materials incidents.

As the Standards Council has already assigned the subject of your request to a Technical Committee Project, it is my experience that the Council would not act on your request until it is first considered and acted upon by the responsible technical committee. If after consideration by the responsible technical committee you are unsatisfied with the proposed course of action, you could file an appeal with the Standards Council.

I suggest that you submit a formal proposal to both NFPA 472 and NFPA 473 which fully describes and substantiates your proposed changes to these documents as well as any recommendations and the need for the establishment of new documents. NFPA 472
and NFPA 473 are both in the Annual 2012 revision cycle which has a public proposal closing date of November 23, 2010. Public proposal forms are available on NFPA’s website (www.nfpa.org) under the codes and standards tab.

You may also wish to seek the input from the Technical Correlating Committee on Professional Qualifications which has responsibility for the “1000 series” documents on professional qualifications. The Standards Council has assigned this committee primary responsibility for the management of the NFPA Professional Qualifications Project and documents related to professional qualifications for fire service, public safety and related personnel.

I further suggest that you contact David Trebisacci, who is the NFPA staff liaison to the TC on Hazardous Materials Response Personnel, and Frank Florence, who is the NFPA staff liaison for the TC on Professional Qualifications to obtain further assistance in obtaining input from these committees on this matter. I have copied both staff liaisons on this response.

I hope you find this information helpful. I attempted to reach you by phone to discuss this matter but was unsuccessful in reaching you. Should you have any questions concerning my response or on NFPA’s codes and standards development activities, please do not hesitate to contact me.

Sincerely,

[Signature]

Milosh Puchovsky, P.E.
Assistant Vice President Codes & Standards Administration and Secretary to NFPA Standards Council

c: F. Florence, Staff Liaison to TC on Professional Qualifications
   L. Nisbet, Recording Secretary of NFPA Standards Council
   J. Pauley, Chair of NFPA Standards Council
   C. Peterson, Director of Public Fire Protection
   J. Shannon, NFPA President and Chief Executive Officer
   D. Trebisacci, Staff Liaison to TC on Hazardous Materials Response Personnel
February 1, 2008

Mr. James T. Pauley, Chairman
NFPA Standards Council
1 Battermarch Park
Quincy, MA 02169-7471

Dear Mr. Pauley:

On January 15, 2008 the Board of Directors for both the North American Fire Training Directors (NAFTD) and the National Board on Fire Service Professional Qualifications (Pro-Board) met in College Park, Maryland. This meeting was co-chaired by Pro-Board Chair Jim Estepp and me. This meeting was a continuation of one held last year. We have found that it is essential that the NAFTD, who represents the principal deliverers of fire service training following the Professional Qualification Standards, take a proactive partnership role in working on fire service issues and concerns with our allied entities. These meetings have confirmed that we are very strong allies for each other in the advancement of emergency services training and certification in the United States and Canada.

The National Fire Protection Association has a model which is utilized in at least two occasions in its standards:

- **NFPA 600 Standard on Industrial Fire Brigades** which has a scope of identifying the minimum requirements for organizing, operating, training, and equipping industrial fire brigades.
- **NFPA 1081 Standard for Industrial Fire Brigade Member Professional Qualifications** which has a scope of identifying job performance requirements (JPRs) necessary to perform duties as a member of an organized industrial fire brigade.

And

- **NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents** which has a scope of identifying and establishing the functional capability for conducting operations at technical search and rescue incidents.
- **NFPA 1006 Standard for Technical Rescuer Professional Qualifications** which has a scope of establishing the minimum requirements necessary for fire service and other emergency response personnel who perform technical rescue operations.

The common theme is having an operational standard which would have a sister professional qualifications standard. This seems to both make sense and it works! The Pro-Board in its mission relating to accreditation “accredits fire service training agencies that use the National Fire Protection Association’s professional qualification standards.”

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P.O BOX 80065 • WASHINGTON, D.C. 20018
• mail@naftd.org • www.naftd.org
This is true except when relating to the professional qualification of hazardous materials/weapons of mass destruction standards:

- NFPA 472 Competence of Responders to Hazardous Materials/Weapons of Mass destruction Incidents, and NFPA 473 Standard for Competencies of EMS Personnel responding to Hazardous Materials/Weapons of Mass destruction Incident, both have a scope of identifying the minimum level of competence required by responders to emergencies involving hazardous materials and weapons of mass destruction. These are not written in the typical JPR format utilized in the Professional Qualifications Standards developed under the guidance of the Standards Council.

The purpose of this communication is to initiate the process to develop a professional qualification standard (in the 1000 series of the NFPA Codes) that would become a sister standard to NFPA 472 and NFPA 473, written in the JPR format as the other related standards. NAFTD would gladly work with a Task Force under your supervision of members of the 472 & 1001 committees.

We feel that this would bring continuity to the standards making process, which we feel would eliminate the one exception for accreditation to the professional standards, and that this enhancement would be easier to follow for our constituents...the approximate one-million firefighters we teach and certify every year.

Our Board and Membership stands ready to assist in any manner possible through this process. Thank you for your time and actions regarding this request.

Sincerely,

Richard A. Mason
President
North American Fire Training Directors

CC: James Shannon, President/CEO NFPA
    Jim Estep, Chair, Pro-Board
    Tim Bradley, IFSAC Board of Governor

P.O BOX 80065 • WASHINGTON, D.C. 20018
• mail@naftd.org • www.naftd.org
Item 12-3-17
Maynard, Mary

Subject:

Amy and Linda-

Please find attached the draft of NFPA 4 that has been balloted by the Committee. If approved by the Council, the Committee would like to enter this document in the A2014 revision cycle. Please let me know if you have any questions.

Regards,

Matt Klaus

Senior Fire Protection Engineer

NFPA

**Important Notice:** This correspondence is not a Formal Interpretation issued pursuant to NFPA Regulations. Any opinion expressed is the personal opinion of the author, and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should be relied upon, to provide consultation or services.

*The United States Fire Administration (USFA) and National Fire Protection Association (NFPA) are working together to remind everyone that home fires are more prevalent in winter than in any other season.*

*Learn how to reduce your risk of experiencing a fire this winter.*

<image001.jpg>

www.nfpa.org/winter

Check out NFPA on social media…

www.nfpa.org/socialmedia
Committee Scope: This Committee shall have primary responsibility for documents that address commissioning and integrated system testing activities and tasks for fire protection and life safety systems. This includes the requirements for planning, organization, coordination, responsibility, implementation, and documentation of commissioning and integrated system testing of active and passive systems and features that serve a fire protection or life safety purpose.

Chapter 1 Administration

1.1 Scope.

1.1.1* The standard shall provide the minimum requirements for testing of integrated fire protection and life safety systems where such testing is required by governing laws, codes, regulations, or standards.

1.1.2* This standard shall not provide requirements for testing of individual systems.

1.1.3 The requirements of this standard shall apply to new and existing systems.

1.2 Purpose. The purpose of this standard shall be to provide a testing protocol that will ensure integrated fire protection and life safety systems perform as intended.

1.3 Application.

1.3.1* This standard shall apply to integrated passive and active fire protection and life safety equipment and systems.

1.3.2* Integrated systems testing shall verify and document the following:

(1) Performance in accordance with applicable codes and standards

(2)* Sequence of operation

(3) Performance in accordance with manufacturers’ published instructions

(4) Accuracy of Record Documents

1.4 Equivalency.
1.4.1 Nothing in this Standard shall prevent the use of systems, methods, devices, or appliances of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this Standard.

1.4.2 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.3 The systems, methods, devices, or appliances that are found equivalent shall be approved.

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### Chapter 2  Referenced Publications

2.1 **General.** The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 **NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


2.3 **Other Publications.**


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### Chapter 3  Definitions

3.1 **General.** The definitions contained in this chapter apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster’s Collegiate Dictionary*, 11th edition, is the source for the ordinarily accepted meaning.

3.2 **NFPA Official Definitions.**

3.2.1* **Approved.** Acceptable to the authority having jurisdiction.
3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Standard. A document, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1* Basis of Design (BOD). A document that shows the concepts and decisions used to meet the owner’s project requirements and the requirements of governing laws, codes, regulations and standards.

3.3.2* Building. Any structure used or intended for supporting or sheltering any use or occupancy. [101, 2012]

3.3.3 Commissioning.

3.3.3.1 Commissioning (Cx). A systematic process that provides documented confirmation that building systems function according to the intended design criteria set forth in the project documents and satisfy the owner’s operational needs, including compliance with applicable laws, regulations, codes, and standards.

3.3.3.2* Commissioning Authority (CxA). The qualified person, company, or agency that plans, coordinates, and oversees the entire commissioning process.

3.3.3.3* Commissioning Plan. The document prepared for each project that identifies the processes and procedures necessary for a successful commissioning process.

3.3.3.4 Commissioning Record. The complete set of commissioning documentation for the project that is turned over to the owner at the end of the construction phase.
3.3.3.5* Fire and Life Safety Commissioning (Cx). A systematic process that provides documented confirmation that fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the owner’s operational needs, including compliance with requirements of any applicable laws, regulations, codes, and standards requiring fire and life safety systems.

3.3.3.6 Fire Commissioning Agent. (FCxA). A person or entity identified by the owner, who leads, plans, schedules, documents, coordinates the fire protection and life safety commissioning team, and implements the commissioning process and integrated testing of fire and life safety systems.

3.3.3.7* Re-commissioning (Re-Cx). The process of verifying the performance of existing fire protection and life safety systems that have been previously commissioned to ensure that the systems continue to operate according to the design intent or current operating needs.

3.3.3.8* Retro-commissioning (RCx). The process of commissioning existing fire protection and life safety systems that were not commissioned when originally installed.

3.3.4 Component. A part of an architectural, electrical, or mechanical system. [5000, 2012]

3.3.5 Construction Documents. Plans, specifications and other documents that describe the construction project.

3.3.6 Drawings.

3.3.6.1* Coordination Drawing. A drawing used to show and coordinate the placement and interaction of multiple individual systems or components.

3.3.6.2* Record (Plan) Drawing. A drawing that is submitted as the final record of documentation for the project.

3.3.6.3 Shop Drawing. Scaled working drawings, equipment cutsheets, and design calculations. [1031, 2009]

3.3.6.4 Working (Plan) Drawing. Approved plans and drawings that are used for construction of the project.

3.3.7 Individual System. See System.

3.3.8* Inspection. A visual examination of a system or portion thereof.

3.3.9* Installation Contractor. A person or entity that provides labor and materials to install systems and equipment.

3.3.10 Integrated System. See System.
3.3.11 **Integrated Testing Agent (ITa).** A person or entity identified by the owner, who, plans, schedules, documents, coordinates, and implements the integrated testing of individual fire protection and life safety systems and their associated subsystems.

3.3.12 **Interface.** That place at which individual systems meet and act on or communicate with each other.

3.3.13* **Interface Device.** A component that connects an individual system to one or more other individual systems.

3.3.14 **Issues Log.** A formal and ongoing record of failures, deficiencies, or concerns, as well as associated priorities, implications, and resolutions.

3.3.15* **Manufacturer’s Published Instructions.** Published installation and operating documentation provided for each product or component. [72, 2013]

3.3.16* **Narrative.** A written summary description of the property and all applicable fire protection and life safety systems and related integrated operational features.

3.3.17 **Operation and Maintenance Manual.** A document that includes operation and maintenance requirements.

3.3.18* **Owner’s Project Requirements (OPR).** Documentation of the Owner’s goals and requirements for the project.

3.3.19 **Phase.**

3.3.19.1 **Construction Phase.** The phase during which the systems and materials are fabricated and installed, tested, and accepted.

3.3.19.2 **Design Phase.** The phase during which the basis of design is produced, and drawings and calculations are produced and testing procedures are developed.

3.3.19.3 **Occupancy Phase.** The phase during which the training and periodic inspection, testing, and maintenance are scheduled and performed.

3.3.19.4 **Planning Phase.** The phase during which initial project requirements are developed.

3.3.20 **Registered Design Professional (RDP).** An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the jurisdiction in which the project is to be constructed, or other professional with qualifications or credentials acceptable to the jurisdiction in which the project is to be constructed.

3.3.21* **Sequence of Operation.** A matrix, narrative, or table of system inputs and outputs or responses that illustrate the interactions of interconnected fire protection and life safety systems.
3.3.22 **Stakeholder.** Any individual, group, or organization that is involved in or affected by the project.

3.3.23 **System.**

3.3.23.1* **Active Fire Protection System.** A system that uses moving mechanical or electrical components to achieve a fire protection goal.

3.3.23.2 **Fire Protection Systems.** Systems, devices, and equipment used to detect a fire and its by-products, actuate an alarm, or suppress or control a fire and its by-products, or any combination thereof. [1031, 2009]

3.3.23.3* **Individual System.** Components or equipment that are assembled, grouped, or otherwise interconnected, or procedures used to accomplish a purpose or function.

3.3.23.4* **Integrated System.** A combination of individual systems that are required to operate together as a whole to achieve an overall objective.

3.3.23.5* **Interconnected System.** An integrated system that has component systems or devices physically connected to achieve fire protection and life safety objectives.

3.3.23.6* **Life Safety Systems.** Those systems that enhance or facilitate evacuation, smoke control, compartmentalization, and/or isolation. [1031, 2009]

3.3.23.7* **Passive Fire Protection System.** Any portion of a building or structure that provides protection from fire or smoke without any type of system activation or movement.

3.3.24 **System Connection.**

3.3.24.1* **Switch Connection.** A connection between multiple individual systems using a device for making or breaking the connection in an electric circuit.

3.3.24.2* **Data Sharing Connection.** A connection between multiple individual systems in which data streams are transferred.

3.3.24.3* **Interconnection.** The physical connections between interconnected systems.

3.3.25 **Systems Manual.** A compilation of all operational and maintenance manuals and description of the integrated fire protection and life safety systems.

3.3.26 **Test.**

3.3.26.1 **Test.** A procedure intended to establish the operational status, or performance a system.
3.3.26.2 Acceptance Test. Tests performed at the completion of installation to confirm compliance with applicable manufacturers’ installation specifications, applicable codes and standards, and the project Basis of Design and Owners Project Requirements.

3.3.26.3 Control Group Test. An integrated system test that verifies the response of one or more individual systems by examining software programming and by testing only one or more initiating devices of another individual system.

3.3.26.4 End-to-End Integrated System Test. A test of the response of one or more individual systems to an input on another individual system.

3.3.26.5* Integrated System Test. A test of integrated fire protection and life safety systems.

3.3.26.6* Interface Test. Any test of the interface between two individual systems that are part of an integrated system.

3.3.26.7 Periodic Test [RESERVED.]

3.3.26.8* Pre-Functional Test. Tests performed prior to acceptance testing to confirm compliance with manufacturers’ specification, applicable codes and standards, and the project Basis of Design and Owners Project Requirements.

3.3.27 Qualified. A competent and capable person or entity that has met the requirements and training for a given field acceptable to the authority having jurisdiction.

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**Chapter 4 General Requirements**

4.1 Conducting Integrated Tests

4.1.1 This chapter shall apply to the testing of integrated systems provided for fire protection or life safety.

4.1.2 Personnel responsible for integrated testing shall meet the qualifications listed in 4.3.

4.1.3 Where required by codes, standards or regulations, integrated testing of new or existing fire protection and life safety systems shall occur.

4.2 Initial Integrated Test

4.2.1 Initial integrated test shall be performed where required by a commissioning plan or integrated test plan.

4.2.1.1 Initial Integrated Test shall verify the proper operation all interconnected systems and functions in accordance with either the:

   (a)* Commissioning plan or,
(b) Integrated Testing Plan

4.3 Periodic Integrated Testing

4.3.1 Integrated fire protection and life safety systems shall have periodic system testing.

4.3.2* Where periodic tests are not performed in accordance with 4.3.3 or 4.3.4, the periodic test interval shall not exceed five years.

4.3.3 Integrated systems that were commissioned upon installation shall have periodic integrated testing at the interval specified in the commissioning plan.

4.3.4 For integrated systems that were not commissioned, an integrated testing plan shall be developed to identify the appropriate extent and frequency of periodic integrated system testing.

4.3.5* In addition to periodic integrated testing, integrated system testing should be done when any of the following events occurs:

1. New fire protection or life safety systems are installed and interconnected to existing fire protection and life safety systems.

2. Existing fire protection or life safety systems are modified to become part of interconnected systems.

3. Interconnections or sequence of operations of existing integrated fire protection and life safety systems are modified.

4. Whenever failures of an individual system interfaces occur during routine operation or testing of an interconnected fire protection and life safety system.

4.4 Integrated System Testing Team.

4.4.1 This chapter applies to the testing of integrated systems provided for fire protection or life safety.

4.4.2 Personnel responsible for integrated system testing shall meet the qualifications listed in 4.5.

4.4.3 The integrated system testing team shall include an Integrated Testing Agent.

4.4.3.1 The integrated system testing team shall be identified and documented.

4.4.3.2 The exact size and members of the integrated system testing team shall be dependent upon project type, size, and complexity.

4.5* Qualifications.

4.5.1 Personnel involved in integrated system testing shall meet the requirements of this chapter. Team members shall provide evidence of their qualifications and/or certifications when requested by the authority having jurisdiction.
4.5.1.1 Documentation of these qualifications shall be provided to the Owner.

4.5.2 The Integrated Testing Team members shall be knowledgeable and experienced in the proper application of the integrated system testing requirements of this standard and general industry practices.

4.5.3.* The Integrated Testing Agent shall have an understanding of the design, installation, operation and maintenance of the type of fire protection and life safety systems installed.

4.6 Testing Responsibilities.
4.6.1 The owner shall be responsible for integrated system testing of fire and life safety systems.
4.6.2 The owner shall be permitted to delegate the authority and responsibility for integrated system testing of the fire protection and life safety systems to the management firm or managing individual through specific provisions in the lease, written use agreement, or management contract.

4.6.3* The Integrated Testing Agent shall be responsible for planning, scheduling, documenting, coordinating, and implementing the integrated system testing of the fire protection and life safety systems.

4.6.4 Where a commissioning plan does not exist, the Integrated Testing Agent shall prepare a test plan providing, but not limited to, the following information:
   (1) A comprehensive functional matrix depicting all system inputs and associated output functions
   (2) The extent of systems to be tested under the direct supervision of the Integrated Testing Agent
   (3) The testing of component systems required by associated NFPA standards
   (4) Test processes to be incorporated
   (5) Test scenarios developed to verify appropriate system responses to the functional matrix
   (6) A test event schedule with the applicable stakeholders

4.7 Test Plan
4.7.1 Integrated testing shall begin by performing the test scenario tasks described in the Integrated Testing Plan.

4.7.2 The test shall verify that required responses have occurred in accordance with the integrated testing plan.

4.7.3 Unless otherwise permitted in section 4.x, integrated system testing shall test all of the responses and interactions found on integrated fire protection and life safety systems.

4.7.4* The test shall begin with each initiating device and end with the actions and responses identified in the integrated testing plan.
4.7.5 Where all of the following conditions and tests are verified, it shall not be required to test all devices on one individual system used to initiate a common response on other individual systems:

1. Two or more individual systems are interfaced using an interface device.
2. The integration of the systems is through a single interface.
3. The interface is programmed to deliver notification whenever any initiating device in a defined control group changes state.
4. At least one test is conducted by activating each of the initiating devices listed in the control group and observing the response of the interconnected systems (end-to-end test).
5. At least one test is conducted by activating an initiating device that is not listed in the control group and observing the response of the interconnected systems (end-to-end test).
6. The control group initiating devices have been verified by testing of the individual system in accordance with the applicable system standard for inspection, testing and maintenance.

Chapter 5 Test Methods

5.1 General.

5.1.1 This chapter applies to the testing of integrated systems provided for fire protection or life safety.

5.2 Test Method.

5.2.1* Integrated testing shall demonstrate that the final integrated system installation complies with the specific design objectives for the project and applicable codes and standards

5.2.2 Test scenarios shall include events and combination of events, including but not limited to:
   1. Loss of normal power
   2. Water flow
   3. Presence of smoke

5.2.2.1* Where approved, test scenarios with a combination of events shall be permitted to include simulated events to initiate activation devices.

5.2.3 Test scenario events shall demonstrate all annunciation, supervision, notification and integration between systems occurs, at locations specified by the individual systems.

5.2.4* Test scenario events shall verify that all required building functions occur.

5.2.5 Verify the wiring methods required for supply and interlocking life safety systems meets the survivability requirements as specified by the applicable codes to include but not limited to:
1. Generator start circuits
2. Emergency feeder circuits including wiring tests to the device
3. Emergency fire alarm circuits
4. Fire pump feeders

5.2.6* Integrated testing of fire protection and life safety systems shall verify the interconnections function properly.

5.2.7* During integrated testing, equipment shall be tested in accordance with the applicable system standard to verify systems perform according to their design function.

5.2.8 Written documentation of the testing shall be provided in accordance with Chapter 6.

5.2.9* Testing shall be repeated if changes or corrections are made to systems during testing that could affect the overall functionality of the systems.

5.2.10 Switch connections to fire alarm systems shall be tested in accordance with NFPA 72, National Fire Alarm and Signaling Code.

5.2.11 Control circuits requiring electrical power shall be tested for presence of operating voltage.

5.2.12 Loss of power to monitored circuits shall be tested to confirm signal receipt at one of the following:

(1) A constantly attended location at the premises

(2) A monitoring station as described in NFPA 731, Standard for the Installation of Electronic Premises Security Systems, Chapter 9

(3) A supervising station as described in NFPA 72, National Fire Alarm and Signaling Code

5.2.13 Integrated testing of data sharing systems shall document the following:

(1) Completion of acceptance testing for each component system

(2) Verification of data transfer between component systems

(3) Test of visual and audible signal upon loss of communication

(4) Test of degrade mode for each component system

(5) Proper function of integrated data sharing systems

5.3 Issues Logs and Corrective Action Reports

5.3.1 The issues log shall list each separate finding and its corresponding resolution, including dates of discovery and resolution.
5.3.1.1 Corrective action reports shall provide a specific and detailed description of actions taken to remediate faults, failures, and discrepancies discovered during the testing process.

5.3.1.2 Upon completion of testing, the Integrated Testing Agent shall submit a final test report to the owner and other stakeholders as requested.

5.3.1.3 The final test report shall summarize the results of the integrated testing and shall include issues logs and corrective action reports.

Chapter 6 Documentation

6.1 Application

6.1.1 Documentation of integrated system testing shall comply with the minimum requirements of this Chapter.

6.1.2 Documentation required by other approved installation standards referenced in the Basis of Design for the individual systems that make up the integrated system shall be used as required by those standards.

6.1.3 This Chapter outlines documentation requirements, but does not prohibit additional documentation from being provided.

6.1.4 Where required by any design documents or by other governing laws, codes, standards, or authority having jurisdiction, the Integrated Testing Agent shall furnish documentation stating that the integrated system has been tested in accordance with the approved test plan and this standard.

6.2 Minimum Required Test Documentation

6.2.1 The final test report shall summarize the results of the integrated testing.

6.2.2 The test report shall include a narrative or matrix describing each test and the response of the integrated system and individual systems.

6.2.2.1 *The test report shall include a description of the status of each individual system for each test.

6.2.2.2 The report detail for each test shall identify the individual system where a condition was simulated or where a device state change was initiated.

6.2.2.3 The report detail for each test shall identify each individual system where a response occurred as the result of a simulated condition or a change in state for an initiating device.

6.2.3 The test report shall include a statement that all input and output functions of the integrated system have been tested and operate as intended.

6.2.3.1 Where any test result does not comply with the intended design, a description of the fault shall be made in an issues log.
6.2.3.2 Where any test result does not comply with the intended design, corrective action report shall be prepared.

6.2.4 The Integrated Testing Agent shall maintain a record of faults, failures, and discrepancies discovered through the testing process in the issues log.

6.2.5 The issues log shall list each separate finding and its corresponding resolution, including dates of discovery and resolution.

6.2.6 Corrective action reports shall be prepared and shall provide a specific and detailed description of actions taken to remediate faults, failures, and discrepancies discovered during the testing process.

6.3 Completion Documents

6.3.1 Upon completion of testing and after all issues and discrepancies have been resolved, the Integrated Testing Agent shall submit Completion Documents to the owner and, where requested, to other stakeholders.

6.3.2 All documents required by section 6.2 of this standard shall be included in the Completion Documents.

6.3.3 A copy of the Test Plan required by 4.3 shall be included in the Completion Documents.

6.3.4 The Completion Documents shall include all documentation required by the integrated system design documents or by other governing laws, codes or standards.

6.4 Record Retention, and Record Maintenance

6.4.1 The property or building or system owner or the owner’s designated representative shall be responsible for records retention.

6.4.2 Records shall be on a medium that will survive the retention period. Paper or electronic media shall be permitted.

6.4.3 All records required by this chapter shall be available for examination by the authority having jurisdiction.

6.4.4 Archiving of records by any means shall be permitted if hard copies of the records can be provided promptly when requested.

6.4.5 All documents required by this chapter shall be retained as follows:

6.4.5.1 Documentation of the Initial Integrated System Test shall be retained until a new initial integrated system test report has been provided to the owner.

6.4.5.2 Documentation of the Periodic Integrated System Test shall be retained until the next Periodic Integrated System Test has been completed and the documentation provided to the Owner.

6.4.6 All records required by this chapter shall be kept in one location.

6.4.7 The location of the documentations shall be identified at the fire alarm control unit.
6.4.8 The records shall be accessible by authorized personnel only.

6.4.9 * Security for documentation shall be determined by the stakeholders.

6.4.10 Where documents cannot be protected from public access, it shall be permitted to remove sensitive information from record documents provided that the owner retains complete documentation that will be made accessible to the authority having jurisdiction at an owner designated location.

6.5 Forms

6.5.1 Approved documents and forms shall be used to record integrated testing of fire and life safety systems.

6.5.2 Forms required by other governing laws, codes or standards or by project specifications or drawings, shall be permitted to be used in place of forms required by this section provided that the minimum required content is included.

6.5.3 Custom forms shall be permitted to be used in place of forms required by this section provided that the minimum required content is included.

6.5.4 Where no form or checklist exists, specific forms or checklists shall be developed to document testing of the integrated system and individual systems.

6.5.5 Unless otherwise permitted or required in 6.5.1 through 6.5.4, Figure 6.5.5(a) shall be used as the issues log form and 6.5.5(b) shall be used as the corrective action report form.
### COMMISSIONING ISSUES LOG

<table>
<thead>
<tr>
<th>#</th>
<th>Issue</th>
<th>Date Found</th>
<th>Code/Document Reference</th>
<th>Possible Cause</th>
<th>Recommendations</th>
<th>Actions Taken</th>
<th>O&amp;M Dec.</th>
<th>Issue?</th>
<th>Signature and Date</th>
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</table>

Attach additional pages as necessary for issues requiring more explanation and tracking.

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**FIGURE 6.5.5(a) Issues Log**
FIGURE 6.5.5(a) Corrective Action Report
Annex A  Explanatory Material

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

A.1.1.1 These requirements include protocol for testing procedures, responsibilities for various parties, methods and documentation for verifying the operational readiness and sequence of integrated systems. The standard is designed to ensure that interconnected active and passive fire protection and life safety systems operate as intended. It is not the intent of this standard to require implementation of emergency response procedures, evacuation drills or other exercises that require facility staff or fire department response. However, when integrated systems tests are being conducted, it may be an appropriate opportunity to practice emergency procedures or drills.

This standard does not prohibit the owner of the property, building or individual system, or the owner’s designated representative from requiring integrated system testing by design or contract documents.

A.1.1.2 Individual systems should be tested in accordance with the requirements of the appropriate installation standard.

A.1.3.1 These systems and equipment can include, but are not limited to, the following:

(1) Infrastructure supporting the building fire protection and life safety systems within the boundaries of the project. Project infrastructure should include those systems and utilities necessary for the support and operation of the fire protection and life safety systems of the proposed project. These infrastructure items can include the following:
   
   (a) Access roadways for general ingress and egress and those necessary for fire department access in accordance with local codes, standards, and policies
   
   (b) Utility systems for the provisions of electric power, fuel gas, water, and waste water; communication systems; and any other utility system deemed essential for the support of project operations
   
   (c) On-site combined heat and power generation systems, electric power generation plants or systems, fuel gas storage facilities, water supply and storage facilities, and environmental or waste management systems
   
(2) Fixed fire suppression and control systems
(3) Fire alarm systems
(4) Emergency communications systems (ECS)
(5) Smoke control systems
(6) Normal and emergency standby power systems including, but not limited, to those powering the following:

   (a) Smoke control systems
   (b) Stair pressurization systems
   (c) Smoke-proof enclosure ventilation systems
   (d) Electric driven fire pumps
   (e) Elevator systems
   (f) Fire suppression system controllers

(7) Explosion prevention and control systems

(8) Fire-resistant and smoke-resistant assemblies. Examples include, but are not limited to, floor ceilings and roof decks, doors, windows, barriers, and walls protected by a firestop system or device for through-penetrations and membrane penetrations, and other fire and smoke control assemblies.

(10) Systems associated with commercial cooking operations

(11) Elevator systems

(12) Means of egress systems and components including, but not limited to, the following:

   (a) Emergency lighting and exit signs
   (b) Major egress components, such as corridors, stairs, ramps, and so forth
   (c) Exit path marking systems

(13) Other systems or installations integrated or connected to a fire or life safety system, such as, but not limited to, access control, critical processes, and hazardous operations

A.1.3.2 Where integrated systems testing is performed as part of a commissioning process, compliance with the Basis of Design and Owners Project Requirements should be verified.

A.1.3.2(2) See Figure A.3.3.21 for a sample sequence of operation

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.
A.3.2.2 **Authority Having Jurisdiction (AHJ).** The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 **Listed.** The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1 **Basis of Design (BOD).** The Basis of Design is normally used to assist in the plan review, inspection, and acceptance process.

A.3.3.2 **Building.** The term *building* is to be understood as if followed by the words “or portions thereof.” The intent is to also apply this standard to structures such as roadway and transit tunnels, bridges, towers, fuel storage facilities, and other structures insofar as this document applies.

A.3.3.3.2 **Commissioning Authority (CxA).** A commissioning authority is typically provided and leads the overall fire protection and life safety commissioning team when the commissioning process is applied to more than one building system — that is, building commissioning. When the commissioning process is only applied to fire and life safety systems, the FCxA can assume the role of the commissioning authority.

A.3.3.3.3 **Commissioning Plan.** The commissioning plan establishes the framework for how commissioning will be handled and managed on a given project.

A.3.3.3.5 **Fire and Life Safety Commissioning (Cx).** Commissioning is achieved in the design phase by documenting the design intent and continuing throughout construction, acceptance, and the warranty period with actual verification of performance, O&M documentation verification, and the training of operating personnel.

A.3.3.3.7 **Re-commissioning (Re-Cx).** Re-commissioning can be initiated periodically or in response to building renovation or a change in building use.

A.3.3.3.8 **Retro-commissioning (RCx).** Retro-commissioning is a process that ensures that building systems perform interactively according to the design intent and/or to meet the owner’s current operational needs. This is achieved by documenting the design intent where possible and the current operational needs, measuring the existing performance, and implementing necessary operational and/or system modifications, followed by actual verification of performance, verification of O&M documentation, and training of operating personnel.
Retro-commissioning explains the analogy and methodology used by the designers in the design of the systems for the protection of the building, occupants, and emergency response personnel.

A.3.3.6.1 Coordination Drawing. Coordination drawings include information such as horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other property components or systems.

A.3.3.6.2* Record (Plan) Drawing A drawing is also referred to as a plan. A record drawing might also be referred to as an as-built drawing or working drawing.

A.3.3.8 Inspection. One purpose for inspections is to verify that systems and components appear to be in operating condition and is free of physical damage.

A.3.3.9 Installation Contractor. Installation contractors often provide shop drawings, working plans, and other related documents.

A.3.3.13 Interface Device. Examples of interface devices include switches and data sharing as defined under System Connections.

A.3.3.15 The manufacturer’s published instructions include directions and information necessary for the intended installation, maintenance, and operation of the product or component.

A.3.3.16 Narrative. The narrative is written to assist and expedite the plan review and inspection process by the AHJ. The narrative is a written description of an individual or integrated system. The narrative for an integrated system includes details on how individual systems are integrated to meet the overall fire protection and life safety system objectives. It is maintained on file for use at the time of final inspection and for periodic reviews during future field inspections. It is referenced by the building owner and authority having jurisdiction to ensure that all future modifications, alterations, additions, or deletions to the original systems are current and that the original system’s protection and required system performance are not compromised or have not been altered without building or fire official prior review. The narrative should be recognized by all entities that it is one of the key documents associated with the commissioning process.

Building owners benefit by knowing how their building’s fire protection and life safety systems work. The narrative provides a procedure including methods for testing and maintenance. A copy of the narrative report should be kept on the premises and should be available for review prior to testing and proposed modifications to any portion of the building’s fire protection and life safety systems.

Development Format. The narrative is prepared by a qualified, identified individual who has “taken charge” in the development of an entire coordinated narrative that includes all information regarding the design basis, sequence of operation, and testing criteria associated with all required or non-required fire protection systems set forth by applicable laws, codes, regulations, and local ordinances of the jurisdiction and applicable national and/or international standards.
The narrative should be submitted with plans and specifications for review and approval by the AHJ prior to the issuance of a building permit. The narrative should be written in a clear conversational format. The construction specifications should not be considered a narrative; however, some applicable portions of the construction specifications could be included to support or clarify the intent of the narrative. The narrative is a stand-alone document, it should be 8½ in. × 11 in. for filing and ease of use by the AHJ and building owners, and it should include an administrative cover page identifying the project name, building address, and name, address, and phone number of the individual who has “taken charge” in the preparation of the narrative.

**Commentary.** Codes and standards are written in a way to require uniformity in design and construction for all buildings and structures. The codes and standards can be subjective and are subject to interpretation by building owners, designers, and the AHJ; uniformity is not always necessarily achieved. The narrative should attempt to clarify to the AHJ the designer’s intent and interpretation of the code and standards. The AHJ can agree or disagree with the designer’s interpretation. Historically, the requirements for fire protection and life safety systems have become site-specific, and building code requirements are not uniformly enforced. The size of the community, fire department staffing, fire department equipment availability, and suppression tactics established by the local fire department have affected the uniformity of enforcement. Site-specific requirements more or less than that of the building code can have reasonable intent; however, this type of enforcement in some cases has proven to be controversial in the applicability of code uniformity. The narrative can be and should be a valuable instrument when accurately prepared, and it will establish a line of communication between the designer and the authority having jurisdiction, resulting in what the building codes and standards mandate, which is uniformity and consensus in the interpretation of the codes and standards. The narrative should be written in a three-sectional format with subsections as necessary (methodology, sequence of operation, and testing criteria sections) for clarity and should be limited to a summary. A sample narrative outline can be found in Annex B.

**A.3.3.18 Owner’s Project Requirements (OPR).** The Owner’s Project Requirements document the owner’s goals for the project, their expectations for how individual systems will be integrated and how the individual systems and the integrated systems will be used and operated. The Owners Project Requirements also establishes benchmarks and criteria for performance.

**A.3.3.21 Sequence of Operation.** See Figure A.3.3.21(a) and Figure A.3.3.21(b). The matrix and the sequence of operations form are examples only, and they might need to be modified based on the actual installation requirements. The system outputs on the sequence of operations matrix correspond to the system outputs on the sequence of operation form.
FIGURE A.3.3.21(a)  Sequence of Operation.
FIGURE A.3.3.21(b)  Sequence of Operation Form.

<table>
<thead>
<tr>
<th>System Input</th>
<th>System Output</th>
<th>Test Results</th>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Typical manual pull station (by device) floors 1–5</td>
<td>A. Actuate common alarm signal indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Actuate audible alarm signal</td>
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<td>C. Display and print change of status and time of initiating event</td>
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<td>D. Transmit alarm to FD and central station masterbox</td>
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<td>E. Actuate associated exterior fire alarm beacon</td>
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<td>F. Actuate all evacuation signals for the building</td>
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<td>G. Release all magnetically held doors</td>
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<td>H. Recall associated elevator in accordance with recall sequence</td>
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<td></td>
<td>I. Elevator hoistway open</td>
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<td>2. Typical elevator recall smoke detector (by device) by floor (lobby)</td>
<td>A. Actuate common alarm signal indicator</td>
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<td>B. Actuate audible alarm signal</td>
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<td>I. Elevator hoistway open</td>
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<td>3. Elevator machine room smoke detector</td>
<td>A. Actuate common alarm signal indicator</td>
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<td>B. Actuate audible alarm signal</td>
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<td>D. Transmit alarm to FD and central station masterbox</td>
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<td>E. Illuminate associated detector LED indicator</td>
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<td>System Input</td>
<td>System Output</td>
<td>Test Results</td>
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<td>3. Elevator machine room smoke detector (continued)</td>
<td>J. Actuate associated exterior fire alarm beacons</td>
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<td>K. Actuate all evacuation signals for the building</td>
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<td>L. Release all magnetically held doors</td>
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<td>P. Elevator hoistway open</td>
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<td>4. Typical smoke detector (by device) computer room 3rd floor preaction system</td>
<td>A. Actuate common alarm signal indicator</td>
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<td>B. Actuate audible alarm signal</td>
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<td>M. Recall associated elevator in accordance with recall sequence</td>
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<td>5. Typical wet sprinkler system flow control valve assembly flow switch — by floor</td>
<td>A. Actuate common alarm signal indicator</td>
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<td></td>
<td>B. Actuate audible alarm signal</td>
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<td>C. Actuate audible alarm signal</td>
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<td>L. Release all magnetically held doors</td>
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<td>6. Typical wet sprinkler system flow control valve assembly tamper switch — by floor</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>7. Typical preaction sprinkler system flow control valve assembly flow switch — by floor</td>
<td>A. Actuate common alarm signal indicator</td>
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<td>B. Actuate audible alarm signal</td>
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<td>F. Actuate audible trouble signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>H. Transmit alarm to FD and central station masterbox</td>
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<td>K. Actuate all evacuation signals for the building</td>
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<td>L. Release all magnetically held doors</td>
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<td>8. Typical preaction sprinkler system flow control valve assembly tamper switch — by floor</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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FIGURE A.3.3.21(b)  Continued
### FIGURE A.3.3.21(b)  Continued

<table>
<thead>
<tr>
<th>System Input</th>
<th>System Output</th>
<th>Test Results</th>
<th>Date</th>
<th>Initials</th>
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</thead>
<tbody>
<tr>
<td>9. Kitchen cafeteria wet chemical system — 1st floor</td>
<td>A. Actuate common alarm signal indicator</td>
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<td></td>
<td>B. Actuate audible alarm signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>H. Transmit alarm to FD and central station masterbox</td>
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<td>L. Release all magnetically held doors</td>
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<td>P. Elevator hoistway open</td>
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<td>10. Typical duct smoke detector (by device) — by floor</td>
<td>G. Display and print change of status and time of initiating event</td>
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<td></td>
<td>N. Shutdown associated mechanical equipment</td>
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<td>11. Fire pump running</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td></td>
<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>12. Fire pump power failure</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>13. Fire pump phase reversal</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td></td>
<td>G. Display and print change of status and time of initiating event</td>
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<tr>
<td>14. Fire pump connected to emergency power</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>15. Fire pump circuit breaker at generator output</td>
<td>C. Actuate common supervisory signal indicator</td>
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<td>D. Actuate audible supervisory signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>16. Fire alarm system open circuit</td>
<td>E. Actuate common trouble signal indicator</td>
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<td>F. Actuate audible trouble signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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<td>17. Fire alarm system ground fault</td>
<td>E. Actuate common trouble signal indicator</td>
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<td>F. Actuate audible trouble signal</td>
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<td>G. Display and print change of status and time of initiating event</td>
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A.3.3.23.1 **Active Fire Protection System.** Examples of active systems include, but are not limited to, gaseous extinguishing systems, sprinklers, standpipes, dampers, or fire alarm systems.

**A.3.3.23.3* Individual System.** Individual systems might be made up of various hardware and software components and assemblies. For example, see the list in A.5.2.6. Other systems might
include building architectural features such as ceiling and walls that might affect voice
messaging, alarm audibility or smoke migration. Some individual systems that are a critical part
of a successful integrated system might be composed of procedures rather than just hardware and
software.

A.3.3.23.4* Integrated System. Integrated systems are made up of individual systems that are
each covered by other specifications, governing laws, codes, or standards. Individual systems
that make up an integrated system might be physically connected or might require manual
operation by a person to achieve integrated operation. An example of an integrated system is a
fire alarm system, sprinkler system and elevator system that are interconnected to respond in
specific ways to specific conditions. Several different standards, codes, designers, authorities
and installers are involved in the different individual systems that make up the integrated system.

An integrated system contains individual systems that are physically connected and others that
are not. An integrated system can contain a combination of individual fire protection and life
safety systems and individual non–fire protection and life safety systems (i.e., building systems
such as elevators, HVAC systems, and automatic door closures) that might or might not be
physically connected, but that are required to operate together as a whole to achieve overall fire
protection and life safety objectives.

For example, a smoke control system is often activated by water flow in a sprinkler system but
the sprinkler system is not physically connected to the HVAC system. The physical connection
might be is from the sprinkler system to the fire alarm system and then to the building
automation system. Further examples of integrated systems include the need for wall integrity
when using total flooding suppression agents or automatic door closers that are to close upon
activation of smoke control systems or stair pressurization systems. See Figure A.3.3.23.4 for
examples of integrated systems.
FIGURE A.3.3.23.4 Integrated System.

[A.3.3.23.5 Interconnected System. An example of two interconnected, individual systems that interface using an interface device is a fire alarm system that uses a relay as an interface device to connect to an elevator controller. Another example would be an energy management systems that is interconnected to a fire alarm system using a network data connection and a communications software protocol.

Some integrated systems may rely on individual systems that are not interconnected. In a prison, a fire alarm and emergency communications system might present information to an operator who in turn must make decisions and manually control a separate door locking system. The door locking system is an individual system that is not interconnected to the fire alarm system. The door system, the fire alarm system and the operations personnel are all part of an integrated fire and life safety system.

A.3.3.23.6 Life Safety Systems. Life safety systems can include both active and passive fire protection systems, devices, or assemblies. These systems are comprised of several items of equipment, processes, actions, or behaviors, grouped or interconnected so as to reduce injuries or death from fire or other life-threatening event.

A.3.3.23.7 Passive Fire Protection System. Examples of passive systems include, but are not limited to, floor-ceilings and roof, door, window, and wall assemblies, spray-applied fire-]
resistant materials, and other fire and smoke control assemblies. Passive fire protection systems can include active components and can be impacted by active systems, such as fire dampers.

**A.3.3.24.1 Switch Connection.** For purposes of this definition, a relay is an electrically controlled switch. An example of a monitored switch is a waterflow switch that is either open or closed (normal/not-normal output), which when connected to the input of a fire alarm system can cause multiple outputs in the fire alarm system including sounding the waterflow bell and notification appliances, starting smoke control systems, and so forth. An example of a relay as a switch connection is for elevator control when a fire alarm relay controls when the fire fighters’ recall occurs through the elevator control monitoring the status of the fire alarm relay.

**A.3.3.24.2 Data Sharing Connection.** Data sharing systems are connected such that data from one component system is shared with other component systems, which then make independent decisions to achieve a desired result. The communication can be one-way or two-way, serial or parallel. A data sharing system can have components that are switch connections too.

**A.3.3.24.3 Interconnection.** Interconnections could consist of electrical binary connections (switches) or data sharing connections transfer protocols. Example of data transfers are BACnet or other data exchange protocols.

**A.3.3.26.1 Test Examples**

Examples of tests include waterflow tests, fire pump tests, alarm tests, trip tests of dry, preaction, or deluge valves.

**A.3.3.26.5 Integrated System Testing.** Integrated testing can include other building systems integrated to fire and life safety systems such as elevator recall or HVAC control. Integrated tests might also be referred to as end-to-end tests. An integrated test might include activation of all individual system inputs and observation of all individual system responses or outputs, or it might only test specific inputs and outputs or responses.

An integrated system test might not be an end-to-end test. For example consider an integrated system consisting of a fire alarm system and an elevator system. An end-to-end test would require that the fire alarm smoke detector be activated and the elevator be observed to respond to the signal by returning to a specific location, parking properly and opening the elevator doors. However, another integrated test might only test the interface between the two systems by using a menu command on the fire alarm system to activate the interface device – a relay powered by the fire alarm system and interfaced to the elevator controller. The elevator might be observed to return, but the test did not originate at the fire alarm initiating device. Therefore, the test is not an end-to-end integrated system test.

**A.3.3.26.6 Interface Test.** A test of an interface between two individual systems might be accomplished by conducting an end-to-end test by activating an input on one individual system and observing the response of the second, interfaced system. An interface test might also be done by directly activating an interface device controlled by one individual system to confirm signal receipt on the second individual system. That test would be an interface test, but not an end-to-end test.
A.3.3.26.8  Pre-Functional Testing. Pre-functional testing is conducted in preparation for other types of testing, including integrated testing and acceptance testing. This testing is typically conducted according to a checklist developed by the FCxA that incorporates manufacturers’ requirements and ensures that equipment and components are functioning as intended prior to final acceptance testing. These tests can be complete or partial. In many cases, such as with fire pumps per NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, this is required prior to acceptance testing, as the coordination of attendance by multiple members of the commissioning team may be required. Pre-functional testing is synonymous with the term preliminary testing.

A.4.1.1.1 (a) An Initial Integrated Test as part of the Commissioning Plan can be developed utilizing NFPA 3, Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems.

A.4.3.2  Intervals other than 5 years should be determined based upon a risk analysis. The risk analysis to determine the frequency should be based on the life safety implications of the building such as a highrise or large area building, the complexity of the interconnected systems and the property protection implications based on the hazards contained in the building such as flammable liquid storage etc. Case studies of similar occupancies and component failure rates should also be considered when determining the periodic integrated testing frequency. The number of design and construction modifications following initial commissioning should also be a factor in the determination of periodic integrated testing. Other factors that should be considered include the environment in which the system and equipment is expected to operate. Harsh environments such as corrosive atmospheres or areas subject to wide temperature variations, should require more aggressive testing programs.

A.4.3.5  It is not the intent of this standard to require complete testing of the entire integrated system when only a portion of the facility undergoes modification, remodel, refurbishment or tenant improvement work. When only a portion of the facility or integrated system has been modified, only those areas or portions of the integrated system that has been impacted shall be tested.

A.4.4.3.2* The integrated system testing team may include the following members:

1. Owner’s technical support personnel
2. Facility manager or operations personnel
3. Installation contractor(s) responsible for the systems involved
4. AHJ
5. RDP(s)
6. Construction manager/general contractor
7. Manufacturer’s representatives
8. Insurance representative
9. Third-party test entity
Entities not included as part of the project are not required to be part of the integrated system testing team.

A.4.5 The following descriptions are provided for various team members and can be used to determine that team members are qualified

Third Party Test Entities
The Third Party Test Entity shall be individually identified in the Integrated System Plan specifications or other enabling documentation. The Third Party Test Entity shall provide an objective and unbiased point of view.

Requisite Knowledge. A qualified Third Party Test Entity shall have an advanced understanding of the installation, operation, and maintenance of all fire protection and life safety systems proposed to be installed, with particular emphasis on system integrated system testing.

Requisite Skills. A Third Party Test Entity shall have the ability to do the following:
(1) Read and interpret drawings and specifications for the purpose of understanding system installation, testing, operation, and maintenance.
(2) Analyze and facilitate resolution of issues related to failures in fire protection and life safety systems.
(3) Provide clear, concise written reports and verbal communication, and have the ability to resolve conflicts.

Installation Contractor.
Each installation contractor shall submit evidence of required license or certification to the Integrated Testing Agent.
System installation personnel shall be qualified or shall be supervised by persons who are qualified in the installation and testing of the systems.
State or local licensure regulations shall be followed to determine qualified personnel. Depending on state or local licensure regulations, qualified personnel shall include, but not be limited to, one or more of the following:
(1) Personnel who are registered, licensed, or certified by a state or local authority
(2) Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction
(3) Personnel who are factory trained and certified for the specific type and brand of system and who are acceptable to the authority having jurisdiction

Registered Design Professional (RDP).
The RDP shall be individually identified in the Integrated system testing Plan.

Requisite Knowledge. A qualified RDP shall have comprehensive knowledge of the following:
(1) The design, installation, operation, and maintenance of the fire protection and life safety systems
(2) How individual and integrated systems operate during a fire or other emergency
State or local licensure regulations shall be followed to determine qualified personnel. Depending on state or local licensure regulations, qualified personnel shall include, but not be limited to, one or more of the following:

1. Personnel who are registered, licensed, or certified by a state or local authority
2. Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction
3. Personnel who are factory trained and certified for the specific type and brand of system and who are acceptable to the authority having jurisdiction

**Construction Manager and General Contractor.** Construction managers and general contractors shall be knowledgeable and experienced in the field of construction project management and the operation of integrated fire protection and life safety systems. State or local licensure regulations shall be followed to determine qualified personnel. Depending on state or local licensure regulations, qualified personnel shall include, but not be limited to, one or more of the following:

1. Personnel who are registered, licensed, or certified by a state or local authority
2. Personnel who are certified by a nationally recognized certification organization acceptable to the authority having jurisdiction

**Facilities Management Personnel.** Facilities management personnel shall include building maintenance and service personnel, building engineering personnel, service contractors hired by the building owner or his representative and similar job functions. Facilities management personnel shall have the ability to perform the following:

1. Assess a facility’s need for building systems and recommend building systems.
2. Oversee the operation of building systems.
3. Establish practices and procedures.
4. Administer the allocation of building systems resources.
5. Monitor and evaluate how well building systems perform.
6. Manage corrective, preventative, and predictive maintenance of building systems.
7. Develop and implement emergency procedures and disaster recovery plans.

Facilities management personnel shall be knowledgeable and qualified in the operation and maintenance of the fire protection and life safety systems installed in their facility.

Facilities management personnel who perform the ongoing system operation, inspection, testing, and maintenance shall be thoroughly familiar with the required and recommended operation and maintenance tasks.

Facilities management personnel who will be responsible for management of a contract for system operation, inspection, testing, and maintenance shall be thoroughly familiar with the tasks to be performed and the frequency of such tasks, but not necessarily the implementation of those tasks.

**Authority Having Jurisdiction (AHJ).**
The AHJ shall be knowledgeable in the applicable codes, ordinances, and standards as they relate to the fire protection and life safety systems installed.
The AHJ shall have the ability to determine the operational readiness of the fire protection and life safety systems installed. The AHJ shall have the ability to verify completion of integrated system testing for the purpose of system acceptance.

**Insurance Representative.** The insurance representative shall be knowledgeable and experienced in property loss prevention and life safety to mitigate possible risk.

**A.4.5.3** Larger projects may require a more qualified integrated testing team based upon the level of fire protection and life safety system installed. {Examples to be provided} The Integrated Testing Agent shall demonstrate experience and knowledge of performance verification methods to validate functionality of integrated systems and components. The Integrated Testing Agent shall demonstrate knowledge, experience, and understanding of the operating components of all systems and subsystems to the extent they affect the installation and operation of the fire protection and life safety systems in accordance with the approved design. The Integrated Testing Agent shall provide an objective and unbiased point of view. Whenever required by the owner or by an AHJ, the Integrated Testing Agent can be a Third Party Entity. When the Integrated Testing Agent is a third party entity, qualifications in section 6.2.7 should be considered.

**A.4.6.3** Examples of the responsibilities of an Integrated Testing Agent are as follows:

1. Review the installation contractor requirements.
2. Review the design and construction documents and specifications for each fire protection and life safety system and their associated subsystems.
3. Develop the integrated systems testing plan.
5. Coordinate the scheduling of trades to perform integrated system testing of systems and subsystems.

**A.4.7.4** The integrated test should be considered a test of the entire system or process that begins at the integrated system’s activation device (an end point) and continues through to the desired response, function, result or action. This test intended to be an “end-to-end” test to show that integrated systems perform effectively together to achieve the fire protection and life safety goals.

**A.5.2.1** The goal of integrated testing is to verify that fire protection and life safety systems operate as designed and as required by codes and standards. The scope of work can include, but is not limited to, the following:

1. Review of building plans and specifications.
2. Review of applicable codes and standards.
3. Review of one line riser diagram of smoke control and exhaust systems, schedules for ducts, fans, dampers, and submittals for damper operators and sequence of operation. Each piece of equipment should be numbered and identified.
(4) Review of system testing matrices and as-built drawings.
(5) Review of testing matrix checklist of integrated systems.
(6) Review of final individual testing reports (including TAB).
(7) Review of one line riser diagrams of normal and emergency electric system (EPSS).
(8) Review of equipment software submittals.
(9) Establishment of a team of testing participants and assignment of duties.
(10) Coordination of pre-test meetings with stakeholders.
(11) Implementation of integrated testing by appropriate methods and verification and documentation of operation of interface equipment under normal and emergency power after all trades complete their work.
(12) Correction of problems and retest.
(13) Submission of final report and documentation.

A.5.2.2.1 Where required ITM has been performed in accordance with NFPA standards, simulating the function of initiating devices shall be permitted for periodic integrated system testing.

A.5.2.4 These functions shall include but not be limited to:
(1) Sprinkler System Alarms and Notification
(2) Egress lighting
(3) Smoke control
(4) Elevator control and operation
(5) Fire alarm signaling
(6) Fire pump operation
(7) Security Systems
(8) HVAC Control and Operation
(9) Suppression

A.5.2.6 The following are examples of systems that can be interconnected:
(1) Fire alarm system
(2) Emergency Communication Systems
(3) Building automation management system
(4) Means of egress systems and components
(5) Heating, ventilating, and air conditioning (HVAC) system
(6) Gas detection system
(7) Normal, emergency, and standby power systems
(8) Automatic sprinkler system
(9) Fixed fire suppression and control systems
(10) Automatic operating doors and closures
(11) Smoke control and management systems
(12) Explosion prevention and control systems
(13) Elevator and pedestrian movement systems
(14) Security systems
(15) Commercial cooking operations

A.5.2.7 Fire protection or life safety systems can operate equipment that is not necessarily part of the fire protection or life safety system. One such example is shunt trip breakers that should be tested for proper operation.

A.5.2.9 Additions, modifications, or alterations to systems can cause unintended consequences of operation to the interactions of integrated systems. The testing procedure should be re-evaluated to ensure repeat testing is adequate to determine the correctness of the revision.

A.6.2.2.1 The status of an individual system might be “all normal”. For some tests, the status might be “operating on secondary power” or “operating with an open circuit condition on SLC#2 between device 102 and 103”. It is important to document the system status so that test results can be properly interpreted.

A.6.4.5.1 RESERVED ANNEX NOTE

A.6.4.9 Document security should consider both physical security of the information that they contain and security against hazards such as fire and flood.

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Annex B  Sample Integrated Test Plan

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This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

**B.1 RESERVED**
MEMORANDUM

TO: NFPA Technical Committee on Commissioning and Integrated Testing
FROM: Elena Carroll, Administrator, Technical Projects
DATE: February 7, 2012
SUBJECT: NFPA 4 Draft Release TC Final Ballot

The Final Results of the NFPA 4 Draft Release Letter Ballot are as follows:

33 Members Eligible to Vote
3 Not Returned (Caputo, Howard and Willse)
29 Affirmative on All
1 Negative (Church)
0 Abstentions

An affirmative vote of at least a simple majority of the total membership eligible to vote is required. This is the calculation for simple majority:

\[
\frac{33 \text{ eligible}}{2} = 16.5 = (17)
\]

Reasons for negative votes, etc. from alternate members are not included unless the ballot from the principal member was not received.
Technical Committee on Commissioning and Integrated Testing
Letter Ballot to Release the Draft for NFPA 4

Please record me as voting:

_____ AFFIRMATIVE  ___ NEGATIVE*  _____ ABSTAINING*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a negative or abstaining vote.

This standard should not be following the vague NFPA 3 concept of using a team to develop a plan for each building. Attempting to incorporate everything within and around the building is excessive. Egress components, access roadways, utilities systems, and all passive assemblies are just some examples of the excessive reach. It seems wise to ensure that the Standards Council concurs with this interpretation of their initial scope statement before releasing anything to the public.

We need a definitive standard addressing the interface of the different active integrated systems. This draft should not be released unless it is accompanied by an explicitly statement asking for input on the extent of scope and that the committee is willing to completely rewrite the text if sufficient proposals suggest it instead of rejecting such proposals based on no suggested text provided. Without it, the public will think this is the intended scope. Such a broad scope philosophically has value (and could be a good future standard) but the current urgent need is on the much smaller family of integrated active systems and passive systems with active components.

Signature

GEORGE L. CHURCH, JR.

Name (Please Print)

11/30/12

Date

Please return your ballots not later than Monday, January 30, 2012.

RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park, Quincy, MA 02169-7471
ecarroll@nfpa.org or FAX: (617-984-7110)
Technical Committee on Commissioning and Integrated Testing
Letter Ballot to Release the Draft for NFPA 4

Please record me as voting:

X AFFIRMATIVE  _____ NEGATIVE*  _____ ABSTAINING*

EXPLANATION OF VOTE - Please type or print your comments:
*An explanation must accompany a negative or abstaining vote.

See Attachment A.

__________________________________________

Signature

__________________________________________

Name (Please Print)

01/24/12

Date

Please return your ballots not later than Monday, January 30, 2012.

RETURN TO:
Elena Carroll, Administrator, Technical Projects
NFPA
1 Batterymarch Park, Quincy, MA 02169-7471
ecarroll@nfpa.org or FAX: (617-984-7110)
Attachment A

Comment:

A section of “Retroactivity” needs to be included in this standard. We believe the exclusion of this clause will result in this standard not being adopted by jurisdictions, because we are forcing an all or nothing approach. During these economic times, the cost of implementing this standard will be heavily scrutinized. If the economic burden of this standard is too great nobody will adopt it.

We suggest the following be included in Administration Section of the standard.

1.X Retroactivity.

1.X.1 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.

1.X.2 In those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or property, retroactive application of the provisions of this document shall be permitted

Signed by:

Date 01/24/12
I am transmitting to you herewith the following action of the Standards Council (August 8-11, 2011):

At the February/March 2011 meeting, the Council reviewed the request of the Technical Committee (TC) on Commissioning Fire Protection Systems to develop a new document, NFPA 4, *Standard for Integrated Testing of Fire Protection Systems*. At that time, the Council voted to solicit public comments on the need for the project, information on resources on the subject matter, those interested in participating if established, and other organizations actively involved with the subject. The Council received 20 public comments.

After review of all the information before it, the Council has voted to approve the development of NFPA 4, *Standard for Integrated Testing of Fire Protection Systems*. The Council believes that a single Technical Committee ought to be responsible for developing both NFPA 3, *Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*, and the new NFPA 4. The new NFPA 4, however, calls for a review of the committee structure of the current TC and a fresh consideration of the interests and balance appropriate to a technical committee responsible for both NFPA 3 and NFPA 4. In particular, the new NFPA 4 will need a technical committee makeup that maximizes the ability to provide the coordination among the many documents and responsible committees that will be necessary to make this complex effort a success. Accordingly, the Council intends to reconstitute the TC under a new name and updated committee scope, and it will do so after conducting a full review of the structure and membership of the TC to ensure the expertise and the representation of the membership is appropriate to the expanded tasks before the Committee. The Council is requesting staff to provide it with recommendations concerning the name and scope of the reconstituted TC and to issue a call for members for the TC. All current members of the TC on Commissioning Fire Protection Systems members who are interested are encouraged to submit a committee application so that they can be considered for membership on the newly constituted committee. Anyone wishing to be considered for committee membership should send their application to NFPA no later than September 1, 2011. The Council will review all candidates for the new TC at the October 2011 Council meeting.

So as to provide guidance as to the scope of the new NFPA 4 integrated testing document that the Council will be assigning to the new committee to develop, the Council is providing the following draft document scope as follows:
The standard shall provide the minimum requirements for integrated testing of fire protection and life safety systems. These requirements include protocol for testing procedures, responsibilities for various parties, methods and documentation for verifying the operational readiness and sequence of integrated systems. The standard is designed to ensure that interconnected active and passive fire protection and life safety systems operate as intended.

The standard shall not require integrated testing but shall provide minimum requirements for integrating testing where such testing is required by another code, standard, or design document or by an Authority Having Jurisdiction.

The standard shall not provide testing requirements, including test procedures or test frequencies, for individual systems.

c: M. Brodoff, A. Cronin, C. Dubay, R. Bielen, M. Klaus, D. Baio, C. Cronin, J. Goyette, E. Carroll


11-8-27
Item 12-3-18
MEMORANDUM

TO: Amy Cronin, Secretary to the NFPA Standards Council
FROM: Denise Beach, Senior Engineer
DATE: February 3, 2012
SUBJ: Physical and Chemical Data Consistency Advisory (PCDCA) Committee Dissolution Request
CC: Guy R. Colonna, Linda Fuller, Nancy Pearce

Dear Amy,

The purpose of this letter is to request dissolution of the Physical and Chemical Data Consistency Advisory (PCDCA) Committee. The scope of the PCDCA is stated in the NFPA Directory as "maintaining accurate and uniform physical and chemical data values, including source data, to committees of the Association." To the best of my knowledge, all such data is now available exclusively in the Fire Protection Guide (FPG) to Hazardous Materials. The FPG is updated by NFPA staff with input as needed from the Technical Committee on Classification and Properties of Hazardous Chemical Data (CLA-AAA). The PCDCA Committee has not met or been consulted in the three years since I joined NFPA. In my opinion, the PCDCA Committee no longer serves a useful purpose because the data is compiled in a single publication and the CLA-AAA technical committee establishes new ratings to be added to the FPG.

I have not contacted the members of the PCDCA Committee for comment. Four of the eight PCDCA Committee members are also members of the CLA-AAA Technical Committee.

Please consider this request to dissolve the PCDCA.

Denise Beach
Maynard, Mary

Subject: FW: Physical and Chemical Data Consistency Advisory Committee

---

From: Richard Gowland <Rtgowland@aol.com>
To: Beach, Denise
Cc: Colonna, Guy; Fuller, Linda; Curtis, Martha; Pearce, Nancy
Sent: Tue Feb 14 05:22:52 2012
Subject: RE: Physical and Chemical Data Consistency Advisory Committee

I agree with the proposed dissolution. rgds

---

From: Beach, Denise [mailto:dbeach@NFPA.org]
Sent: 13 February 2012 22:17
Cc: Colonna, Guy; Fuller, Linda; Curtis, Martha; Pearce, Nancy
Subject: Physical and Chemical Data Consistency Advisory Committee

All,

This email is to solicit feedback on a request I made to the NFPA Standards Council to dissolve the Physical and Chemical Data Consistency Advisory Committee (PCDCAC). The PCDCAC was established in 2002 to maintain “accurate and uniform physical and chemical data values, including source data, to committees of the Association.” Much of the chemical data in question is located in the Fire Protection Guide to Hazardous Materials, a document that is updated and maintained by staff. The source data for the chemical ratings is maintained by NFPA Staff. Requests for revising the hazard classification published in the Fire Protection Guide have been referred to the Technical Committee on Classification and Properties of Hazardous Chemical Data; the committee responsible for NFPA 704.

There are several committee documents that contain specific chemical data: NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations and Chemical Process Areas; NFPA 77, Recommended Practice on Static Electricity; NFPA 400, Hazardous Materials Code; NFPA 484, Standard for Combustible Metals; and NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

To the best of my knowledge, the technical committees responsible for these documents have neither sought input from nor reported data back to the PCDCAC. Most questions regarding hazard classifications for chemicals have been referred to and largely addressed by the Technical Committee on Classification and Properties of Hazardous Chemical Data. The PCDCAC has not met in at least the last three years, nor has there been any request for such a meeting.

Therefore, I have requested that the Standards Council dissolve the PCDCAC. The Standards Council Secretary has asked for input from the PCDCAC members on this proposed action. I encourage you to use the “Reply to All” button with your comments as soon as possible.

Thank you for your help and your willingness to participate in NFPA activities.
Best Regards,

Denise

Denise Beach  
Senior Engineer  
National Fire Protection Association  
Ph. 617/984-7501  
Fax. 617/984-7110  
www.nfpa.org
My advice is against dissolving this committee. This Committee's intended role and scope (below) is still highly relevant today. In addition to those you listed, there are many other NFPA standards that publish data (e.g. NFPA 68 and 69).

Perhaps one of the reasons the Committee did not achieve much in the past was not many people knew about it. Therefore, I would recommend reorganizing the committee to take a more proactive stance.

A good working model PCDCAC could be that of the Glossary of Terms Technical Advisory Committee.

I will be happy to discuss this matter further with you or any of your colleagues who might be interested.

Sincerely Yours,
Erdem

In order to have consistent data throughout NFPA codes and standards, this PCDC Committee shall be responsible for maintaining accurate and uniform physical and chemical data values, including source information, to committees of the Association. Initial data will be provided by the individual NFPA Technical Committees, and will be verified and maintained in the database by the PCDC Committee. The respective Technical Committees will still be responsible for providing input and recommendations for addition or modification of data to the PCDC and keeping the PCDC aware of any changes in data in their respective fields of expertise. Similar to the NFPA Glossary of Terms project, the NFPA Technical Committees will then use this database for the official values to use in their respective documents. The PCDC Committee is also responsible for resolution of questions and policies (including data inconsistencies) relating to these data within NFPA codes and standards. This Committee shall report its activities annually to the Secretary, NFPA Standards Council.
As Global Harmonization continues its slow adoption in the U.S., the maintenance of the uniformity of chemical and physical data throughout NFPA remains a matter of continuing concern. That said, I see no reason to maintain PCDCAC as a separate entity, since its duties could reasonably be included within the scope of activity of the Technical Committee on Classification and Properties of Hazardous Chemical Data.

Arthur
All,

Perhaps some of you may recall that ‘PCDCAC’ was established to function like a technical correlating committee to address consistent chemical physical property information. It was hoped that the actions of the PCDCAC would have reduced or totally eliminated differences in printed chemical property data found in many of the NFPA documents. As an example NFPA 58 and NFPA 497 both have listings for propane and each still have different flammable limits and different values for autoignition (vs. ignition) temperatures.

Another aspect for the PCDCAC was a goal for NFPA to establish on on-line reference for this data. It was understood that NFPA did have a book, called the Fire Protection Guide, but this book was not updated frequently and users did not like having to purchase a book to quickly find a single series of correct physical property values. Lacking a supported data base, the PCDCAC had no means to document their actions and this presented a significant problem for our work.

Clearly, none of the objective for the PCDCAC have been achieved.

I am a committee member of NFPA 704 and while in the past we have considered some chemical physical property data, I do not think we have acted as a correlation committee to assure that the chemical property information being used in the various NFPA documents is consistent. Perhaps NFPA 704 may assume some of the roles thought to be addressed by the PCDCAC, however that would be a NFPA 704 Committee decision.

I still remain a strong proponent for NFPA taking action to create on on-line database for Chemical Property data. The NFPA solution of a non identified/published NFPA staff person retaining current copies of the revised information either on paper in a folder in their desk, or in an electronic file located on their computer, or the infrequently published Fire Guide, really do not aid users.

As to meetings of the PCDCAC, I think we only had two face-to-face meetings and a few phone call meetings. We did manage to make some progress, but found we had no means to publically document our findings. We had an excellent staff support person working with us and she did keep records in her files of our work, but again, aside from getting phone calls, I am not certain how this material data was used by other NFPA Committees. I am also not certain that NFPA did much to publish the fact that the PCDCAC existed and that NFPA Committees needed to work with them to correlate chemical data.

Perhaps the best solution is for NFPA to develop an informational note or appendix template item advising uses that chemical information contained in the specific NFPA XX, is provided for information only, and that there may be other sources which have better or equally valid data. This would then end the need for the PCDCAC.

Regards,

Dave
MEMORANDUM

DATE: August 16, 2000

TO: Technical Committees Responsible for NFPA 30, NFPA 69,
NFPA 77, NFPA 86, NFPA 704, NFPA 430, NFPA 497

FROM: Leona A. Nisbet, Standards Council Recording Secretary

SUBJECT: Physical and Chemical Data Consistency Advisory Committee

In July 2000, the NFPA Standards Council approved the formation of a new advisory committee, the Physical and Chemical Data Consistency Advisory (PCDCA) Committee. Below is the scope of the advisory committee:

Scope: In order to have consistent data throughout NFPA codes and standards, this PCDCA Committee shall be responsible for maintaining accurate and uniform physical and chemical data values, including source information, to committees of the Association. Initial data will be provided by the individual NFPA Technical Committees, and will be verified and maintained in the database by the PCDCA Committee. The respective Technical Committees will still be responsible for providing input and recommendations for addition or modification of data to the PCDCA and keeping the PCDCA aware of any changes in data in their respective fields of expertise. Similar to the NFPA Glossary of Terms project, the NFPA Technical Committees will then use this database for the official values to use in their respective documents.

It should be noted that only data inherent to the substance would be examined, (i.e. flash point), not derived data (i.e. sprinkler discharge characteristics or conduit sizing data). A centralized electronic chemical property database will be created and maintained to house the data. This PCDCA Committee shall direct NFPA staff regarding establishment of data and its entries, maintenance of data fields, and structure of data fields. The PCDCA Committee is also responsible for resolution of questions and policies (including data inconsistencies) relating to these data within NFPA codes and standards.

If you are interested in learning more about the Committee, or would like to apply for membership on the Committee, you may contact Staff Liaison, Amy Spencer at 617-984-7949 or by e-mail aspencer@nfpa.org. Thank you for your interest.

CC: Staff Liaisons
    G. R. Colonna
    A. Hoffman
    R. J. Vondrasek

IMPORTANT NOTICE: This correspondence is not a Formal Interpretation issued pursuant to NFPA Regulations. Any opinion expressed is the personal opinion of the author, and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should be relied upon, to provide professional consultation or services.
Item 12-3-19
# 2016 NEC Annual Revision Cycle

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November 29, 2011

NFPA Standards Council
National Fire Protection Association
One Batterymarch Park
Quincy, MA 02169-7471

Re: Proposal to change NEC* Revision Cycle to 5 Year

To Whom It May Concern:

It is without question or reservation that the National Electrical Contractors Association (NECA) has been and will continue to be profoundly committed to promoting and improving the NEC* with active participation in its development processes. Any changes to this revision process should be undertaken in order to strengthen the document and further its widespread and timely adoption.

During the 2009 meeting of the NECA Board of Governors, the following Ordinary Proposal was adopted: “Therefore Be It Resolved that the National Electrical Contractors Association promotes and endorses revising the National Electrical Code on a five-year cycle rather than the existing three-year cycle.” On behalf of NECA’s Board of Governors, this proposal is being submitted to NFPA* for serious consideration. NECA is mindful of the significance of such a change, but over the course of several NEC* development cycles, the proposal has been carefully evaluated and is believed to be both timely and justified for the following principle reasons:

1. ANSI-accredited standards are required to be reviewed, revised, or reaffirmed as appropriate within in a 5-year timeframe, which is two years longer than your development process.

2. A tentative interim amendment process (TIA) is established for situations where additional requirements or revisions are necessary based on an emergency nature or to address a technical deficiency.

3. Adoption every three years has proven impractical by many authorities having jurisdiction. In reality, many jurisdictions are skipping a cycle so that the adoption process occurs every 6 years. NECA believes it is in the best interest that the latest edition of the NEC* be regularly and consistently adopted and enforced. This is also of significant importance to our contractors and others involved in the built environment that the same edition of the NEC* be adopted and enforced across jurisdictional lines.

4. New and revised NEC* requirements every three years results in some adopting agencies using a selective adoption process (deleting necessary requirements), which NECA believes is a safety risk and increased liability for consumers and installing contractors.
5. Code training in the industry would be improved by reducing the focus on so many frequent changes (and proposing changes) and instead addressing better and more in depth Code knowledge and application.

6. NECA believes the NEC* process has become distorted in ways that do not benefit the industry and that less frequent revisions would not affect public safety. Too many Code changes today are not safety-driven but pursued by manufacturers using the regulatory process to gain a competitive edge.

The above identified reasons for this proposal are non-inclusive. NECA has not only evaluated the reasons for changing to a 5-year development process, but has considered the current 3-year cycle and its advantages. It is understood that changes in the electric industry often occur rapidly. The interim Code process can and does currently address those few situations.

The NECA ordinary proposal was reviewed and discussed by NECA’s Codes and Standards Committee at its February 2011 meeting. The committee reviewed advantages and disadvantages of moving to a five year revision cycle and concluded that change is needed. It should also be noted that moving to a 5-year cycle is of interest to many key industry partners such as NJATC, IAEI, IBEW, IEC and others currently participating in the NEC development process.

NECA is aware of efforts to modify the current NEC* development process timeline which is a good opportunity to consider this proposal. All organizations that support the NEC* development process have a vested interest in changes that impact their current business models operational schedules, a significant investment. If changes are necessary to improve safety and strengthen more wide-spread adoption of the NEC*, then it makes sense to implement such changes. NECA supports those efforts that are based on the needs related to public safety and safe electrical installations as a whole.

Once again, let me emphasize NECA’s dedication and interest in providing unselfish support and commitment to NFPA and the NEC* development process. This is evidenced by NECA holding leadership positions with Michael Johnston chairing the NEC* Technical Correlating Committee and 6 NECA representatives chairing NEC* technical subcommittees. NECA has been a principal voice of electrical contractors in the NEC* process and values this involvement, as it has for over 100 years; it is extremely important. In light of this strong endorsement, we are requesting a meaningful response and consideration of this proposal and look forward to additional discussions as deemed necessary.

Thank you for your consideration and please contact me if there are any questions or if additional clarification is needed.

Sincerely,

[Signature]

John Grau
Chief Executive Officer

pc: Executive Committee
December 21, 2011

NFPA Standards Council
National Fire Protection Association
One Batterymarch Park
Quincy, MA 02169-7471

Re: Proposal to Change the NEC Revision Cycle to Five Years

To NFPA Standards Council:

The revision cycle of the National Electrical Code® (NEC®) has a dramatic impact on the operation of the National Joint Apprenticeship and Training Committee (NJATC) and training of electrical workers. We are hereby requesting that the National Fire Protection Association Standards Council give serious consideration to a five-year revision cycle rather that the present three-year revision cycle.

The move to a five-year revision would continue to meet the requirements of the American National Standards Institute (ANSI) and parallel the typical NJATC Inside apprenticeship program which spans a five-year period. A five-year revision cycle would allow for compliance with the ANSI process and afford a deeper and more meaningful study by students by virtue of spreading their NEC training out over a longer period of time. Presently, depending on what point in the NEC cycle a student begins their apprenticeship, their studies could span three editions of the NEC. A student, along with the entire electrical industry, could literally require retraining twice within a five year timeframe. This is not practical. We also do not believe that this is the most beneficial use of time and resources for an apprenticeship program in particular or the electrical industry in general.

Our organization is well aware of how the NEC process works. In fact, that very topic is included in our training. We do submit, however, that a significant number of the changes in the NEC are only editorial or generated and accepted to enhance usability. The move from fine print notes to informational notes, the creation of parallel numbering, and the relocation of tables within Articles 250, 310 or 430 to more logical locations for example. Worthy endeavors to be sure, but not necessarily imperative that they be implemented immediately. The industry and the consensus process can most certainly handle these concerns every five years rather than every three. What about those technical issues that some believe cannot wait an additional two years? We feel that is exactly why the Tentative Interim Amendment (TIA) is provided for in the Regulations Governing Committee Projects. Processing a TIA will determine which proposed changes meet the threshold of technical merit and emergency nature. Those that do not will then simply wait for the next revision cycle.

Many have commented that it seems like the NEC revision process never ends. Quite frankly, it would be hard to argue against that school of thought. Consider the time and effort spent every three years on NEC adoption at the state or local level, the shift to a five-year cycle could result in more jurisdictions adopting each current edition, as opposed to skipping editions. Consider the resources expended every three years to create and revise NEC-related training materials for workers, contractors and inspectors. Consider also the countless hours and lost productivity getting these same workers, contractors and inspectors retrained. These are not insignificant investments of personnel, time, or money in this or any economic climate.
We are confident that persons and property will continue to be protected under a five-year NEC revision process as they have been under a three-year revision process. We are convinced that the time is right to move to a five-year revision of the NEC and trust that you will give the issue thoughtful and careful consideration.

Sincerely,

Michael J. Callanan
Executive Director
Subject: SC agenda items

Hello Amy,

I have been waiting for the March SC agenda to be posted. I see that there are two requests to extend the NEC revision cycle to five years. These are from NECA and NJATC.

I can not personally speak on behalf of the IBEW. That would require a letter from President Hill. However, I am absolutely certain that the IBEW would not support a five year cycle. It is imperative that the three year cycle remain in place to allow the many changes in products and emerging technologies that we need to continue to grow our economy.

While the IBEW has relationships with both organizations, I would like to note that their requests are not made on behalf of or in partnership with the IBEW.

Regards,

Jim

James T. Dollard Jr.
Safety Coordinator
IBEW Local 98
1701 Spring Garden Street
Philadelphia, PA 19130
office 215-563-5592
cell 215-802-3772
Item 12-3-21
TECHNICAL COMMITTEE ON
FINISHING PROCESSES

MEMORANDUM

TO: Linda Fuller
FROM: R. P. Benedetti
DATE: January 3, 2012
SUBJECT: Request to Change Document Revision Cycle — NFPA 33 & NFPA 34

Linda:

The Technical Committee on Finishing Processes requests a change to the scheduled document revision cycles for NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, and NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids*, from the Annual 2013 cycle to the Fall 2014 cycle, which establishes a Public Input Closing Date of January 4, 2013 for both.

The Technical Committee has recently received a proposal to include an entirely new chapter in NFPA 33 that will incorporate provisions for a very untraditional method of conducting spray painting of large ocean-going pleasure craft (motor yachts). This method involves dry-docking the vessel, erecting scaffolding around the hull and superstructure, then encapsulating the scaffolding in a plastic sheet cocoon. Scraping, sanding, cleaning, and spray painting are done within this cocoon. The cocoon does not meet current NFPA 33 requirements for a spray area. The proposed new chapter will provide the requisite requirements for such operations to be conducted safely.

In order to properly evaluate the new chapter (the submitter intends the proposed new chapter to be a starting point), the Technical Committee will need additional time to conduct at least one, preferably two, site visits to observe and evaluate operations as they are currently conducted.

Conversion to the new standards making procedures precludes a six-month extension to Fall 2013; the public input closing date (1-4-2012) is already upon us. The Technical Committee might want to make a public announcement concerning this issue to solicit specific input in the coming months. We cannot change to the Annual 2014 cycle, either, due to the number of documents already reporting in that cycle.

rpb/

cc FAA/CORR
      FAA/NM
      Stds. Cncl. File
      DMatthews
Linda:

The leadership of the technical committees responsible for NFPA 75 and 76 would like to keep the documents in the same revision cycle. The two committee projects benefit from having joint efforts on technical matters. I understand that placing both documents in the Fall 2015 revision cycle should be acceptable to the Standards Council. Therefore, I request that NFPA 75 be placed in that cycle to coincide with NFPA 76. I have copied the Chairs, Secretaries and selected task group leaders of the technical committees for their information.

Thank you for your consideration of this request.

Happy holidays,

Ralph T.
MEMORANDUM

TO: Amy Cronin – Secretary, Standards Council
FROM: Barry D. Chase – Staff Liaison, AIS-AAA
DATE: January 3, 2012
SUBJECT: Requested Changes to the Revision Cycles for NFPA 409, 415, and 423

On behalf of the chair for the Technical Committee on Airport Facilities (AIS-AAA), I am requesting the following changes to the revision cycles for NFPA 409, 415, and 423:

<table>
<thead>
<tr>
<th>Document</th>
<th>Current Edition</th>
<th>Current Revision Cycle</th>
<th>NEW Revision Cycle</th>
</tr>
</thead>
</table>

*Annual 2012 document

At a recent meeting, the technical committee voted unanimously to move all three of the above listed documents into the same revision cycle. In addition to the chair, there were 16 voting members present when the vote was taken, representing 59% of the committee (17 of 29).

Each of these documents is on a 5-year cycle. Therefore, this request will have the following effects:
- NFPA 409 will experience no change, as it is already projected to enter the Annual 2015 cycle.
- NFPA 415 will experience an accelerated cycle (3 years), as it is currently being revised in the Annual 2012 cycle.
- NFPA 423 will experience an extended cycle (6 years), requiring a late document notice to be filed with ANSI. However, this document generally receives few proposals, and the committee does not foresee an imminent need to revise the document.

Following the Annual 2015 revision cycle, all three documents should again be placed on a 5-year revision cycle, next entering the Annual 2020 cycle.

As always, if you have any questions or concerns, please do not hesitate to contact me.

Thank you.

CC: Linda Fuller, Richard Bielen, Jim Doctorman (Chair)
Amy:

I support this change in cycle.

Cheers

Marcelo

Marcelo M. Hirschler
GBH International
2 Friars Lane - Mill Valley - CA - 94941 - USA
Tel: (415) 388 8278/FAX: (415) 388 5546
e-mail: gbhint@aol.com
e-mail: mhirschler@gbhinternational.com
web site: www.gbhinternational.com

In a message dated 1/20/2012 8:24:44 A.M. Pacific Standard Time, kbigda@NFPA.org writes:

Amy –

This email serves as the request for NFPA 556, *Guide on Methods for Evaluating Fire Hazard to Occupants of Passenger Road Vehicles,*

to change cycle from A2014 to A2015. NFPA 556 is developed by the TC on Hazard and Risks of Contents and Furnishings (HAR-AAA). I have spoken with the current TC chair, Marcelo Hirschler, regarding this request. We have discussed the need for the committee to recruit more members as well as allow more time for public input.

Please let me know if you require any additional information.

Kristin

Kristin (Collette) Bigda, P.E.

Fire Protection Engineer
RE: NFPA 1901 and 1906 Cycle Request

NFPA Standards Counsel:

For many years the Apparatus Committee worked on NFPA 1901 Standard for Automotive Fire Apparatus and NFPA 1906 Standard for Wildland Fire Apparatus in alternating cycles. This allowed the committee to spread the work, focusing on one standard at a time. The downside to this approach is that it is very difficult to keep these two standards in sync. Although there are some aspects of a Wildland apparatus that are unique, there are many other aspects that are, and should be, common to municipal apparatus.

The committee made great strides to bring commonality to these standards where applicable in the last revision cycle of 1906. NFPA 1906 chapters were renumbered, and text was moved, in order to align 1906 content with the chapters in 1901. This change will assist both the committee and the user, as the material between these standards will be in the same place within the standard. One problem remains. With both standards on separate tracks, the changes made in the common aspects of one standard are always half a cycle out of sync with the other standard. The updates to common aspects must be kept track of and captured in the next revision of the companion standard. We try to do a good job of this, but inevitably some things slip through the cracks.

To solve this dilemma, the committee proposes to change the approach so that both 1901 and 1906 are revised in the same cycle. To do this we would like to slip cycle in 1901, and pull up the cycle for 1906. In a straw poll during our last meeting, committee members overwhelmingly agreed to this approach.

We do not believe that 1901 will suffer by slipping cycle as there are no major safety issues pending for municipal apparatus. Our 2009 revision included sweeping changes that had significant impact on the industry and no one will complain if the standard remains as it is for an extra year or two. On the other hand, there was at least one major wildland issue that the committee was unable to address in the 2011 revision. Pulling 1906 up in cycle will allow us to tackle this issue in a timely manner.
We therefore request that the Standards Counsel slip NFPA 1901 to the next available slot and pull NFPA 1906 forward into that same slot. Please let us know as soon as possible. If this request is not approved we will need to begin planning the 1901 ROP meeting quickly.

Sincerely,

Donald L. Frazeur
Apparatus Committee Chair
Linda,

I have been in communication with the NWCG representative on the FDA-AAA committee and the committee chair. Tentatively the NWCG is not aggressively opposing the cycle slip of NFPA 1901 and 1906 and are cautiously following the process. They have not withdrawn their letters or statements opposing the committee request, however they are holding back on filing a third letter of opposition. NWCG wants their position understood that they are a minority in a document development. NFPA staff is working with the committee chair, the committee and the NWCG to work through the process.

Best regards,
Larry Stewart, Fire Service Specialist
Executive Secretary Fire Service Section
NFPA Public Fire Protection Division
1 Batterymarch Park
Quincy, MA 02269
617-984-7493

Important Notice: This correspondence is not a Formal Interpretation issued pursuant to NFPA Regulations. Any opinion expressed is the personal opinion of the author and does not necessarily represent the official position of the NFPA or its Technical Committees. In addition, this correspondence is neither intended, nor should it be relied upon, to provide professional consultation or services.
July 13, 2011

Mr. William Kaage
NWCG Chairman
National Interagency Fire Center
38233 S. Development Avenue
Boise, ID 83705-5354

Dear Mr. Kaage,

Thank you for your letter of June 13, 2011, outlining the National Wildfire Coordinating Group’s (NWCG) concerns regarding NFPA 1906, Standard for Wildland Fire Apparatus. In summary, you expressed concern regarding the NFPA Fire Department Apparatus Committee’s intent to slip cycle with NFPA 1901, Standard for Automotive Fire Apparatus, and enter cycle early with NFPA 1906, so that both documents would be revised during the same cycle. Central to the NFPA process are the needs of all interested parties involved in the development of the fire apparatus standards and public input is an integral part of the NFPA process.

The overall consensus of the committee was in favor to align both documents into the same cycle. Your letter representing the NWCG’s concern was shared with the NFPA Fire Department Apparatus Committee Chair, Mr. Donald Frazeur, and he provided the following response:

“Mr. Kaage makes some good points that underscore NWCG’s principle concern: does NFPA intend to fold the 1906 standard into the 1901 standard. It is not the Chair’s intent, and, by vote of the committee, not the committee’s intent, to merge the 1906 and 1901 standard into one standard.

There are two principle reasons for shortening the 1906 revision cycle:

1. The wildland fire arena, especially with respect to 1906 apparatus, is changing faster than apparatus covered under the 1901 standard. This was evidenced by the large number of comments submitted at our last 1906 meeting.

2. Consistency between standards will improve if both standards are reviewed simultaneously.
I disagree with Mr. Kaage on the crew carrier issue. The 2010 accident in Los Angeles County involving a crew carrier transporting inmate firefighters points to the need for inclusion under the standard. Another example occurred July 5, 2011, when a crew carrier went off the road and overturned in Palmdale, California, injuring 9 firefighters.

Alternate seating positions on 1906 trucks utilized in flat areas around the Country point to the need for committee action. The committee's action to hold this item until the public had time to provide comment was prudent. Mr. Kaage is correct, by itself, the Tentative Interim Amendment (TIA) process could address this issue. However, when coupled with the rate of change occurring with the Wildland arena, the need to establish criteria for crew carriers, and the need to review off-road vehicles, the plan to shorten the 1906 cycle this time, from 5 years to 3 years, has merit.”

The Chair, Donald Frazeur, also provided justification for aligning both documents. Mr. Frazeur expressed that it is not the committee's intent to merge both documents into a single standard. The Technical Committee is very aware of the importance of having separate standards for NFPA 1901 and NFPA 1906. Should the NWCG not be satisfied with the committee’s intent, an appeal can be sent to the NFPA Standards Council.

In closing, let me stress that it is only through the active participation and advocacy of participants such as the NWCG that NFPA standards can evolve and meet new challenges as they arise. It is for that reason that we so appreciate NWCG’s participation in the NFPA process. Of course, as you proceed, NFPA staff remains available throughout to discuss these matters with you and others and to facilitate in any appropriate ways.

Sincerely,

Amy Beasley Cronin
Division Manager, Codes and Standards Administration
and Secretary, Standards Council

ABC/rmf

cc: L. Stewart
    K. Willette
    D. Frazeur
    1906 File
Larry,

Yes, please feel free to use my response. I would modify my response slightly, as highlighted in yellow.

“Mr. Kaage makes some good points that underscore NWCG's principle concern: does NFPA intend to fold the 1906 standard into the 1901 standard. It is not the Chairs intent, and, by vote of the committee, not the committee's intent, to merge the 1906 and 1901 standard into one standard.

There are two principle reasons for shortening the 1906 revision cycle:

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On Wed, Jul 13, 2011 at 7:46 AM, Stewart, Larry <lstewart@nfpa.org> wrote:

Don,

I have been asked if you would allow your response to the NWCG letter be used as part of an NFPA response back to NWCG. You wrote:

...
“Mr. Kaage makes some good points that underscore NWCG’s principle concerns. Does NFPA intend to fold the 1906 standard into the 1901 standard. It is not the Chairs intent, and, by vote of the committee, not the committee’s intent, to merge the 1906 and 1901 standard into one standard.

There are two principle reasons for shortening the 1906 revision cycle:
1. The wildland fire arena, especially with respect to 1906 apparatus, is changing faster than apparatus covered under the 1901 standard. This was evidenced by the large number of comments submitted at our last 1906 meeting.

2. Consistency between standards will improve if both standards are reviewed simultaneously.

I disagree with Mr. Kaage on the crew carrier issue. The 2010 accident in Los Angeles County involving a crew carrier transporting inmate firefighters points to the need for inclusion under the standard.

Alternate seating positions on 1906 trucks utilized in flat areas around the Country point to the need for committee action. The committee's action to hold this item until the public had time to provide comment was prudent. Mr. Kaage is correct, by itself, the Tentative Interim Amendment (TIA) process could address this issue. However, when coupled with the rate of change occurring with the Wildland arena, the need to establish criteria for Crew Carriers, and the need to review off-road vehicles, the plan to shorten the 1906 cycle this time, from 5 years to 3 years, has merit.”

From: Donald Frazeur [mailto:donald.frazeur@lacity.org]
Sent: Wednesday, July 13, 2011 9:11 AM
To: Stewart, Larry
Subject: Re: Retirement of FDA-AAA Committee Member

Good morning Larry,

I hope all is well and that you had a great vacation.

I wonder if I could use you as a reference. I intend to apply for the Fire Chief position in L.A.

Don

On Wed, Jul 13, 2011 at 5:54 AM, Stewart, Larry <lstewart@nfpa.org> wrote:

Cheryl,

I have just been notified the Ronald Gill, Principal member of the FDA-AAA committee has retired from the District of Columbia Fire & EMS Department. He has an Alternate on the committee, Ed Rice, who will serve as voting alternate until the DCFD provides a replacement.

Best regards,
June 13, 2011

Standards Council Secretary
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Re: Report on Comments (ROC) Meeting Minutes for NFPA 1906, Standard for Wildland Fire Apparatus

Dear Standards Council Secretary:

This letter addresses the concerns of the National Wildfire Coordinating Group (NWCG) regarding the potential short cycling of NFPA 1906, Standard for Wildland Fire Apparatus, as proposed in the Report on Comments (ROC) Meeting Minutes of March 21-23, 2011.

Background: The meeting minutes include information on shortening the next revision cycle on NFPA 1906, which “would allow the committee to properly address crew carriers, off road vehicles, and alternate seating positions.” The minutes also include proposals: 1) to “enter cycle early on the next revision of 1906,” and 2) to “delay the revision of NFPA 1901 by 1 year” “so that they will both be revised at the same time.”

Aligning the two standards (NFPA 1906, Standard for Wildland Fire Apparatus, and NFPA 1901, Standard for Automotive Fire Apparatus) in the same revision cycle schedule would require that NFPA 1901 be taken out of cycle (revision delayed) by one (1) year and NFPA 1906 be short cycled by two (2) years. This means that the Report on Proposal process would begin in 2012, immediately following the release of the 2012 Edition of NFPA 1906.

Discussion: The primary justification for entering the cycle early appears to be one of convenience for the technical committee. That is, the ability to revise two (2) standards simultaneously to maintain consistent language. In our opinion, this is not an appropriate justification for entering the cycle early. The proposal for simultaneous review of NFPA 1901 and 1906 reintroduces the concerns stated in our earlier correspondence dated February 26, 2010. There is a definite need to maintain the integrity of the 1906 document so that it reflects the needs of the wildland fire community and not just be a reflection of the 1901 document. We believe simultaneous review may not ensure NFPA 1906 integrity.
The meeting minutes also reference other reasons for entering the cycle early, which include the ability to address crew carriers, off road vehicles, and alternate seating positions. Each of these issues is addressed as follows:

*Crew Carriers:* NWCG member agencies are the primary users of crew carriers – a specialty vehicle for transporting approximately 5 to 15 crew members, tools, and firefighting equipment (crew carriers are not equipped with pumps, ladders, or water tanks). Although there are potential advantages to having a new chapter in 1906 specifically for this vehicle type, there is no overriding need or urgency. The addition of this vehicle type, if needed, can wait until the next scheduled edition of NFPA 1906.

*Off Road Vehicles:* NFPA 1906 does not apply to non-highway use vehicles – specifically specialty fire vehicles such as ATVs, UTV’s and tracked vehicles. There is apparently some interest in evaluating the possibility of including requirements for non-highway use vehicles into NFPA 1906. To our knowledge, although the need for such a standard has been discussed, a determination has not been made. As such, it would be improper to justify the short cycling of NFPA 1906 prior to determining the actual need and appropriateness of incorporating this information into the standard.

*Alternate Seating Positions:* 1906 ROC Log #144 recommended requirements for an exterior fire attack position for firefighting personnel. The recommended committee action was to “hold” the public comment because it included new language that was not available for the public review. If there is an overriding need to address the issues brought forth in ROC #144, they should be addressed via the established NFPA Tentative Interim Amendment (TIA) process.

**Summary:** The NWCG does not concur with the rationale for entering cycle two (2) years early on NFPA 1906. The primary justification appears to be one of convenience for the technical committee. If the external riding position needs to be addressed before the next scheduled cycle, then the TIA process should be used. Entering the cycle early in the absence of adequate justification is unfair to end users and manufacturers.

Thank you for your attention to this critical issue for the wildland fire service. If you have any specific questions regarding our concerns, please contact Tory Henderson, NWCG Equipment Technology Committee Chair, at (208) 387-5348 or by email: thenderson@fs.fed.us.

Sincerely,

William Kaage
NWCG Chairman

Attachment A: ROC Meeting Minutes of 3/21-23/11

cc: NWCG Executive Board
    Tory Henderson, ETC Chair
March 12, 2010

Mr. William Kaage  
NWCG Chairman  
National Interagency Fire Center  
38233 S. Development Avenue  
Boise, ID  83705-5354  

Dear Mr. Kaage:

Thank you for your February 26, 2010 email detailing your concerns from the National Wildfire Coordinating Group (NWCG) regarding NFPA 1906, *Standard for Wildland Fire Apparatus*. Your e-mail outlined your concerns regarding the content of the proposed revision, the perceived lack of wildland fire expertise on the Technical Committee (TC) as well as process concerns regarding Task Groups and participation. You requested that the NFPA Standards Council take NFPA 1906 out of cycle and reconstitute the TC at their March 2010 meeting.

The detailed factual assertions and serious concerns that you set forth in your letter could not be adequately evaluated by the Standards Council, nor would it be fair for the Council to consider or act on your requests, without affording the Technical Committee or other interested parties an opportunity to review and respond to your letter. Your letter was received in this office on Friday, February 26, 2010, which did not allow sufficient time to give others an opportunity to review and comment on your letter before the start of the recent Standards Council meeting the following Monday, March 1. Accordingly, your requests could not, in fairness, be placed on the agenda of the Council for consideration at that meeting.

This does not mean, however, that the concerns you raise go unaddressed. On the contrary, the NFPA standards development process affords multiple opportunities for concerns to be raised and considered, and the processing of NFPA 1906 is far from over. The Standards Council frequently stresses that standards participants should raise and advocate their positions through all of the procedures available within the standards development process, and the Council, as a matter of practice, would rarely intervene in that process before a revision cycle has been completed. This is because issues which arise during the standards development process may, by the end of the process, be resolved and superseded by later events. More importantly, by waiting until the end of the process to consider issues raised by appropriate appeals to the Council, all issues related to the issuance of a document can be considered at once, in context, with the benefit of a complete record and maximum input from all interested participants. I and other NFPA staff are available, and would very much like to discuss with you the options that may be available to you to further raise your concerns and advocate your positions within the NFPA process. Of course, if, at the end of the process, you are dissatisfied with the outcome, you may...
always file an appeal with the Council when the proposed standard is presented to the Council for consideration of appeals related to whether, or in what form, the standard should be issued.

In order to have the maximum opportunity to advocate your positions and the best opportunity to prevail on any appeals to the Council should it become desirable, it is important that appropriate public comments be filed and, as necessary, be followed up on with appropriate motions. To facilitate this submission, on Wednesday, March 3, I sent an e-mail to all the NWCG members who were copied on your e-mail; I advised them of the NFPA 1906 comment closing date and provided them with the comment form. As you are aware, the Fire Department Apparatus Committee will have their next meeting for the NFPA 1906 Report on Comments (ROC) on April 13-14, 2010 in Salt Lake City, UT. As all Technical Committee Meetings are open to the public, I encourage you to attend the meeting and perhaps request to make a presentation at the meeting. Additionally, I also encourage you to have your members submit applications to serve on the Committee. I am enclosing the membership application. Additionally, to ensure that your concerns are presented to the Technical Committee I have forwarded a copy of your letter and my response to the Technical Committee Chair, Donald Frazeur and the Staff Liaison, Larry Stewart to include on the next meeting agenda.

I hope this information is helpful. Should you have additional questions or wish to further inquire about NFPA Standards Council procedures or committee procedures, I would be happy to discuss them with you in more detail. Please feel free to contact me at (617) 984-7241 or by email at acronin@nfpa.org.

Sincerely,

Amy Beasley Cronin
Division Manager, Codes and Standards Administration
and Secretary, Standards Council

ABC/rmf

Enclosure

cc: Donald Frazeur, Chair, Technical Committee on Fire Department Apparatus
Larry Stewart
Dave Nuss
Chris Dubay
Tory Henderson
Ken Willette
Bonnie Bradshaw
Ms. Amy Cronin  
Standards Council Secretary  
National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02169-7471

Re: NFPA 1906, Standard for Wildland Fire Apparatus

Dear Ms. Cronin:

Background
This letter addresses the concerns of the National Wildfire Coordinating Group (NWCG) regarding NFPA 1906, Standard for Wildland Fire Apparatus, and the Technical Committee on Fire Department Apparatus.

The NWCG is an operational group designed to coordinate programs of the participating wildland fire management agencies and is comprised of representatives from the USDA Forest Service, four Department of Interior agencies (Bureau of Land Management, National Park Service, Bureau of Indian Affairs and U.S. Fish and Wildlife Service), the Intertribal Timber Council, 50 state forestry agencies and Puerto Rico (through the National Association of State Foresters), the U.S. Fire Administration and the Federal Emergency Management Agency (FEMA). In the 10 year period from 1999 to 2008, member agencies and cooperators were responsible for suppressing an average of 79,919 wildland fires and 6.9 million acres per year. The majority of these fires occur within state jurisdictions.

NFPA 1906 ROP
The Report on Proposals (ROP) for NFPA 1906 was completed and balloted in September, 2009. We have major concerns related to the content of the standard (as reflected in the ROP), as well as the manner in which the ROP was processed.

The draft revision of NFPA 1906 has additions and omissions that are problematic for the wildland fire community. The Technical Committee has matched, to the greatest extent
possible, the language of NFPA 1901, Standard for Automotive Apparatus (municipal apparatus), in the draft revision of NFPA 1906. This was done in order to make future revisions of both standards easier. Unfortunately, this has resulted in the dilution and elimination of wildland-specific requirements and the inclusion of unnecessary and unwanted municipal apparatus requirements in the NFPA 1906 draft. Examples of NFPA 1906 (2006 Edition) requirements that were deleted in the ROP include requirements for a pump cooler line (9.6.6) and a water only discharge (9.6.12), both important features in a wildland engine. Examples of unwanted and unnecessary municipal requirements include requirements for automatic external defibrillators (AED), vehicle data recorders (VDR), and a label requirement stating “DO NOT WEAR HELMET WHILE SEATED.” Additional information regarding these municipal apparatus requirements is as follows:

AED: The scope of this standard (as well as the NFPA 1901 standard) does not include medical equipment carried on the apparatus. As such, AEDs should not be required in a minimum standard. Information regarding automatic external defibrillators could be included as annex language.

VDR: VDRs are not available on some commercial chassis brand/models commonly used for wildland firefighting. By including a requirement for a VDR, the committee is knowingly creating a situation where it will not be possible to comply with the standard. VDR information could be added as annex language.

Helmets: Whereas municipal fire apparatus typically stay in one location for the duration of an incident, wildland engines are driven while performing mobile attack, often throughout the course of a shift. Hazards are all around the apparatus during a wildland incident and not confined to a specific structure or location. Because hazards are often present immediately after exiting the apparatus, wildland firefighters must be able to don all personal protective equipment (including their helmet) while seated, prior to exiting the apparatus. In many cases, there is no room available for helmet storage in the cab, as wildland engines are commonly equipped with a single pickup-size cab with two to three crew members. This requirement creates a hazardous situation for wildland firefighters.

Regarding the ROP process specifically, over 200 proposals and “committee edits” (proposals by committee members not handled as public proposals) were processed in less than one day. This resulted in inadequate time allocated to addressing serious concerns by the wildland fire community in order to finish in the allocated amount of time. For example, a proposal adding a requirement for ramp breakover angle (1906-21, Log #55) was rejected because inadequate time was available to discuss and possibly develop a more appropriate requirement (by accepting in principle). We respectfully submit that finishing a meeting on time is no excuse for improperly processing an ROP.

**Technical Committee**

In addition to our concerns about the ROP, we also have concerns about the Technical Committee itself. The committee has only two members from the wildland fire community [one each from Cal Fire (“User” classification) and the U.S. Forest Service (“Applied Research/Testing Laboratory” classification)]. The committee is comprised primarily of
members whose expertise and focus relates to municipal fire apparatus, not wildland fire apparatus. Based on the lack of committee members from the wildland fire community and the ROP results, we do not believe the committee has the required experience and expertise to process this standard. This is reflected in the acceptance of only 23 of 99 Forest Service proposals and “committee edits.”

Also of concern is that many committee task groups have been chaired by manufacturers for a number of years. The chassis, pump, foam, and aerial task groups are currently chaired by representatives of companies in those respective businesses. Only the Wildland Task Group was chaired by a fire service representative during the ROP Meeting. Of particular concern is that proposals assigned to the “Function” Task Group for development of recommendations for the full committee were handled by the “Chassis” Task Group at an unscheduled time (the Function Task Group is normally chaired by a fire service representative that was unable to attend the ROP Meeting). As a result, visiting wildland fire community representatives that wanted to provide input on proposals assigned to the Function Task Group were unable to do so.

We acknowledge that the manufacturer representatives are recognized experts in their field and their participation in the standards development process is critical. However, we believe it is more appropriate for fire service (or other non-manufacturer committee members) to chair task groups to reduce the potential of perceived conflict of interest. If there is inadequate fire service participation to chair these task groups, we urge the Standards Council to review committee participation and act accordingly.

Recommendations and Conclusion
The current edition of NFPA 1906 has an enormous amount of useful information. Revising the standard as reflected in the ROP will cause NWCG member agencies and cooperators to take so many exceptions that the standard will not be usable. However, some state and other governments are required to use NFPA standards through their own legislation. In this case, it has a potentially high dollar impact to these agencies and does not provide a real benefit in the wildland firefighting mission. In addition, the interagency wildland fire community includes international partners that adopt NFPA Standards as well. NWCG member agencies would prefer to continue to use NFPA 1906 as a wildland fire apparatus standard. However, in the absence of effective Standards Council action on these issues, we will consider alternatives to NFPA 1906, which may include development of an NWCG-specific apparatus standard that will meet our needs. The NWCG standard would be available to our member agencies (including international partners) and any of our state and local cooperators that can adopt other standards.

We respectfully request that a new wildland fire apparatus-specific technical committee be formed with adequate representation from the wildland fire community, including expertise in wildland firefighting operations, maintenance, testing, and manufacturing. Until a new committee is formed, we request that work on NFPA 1906 immediately cease, the standard be taken out of cycle, and the ROP be reprocessed after a new committee is formed.

Thank you for your attention to these critical issues for the wildland fire community. If you have any specific questions regarding our concerns or recommendations, please contact
Tory Henderson, NWCG Equipment and Technology Committee Chair, at (208) 387-5348 or by email: thenderson@fs.fed.us.

Sincerely,

William Kaage
NWCG Chairman

cc: NWCG Executive Board
Subject: FW: NFPA 1901/1906 Slip Cycle

From: Stewart, Larry
Sent: Friday, February 24, 2012 10:56 AM
To: Fuller, Linda
Subject: NFPA 1901/1906 Slip Cycle

Linda,

Staff has been working with NWCG and the Fire Department Apparatus Committee Chair regarding the cycle changes for NFPA 1901 and NFPA 1906. The majority of the committee voted in favor of placing both documents into the same cycle, however, NWCG submitted a letter expressing their opposition. On January 19th the staff liaison facilitated a conference call with the committee chair, Don Frauzer, and a representative from NWCG, Dave Haston, where Mr. Haston inquired what was needed to be considered by the chair to illustrate how the needs of federal wildland fire folks could benefit with the existing document. At the conclusion of the call the understanding was that NWCG was not going to withdraw their letter of opposition, but they were not going to pursue further opposition and would cautiously proceed with the committee. Further discussions with the committee chair where had via phone call on January 23rd about options for possibly increasing the committee size to include several folks representing the wildland fire perspective and the chair was open to the possibility. On February 7th, staff had contact with Dave Haston via phone call and discussed possible options, including adding wildland fire reps to the committee, as well as recommending NWCG develop a crosswalk that could be used as input on the next revision of NFPA 1906. Mr. Haston felt that adding additional wildland folks on the committee would not be enough to help their cause. The NWCG is currently in the process of developing a document that will identify the needs of the NWCG for apparatus and locate the deficiencies in NFPA 1906 so that it can be used as input for the next revision cycle. NWCG is working to finish this crosswalk prior to the NFPA Standards Council meeting so that further discussions with the committee chair can take place to head off any last minute changes in consensus with proceeding in the cycle change. Based on the discussions with all involved parties, I would recommend council approve the slip cycle and that the technical committee work with the NWCG to address concerns raised in their letter.

Best regards,
Larry Stewart, Fire Service Specialist
Executive Secretary Fire Service Section
NFPA Public Fire Protection Division
1 Batterymarch Park
Quincy, MA 02269
617-984-7493

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